



GREEN economy

Scoping Study

BARBADOS



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BARBADOS' GREEN ECONOMY SCOPING STUDY

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LIST OF ACRONYMS

ACS	Association of Caribbean States	IPCC	Inter-governmental Panel on Climate Change
BCCI	The Barbados Chamber of Commerce and Industry	LEED	Leadership in Energy and Environmental Design
BNSI	Barbados National Standards Institution	MBSS	Modernisation of Barbados Statistical Systems
BPOA	Barbados Programme of Action	MEA	Multilateral Environmental Agreement
BRT	Bus Rapid Transit	MIF	Multilateral Investment Fund
BTA	Barbados Tourism Authority	Mmbtu	Million Metric British Thermal Units
BWA	Barbados Water Authority	MOT	Ministry of Tourism
CARICOM	Caribbean Community	NCSA	National Capacity Self Assessment Project
CCRIF	Caribbean Catastrophe Risk Insurance Facility	NGO	Non-Governmental Organization
CFL	Compact Fluorescent Lamp	NTESC	National Trade and Environment Sub-Committee
CGEF	Caribbean Green Economy Forum	OAS	Organization of American States
CPS	Country Programme Strategy	OECD	Organisation for Economic Cooperation and Development
CSI	Collaborative Standards Initiative	PV	Photovoltaic
CSME	CARICOM Single Market and Economy	RETIC	The Resource Efficiency and Technology Innovation Centre
CTO	Caribbean Tourism Organization	SCORE	Strengths-Challenges-Opportunities-Responses-Effectiveness
DFID	Department for International Development, United Kingdom	SIAP	Sustainability Policy Impact Assessment Framework
EAF	Ecosystem Approach to Fisheries	SIDS	Small Island Developing States
ECLAC	The Economic Commission for Latin America and the Caribbean	SIDS-TAP	SIDS Technical Assistance Programme
EMAS	Eco-Management and Audit Scheme	SMEs	Small and Medium Enterprises
EMLUP	Environmental Management and Land Use Project	SWH	Solar Water Heaters
EPD	Environmental Protection Department	SWOT	Strengths-Weaknesses-Opportunities-Threats
EU	European Union	TBBA	The Barbados Bankers' Association Inc.
FAC	Fisheries Advisory Committee	TCDPO	Town and Country Development Planning Office
FDI	Foreign Direct Investment	TEEB	The Economics of Ecosystems and Biodiversity
FTC	Fair Trading Commission	UDC	Urban Development Commission
GBI	Green Building Initiative	UNEP	United Nations Environment Programme
GDP	Gross Domestic Product	UNEP-FI	UNEP Finance Initiative
GEF	Global Environment Facility	UNEP-ROLAC	UNEP Regional Office for Latin America and the Caribbean
GEF-SGP	Global Environment Facility Small Grants Program	UNWTO	United Nations World Tourism Organization
GESS	Green Economy Scoping Study	UWI-CH	University of the West Indies - Cave Hill
GETSC	Green Economy Technical Steering Committee	WTO	World Trade Organization
GIS	Geographical Information System	WTO TRIPS	WTO's Agreement on Trade-related Aspects of Intellectual Property Rights
GISS	Geographic Information Services and Solutions		
GOB	Government of Barbados		
ICT	Information and Communication Technologies		
IDB	Inter-American Development Bank		
ILAC	Initiative for Latin America and the Caribbean		

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**HONORABLE
FREUNDEL J. STUART, Q.C.**
PRIME MINISTER OF
BARBADOS

In June 2012 world leaders gathered in Brazil for the UN Conference on Sustainable Development, also known as Rio+20, marking the 20th anniversary of the United Nations Conference on Environment and Development. The Rio+20 outcome document, dubbed *The Future We Want*, was important for Barbados and other Small Island Developing States (SIDS) because therein the international community reaffirmed its commitment by acknowledging that SIDS remain a special case for sustainable development in view of our unique vulnerabilities.

Also significant on that occasion was the agreement on a broad policy framework on “The Green Economy in the Context of Sustainable Development and Poverty Eradication”, one of two themes of the Rio+20 Conference.

The issue of green economy is of particular importance to Barbados given our national commitment to advance an inclusive sustainable development paradigm – in the process creating a Barbados that is socially balanced, economically viable and environmentally sound. These outcomes are, and will continue to be, at the centre of the local discourse regarding the pursuit of greening the Barbados “small island open economy”.

At this juncture, I wish to laud the support provided by United Nations Environment Programme (UNEP) as evidenced by this report. The continued partnership of UNEP and other UN System organizations will certainly be sought as the Government of Barbados moves ahead in building a resource-efficient green economy.

I also wish to thank the University of the West Indies, Cave Hill Campus for their unwavering support to the completion of the Green Economy Scoping Study Final Report. It was particularly pleasing to see how that institution, my alma mater, asserted itself in ‘unravelling’ the green economy concept, and thereafter in contextualising its application to an island state, such as Barbados. I believe that the expertise gained, and the methodologies applied throughout the scoping exercise, have great potential for application to other SIDS in the Caribbean and beyond.

Deep gratitude is also owed to the Cabinet-approved Green Economy Technical Steering Committee, led by the Ministry responsible for the environment. That body, comprising government agencies, the trade unions, the private sector and other non-governmental organisations, was critical to the success of this enterprise and I therefore salute those agents for providing the necessary governance and technical leadership in support of the Green Economy Scoping Study.

I wish to assure our stakeholders that the policy, investment and research proposals contained in the Green Economy Scoping Study Final Report will not be confined to a shelf. Evidence of this can be witnessed in the budgetary and fiscal measures adopted in 2012 and 2013, as well as the integration of the green economic policy proposals into the new Barbados Growth and Development Strategy, particularly regarding the birthing of a new renewable energy sector. Major investments in consonance with our green economic goals are also being mobilized in areas such as agriculture, tourism, waste, and water.

I commit my Government to continuing to work assiduously with our local, regional and international partners to ensure that Barbados stays on the path of sustainable development.



DR THE HONORABLE DENIS LOWE MINISTRY OF ENVIRONMENT AND DRAINAGE

Almost six years ago, the Government of Barbados took yet another major national step towards sustainable development by articulating a vision for Barbados to become the “most environmentally advanced green country in Latin America and the Caribbean”. That pronouncement was pivotal for Barbados becoming the first Small Island Developing State (SIDS) to undertake and complete the production of a Green Economy Scoping Study (GESS). Important in that journey was the gathering of views of Barbadians in how such a vision might be achieved.

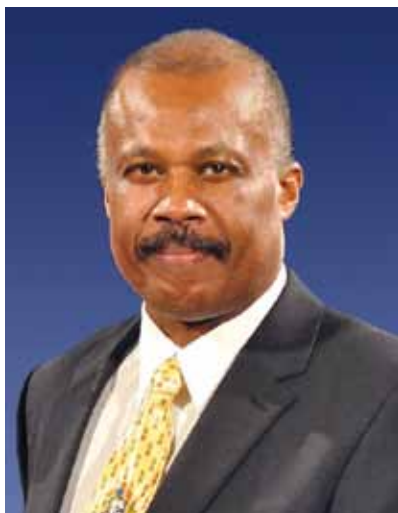
I am pleased to have been personally involved in the life of Barbados’ (GESS) exercise that began in 2009 with discussions with the United Nations Environment Programme Executive Director on Barbados’ green economy thrust. That dialogue was also placed in the context of Barbados’ engagement with other Caribbean Member States in shaping the international policy framework to promote Sustainable Consumption and Production.

Formal collaboration on green economy was thereafter crystallized in 2010 with Cabinet’s adoption of a formal partnership between the Government of Barbados and UNEP for Building a Resource-Efficient Green Economy in Barbados.

Beyond the GESS, the partnership was also responsible for convening the first Caribbean Green Economy Forum in March 2012. The latter included the formal hand over of the GESS Synthesis Report.

It would be remiss of me not to acknowledge the efforts of my Ministry, the University of the West Indies-Cave Hill Campus and the Green Economy Technical Steering Committee. I wish to offer heartfelt thanks to all those who played roles in this very important national exercise.

Looking forward, I commit my Ministry to work to the further elaboration of the GOB-UNEP partnership as well as to advance the environmental sustainability agenda in Barbados.



PROFESSOR HILARY BECKLES, K.A. PRO-VICE CHANCELLOR AND PRINCIPAL OF THE UNIVERSITY OF THE WEST INDIES, CAVE HILL CAMPUS

Barbados' developmental record since independence is remarkable, with a high level of human development, quality public services and a stable political climate. This record has been achieved despite its limited size, access to natural resources and opportunities for economic diversification. A green economy has the potential to reduce these limitations.

The University of the West Indies, Cave Hill Campus was therefore a very willing partner in this Green Economy Scoping Study, which focuses on the potential for 'greening' five key industries: tourism, agriculture, fisheries, building/housing and transportation. The analysis also addresses the cross-cutting issues of water, energy, waste and land-use. One of the features of the report is its integrated approach. All stakeholders were consulted during this study, which is as a result firmly grounded in their views. This should enhance the support for implementation.

The Cave Hill Campus was an ideal partner for this Green Economy Scoping Study. For some time now, The University of the West Indies has been at the vanguard in relation to issues of resource efficiency. Furthermore, given the important role of human resource development in enabling a green transition, The University of the West Indies has a critical role to play. This Green Economy Scoping Study report not only reflects The University of the West Indies' commitment to the Green Economy transition, but also the beginning of a fruitful partnership on this new path of sustainable development in Barbados and the Caribbean.



ACHIM STEINER

EXECUTIVE DIRECTOR OF THE UNITED NATIONS ENVIRONMENT PROGRAMME

The government and people of Barbados, a Caribbean island at the cutting edge of the fight against the impacts of climate change, and champions of UNEP's "Raise your Voice, not the Sea Level" campaign, are forging new pathways to sustainable economic growth.

As the world marks the International Year of Small Island Developing States (SIDS), renewed and sustained action is needed by the international community to urgently address the natural, economic and social challenges that climate change is placing on these countries.

Moving towards a green economy offers SIDS an opportunity to better adapt to the impacts of climate change, manage natural capital, protect fragile ecosystems, create green jobs and achieve sustainable development.

Home to 62.3 million people, the world's 52 SIDS are custodians of 30 per cent of the world's 50 largest exclusive economic zones and play an important role in protecting the oceans.

SIDS contribute little to climate change – emitting less than one per cent of global greenhouse gases. However, they suffer disproportionately from its effects due to their small size, remote locations and low economic resilience.

Many adaptation efforts are well underway in Barbados. Since it was first launched in the 1970s, the Barbados Solar Water Heater programme has netted between US\$ 133.5 and US\$ 137 million in energy savings through the installation of 40,000 solar water heaters.

Through a step-by-step approach, this timely Green Economy Scoping Study provides a practical roadmap for policymakers and businesses for the greening of Barbados' five key industries: tourism, agriculture, fisheries, building/housing and transportation. Its commitment and leadership to advancing a green economy provides a model for not only the Caribbean but for the world.

“Looking beyond the environmental benefits, green economy will also open business growth opportunities in areas such as energy services, water and waste management, low carbon transport and ‘clean’ technologies. Sustainability and green industries are expected to be among the most significant business growth sectors this century.”

**Mr Roger Blackman, Chairman of the Green Committee,
Barbados Chamber of Commerce & Industry**

Address during the Launch of the Government of Barbados – United Nations Environment
Programme Partnership for a Resource Efficient Green Economy in Barbados
and the Green Economy Scoping Study, 9 March 2011

THE GENESIS OF BARBADOS' GREEN
ECONOMY SCOPING STUDY

THE POTENTIAL FOR GREENING
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ANALYSIS OF ENABLING CONDITIONS
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EXECUTIVE SUMMARY



THE GENESIS OF BARBADOS' GREEN ECONOMY SCOPING STUDY

The inclusion of green policy objectives in Barbados can be traced to the National Strategic Plan (2006-2025) and the Budget Speech of 2007. The process was given further impetus in 2009 when the then Prime Minister laid down the challenge of committing Barbados to become the “most environmentally advanced green country in Latin America and the Caribbean”. It was against this backdrop that the government engaged the United Nations Environment Programme (UNEP) in the establishment of a partnership to support the country's transformation.

After an initial scoping mission, the government and UNEP commissioned a Green Economy Scoping Study (GESS), conducted in partnership with the University of the West Indies, Cave Hill Campus. The goals of the study were to consider the steps that would be necessary to move towards a greener economy and the resulting net benefits that might accrue. The project focused on five sectors – agriculture, fisheries, building/housing, transportation and tourism – and four cross-cutting issues: waste, water, energy and land. From its inception, an integrated approach to assessment was applied. One of the key actions of this process was the establishment of the Green Economy Technical Steering Committee (GETSC,) whose role was to undertake the technical oversight of the study. The Committee consisted of members of the technical team, government, NGOs and business. Data gathering involved consultations with key government agencies and stakeholders in the five sectors and four crosscutting issues. In addition, a series of technical seminars were held to facilitate the articulation of the requisite enabling environment.

TRANSFORMATION TO A GREEN ECONOMY

While green economy has been placed at the core of the Rio+20 Conference, the definition and

philosophical underpinnings of the concept is still the subject of a great deal of discussion. UNEP (2011e) defines a green economy as “one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities”. The definition seemingly harks back to the three pillars of sustainable development (environmental protection, social development and economic development) that were popularised by the Rio Earth Summit in 1992. Given this similarity, the Group of 77 and China saw no valid reason to abandon the concept. It is also unclear as to what constitutes ‘green’, with definitional difficulties arising in relation to green production and green jobs. In this regard, some commentators therefore suggest breaking the concept into a family of ideas surrounding a low carbon economy, a circular economy, sustainable consumption and production, green growth, sustainable development and Green New Deal.

In spite of the concerns raised in relation to the concept, the pursuit of a greener path to economic development is very attractive to Barbados, given its limitations in relation to size and dependence on fossil fuels. A green economy approach would give consideration to the level of available natural resources and ensure that they are used in a sustainable manner, as well as contribute to the maintenance and rehabilitation of important environments. While the island is a very small net contributor to global greenhouse gas emissions, the utilization of renewable energy and the promotion of energy efficiency would address vulnerabilities in relation to energy supplies and price.

In a green economy, land use policies would seek to prioritise uses that contribute to the maintenance of natural resources and ecosystem services. This approach to land use would be complemented with a green approach to the built environment and the adoption of alternative means of ground transportation. The green economy concept also complements several international and regional conventions as well as Multilateral Environmental Agreements (MEAs) that Barbados has ratified. At the national level, the Barbados Programme of Action (BPOA) also integrates some of the ideas at the heart of the green economy concept such as energy resources, tourism resources and management of wastes as well as coastal and marine resources.

More importantly, the island has advanced its own definition of a green economy that integrates many of the special challenges faced by small island developing states:

“an integrated production, distribution, consumption and waste assimilation system that, at its core, reflects the fragility of our small island ecosystems as the basis for natural resource protection policy intervention, business and investment choice, human development programming, and for the facilitation of export market development strategies”.

Notwithstanding, while the efficient management of our natural resources should remain a fundamental goal, the country’s transition to a green economy faces a daunting task as it addresses the challenges faced by small island developing states.

THE POTENTIAL FOR GREENING VARIOUS SECTORS

AGRICULTURE

Agriculture in Barbados is by and large dominated by the sugar cane industry, with production trends for most of the other non-sugar crops being erratic. The industry is dependent on water as a primary input into its production processes and, given the scale of agricultural activity worldwide, it is easy to see why it appropriates between 60 to 70 per cent of the world’s water resources. In an effort to conserve water and reduce input costs in the local industry, which has recorded a concomitant rise in the utilisation of this technology. However, there is a need to train farmers in relation to matching water application to growth stages and crop needs. Energy, on the other hand, is primarily used for the operation of irrigation systems, agricultural machinery/equipment and animal husbandry. Agriculture also produces waste material such as animal waste and waste from sugar processing, the disposal of which can be problematic in some cases (animal waste and waste from sugar processing). Land preparation and tillage practices in agriculture have impacts on groundwater recharge, surface water run-off and ponding/flooding, erosion and loss of topsoil.

It is envisioned that green policies to support agriculture would be characterised by increasing use of farming practices and technologies that

simultaneously enhance farm productivity, reduce negative externalities, and rebuild ecological resources such as soil, water, air, and biodiversity. Conventional farming practices, on the other hand, tend to have major negative impacts, including damage to soil structure, environmental damage, creation of potential health hazards in food, reduction in food quality and high use of energy. It also involves intensive animal production systems that are ethically unacceptable and generate exorbitant social costs.

Over the past two decades, the industry has benefitted from several initiatives aimed at enabling sustainable agricultural development. New legislation passed included the Fisheries Act, Plant Protection Act, Soil Conservation and Scotland District Act, among others. Incentives have been provided for returning idle land to cotton production, utilising efficient irrigation systems, implementing soil conservation measures and for underwriting the costs of obtaining organic farm certification and components for greenhouses and hydroponics, as well as numerous other areas. The results of the analysis done as part of this study suggest that the key critical challenges facing the sector relate to the lack of an acceptable level and quality of research and development infrastructure, inadequate



Small-scale agriculture plot. Photo: Travis Sinckler

financial capacity of regional and international institutions, and the problem of praedial larceny. To close the huge investment gaps identified, public and private sector investments in the critical areas identified should enable the sector to meet domestic demands for fresh produce (conventional and organic) and other value-added products, including packaged and graded produce along with processed mixed vegetables. Such investments would also increase exports, and provide greater support to the agro-processing industry. The results of this study also suggest that there is an urgent need to address related investment gaps in the following areas: access to capital for upgrading of technology, physical plant and animals; delays experienced due to manpower shortages in the Attorney General's Office with respect to upgrading of the regulatory framework to meet international standards; shortage of trained manpower in the sector; weak extension services; inadequate laboratory facilities for testing, research and development; inefficient marketing systems; and minimal technical capacity for planning by the Barbados Agricultural Society.

In relation to opportunities for growth, the greening of a restructured sugar cane industry is likely to reverse the negative outlook for this industry. While such a venture will require both public and private sector investment in infrastructure, training, research and development and marketing, green policies in support of a sugar cane industry would create an environment that recognizes and responds to the high average age of workers and the competitiveness of the industry. Other growth opportunities identified include the increased production of fertilizers, soil conditioners and animal feeds. Indeed, the adoption and promotion of organic agriculture would require the substitution of imported inorganic fertilizers and products with locally produced organic alternatives. Therefore, such a shift to organic farming, supported by locally produced fertilisers and agricultural products, would buttress economic growth in the local agricultural sector and contribute to poverty alleviation.

One of the government's major roles in relation to supporting the transition to a greener agricultural industry is in the area of policy implementation. Some effort should be made to harmonize public policy with respect to commerce and domestic production in agriculture. In addition, government support to facilitate the raising of capital from the private sector will be essential to ensure the success of this new direction in agriculture. The enforcement of measures to minimize the incidence of praedial larceny also needs to be tightened promptly.

The growth of a vibrant agricultural industry can lead to economic growth both within the agricultural sector and most other sectors of Barbados' economy. The sector plays a significant role in maintaining green spaces and the overall environment that visitors to the island expect of a tourist destination. Indeed, this has been one of the reasons advanced for the continued support provided to the sugar (cane) industry. Green policies to support agriculture also create avenues for growth in energy production and waste management. To support this growth, a comprehensive and integrated green agriculture development plan will be required.

FISHERIES

Fishing and fish have historically been an important part of the social and economic fabric of Barbados. These resources are often used to supply food, recreational opportunities, ecosystem services, jobs, income and tax revenues.

The fishing industry serves as an important social safety net, providing work for those unable to find other employment, and supplements the incomes of those employed in other activities. The total value of local fisheries was estimated at about US\$ 25 million in 2006 (Mahon et al., 2007), and includes both the ex-vessel value (the value of landed raw fish) and the on-shore value-added components such as deboning, filleting and processing into fish fingers and other convenience products. In terms of overall value, Flyingfish and Dolphinfinh account for more than 80 per cent of the total value of fisheries.

Fish processing, particularly fish harvesting operations, consumes significant quantities of energy, while the post-harvest process consumes large quantities of water resources. The island has more than 30 landing sites, with facilities of varying standards. These sites are usually categorized as primary (markets), secondary (sheds) or tertiary (beaches) based on the type of physical infrastructure or lack thereof. The majority of the country's catches are landed at seven primary sites: Bridgetown Public Market, Oistins Fish Market, Skeete's Bay Fish Market, Conset Bay Fish Market, Payne's Bay Fish Market, Weston Fish Market and Speightstown Fish Market.

It is envisioned that greening the fisheries industry would be based on the notion of sustainable fisheries, which implies resources that can be harvested to meet the needs of today's generation

without compromising the ability of future generations to harvest fish for their needs. Greening the fisheries sub-sector requires an ecosystem-based management of coastal, marine and socioecological systems that enhance livelihoods and well-being within the fishing industry and related marine economic sectors, while allowing individuals and communities to maintain their social and cultural heritage. Given that most Caribbean coastal resources are considered to be under stress from overexploitation, degradation of coastal and marine ecosystems, limited or poor management and climate change, the concept of greening fisheries holds significant potential for the region.



Managing small scale fisheries: a major sustainable development challenge in Barbados and other SIDS.
Photo: Robin Mahon

The institutional and governance framework for sustainable fisheries on the island is enshrined in the Barbados Fisheries Act of 1993, which was designed to manage and develop fisheries in Barbados. The main objective of this legislation is to ensure the optimal utilisation of fisheries resources in the waters of Barbados. Nevertheless, there are still numerous challenges in relation to greening fisheries, such as conservation of marine resources, capacity building, finance, communication and coordination among economic sectors, and collaboration in managing and developing transboundary marine resources. The results from the analysis conducted in this study suggest that greater investment in institutional

strengthening, development of standards for the industry and eco-labelling would be required to address the outlined challenges.

There are also opportunities for greening fisheries in relation to the greater utilisation of clean technologies, processing fish offal into high value added products and the use of Dolphinfish skin as fish leather. In this regard, water conservation measures are currently being implemented at the fish markets following a directive from Cabinet to install infrared sensors on taps at the processing bay at the Bridgetown Public Market and other markets across the island. This is particularly important in promoting economic efficiency in operations by reducing water utility costs. In terms of waste, the Bridgetown Public Market, the island's largest, produces about two to three tonnes of fish offal daily. Fish offal has tremendous potential as a fertiliser, compost or dried and made into pellets for feed. The Barbados poultry industry already has the technology to convert its waste into a commercial asset, so it is possible for the fishing industry to follow suit as long as they receive the necessary technical assistance and funding required to recycle its waste into viable products.

Greening the post-harvest fisheries sub-sector and implementing best practices will have no economic impact on the industry if the resource base and its ecosystem are not properly managed and protected. In this regard, the control of entry into fisheries (additions to the island's fishing fleet) to achieve sustainable levels of harvest must be considered, as well as the establishment of a marine management agency and a code of conduct for responsible fishing should both be given priority.

In addition, consideration must be given to the complexity of the Caribbean region and the fact that most resources, exploited and non-exploited, are shared across different marine jurisdictions and resource-use regimes. Although few marine boundaries have been negotiated, it is clear that there must be considerable discussion and collaboration among people from the various territories on issues that cross jurisdictions due to close geographical proximity. Furthermore, there must be a collective recognition that greening fisheries, particularly the ecological and harvesting aspects, is a transboundary matter, even if certain aspects are undertaken as a national initiative.

BUILDING/HOUSING

The building or construction industry is a major contributor to the country's economic growth and development. The total value-added of the industry in 2010 was US\$ 185.5 million or about 5 per cent of GDP. In addition, it employs about 15,000 persons, almost 2,000 more than tourism, Barbados' main industry. Over the years, there has been an expansion of the built environment through the construction of transportation infrastructure along with private and public buildings. Urban residential housing is located within a continuous linear coastal urban corridor that extends along the entire length of the west and south coasts. Traditionally, most people lived in wooden and chattel houses, which was estimated to be 73 per cent in 1970. This ratio, however, has fallen dramatically in recent years due to rising standards of living. In 2000, when the most recent estimate was made, 45 per cent of houses were made entirely of concrete blocks.

The construction of commercial and residential buildings puts a strain on natural and human resources through energy use, land use, removal of natural materials, transport of construction materials, liquid and solid waste generation, poor utilisation and recycling of building materials, and use of hazardous building materials. In 2009, the single largest category of electricity consumers was residential users, accounting for 32 per cent of total sales or 306.6 million kWh. The country, however, has an enviable record in relation to the penetration of solar water heaters, with an estimated 40,000 systems in operation, 75 per cent of which are in residential use. The island is divided into five water protection areas, with Zone 1, which is closest to the production wells and has the most stringent restrictions on development activities, and Zone 5, which is farthest and has the least restrictions.

Protection of the country's water resources is undertaken by the Town and Country Development Planning Office through enforcement of development restrictions, with support given by the Environmental Protection Department and the Barbados Water Authority. Development on the island is guided by the Physical Development Plan, which matches the demand for land to the island's development objectives.

Green policies that support building offer the possibility of improving resource efficiency, reducing waste and the use of toxic substances, and enhancing water efficiency and sustainable



Traditional accommodation on the east coast of Barbados.
Photo: Anne Gonzalez

site development. It also offers the possibility of raising the consciousness of both practitioners in the construction industry and homeowners, thus allowing them to use more green materials when building, as well as the opportunity of experiencing an overall improvement in indoor environmental quality. Most stakeholders in the industry have a strong desire to realise the potential social and financial benefits from improved quality in community living, increased cost savings accruing from greater efficiency in energy usage, and from energy efficient building design and construction.

The constraints in relation to greening the industry have not changed since Barbados' First National Communication on Climate Change was presented to the United Nations Framework Convention on Climate Change in 2001. Then, the challenges to the implementation of renewable technologies were listed as follows: lack of financial and economic resources, lack of awareness of newer technologies, higher local operational costs of newer technologies, the non-inclusion of environmental costs when considering the extent of reliance upon and use of fossil fuels, and lack of training and regional expertise in newer technologies. Today, two other challenges have surfaced, namely: the perception by industry managers that low-cost housing is in direct conflict with sustainable housing, and cultural preferences for the detached housing unit, which hinders the design and sale of alternative dwelling arrangements that would contribute to land conservation.

To address these challenges, stakeholders felt that training programmes to further enhance the expertise of local building professionals (architects,

engineers and contractors) should be developed, and an overarching policy framework be formulated. In addition, it was also felt that greater efforts should be directed towards educating the public on the various greening incentives (i.e. provisions in the Income Tax Act) and grants (i.e. by the Energy Division) that are already available because they could contribute positively to achieving the green economy objectives in the building/housing sector. Furthermore, stakeholders noted that the country has a good contingency of building professionals whose expertise should be enhanced through retraining and technology transfers in order to improve the built environment and quality of new housing stock. It was also indicated that the building code should be updated to include high-rise housing, and calls were made for private lending agencies to play their part by approving or underwriting loans that contain an elevated element of environmental risk.

Greening construction not only has environmental benefits, but it also helps to improve employee productivity and work quality as well as public health, in general, along with decreasing air and noise pollutants. In this regard, four key opportunities for greening the industry were identified: 1) conversion of derelict sugar factories into waste-to-energy plants, 2) education and technology, 3) government provisions and subventions, and 4) recycling communities. Community-based recycling programmes, in particular, encourage reuse of construction and other forms of waste and could lead to growth and savings. In the process of the green transition, there is the potential for green jobs in areas of retrofitting, lighting, sales and maintenance of efficient appliances, and the provision and use of low energy construction materials in a sustainable building/housing industry.

The country, however, requires a parallel strategy and policy for on-going education, outreach and information sharing in order to encourage behavioural change. Given the island's high literacy rate, such a strategy would be highly effective. The launch of private-public sector building projects that integrate environmental and social benefits into their housing/building solutions would result in efficiency gains in natural resource usage, lower waste production and the creation of a healthier indoor environment. In 2010, the Urban Development Commission (UDC) launched a "Go Green" community project that was well received by community residents. While this project was largely focused on beautification, it could be scaled up to include the green building/housing principles highlighted in this study.

TRANSPORTATION

Barbados' road network consists of more than 1,600 km of public paved roads, two active main ports (Bridgetown Port and Port St. Charles) and one airport (Grantley Adams International Airport). Statistical data from the Barbados Licensing Authority reveals that in 2009, the number of vehicles on the island numbered 131,680, which implies that there is approximately 1 vehicle for every two persons on the island. The main causes of air pollution are fuel mixes used by some vehicles and the absence of equipment to enforce a national air emissions standard. Noise pollution by vehicles is also a matter of concern but, as with air quality, enforcement of a national standard is being stymied. The Environmental Protection Department, the official department responsible for setting national standards to mitigate air and noise pollution, relies on standards produced by international organizations, but its work lacks efficacy for the reasons stated. There are three types of operators involved in public transport on the island, of which two are privately owned. The sector is characterised by low levels of service and congestion.

Greening the transport sector should address existing issues in relation to emissions without harming economic activity. Green policies that support transportation should integrate a sustainable transportation policy into the overall



Public transport in Barbados. Photo: Anne Gonzalez

planning process for the sector, and could include the following measures and actions: reduction of private vehicles as the main mode of transport; promotion and improvement of existing public transport; introduction of mode switching; utilisation of existing vehicular infrastructure; building of comprehensive infrastructure for pedestrians and cyclists; reduction of vehicle emissions through enforcement of standards and by facilitating the switch to greener vehicles; and contribution to the development of guidelines for the recycling, recovery and reuse of old vehicles and their components.

The main challenges identified in relation to the transportation vision outlined above include traffic congestion, high fuel costs, public attitudes to green initiatives, lack of investment and inadequate human resource capacity. The retraining and retooling of workers to take up jobs in retrofitting and maintaining greener vehicles would involve technology transfer and capital expenditure. The vulnerability of the transportation system is another challenge and is heightened by the reality that the two main coastal highways are barely above sea level. To address these challenges, therefore, further investment would be required in the areas of air and noise pollution standards, traffic management, mode mixing, disaster management and climate change adaptation. It is believed that the provision of fiscal incentives and development of public-private partnerships within the transportation sector would contribute significantly to the successful realisation of the espoused vision.

Another opportunity to green transportation presents itself through the pursuit of an integrated transportation strategy, an approach that takes into account all the contributing elements to increase effectiveness. For instance, in order to reduce the number of vehicles on the road, there will be a need to enhance the quality and quantity of public transport. The result would be a greater utilisation of public transport, which will, in turn, reduce traffic congestion and the costs of the country's fuel imports. Furthermore, since fuel mixes impact engine performance and, concomitantly, fuel efficiency, there is a potential to set standards for fuels that focus not just on environmental standards but also on quality and performance. Congestion within Bridgetown is also caused by on-street parking due to limited off-street parking facilities. In this regard, a system of on-street parking charges and regularisation of length-of-stay in authorised parking areas should be considered as measures to address the problem as well as to finance initiatives to green the transportation industry.

It is anticipated that opportunities in Barbados for green jobs would revolve, primarily, around the sale and maintenance of fuel-efficient vehicles, and the management of integrated public transportation systems. A more specific analysis is limited by the absence of detailed studies that point to the most appropriate mix of green modes of transport for the Barbadian context. In relation to road construction activity, the construction and demolition waste generated can be used to reclaim quarries and/or be reused in the construction process, itself.

The transportation sector, as considered, consists of various forms of transport (e.g., private and public vehicles, cars and lorries) as well as roads and highways, trails, sidewalks and the fuels consumed by motorised vehicles. The introduction of green approaches would yield, among others, environmental benefits associated with a lower level of emissions and discharge of fewer toxic contaminants into the atmosphere than as obtains with the current reliance on gasoline and diesel vehicles. It is anticipated, therefore, that the use of alternative fuel vehicles would reduce negative impacts on air quality, the environment, public health and the economy as a whole, and would increase Barbados' contribution to the reduction of global warming.

TOURISM

Barbados is one of the more mature Caribbean tourist destinations, with large-scale tourism dating back to the late 50's and early 60's. Over the years, the various entities specifically responsible for tourism product development, the Ministry of Tourism (MOT) and the Barbados Tourism Authority (BTA), have worked tirelessly to diversify the product by creating more competitive niche offerings, such as sports tourism, heritage tourism, gastronomic tourism and, more recently, health and wellness tourism. Total visitor expenditure in 2010 was estimated at US\$ 1.2 billion and was about 6.3 per cent higher than in 2009. The average daily expenditure of stay-over visitors from the UK and other European countries tends to be higher than that of tourists from any other region. Hotels supply most of the accommodation available on the island, but current average occupancy rates tend to be low (about 56 per cent).

The tourism industry tends to have a significant negative impact on a country's resources, environment, economy, people and society, particularly in small states. The main impacts are pollution, depletion of natural resources, soil

erosion, displacement of residents, inflation, excessive foreign ownership accompanied by foreign exchange leakages, loss of culture, cultural commodification, and extensive changes in societal norms. Barbados' tourism products are also highly energy intensive since most rooms are air-conditioned and many of the other amenities provided are driven by electricity. Domestically, the industry consumes about 17 per cent of the total electricity generated on the island, almost as much as commercial activities, and much larger than the needs of the manufacturing industry. In addition, aircraft which operate on long-haul flights that bring most tourists to the island from the United Kingdom, the United States or Canada need to be refuelled. Furthermore, water consumption in hotels is determined as much by the amenities offered and the market it operates in as by its occupancy rate. The use of water in the accommodation sector is also highly correlated to the volume of wastewater it generates. Notwithstanding, it has also been shown that factors such as the level of awareness of staff and management about resource management and use efficiency are important to the reduction of wastage, generally. Hotels are significant producers of solid waste and, as a consequence, require regular municipal waste services. A portion of the waste is of an organic nature and other portions of it are potentially recyclable or recoverable.

Greening tourism is largely focussed on integrated planning and management, but is very concerned about inter and intra-generational equity, and acknowledges that there are limits to the environment, economy and society, which, if breached, can have serious detrimental consequences. The Caribbean Regional Sustainable Tourism Development Programme (CRSTDP) developed a Regional Framework for a more Sustainable Tourism Development in the Caribbean in 2007. This policy framework has six thematic areas – tourism management capacity; marketing; transportation; the environment; linkages with other economic sectors; and health, safety and security. Given the inherent vulnerability of the tourism product in small island states, a green approach to tourism development holds significant potential in relation to sustainable development.

Barbados has a number of inherent strengths that can be built upon in order to pursue a green growth strategy. Indeed, the island was ranked 30th out of 133 countries on the global competitiveness index and 2nd in terms of the attitude of its population towards tourism. It should also be noted that heritage and community-based tourism hold

significant potential. The island has resources dating back several centuries that can be readily packaged as facets of the country's heritage for visitors to the island. The exploitation of these strengths is, however, dependent on the country addressing a number of challenges in relation to greening the industry. One of the main challenges is the low occupancy rate that characterises the industry. These low rates reduce profitability and limit the ability of the industry to finance green initiatives. In addition, the dynamism in the external tourism market with which the local industry competes and the cost of inputs, present a challenge to the future development of the country's tourism industry. Furthermore, access to tourism statistics, a necessary input for both planning and budgetary allocations, is still relatively limited because data collection is largely underdeveloped.

Investments in sustainable tourism solutions can contribute significantly to transforming national and regional economies to green economies. One important investment gap urgently requiring closure is in the area of reducing dependence on imports, in particular, food, manufactures, labour and technology. The creation of business models for sustainable agro-tourism and the adoption of internationally recognised production standards for agricultural products, are equally critical. Moreover, the region faces risks of higher fuel prices and green taxes that originate in source markets.

Undoubtedly, the greening of tourism is likely to be one of the key strategies used in the future to



Heritage Tourism – George Washington house. Photo: Dave Quan/Inkstone Design/Calgary Canada

ensure the future sustainability of the industry. Identified opportunities in this area include marketing Barbados as a green destination, development of heritage tourism sites, building relationships between the tourism industry and firms providing inputs, development of agro-tourism products and the creation of marine protected areas. In relation to heritage tourism, the Barbados Sugar Trail Tour and the Defence of Barbados Tour are products that can be easily marketed and that can yield significant growth benefits. In addition to the island's heritage potential, its rugged coastline, spectacular views and unique plant and wildlife hold some potential for further nature-based tourism development through the development of hiking trails around these resources. The country also needs to ensure that its already existing nature-based tourism products (Harrison's Cave, Graeme Hall Nature Sanctuary and the Folkestone Park and Marine Reserve) are maintained and enhanced.

The opportunities for hotels to improve their resource use efficiency are well articulated and many of the strategies have proven to be cost-effective with short payback periods. The approaches include: carrying out a resource and energy use audit to identify potential areas for savings; organizational change in the importance and support for carrying out audits and setting objectives, implementing recommendations, and monitoring and reporting on progress; behavioural change in the way the use of resources are regarded by management and staff through training, encouragement and team building; and technological change that allows the introduction of resource efficient equipment, fixtures and fittings, and the search for ways in which operations can be reconfigured to maximise resource use.

Tourism, since the 1970s, has been a key driver of economic growth in Barbados. The potential advantages of pursuing a green growth strategy in tourism can enhance the long-term sustainability of the industry as well as act as a catalyst for the adoption of green processes and practices in supporting other related industries. For example, the continued development of green hotels could add further impetus to the adoption of organic farming practices on the island to supply the needs of these hotels. In addition, green transportation and building practices must be adopted if the country is to differentiate its product from traditional mass-market tourism. This process has already started. However, there is a need to further enhance the enabling conditions in order to promote continual growth in this area.

ANALYSIS OF ENABLING CONDITIONS FOR A TRANSITION TO A GREEN ECONOMY

FINANCE

One of the most important aspects of the emergence of green economy will be the exploitation of existing financing schemes and the development and adoption of new approaches to finance green investments. During stakeholder discussions, it was recommended that consideration be given to a series of projects that consider the construction of green communities. The idea was also floated that resource use fees, which attempt to capture some of the willingness-to-pay of the users of protected areas, should also be given consideration. Given the potential that Barbados has in relation to heritage, community and nature-based tourism, these fees could be a useful means of financing other green initiatives throughout the entire economy.

DEVELOPMENT, ACCESS AND TRANSFER OF CLEAN TECHNOLOGY

For technology transfer to take place, issues related to intellectual property will need to be confronted on an ongoing basis. The country already has fairly comprehensive legislation in relation to the protection of intellectual property, is itself in compliance with the WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), and is a signatory to numerous other treaties relating to intellectual property. The main challenge to technology transfer is that existing industrial standards are not strong enough to encourage firms to adopt cleaner technology upgrades. Consequently, the demand is great for legislation to be drafted and enacted to support clean technology transitions and partnerships. In addition, there are also opportunities in relation to the creation of rainwater harvesting and wastewater



Promoting macroeconomic stability through sound monetary policy – The Central Bank of Barbados.
Photos: Central Bank: Creative Commons/Winston Edghill; Coin: Creative Commons/Mark Morgan; Bill: Creative Commons/AJBurgess

treatment systems, and the removal of barriers to their adoption would facilitate the transfer of clean technology.

TRADE, TARIFFS AND INVESTMENT

Trade is an important part of Barbados' economy; it contributes more than 96 per cent of GDP. The use of trade policy to hasten the transition to a greener economy and to elicit behavioural change holds significant potential. Traditionally, the country has tended to focus on green trade liberalisation (resource efficient goods usually attract duty-free access or reduced tariffs) rather than punitive tariffs. If trade policy is used to facilitate a green transition, it will have to be consistent with the country's commitments to CARICOM and the high upfront cost of upgrading, despite duty-free access. For this reason, stakeholders, during consultations, recommended that Barbados consider the possibility of trading in carbon credits and the continued use of lower tariffs or duty-free access for resource efficient products.

TAXATION, INCENTIVES AND FISCAL REFORM

The use of green fiscal policies is another demand-side tool that can be used to elicit behavioural change and facilitate a green transitioning. UNEP has identified five broad fiscal policy options:

environmental taxes, pollution charges, green subsidies, elimination of environmentally harmful subsidies and public expenditure on infrastructure. The country's fiscal regime has focussed largely on environmental taxes and green subsidies. For seven years, Barbados has had fiscal incentives supporting renewable energy initiatives under the Fiscal Incentive Act, while, under the Income Tax Act, taxpayers were encouraged to purchase 'green' devices as such expenditures were made deductible for tax purposes. Further initiatives were introduced in 2007 in relation to green homes, composting and recycling while the 2011 Financial Statement and Budgetary Proposals outlined an even wider array of incentives for renewable energy and energy efficiency.

Nevertheless, the existence of these incentives is unlikely to impact on consumer behaviour unless they are aware that they exist. Indeed, stakeholders identified publicising the availability of tax incentives as a key challenge. The take-up rate for energy efficient technologies might also be hindered by the relatively large upfront costs which act as a constraint on the number of persons able to make the investment. Rather than more incentives, fiscal reform should now focus on efficiency and increasing access. For example, it should be a requirement for access to government incentives that applicants demonstrate that theirs is a sound case for support. In order to encourage the reuse and refurbishment of existing buildings, especially those of some historic, cultural or aesthetic value, consideration must be given to launching a revolving fund rather than developing greenfield sites. This initiative could be coupled with a greenfield tax

scheme to support the fund. While new taxes are a controversial issue, many states have introduced green taxes to elicit behavioural change, on the one hand, and finance the transition to a green economy, on the other. In Barbados, excises on motor fuel use were recently increased, but exemptions still remain. It was estimated that the introduction of a new tax or a further increase in the excise tax to bring the price of fuel in line with that in the UK would net an additional US\$ 45 million.

EDUCATION, TRAINING AND CAPACITY ENHANCEMENT

Investment in training and education helps smooth the transition to a green economy and also allows the population to exploit its potential benefits. During discussions with stakeholders, it was noted that there is a significant gap between the awareness and the availability of requisite skills and expertise to meet the needs of green economy. Undoubtedly, there is a need for investment in the labour force to support its acquisition of pertinent skills. In some areas, this process has already begun: Experts are currently teaching solar PV installation courses and renewable energy modules are being offered by UWI. Notwithstanding, there are other gaps in important sectors that were identified which still need to be addressed – agro-industry, agriculture and fisheries. Moreover, professionals that possess the understanding of sustainable principles and the knowledge to apply them to new projects are still in short supply in the housing and building industry. In general, there will be a need for a variety of knowledgeable technicians, engineers and skilled tradesmen.

STANDARDS AND REGULATION

Consumer demand for new technologies is partially dependent on reliability of the technology and the after-sale service. In this regard, standardisation provides consumers with confidence in relation to what are, sometimes, large upfront investments. The Barbados National Standards Institute (BNSI) is currently drafting standards in relation to various green technologies such as solar heating systems, methods for the thermal testing of solar collectors, energy management systems and energy labelling

of products. Through the CROSQ/IDB-MIF project, a project to promote small and medium enterprise competitiveness in the Caribbean through technical standards, and which is financed in part by non-reimbursable funds allocated by the Multilateral Investment Fund (MIF) through its Technical Cooperation Facility with the Inter-American Development Bank (IDB) along with counterpart funding by the CARICOM Regional Organisation for Standards and Quality (CROSQ), BNSI is seeking to enhance the competitiveness of enterprises through standardisation. Moreover, many hotels have already obtained Green Globe Certification, while major manufacturers have obtained various ISO certifications.

Nonetheless, the benefits of standardisation could be limited by Barbados' capacity to enforce these technical standards. For example, implementing a green building code and regulating the operation of wastewater treatment plants, and the market for reused and recycled products will all require enforcement. This would require the testing of standards, facilities and diagnostic capabilities in place, and meaningful legislative support.

GOVERNMENT PROCUREMENT

With a budget of about 20 per cent of GDP, the government is by far the single largest purchaser of goods and services on the island. This therefore implies that the government can, through its procurement policy, act as a catalyst for change. In this regard, steps have already been taken to modernise the Central Purchasing Department and enhance the procurement process. In addition, there is a Public Sector Energy Conservation Programme (begun in 2006) that mandates an increase in the fuel efficiency of public sector vehicles, the installation of energy efficient lighting and appliances, and energy audits.

Going forward, one of the main challenges to the pursuit of a green procurement policy is the use of the least-cost approach to procurement. Since some green technologies are relatively more expensive, this would imply that they would always lose out to less resource efficient technologies. A further challenge is that procurement is usually seen as simply an administrative function, which limits the utilisation of more technical approaches. A green approach to procurement will also require addressing issues in relation to governance mechanisms.

CONSIDERATIONS FOR A GREEN ECONOMY POLICY ROADMAP

A green economy offers hope for further diversifying Barbados' economy, increasing resource efficiency and supporting the goal of sustainable development. Based on the analysis provided in this report, there exists tremendous potential for greening agriculture, fisheries, building/housing, transportation and tourism. To exploit these potential opportunities, the island will need to address various sector specific challenges. Given the importance of the above-mentioned sectors and the already existing legislation that supports behavioural change by consumers, it is likely that there could be spillover effects to other industries in the economy. In the 1950s and 1960s, Barbados embarked on a plan to diversify its economy away from sugar towards tourism. This vision resulted in the transformation of the island and provided its citizens a relatively comfortable standard of living. A green economy portends a similar such moment in history, whereby the country can enable the next great economic transformation that benefits both current and future generations.

Based on the sectoral recommendations and the enabling conditions articulated above, the following considerations are offered for the development of a strategic roadmap to Barbados achieving an environmentally advanced green economy (cf. Conclusions for a more detailed presentation of the roadmap):

1. Establishment of a set of operational principles as the basis for policy development, education, monitoring and evaluation;
2. Granting umbrella responsibility to the Social Partnership for monitoring, reviewing and reporting on Barbados' green economy roadmap, supported by a GETSC and a research secretariat;
3. Drafting and enactment of legislation on environmental management, water reuse, groundwater provisions and solid waste management, and the incorporation of 'green policies' in the building code along with strengthening of the policy guidelines in the Physical Development Plan;
4. Greater public sector leadership via support for innovative projects and green procurement policies; Support for private sector initiatives that advance the country's green economy transition;
5. Implementation of a public education campaign that promotes green economy;
6. Enhancement of partnerships with stakeholders and international partners (e.g., FAO/UNEP Agri-food Task Force on Sustainable Consumption and Production, Partnership for Clean Fuels, UNEP Global Partnership for Sustainable Tourism, UNEP Sustainable Building and Climate Initiative, Marrakech Task Force on Sustainable Public Procurement, and the Partnership for Education and Research about Responsible Living);
7. Development of a system of indicators that allows for the monitoring and evaluation of green economic policies and broader developmental goals;
8. Promotion of Barbados' success in relation to greening the economy through the publication and dissemination of best practice examples;
9. Building of capacity in appropriate skills and knowledge that supports the green economy transition; and
10. Making use of the science-policy platform, as reflected in the GESS, to conduct further research that supports sustainable development and green economy priorities.



A greener path. Photo: Travis Sinckler

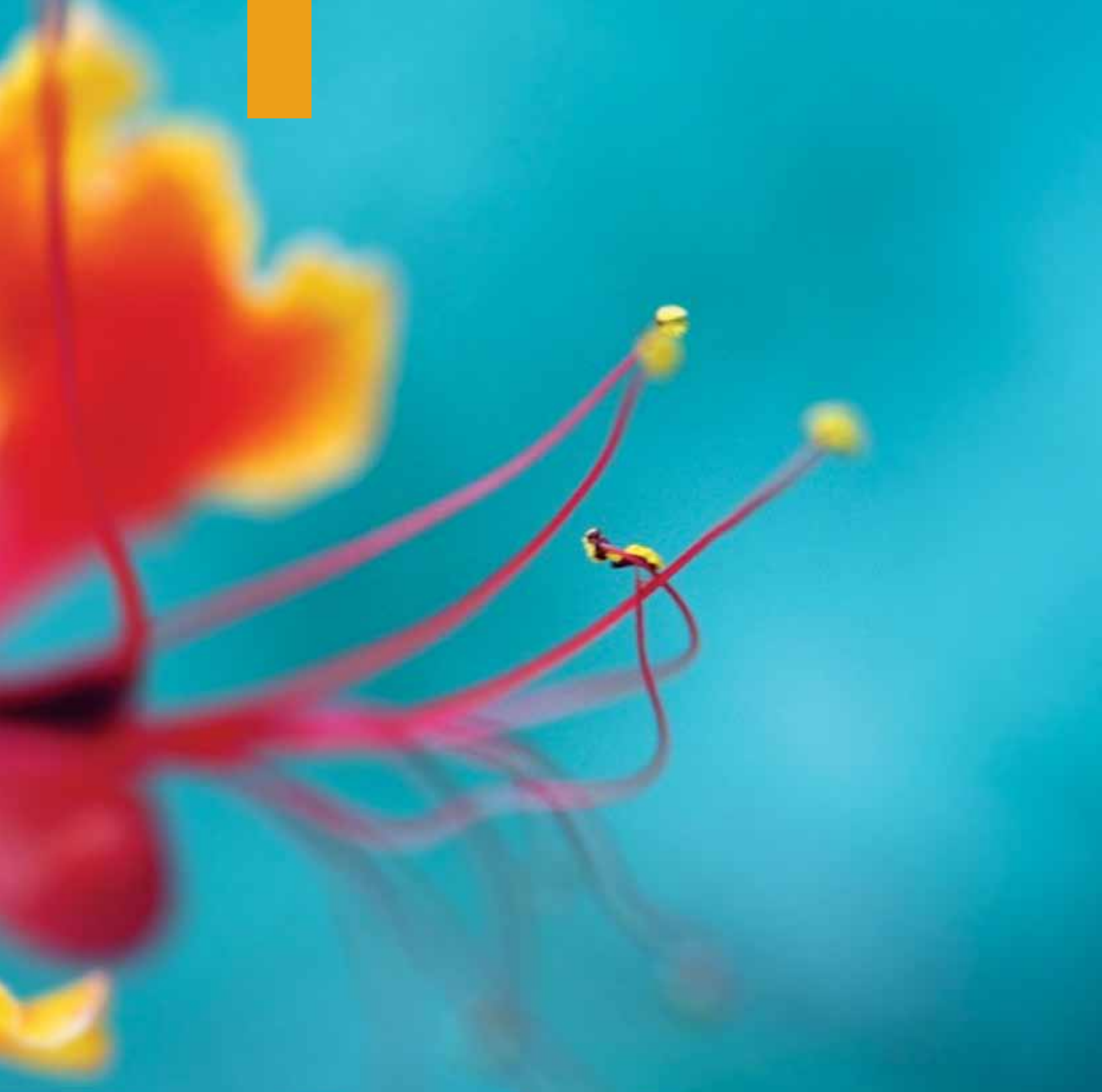
1.1 BARBADOS – COUNTRY PROFILE

1.2 BARBADOS' GREEN ECONOMY SCOPING STUDY



1

INTRODUCTION



1.1.1 GEOGRAPHY AND DEMOGRAPHY

Barbados, the most easterly of the islands of the Lesser Antilles, is a small island developing state of area 431 km², located in the Caribbean at 13° 4' north latitude and 59° 37' west longitude. It is bordered by the Caribbean Sea on the west coast and the Atlantic Ocean on the east, and has a total coastline length of 97 km, with an exclusive economic zone of about 167, 000 km². Barbados has been likened to a 'ham bone' in shape, with a broader mass at the south that tapers towards the north. The island is divided into eleven (11) parishes. Barbados has an estimated population of 272,000 persons making it one of the most densely populated countries in the Western Hemisphere.

Of all of the islands that comprise the Lesser Antillean chain, Barbados is the only entirely non-volcanic, sedimentary rock island. The rocks underlying Barbados consist of sedimentary deposits, including thick shales, clays, sands, and conglomerates, laid down approximately 70 million years ago. Above these rocks are chalky deposits, which were capped with coral before the island rose to the surface.

The topography of Barbados is marked by a complex series of gullies running mainly from the higher, eastern portion of the island to the west coast. These gullies are giant cracks in the limestone cap of the island, which act as conduits of recharge of rainfall to the limestone aquifer, and transport water via underground streams to discharge into the sea at the west coast. These ground water streams are the main source of the domestic water supply. There are no major rivers or lakes on Barbados and only a few streams, springs, and ponds, the very existence of which is often contingent upon level of annual seasonal rainfall.

The highest point on the island is Mount Hillaby, standing at 340 meters above sea level. The rest of the island is low-lying. The majority of the island's population resides within the so-called 'urban corridor', a narrow zone along the west and southwest coasts within two kilometres of the shore, which is below the 25-meter contour line.



Satellite image of Barbados. Source: <http://eol.jsc.nasa.gov>

Barbados has mainly residual soils, including clays, which are rich in lime and phosphates. Soil type varies with altitude: thin black soils occurring on the coastal plains, and the more fertile yellow/brown or red soils being found predominantly in the highest parts of the island, where the coral limestone cap has cracked to reveal the mixed sediments below.

Barbados enjoys a tropical, oceanic climate with an average temperature of 26.8°C. Despite the fact that there are no drastic changes in either seasonal or daily temperatures, it is noteworthy that there appears to have been a general increase in the recorded air temperature over the last forty years or so, by perhaps 0.5 to 1.0°C. Weather seasons can be classified as either wet or dry. The wet season coincides with the Atlantic hurricane season and runs from June to November. The wettest month is October with an average rainfall of approximately 168.4 mm (6.63 in). The dry season lasts from December to May, the driest month being March, with an average rainfall of approximately 39 mm.

The island is affected by a number of weather systems during the year. During the wet months, most of the rainfall is derived from tropical waves

moving across the Atlantic Ocean, along with the Inter-Tropical Convergence Zone (I.T.C.Z.), which shifts northwards on occasions, especially during the passage of tropical waves.

In addition to the above, heavy showers and thunderstorms sometimes develop, mostly over central and western areas, when strong daytime heating, along with light winds and an abundance of moisture, are present. This type of weather is more prevalent during the summer months, and leads to flash flood conditions over low-lying areas sometimes resulting in damage to roof tops, downed trees and electricity poles, damage to roads, erosion of soil from agricultural land and coastal erosion.

The last hurricane to hit Barbados directly was Hurricane Janet in 1955. Since then, Barbados has not received any direct hits from any major storm systems.

The island has one of the lowest population growth rates in the world, largely attributed to the level of economic development and a family planning programme that has been in place since the 1950s. The mid-year population estimate for Barbados in 2011 was 286,705 with a population growth rate of 0.3 per cent. The sex ratio for the total population was 0.94 male(s)/female and 1.013 male(s)/female at birth. As a reflection of the aging population, the proportion of the population under 15 years old has declined from 21.5 per cent of the population in 2000 to 18.9 per cent in 2011. The trends in population aging being experienced by the island is likely to continue in the future as fertility rates are likely to remain low and life expectancy, currently estimated at 74 years, to rise.

If the recent rate of population growth is maintained, then Barbados' population size will be just below 300,000 persons in 2025. Added to this figure, however, is the annual inflow of tourists to the island. While tourism may help the country achieve its developmental objectives, tourist activity can also affect the environment (for example, through waste generation and infrastructural damage), particularly if concentrated in one period and at one focal point. The Medium-Term Strategy of Barbados (GOB, 2010b) projects that by 2014, long-stay tourist arrivals in the island will be about 626,000 in comparison to 568,873 in 2010. It is therefore useful to compute the total population of Barbados including tourists.

The yearly resident equivalent of the tourist population (long-stay and cruise visitors) was derived using the approach outlined by de Albuquerque and

McElroy (1999). The converted tourist population added to local population gives rise to what is called the resident equivalent population. The new trend using the resident equivalent population gives an implied population growth rate of 0.4 per cent, with the projected population in 2025 is just above 300,000 persons (308,054 persons). This projected outcome when compared to that using the Barbadian population alone (residential equivalent rate of growth versus national residential rate of growth) indicates a likely additional population impact of about 8,000 persons on the environment and ecosystems over and above that resulting from actual population growth.

Although the current carrying capacity of the country's ecosystems is not known, the trend computed above, taking tourist arrivals into account, provides us with some idea about the relative sustainability of Barbados' population growth rate. Indeed, a casual observation seems to indicate that the actual population growth rate trend seems a reasonable fit for the country's economic and social development. Indeed, the fact that the stable population growth rate has not jeopardized the development status of Barbados in the context of the Human Development Index (HDI) rankings seems to confirm that point. It should be noted, though, that the HDI does not capture the environmental aspects of development.

Since population affects the environment and the pace of development, there is a need for a clear formulation of population policy. However, this needs to be placed in the context of the medium-term demographic population projections that suggest that total population will peak around 2030 (UNDESA, 2010). Nonetheless, some progress has been made in terms of immigration policy, but this must not be perceived as a substitute for an overall or full population policy which needs to be devised. Successive administrations have unswervingly placed an emphasis on the education of Barbadian citizens. Government support for education is essentially fully subsidised from the primary to the tertiary level and so education expenditures are one of the largest categories of government's annual budget. As a result, the literacy rate in the island (99 per cent) is one of the highest in the region.

Governance

Barbados has a relatively stable political climate with general elections constitutionally due every five years. The Westminster-style parliament is one of the oldest in the Western Hemisphere, being in existence for 369 years. It should be noted, however,

that under the practice of parliamentary democracy, elections could take place within a five-year period.

As a former colony of the United Kingdom, the island has retained The Monarch as the head of state, represented on the island by the Governor General. The government is headed by the Prime Minister, who is the leader of the party holding the majority of parliamentary seats. The legislative branch of government is made up of two houses; an elected House of Assembly (Parliament) and an unelected Senate (chosen by the Governor General on the advice of the Prime Minister and the Leader of the Opposition). The executive branch of the government constitutes the Prime Minister and the 21-member Cabinet. The judicial branch, the Supreme Court of Judicature, oversees the court system.

1.1.2 ECOSYSTEM SERVICES

The economy and quality of life in Barbados are largely dependent on the capacity of its terrestrial and marine ecosystems to continue to provide ecosystem services. Ecosystem services (TEEB, 2009) take many forms: provisioning from natural systems (seafood, wood and plants from gully ecosystems) and altered agro-ecosystems; seashore protection services of reefs and coastal vegetation; sand generation by reefs; non-extractive use services that support income generating activities such as snorkelling, SCUBA diving, hiking and sightseeing; and, finally, the creation of opportunities for recreation, a critical component of human well-being, that is afforded Barbadians through healthy terrestrial and marine ecosystems.

Some of the ecosystems upon which we depend are in good condition. In these cases their conservation must be ensured. In other cases, ecosystems are degraded and their rehabilitation must be a priority. Attention to ecosystem rehabilitation and conservation must be the foundation of any green economy initiative.

Ecosystem rehabilitation and conservation require a broad-based, long-term, comprehensive approach. The various national development plans such as the National Strategic Plan (GOB, 2006) and the Medium-Term Development Strategy, provide considerable insight Barbados' approach to address ecosystem management. In fact, there have been deliberate systematic planning efforts undertaken



Green monkey (*Cercopithecus aethiops*). Photo: Dave Quan/ Inkstone Design/Calgary Canada

to mainstream a comprehensive ecosystem approach to development- the most recent being the Environmental Management and Land use Planning for Sustainable Development. That initiative produced Barbados' Physical Development Plan Amended (2003) (GOB, 2003).¹

Unlike many of its neighbours in the Eastern Caribbean, terrestrial biodiversity is limited largely due to Barbados' isolation relative to the islands of the Lesser Antilles, and to the removal of natural vegetation during the initial settlement of the island in 1627. At present, it is estimated that there are 700 species of flowering plants, 201 species of birds, 15 species of mammals, 8 species of reptiles and 2 amphibians. Less than 2 per cent of the island is covered by primary forest (GOB, 2005). However, the number of secondary growth areas has been rising as areas previously utilised for sugar production revert to tree cover. There are two coral reef systems: an inner reef system (largely located near shore) and an outer reef system, as well as approximately 50 hard coral species and 600 fish species inhabit the island's marine waters.

Most of the island's resources are stressed from economic activities: arable land is largely utilised in sugar production, coral reefs and beaches are used to support the tourism industry. In addition, there is quarrying of limestone, sand, shale and clay, as well as natural gas and oil extraction. Most of the limestone mines are located in the north, west and southeast of the island, while sand and clay are found largely in the Scotland District. Hydrocarbons are found in the southeast and central parts of the island. In the medium-term, it is expected that these resources could be further stressed in the future as the economy continues to be largely dependent upon tourism and related construction.

Managing coastal and marine resources is a key priority for GOB, which could have an impact on its fiscal measures. Coastline and marine resources in Barbados are also under substantial pressure

from coastal erosion, tourism and fishing. In order to address this critical concern, the government recently signed a US\$ 15 million loan from the IDB to support a Coastal Risk Assessment and Management Programme designed to preserve the island's beaches. While many measures in this domain would need to be publicly funded, potential gaps in the fiscal framework may exist: the Folkestone Marine Park, for example, is one of the few such reserves in the Caribbean region not subject to a user charge.

Barbados participates in CARICOM's weather insurance scheme. Launched with donor support in 2007, the Caribbean Catastrophe Risk Insurance Facility (CCRIF) brings together CARICOM countries and provides cover to farmers and other producers from hurricane related damages (paying out in the event, for example, that wind speeds exceed a certain threshold). Diversification is achieved through sovereign issue of catastrophe bonds (for which principal is forgiven if disaster strikes).

A fairly comprehensive legislative network manages the impact of the aforementioned developmental objectives on the integrity of ecosystems (Table 1),

which cover issues ranging from the protection of water resources to the requirement for beverages to be sold in returnable containers.

1.1.3 WATER

Barbados lies in the humid tropics and as such has a marked wet and dry season. Rainfall occurs primarily between July and December and varies considerably with elevation. Rainfall may average 1875 mm per year in the higher central area as compared with 1275 mm in the coastal zone. Wet season rainfall accounts for approximately 60 per cent of average annual rainfall. Rainfall distribution varies with the season such that during the dry season rainfall is highest at the centre of the island, while during the wet season the western side of the island receives more rainfall. Although there is substantial rainfall, most of the rivers in Barbados are dry due to the permeable nature of the underlying coralline karstic limestone. Water finds its way into the underground aquifers via gullies and sinkholes. In the Scotland District, due to the relatively impermeable bedrock, much of the rainfall is lost through run-off to the sea.



Chancery Lane Swamp in Southern Node of the Barbados System of Protected Areas. Photo: Anne Gonzalez

TABLE 1: LEGISLATION AIMED AT PROTECTING ECOSYSTEM SERVICES

LEGISLATION	PROVISIONS	AGENCY
Barbados Territorial Waters Act (1979)	Prohibition of pollution by foreign vessels in Barbados' waters	Ministry of International Business and International Transport
Barbados Water Authority Act (1980)	Management of water resources	Barbados Water Authority
Coastal Zone Management Act (1998)	Preservation of marine areas and discharge standards	Coastal Zone Management Unit
Environment Levy Act (1996)	Levy on non- biodegradable imports	Ministry of Finance and Economic Affairs
The Fisheries Act (1993)	Preparation of fisheries management plan, protection of marine life (including coral reefs)	Fisheries Division
Health Service Act and Regulations (1969)	Removal and disposal of refuse	Ministry of Health
Income Tax Act	Energy conservation and renewable energy deduction	Ministry of Finance and Economic Affairs
Marine Boundaries and Jurisdiction Act (1979)	200-mile exclusive zone within which Barbados will protect the marine environment	Ministry of International Business and International Transport
Marine Pollution Control Act (1998)	Control of marine pollution	Coastal Zone Management Unit
Pesticides Control Act (1973)	Regulates import and handling of pesticides	Ministry of Agriculture, Food and Fisheries
Petroleum Winnings Operations Act (1951)	Obliges licensee to prevent pollution of territorial waters	Natural Resources Department of the Energy Division
Returnable Containers Act (1987)	Beverages to be sold in returnable containers	Ministry of the Environment, Water Resources and Drainage
Sanitation Service Authority Act	Removal and disposal of refuse	Ministry of Health
Shipping (Oil Pollution) Act (1994)	Prevention of pollution by oil	Ministry of International Business and International Transport
Soil Conservation Act (1959)	Utilisation of lands in the Scotland District	Ministry of Agriculture, Food and Fisheries
Standards Act (2006)	Standards for pesticide application in homes	Department of Commerce and Consumer Affairs
Town and Country Planning Act (2003)	Control of development	Town and Country Planning Department
Underground Water Control Act (1953)	Control of use of underground sources	Barbados Water Authority

Source: Ministry of Environment and Drainage, Government of Barbados

Groundwater is the only source of potable water on the island and is often located in large collection areas or “reservoirs” within the aquifer. These aquifers are serviced by natural underground streams and have periodic connection to the surface via sinkholes. The aquifers are divided into two hydrologic zones, referred to as the stream and sheet water zones, depending on whether the aquitard lies above or below sea level. The stream water zone constitutes the bulk of the areal extent of the aquifer with the freshwater lenses of the sheet water zone primarily occurring within 1-2 km of the coast (Jones & Banner, 2003). In the stream water zone, groundwater forms a thin layer a few metres thick at the base of the limestone. In the sheet water zone, the water table lies close to sea level and water level variations are typically due to tidal effects, whereas on the more landward side level variations are associated with influxes of stream water flows.

There is little apparent response of water levels to rainfall during years with average or below-average rainfall. Jones and Banner (2003) report that most recharge is rapid and only takes place during the wettest 1-3 months a year. Recharge events are more likely to occur when soil moisture is high. Monthly rainfall less than 195 mm is likely to be taken up by evapo-transpiration processes and thus make an insignificant contribution to recharge. The variation in recharge over time is related more to the distribution of rainfall throughout a given year than variations in total rainfall. Recharge is higher when rainfall is concentrated in a few months of the year, which usually peak during the wet season months of August, September and October.

According to the 1997 Water Policy proposal (Klohn-Crippen Consultants Ltd, 1997), knowledge and understanding of the water resources situation



Ponding – Capturing surface water for local use. Photo: Anne Gonsalez

TABLE 2. BREAKDOWN OF AVAILABLE WATER RESOURCES

SOURCE	1978 STUDY		1997 STUDY
	Average rainfall conditions [1524 mm]	1 in 15 design drought year	Average rainfall conditions [1424 mm]
	(m ³ /day)		
Groundwater	205 773	137 182	202 591
Surface water	32 682	13 136	15 909
Spring water	8 182	5 909	5 455
Wastewater	n.a.	n.a.	30 018
Runoff	2 409	0.0	1 455
Total	249 046	156 227	225 410

Source: Klohn-Crippen Consultants Ltd, 1997.

in Barbados is greatly hampered by the amount and quality of data available for use in making the estimates of both water supply abstractions and consumption (Table 2). Except for rainfall data, there is very little other data that has been collected on an on-going basis. Table 2 provides a breakdown of the water resources according to the 1978 and 1996 Water Resources Studies.

The water resources of Barbados have been estimated to be 59 Mm³ per year (1996) based on average rainfall, though this differs from the estimations provided in Table 2 (82.3-90.9 Mm³). However, as Jones and Banner (2003) have shown, inter-annual variation of recharge fluctuates in response to El Niño-Southern Oscillation (ENSO), though the relationship is complicated by other factors. In other words, estimates of Barbados' water resources and especially groundwater resources must be treated with care.

The Barbados Water Authority (BWA) operates 22 public supply wells, and two spring sources, and in 1996 and 1997 production was 0.160 Mm³ per day. Out of this some 0.055 Mm³ per day is abstracted from just one source – the Belle Pumping Station in St Michael's Parish. Over the last several years, water production from the public supply wells has averaged around 48 Mm³ per year. A brackish water reverse osmosis desalination plant was commissioned in 2000, with a capacity of 30,000 m³ per day (11 Mm³ per year) to augment the public water supply. In addition, in 1997, there were some 111 active private wells primarily used for irrigation purposes. The amount licensed for private water abstraction is 36,400 m³ per day; however, since

only 30 wells out of the total were metered, there is uncertainty over the precise figure abstracted.

The last formal estimate of Barbados' water demand was undertaken in 1997, building on a 1993 study (Klohn-Crippen Consultants Ltd, 1997) (see Table 3). The report also suggested that by 2016

TABLE 3. ESTIMATED WATER CONSUMPTION

ITEM	YEAR	Amount Mm ³
Domestic consumption	1993	
Metered		5.043
Un-metered		18.022
Government institutions	1993	1.294
Statutory corporations	1993	0.265
Commercial and industrial	1993	3.552
Hotels	1993	1.466
Cruise ships	1997	0.300
Sub-total consumption		29.942
Leakage estimated		27.264
BWA production	1993	57.206
Golf courses	1997	3.200
Agricultural irrigation	1993	
Private		11.300
Public		4.900
Industrial demand	1993	2.600
Total		79.206

Source: BWA and author's estimates

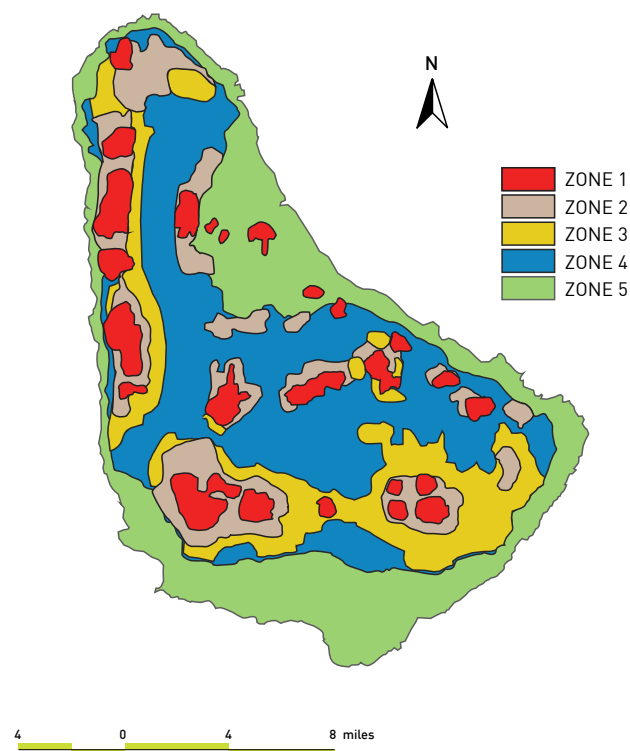
the annual water demand could reach 89.4 Mm³, of which BWA would produce 64.5 Mm³, and the balance would be from private wells. This amount included an allowance for leakage at an estimated level of 60 per cent of domestic consumption, though more recent work suggests that the figure for losses could be nearer to 50 per cent. Since this report was produced domestic metering has increased to virtually 100 per cent. It can also be noted that there have not been any further published figures of water consumption by sector or any future demand projections.

In terms of trends in water demand, it can be expected that there will be increases in domestic and hotel consumption. In the first instance, this is due to increasing living standards and in the second, it would be related to the increase in number of stay-over tourists. The number of golf courses has also increased and is expected to contribute to an increase in the overall level of demand. With respect to the other sectors, there is no sufficient information to estimate whether their consumption would have increased.

An analysis of the balance between water demand and the available renewable resources indicates that within the limits of what can be estimated, the resources are being fully exploited. If the potential effects of climate change are taken into consideration, such as a decrease in rainfall, increased rates of run-off or a decrease in aquifer recharge, then mining of the available resources is quite likely. This is potentially a very serious situation and would have consequences for the economy of Barbados. It is therefore imperative that steps be taken to reduce the level of losses from water supply systems, reduce the level of unit consumption and increase the level of water use efficiency.

With respect to water quality, it is both the source and supplied water qualities that are of interest. Generally, the supplied water quality delivered to homes and businesses conforms to World Health Organization (WHO) standards for drinking water quality. There are occasional problems associated with 'brown water' in some locations that are connected with either repairs after bursts or with the remobilisation of sediments in pipes. Source or groundwater quality presents more of a problem. In the early 2000s, there was concern over saltwater intrusion into the production wells on the west coast following a series of very dry years in which recharge to the aquifers were below normal. Since a return to more 'normal' conditions, this problem is no longer

FIGURE 1. DEVELOPMENT CONTROL ZONES



a serious concern. It should be noted, however, that climate change makes a discussion of 'normal' conditions somewhat difficult.

In 1963, a groundwater protection policy was introduced and has formed the basis for aquifer protection to prevent contamination of water supply wells. Under the Development Control Zones legislation, the country is divided into five zones around existing and proposed public supply sources (Figure 1). The boundaries of the zones were selected such that no wastewater would reach a public well within 300 days travel time, sufficient to ensure that any contamination would have died off before reaching the intake. The policy was initially developed with a bias towards bacteriological protection rather than chemical protection and thus there was little protection from agricultural activities, chemical contaminants, industrial waste and some of the emerging pharmaceutical products. The Town and Country Development Planning Office Development Order (1964) was amended to ensure that the water protection policy restrictions on land use were incorporated and controlled through the Physical Development Plan. Although the protection measures have generally been successful in protecting public health, there are a number of issues associated with the protection policy. As a result, a study was commissioned in 2008



The Belle Pumping Station. Photo: Travis Sinckler

to look into a possible review and overhaul of the Groundwater Protection Zoning Policy and System.

The review made a number of recommendations including revising the zoning such as to provide effective protection against emerging threats and to move towards a system where contamination of the groundwater is controlled at source. This would entail prohibiting the use of suck wells as a primary means of wastewater treatment and the development of communal wastewater treatment facilities as well as guidance for the development of wastewater treatment. The recommended measures were noted by Cabinet in 2011 and, if implemented, would constitute a significant contribution to creating conditions supportive of the aims of a green economy that recognise the importance of the environment.

Meeting future water service needs is a major environmental and fiscal challenge. Water use on the island is highly inefficient, partly due to the ageing condition of the main pipes: loss (so-called “non-revenue water”) rates are estimated in the range of 25 to 60 per cent although as noted above a study carried out in 2010 calculated losses at approximately 50 per cent. This places a significant additional burden on water and other resources used in supply and distribution (including energy for pumping and desalination). Capital costs for mains replacement, desalinization capacity and waste treatment (waste water is largely not recovered currently) are highly significant, potentially exceeding US\$ 500 million in the coming decade.

Although some limited pricing reform has been undertaken to meet the current and capital costs of service provision, the financial and fiscal framework remains weak. The BWA has not publically reported

costs and revenues since 2005, but is reported to have issued bonds and received loans (backed by the GOB) in the order of US\$ 150 to US\$ 200 million since the last annual report. Reflecting the weak financial position of the BWA, the Medium-term Fiscal Strategy (MTFS) established the objective to eliminate transfers to the BWA. To this end, water tariffs were increased by 60 per cent in July 2009 (no explicit charge applies to cover waste water recovery), and reduced costs by encouraging water conservation. However, payment arrears (particularly among residential customers) remain a persistent problem. Future rate rises, and improved revenue collection, are therefore likely to be needed to meet existing and projected liabilities from private sources (given the weak fiscal position).

However, managing associated distributional consequences is likely to be challenging. The distributional consequences of tariff reform in water markets are market specific, and therefore warrant detailed consideration in the Barbadian context. However, available studies for Brazil, for example, show that lower income households spend a higher income share on water than high-income groups under the prevailing tariff structure (Ruijs, 2009). Managing distributional concerns is thus likely to bear on tariff setting decisions, responsibility for which is soon to fall on the Fair Trading Commission (an agency in charge of overseeing fair business practices, with an expanding remit over utilities). In general, however, it may be preferable to make adjustments elsewhere in the fiscal framework, rather than supply resource below cost.

1.1.4 WASTE

There are four operational solid waste disposal sites in Barbados: (1) Mangrove Pond Landfill and the associated Vacluse waste transfer station; (2) Bagatelle Bulky Waste Disposal Site; (3) Rock Hall Asbestos Disposal Site; and, (4) Lonesome Hill Blood and Grease Disposal site. There is also the Greenland Landfill site, which has not yet been brought into operation. In addition, the Edgecombe and Parsons disposal sites are used for construction and demolition waste while sludge generated by the BWA's Bridgetown wastewater treatment facility is disposed of in agricultural area of former sugar lands at Spencers (since May 2007). The Vacluse facility has a chemical waste handling facility that is awaiting certification by Environmental Protection Department (EPD) before being brought on-stream.

The Mangrove Pond is the main landfill site on the island. The site was originally designed to operate until 2007. However, due to a lack of consensus on the location and development of a new landfill it was redesigned to operate until the end of 2009. The site is still in operation. It is an engineered site, meaning that the currently used Cell 3 and Cell 4, which is being excavated and prepared, have been designed to minimize contamination of the groundwater by leachates. There is also a system of groundwater quality monitoring wells in place operated by EPD to check for any groundwater pollution. The other environmental hazard associated has been the odour emanating from the site, which resulted in a court action (1993) by residents of the neighbourhood adjacent to the landfill. Since then, efforts have been made to limit and manage the odours.

More recently, the part of the site that stored old tyres caught fire and it took two days to bring under control. The management of the Rock Hall Disposal site came under criticism in a 2008 report (Forrest Associates, 2008), which noted that much stricter management and current methods of disposal needed to be improved as they posed an environmental hazard. According to Forrest Associates, no particular environmental concerns have been identified in connection with the other disposal sites listed above.

Several studies on the volumes and characterisation of waste generated in Barbados have been carried out over the last 25 years. LH Consulting (2005) reports that the average per capita waste generation was 3.43 kg per person per day. This was up from a figure of 1.7 kg per person per day in 1994 and 3.0 kg per person per day in 2002, indicating a significant increase over time. These rates are comparable with waste generation rates of industrialized developed countries.

What has been noted is a change in the composition of solid waste. Over time, there has been a decrease in the contribution of organics (64 per cent) and an increase in plastics to the overall composition (14 per cent). Construction and demolition material waste has not shown any decrease due to the economic downturn and, along with waste from hotels, has seen growth in the volumes generated. Domestic waste represented only 35 per cent of the waste delivered, which suggests that domestic/household waste generation is 1.2 kg per person per day, which is slightly less than the European average of 1.37 kg per person per day. These figures relate to the Mangrove Pond Disposal Site and do not take into account the contribution of the other sites. The estimated annual amount of waste entering the Mangrove Pond site was

348,000 tonnes all of which went to landfill, or the equivalent of 950 tonnes per day.

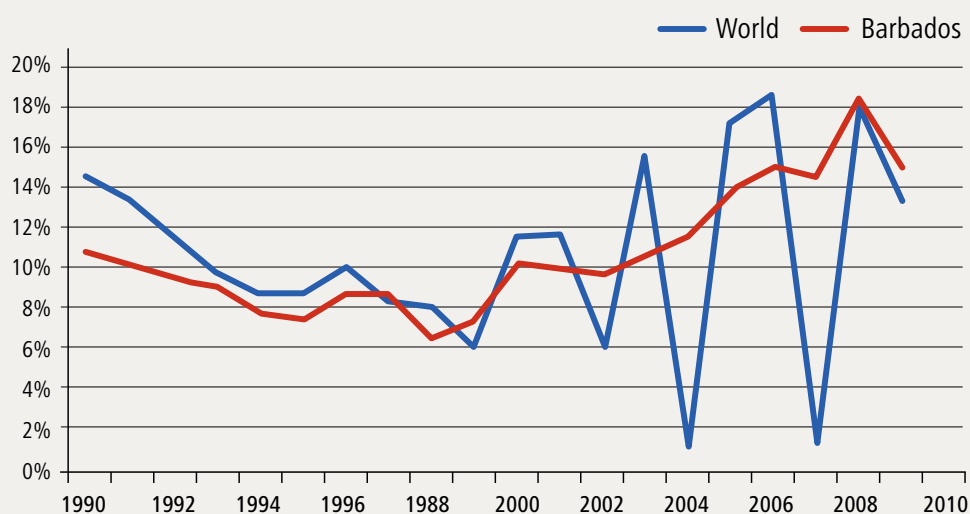
The amount of solid waste being sent for disposal is estimated between 1,000 to 1,300 tonnes per day. The figure would be some 300 tonnes per day higher without the reduction due to recyclers (R. Marshall, pers. comm.). Most recyclable materials are shipped overseas. The Vaucluse Waste Transfer Station (materials recovery, composting facility and chemical waste management) came into operation in 2011 and as a result, the amount of solid waste going to landfill has been reduced by a reported 70 per cent. This includes construction and demolition waste, green waste, wood pallets, plastics, glass and metals. Toxic waste is usually exported, under the stipulations of the Basel Convention, to Canada.

Another area of concern is illegal dumping of waste and littering in gullies and remote areas. The reasons for this behaviour are unclear given that every household in Barbados has waste collection at least once a week and thus there are alternatives to dumping. In addition, there are information and awareness activities which inform the public of the impact of such behaviour and the alternatives. Some reduction of these activities has been achieved through recycling efforts of the private sector for white goods. Littering is a persistent problem that has been addressed by providing litterbins and community activities such as clean-ups and townhall meetings to promote clean-up events.

Land is a scarce commodity in Barbados, making solid waste management a critical issue. The country is a densely populated island with limited land available. The Environmental Levy, a major solid waste management charge levied on a wide range of imported products, was withdrawn in 2010 at a fiscal cost of around US\$ 15-20 million per year.² However, the GOB is believed to be considering the scope for a land tipping charge. The use of tipping fees has been advocated as a means of reducing the amount of material going to landfill by increasing the disposal costs. Such costs are generally passed on to customers who are therefore motivated to recover, reduce and recycle their waste products. As long as there are effective means to prevent illegal (fly) tipping, such measures can be effective. Tipping fees would also provide some fiscal recovery for the government and some of the funds could be used to support recovery, reduction and recycling programmes.

In this regard, a deposit refund scheme has been in operation for over 20 years to encourage reuse of

FIGURE 2. FUEL IMPORTS (% OF MERCHANDISE IMPORTS)



Source: World Bank, *World Development Indicators* (Online Edition).

beverage containers: wholesalers and distributor pay a deposit on beverage containers, which is refunded on return and disposal of these containers. Current refund values are US\$ 0.05 for PET bottles and US\$ 0.10 for glass bottles. The Returnable Containers Act (1987) covers glass, metal, aluminium, steel or plastic bottles, cans or jars of one gallon or less used for carbonated drinks, non-carbonated soft drinks, mineral water, soda water, beer and other malt beverages. However, the Act is not properly enforced and there are a number of items that are covered for which a refundable deposit is not made. Amendments to the Act have been proposed to address this such as the use of refundable deposits as a means of encouraging recycling, principally for bottles. The closing of loopholes in current legislation and ways in which deposit refund schemes could be extended need to be considered.

1.1.5 ENERGY

Energy policy is the responsibility of the Energy Division within the Ministry of Finance, Investment and Energy. This unit has the responsibility for monitoring and regulating energy supply, in particular promoting the use of renewable energy technologies, and the efficient use of energy. Broadly speaking, over the past few years, energy policy in Barbados has aimed at ensuring the security of its supply and making the further development of these supplies sustainable.

The country's sole commercial electricity provider is the Barbados Light & Power Company Limited (BL&P). BL&P is a vertically integrated electric utility company responsible for the generation, supply and distribution of electricity. Apart from a change in name and some changes in shareholder and corporate structure, the utility has an unbroken history going back to before 1909. The ultimate shareholders in the utility are Emera Inc. of Canada with 38 per cent of the shares, the Barbados National Insurance Board with 23 per cent of the shares, and approximately 2,800 other Barbadian investors. Emera Inc., a Canadian energy company that has overseas shareholding interest in electricity generation, transmission and distribution, as well as gas transmission and energy marketing, bought their shares in BL&P in May 2010.

The Fair Trading Commission (FTC) regulates BL&P. The FTC was established in January 2001 under the Fair Trading Commission Act. It took over utility regulation from the previous Public Utilities Board, and also has responsibility for competition law and general consumer protection. The FTC is an independent government entity. It obtains budgetary support from the government, and from levies on the entities regulated by the Commission. A recent World Bank study of regulatory authorities ranked the FTC among the top group due to its mechanisms and procedures for guaranteeing its autonomous administration (World Bank, 2007).

On the fuel side, three government-owned entities are relevant:

TABLE 4. ENERGY SUPPLY IN BARBADOS (GWH)

Item	2003	2004	2005	2006	2007
Total energy supply (GWh)	4 660	4 791	4 982	5 080	5 080
Supply of renewable energies (GWh)	342	351	365	372	372
Share of renewable energies (%)	7.3	7.3	7.3	7.3	7.3
Annual change in total energy supply (%)	1.0	2.8	4.0	2.0	0.0

Source: Schlegelmilch, 2010.

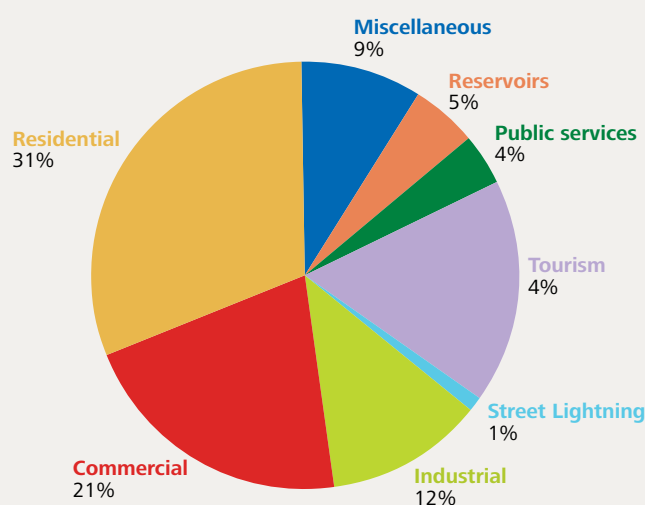
1. The National Petroleum Corporation (NPC) sells piped natural gas for domestic, commercial, and industrial use. Its mission is to provide an adequate, reliable, safe, and efficient gas service to customers at reasonable cost
2. The Barbados National Oil Company Limited (BNOCL) produces about 1,000 barrels per day of crude oil from onshore wells located at Woodbourne in St. Phillip. This crude is sent to PETROTRIN, the state-owned oil refinery of Trinidad and Tobago, to be refined in an exchange arrangement for refined product. The fuel oil received in exchange for the crude represents only about 10 per cent of Barbados' fuel requirements. BNOCL purchases fuel for electricity generation and sells it to BL&P.
3. The Barbados National Terminal Company Limited (BNTCL) is a subsidiary of BNOCL. Initially, BNOCL would source and freight petroleum products to Barbados, and ownership would pass to BNTCL at the ship's flange.

BNTCL would then store and sell products to users. The commercial relationship between BNOCL and BNTCL changed in 2005; today BNTCL is only responsible for storage of products. The new arrangements mean that BNTCL operated only as a terminal facility, charging a throughput fee for product moved through its facilities. BNTCL moves the fuel oil product through the ESSO Holborn terminal, that it is leasing, and a newly installed pipeline. BNTCL has also built a pipeline between Fairy Valley Terminal and BL&P's generation facility at the Seawell generation station. This new pipeline became operational early in 2006.

Imported fossil fuels cover most of the country's primary energy requirements, including electricity generation. This import bill, however, makes the island highly vulnerable to the volatile international energy market. Between 1993 and 1999, fuels imports were 8.5 per cent of merchandise imports (Figure 2). Since this period, fuel imports have averaged 12 per cent of merchandise imports, reaching as high as 19 per cent in 2006 and 17 per cent in 2005 as well as 2008.

With few possibilities of expanding its own limited production of fossil fuels (although offshore fossil fuels are being explored), the most effective alternative to a balanced demand and supply is to: (1) contain demand growth by increasing energy efficiency, and (2) expand production from alternative energy sources and natural gas. Although much progress is now being made, neither of these two areas has an established policy/regulatory framework for the promotion of public or private investments. At the time of the study, policy and legislative recommendations were planned for administrative approval. Detailed information is currently unavailable, nevertheless, six cabinet papers have been sent for approval, which cover areas such as: renewable energy, energy efficiency policy, legislative recommendations as it relates

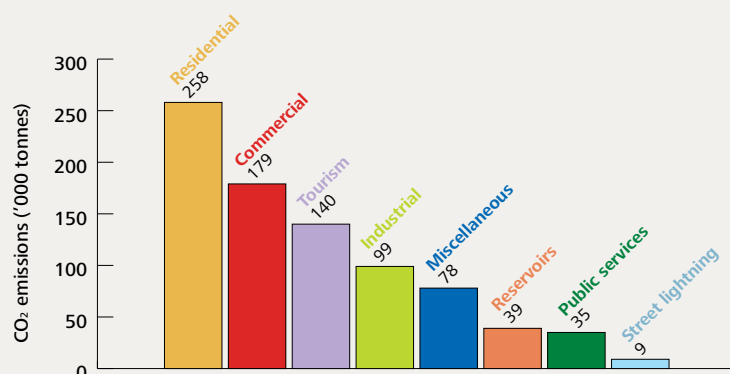
FIGURE 3. ELECTRICITY CONSUMPTION BY INDUSTRY (GWH), 2009

Source: Government of Barbados, *Social and Economic Report*, 2012.



There is an increasing uptake of RE technologies such as solar PV in both the domestic and commercial sectors. Photo: Travis Sinckler

FIGURE 4. CO₂ EMISSIONS FROM ELECTRICITY GENERATION BY SECTOR, 2009



Source: Authors' estimates.

to renewable energy, opportunities for sustainable energy within the sugar industry, and policies/recommendations as regards to the Smart Fund. The primary energy for a country is the initial energy source before conversion has taken place. The main primary energy sources for Barbados are the different types of imported fossil fuels prior to their use in the transport and electricity generation sectors and are the main primary energy source for the island (Table 4). Total primary energy consumption for Barbados increased by almost 30 per cent between 2002 and 2007, while the energy intensity (per cent of GDP) decreased by 7 per cent over the same period. This reduction is significant and suggests a cautious move from energy-intensive manufacturing industries towards service industries. Data for energy consumption per capita is only available since 2005 and shows no significant development in either direction. The source of renewable energy in the primary energy mix originates mainly from the use of solar water heaters, as well as bagasse co-generation during the sugarcane-harvesting period (approximately 50-50 share between the two).

Electricity generation (50 per cent) and transport (33 per cent) are by far the two largest consumers of the fuel imported into the island. Of the electrical energy generated in 2010 (1,036 GWh), domestic consumption was the major user at 34 per cent. The commercial sector was the second largest consumer with 23 per cent, closely followed by the hotels and public buildings, each with 15 per cent of the share. The manufacturing sector consumed 5 per cent of the electricity generated.

The total installed electricity generating capacity in 2010 amounted to 239.1 MWh, with peak load reaching 167.5 MWh. Figure 3 shows the electricity consumption by sector for 2009. There has been a

steady increase in electricity generation in recent years, increasing by 19.6 per cent over seven years. However, the electricity consumption per customer (commercial and residential) peaked in 2007 and has been slowly decreasing since. Most of the generators used for producing electricity are diesel-electric units that run on heavy fuel oil. Some gas turbines are kept in reserve for peak loads and emergencies.

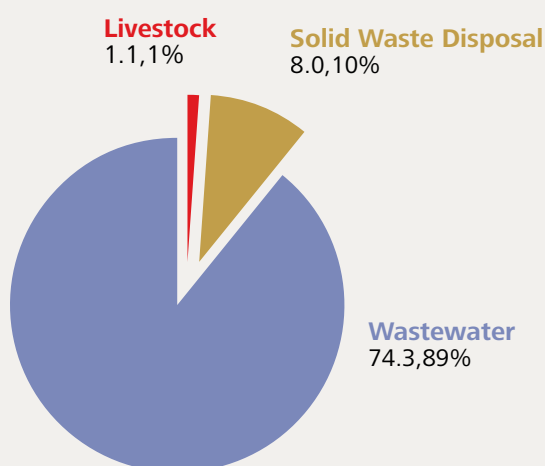
Electricity generation accounted for 56.8 per cent of the island's CO₂ emissions in 2000. This contribution rose to 61.4 per cent in 2005. Figure 4 shows the CO₂ emissions from electricity generation by sector for 2009, whereby the CO₂ emissions were calculated based on BL&P's plant CO₂ emissions factor and energy generated. The total CO₂ emissions from electricity generation that year were 837,000 tonnes. As the largest source of CO₂ emissions, reducing emissions from electricity generation will have a significant impact on the country's emissions profile. Based on 2005 data, reducing CO₂ emissions from electricity generation by 1 per cent can reduce the country's CO₂ emissions by 0.614 per cent. CO₂ emissions tracked the electricity consumption from 2000 to 2004; both grew at around 4.5 per cent per year.

TABLE 5. GHG EMISSIONS FOR FUEL TYPES

Fuel type	Emissions of GHG (kgCO ₂ e/kWh)	GHG emissions savings from using natural gas (%)
Natural gas	0.183	NA
Bunker C	0.268	31
Diesel	0.253	27

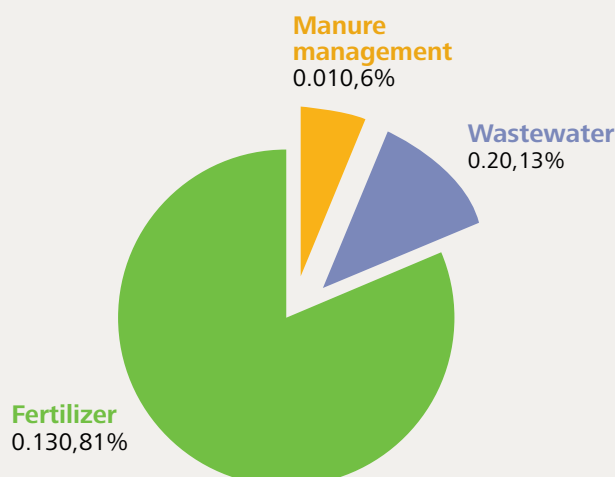
Source: Government of Barbados, *First National Greenhouse Gas Inventory*, 2001.

FIGURE 5. NITROUS OXIDE EMISSIONS IN BARBADOS



Source: Government of Barbados, *First National Greenhouse Gas Inventory*, 2001.

FIGURE 6. METHANE EMISSIONS IN BARBADOS



Source: Government of Barbados, *First National Greenhouse Gas Inventory*, 2001.

The emissions data given in Table 5 is for the direct combustion of the fuel, the emissions per kWh of electricity produced would be higher.

Since the commissioning of the new low-speed diesel plants, which have the lowest emission factor in BL&P's current plant mix, CO₂ emissions have been growing at a much slower annual rate of 0.62 per cent, while electricity demand has been growing at around 3 per cent per year. BL&P currently generates most of its electricity from a mix of Bunker C (heavy fuel oil, the same as used for large ships and cruise liners) and diesel. Aviation fuel is used on occasion to meet peaking demands. A move towards a natural gas dominated fuel mix in the electricity sector would help to decrease CO₂ emissions. The reason for this is that natural gas produces less CO₂ per kWh of energy generated from its combustion (see Table 5).

Typically conversion efficiencies for oil-fired plants are around 33 per cent, while those for combined-cycle gas fired plants are up to 50 per cent. This would suggest that emissions per kWh of electricity produced would be 0.37, 0.81 and 0.77 kgCO₂e per kWh electricity for natural gas, bunker c and diesel, respectively. The greenhouse gas (GHG) emissions savings from using natural gas, rather than Bunker C and diesel, would be 54 per cent and 52 per cent, respectively.

Barbados is heavily dependent on the importation of fossil fuels for energy and transportation requirements, thus making fuel combustion the main source of GHG emissions. The only detailed

data on GHG emissions for the island is from Barbados' First National Greenhouse Gas Inventory (GOB, 2001), which reports on a complete assessment of anthropogenic emissions and removals of GHGs (in accordance with the United Nations Framework Convention on Climate Change, Article 4.1a). Estimations of GHG emissions were made for the following sectors for the years 1990, 1994 and 1997:

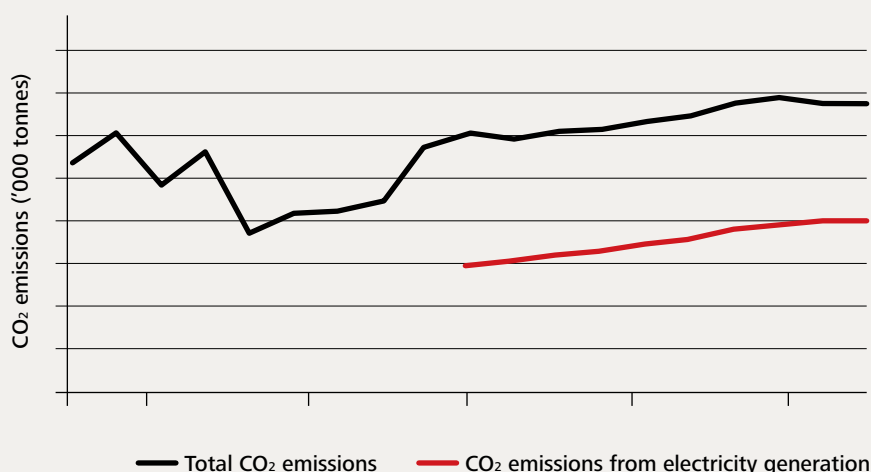
- Energy
- Industrial processes
- Agriculture
- Land use changes and forestry
- Waste

The report shows that, unsurprisingly, the greatest source of CO₂ emissions came from the combustion of fuel used for the generation of electricity, an average of 71 per cent for the three years investigated. This was followed by CO₂ emissions from combustion of fuel for road transportation, which on average accounted for 14 per cent of CO₂ emissions. CO₂ emissions from fuel combustion in the manufacturing/industrial, commercial/institutional, residential and agricultural sectors in Barbados were relatively small, together making up an average of 9 per cent of total CO₂ emissions. Based on the data collected, the CO₂ from the industrial processes sector contributed an average of 7 per cent of total emissions. There is little heavy industry on Barbados and the most significant source of GHG emissions in the industrial sector is the island's lone cement plant. Therefore emissions from this sector are closely linked to



Wave energy along Barbados' East Coast – Electricity generation potential requires research. Photo: Dave Quan/Inkstone Design/Calgary

FIGURE 7. ANNUAL CO₂ EMISSIONS IN BARBADOS



Source: UN Statistics Division, 2007.

cement production at that plant, which can vary substantially from year to year. There is locally significant production of alcoholic beverages (beer and rum) and limited production of foods, which, during the three years it was monitored, was responsible for generating small emissions of non-methane volatile organic compounds (NMVOCs).

The agricultural sources of GHGs in Barbados come from the rearing of domestic livestock (enteric fermentation and manure management) and agricultural soils (Figure 5). There is no official burning of agricultural residues and although this activity may take place at the scale of the individual farmer, documented information was unavailable from which estimates of GHG emissions activity could be made. CO₂ emissions from the agricultural sector are minimal, with emissions of methane from domestic livestock forming the main source of GHGs (1,120 tonnes), and nitrous oxide from manure management and soil fertilizer also contributing 140 tonnes. As seen in Figure 5, fertilizer is the biggest contributor of nitrous oxide. The country's average annual nitrous oxide emissions for the three years it was monitored were 160 tonnes per year. Disposal and treatment of industrial and municipal wastes can produce substantial emissions of the most detrimental GHGs. The most important gas produced in this source category for Barbados is CH₄ from solid waste disposal to land fill and wastewater treatment. Barbados' average annual methane emissions for the three years monitored were 82,300 tonnes per year. In addition to CH₄, solid waste disposal sites may produce substantial amounts of CO₂ and NMVOCs (Figure 6). The

process of wastewater treatment can produce NMVOCs, methane and nitrous oxide.

Since 1997, no detailed estimations of GHG emissions by sector have been made. However, as CO₂ emissions are one of the Millennium Development Goal (MDG) indicators, annual country data is available for Barbados and is shown in Figure 7. Also, BL&P operating statistics are available from 1999 and from these, emissions from electricity generation can be deduced. Throughout this period, the share of electricity generation towards Barbados' CO₂ emissions has slowly risen from 48 per cent in 1999, to 59 per cent in 2008. However, the share is lower than the 1990, 1994 and 1997 figures, which is likely due to a large share in transportation due to more cars on Barbados' roads.

There is an extensive natural gas network on the island that supplies approximately 16,700 customers, of which 16,100 are residential. Alternately, bottled liquefied petroleum gas (LPG) is used by many households for cooking. The GOB has mandated the National Petroleum Corporation (NPC) to make natural gas available to the entire island. NPC has embarked on some initiatives to facilitate this mandate and to use the natural gas more efficiently.

The possibility of the wide spread introduction of Natural Gas Vehicles (NGVs), also known as Compressed Natural Gas (CNG) vehicles, to its vehicle fleet is being explored (to date the NPC has three such vehicles, with a further eight NGVs on Barbados' roads). Also being explored is the expansion of natural

TABLE 6. ELECTRICITY TARIFFS IN BARBADOS

Tariff Type	Domestic	General business	Secondary voltage	Large power	Time use
Fixed fee ex VAT (US\$ /month)	3 – 7	4 – 7	10	150	150
Unit charges ex VAT (US\$ /kWh)	0.075 – 0.112	0.092 – 0.145	0.069	0.059	On-peak: 0.110 Off-peak: 0.031
Fuel surcharge (approx.) (US\$ /kWh)	Varies with market fuel price, currently around 0.135				

Source: Barbados Light and Power.

TABLE 7. RENEWABLE ENERGY TECHNOLOGY POTENTIAL OF BARBADOS

Energy source	Technologies	Units in operation	Technical potential	Application
Solar	Hot Water	~ 1/3 of buildings	High	Water heating
	Photovoltaic	~ 400kWp installed	High (> 50 MW)	Electricity and pumping
	Solar drying	Few	High	Crop drying
	Hybrid photovoltaic/thermal	None	High	Heating and electricity
Biomass	Bagasse co-generation	Some (used in sugar processing industry)	High (30MW plant under consideration)	Heating and electricity
	Waste-to-energy	None	High (13.5 MW plant under consideration)	Heating and electricity
	Biodigesters	Several but unsuccessful	Medium (Livestock farming + sewerage treatment)	Electricity
	Biofuels	Some biodiesel from cooking oil	Medium	Transport (inc. fishing fleet)
Wind	Small-scale	Few	Medium (~0.5MW capacity)	Electricity
	Large-scale	None	High (50MW for 2025)	Electricity
Marine	Wave power	None	Medium (requires resource investigation) 2 MW	Electricity
	SWAC ³	None	High potential – 2MW at Needhams point	Cooling

Source: Castalia Ltd., *Sustainable Energy Framework for Barbados*, 2010.

gas air-conditioning technology, which for the past ten years has been used to cool the lobby, hallways, meter work shop and cashier station of the NPC's office. Additionally, there are two major installations of natural gas air-conditioning units in operation in the island with a scope for further development in the hotel and commercial sectors.

However, the expansion is limited because of the low volume of natural gas supply from Barbados National Oil Company Limited (BNOCL). The recent decline

in local reserves coupled with a growing demand for natural gas has prompted government to institute further research on the viability of allowing the importation of natural gas into Barbados; either by liquefied natural gas (LNG) tankers, or by pipeline.

Since 2007, the idea of an Eastern Caribbean Gas Pipeline has been under consideration. The proposal is to build a 600-mile (970 km) long network of undersea pipelines stretching from the generation point in Tobago, northward to other islands including

Barbados, Saint Lucia, Dominica, as well as both of the French overseas regions of Martinique and Guadeloupe. These two islands would be considered anchor markets because Martinique and Guadeloupe give the pipeline a good ratio of total population served in comparison to the total distance covered. The natural gas pipeline importation project is run by a committee chaired, and headed by the Economic Policy Committee and representatives of a wide cross-section of both public and private sector interests, including BL&P, Ministry of Commerce, Ministry of Foreign Affairs and Foreign Trade, NPC and BNOCL, among others. At this time BNOCL is the entity with lead responsibility for the importation of the product.

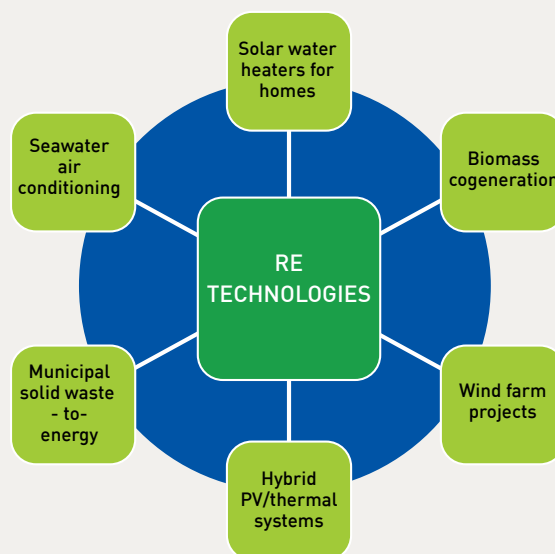
The pipeline connection points with Barbados would be at Checker Hall, St Lucy and Spring Garden, St Michael. The pipeline would carry Liquefied Natural Gas (LNG), which would have the potential to both decrease the cost of energy for Barbadians, and reduce the emission of CO₂ and other GHGs, as discussed earlier.

Some tariff reforms have taken place, but various fiscal measures artificially hold down production costs. Responsibility for setting tariffs now resides with the Fair Trade Commission, and the most recent price reform took effect in 2010 (a fuel surcharge is automatically adjusted in response to changes in the oil price). The current rate schedule is set out in Table 6, and shows that domestic users generally pay lower rates than business. However, output costs are reduced by a range of fiscal policies, undermining incentives for demand conservation and greater use of renewable sources. Critically, fuel oil, the principle generating input, remains exempt from excise taxation. In addition, the utility enjoys relatively highly favourable treatment under the corporate tax regime. Barbados Light and Power's (BL&P) debt servicing costs are also anchored by the GOB's financial guarantees.

Table 7 gives an indication of the potential for different renewable energy (RE) options in Barbados, with solar power, wind and biomass (including waste-to-energy) providing the most immediate potential. The Sustainable Energy Framework for Barbados (GOB, 2010) suggests that RE could produce 30 per cent of the island's total energy needs by 2029. The report also identifies six renewable energy technologies that are already economically and commercially viable in Figure 8.

This figure assumes the price of oil to be US\$ 100 per barrel. Any increase in the price of oil, or

FIGURE 8. COMMERCIALY-VIABLE RENEWABLE ENERGY TECHNOLOGIES



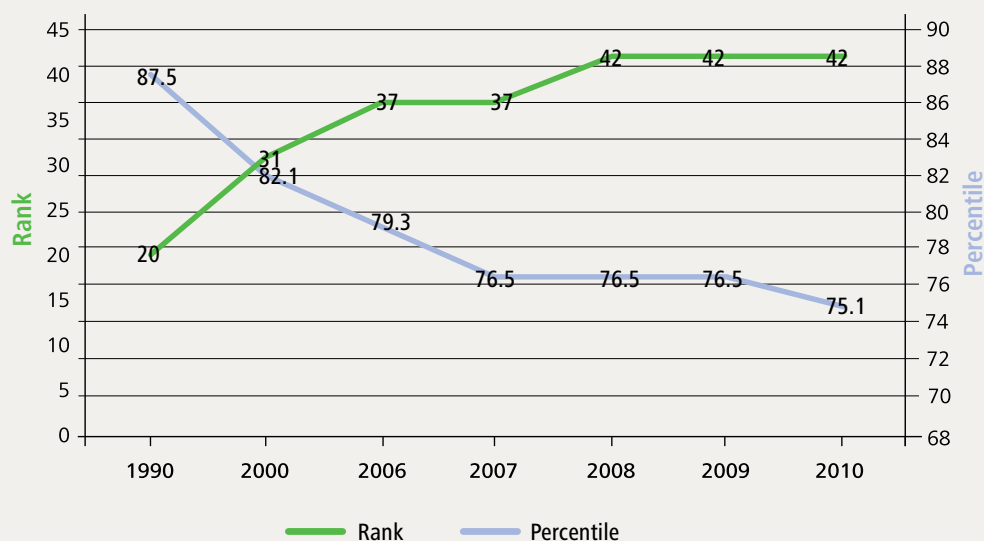
Source: Castalia Ltd., *Sustainable Energy Framework for Barbados*, 2010.

a reduction in the manufacturing costs of RE technologies (both of which are more than likely), means that further groups of technologies will become viable in the very near future. These include certain types of small-scale and commercial solar PV technologies (thin-film PV, high concentrating PV with two-axis tracking, low concentrating PV with single-axis tracking); and solar water heaters for commercial and industrial use.

The GOB has begun to introduce measures designed to increase the share of renewable energy supply and energy conservation measures, reflecting concerns about the GHG emissions and the terms of trade risks from fuel import costs. In an effort to utilize the islands wind and solar resources, the GOB introduced a two-year trial, which is effectively a feed-in-tariff, to lower the costs of renewable generation. The current payment is 1.8 times the fuel related element of the electricity tariff (currently around US\$ 0.24 per kWh). The customer is billed for their electricity use, as usual, on a monthly basis, and then receives credit at the end of the year for the amount of electricity generated from their solar PV or wind system. Note that this measure has no direct fiscal impacts since the costs are passed on to consumers by BL&P (although there may be indirect effects for example on receipts from income and profit taxes).

In addition, a Smart Energy Fund, financed through a loan from the IDB Bank, has been established, with external financial support, and to promote renewable energy and energy conservation. Of the US\$ 10 million total funding envelope, US\$ 6 million is set to be allocated to renewable energy

FIGURE 9. HUMAN DEVELOPMENT INDEX IN BARBADOS



Source: Human Development Report (various years).

loans, while the remainder is being used for grant finance, including the promotion of energy efficient technologies which comprise lighting, air conditioning and other appliances.

Temporary price support measures, introduced in 2008 entitle farmers, fisherman and manufacturers to a US\$ 0.11 per litre rebate on diesel. Privately-owned public service vehicles (PSVs) are eligible for a separately administrated rebate of US\$ 0.04 per litre. A total budget of US\$ 9 million was allocated to such subsidies in 2010. However, the distributional consequences of current fuel pricing arrangements are to some extent unclear. In terms of environmental consequence, by way of a crude indication, such measures could artificially increase fuel demand by around 130,000 litres a year (and associated import costs of around US\$ 100,000 per annum [at US\$ 100 per barrel]).

Vehicle excises have indirect environmental impacts, for example, through incentives for lower vehicle ownership (although their impact on vehicle use is effectively zero). Imported vehicles are subject to excise rates of 46 to 120 per cent on all vehicles (graduated according to vehicle size and import value). Reduced excise tax rates (20 per cent) on hybrid and solar, LPG and compressed natural gas powered hybrid vehicles (as compared to the lowest rate of 46.9 per cent on regular cars). Public transport subsidies are in place for bus transportation, but have recently been subject to a number of minor revisions. The price of bus tickets was increased from US\$ 0.75 to US\$ 1 in 2010. However, free bus travel was extended to

schoolchildren. Parking rates in Bridgetown city centre are low, at around US\$ 4 to US\$ 5 per day, depending upon which parking centre is used. All passengers charge for aviation services through a departure tax of US\$ 27.50 payable for persons above the age of 12 years old.

Barbados has a limited endowment of onshore oil and gas resources, for which resources are shared with the GOB through a tax and royalty based fiscal regime. A royalty of 3 per cent applies to the value of all output. In addition to the standard corporate income tax rate, an additional 30 per cent tax is applicable in the event oil prices exceed US\$ 60 per barrel (for natural gas, this 'trigger rate' is US\$ 6 per mmbtu of extracted natural gas. Withholding taxes of 15 per cent (and 5 per cent for preferred trading partners) are repatriated profits.

1.1.6 ECONOMIC REVIEW AND OUTLOOK

The island's social market model, which is characterized by extensive social welfare provisions – especially in the areas of health and education – a steadfast commitment to democracy, enterprise and gradual liberalisation, has resulted in enviable economic and quality of life statistics. Figure 9 provides the Human Development Index (HDI) ranking as well as percentile score for the island over the period 1990 to 2010. Throughout this entire period, the island had one of the highest ranking HDI for any developing country.

TABLE 8. KEY MACROECONOMIC INDICATORS OF BARBADOS

	2006	2007	2008	2009	2010
Production					
GDP at basic prices (US\$ million)	3 598.6	3 852.7	3 723.0	3 721.2	3 665.2
Finance and business services	1 103.6	1 144.4	1 103.6	1 176.7	1 140.9
Hotel and restaurants	561.5	621.6	624.5	565.1	553.7
Government services	411.8	467.7	473.4	530.5	530.6
Wholesale and retail trade	399.4	385.6	376.6	354.6	376.2
Other	1 122.4	1 233.4	1 145.0	1 094.4	1 063.9
Expenditure (US\$ million)					
GDP at market prices	4 197.8	4 485.3	4 345.4	4 393.0	4 264.4
Consumption	3 570.2	3 773.9	3 929.2	3 899.0	3 861.9
- Personal	2 958.4	3 015.2	3 084.9	3 003.5	3 027.4
- Government	611.9	758.8	844.3	895.6	834.5
Gross capital formation	834.4	932.7	750.8	661.6	601.2
Exports of goods and services	1 938.7	2 043.9	2 090.4	1 861.9	1 945.6
Less imports of goods and services	2 131.9	2 216.2	2 433.5	2 039.7	2 153.4
Electricity consumption ('000 kwh)	903 398.0	940 845.0	937 983.0	949 878.0	958 100.0
Domestic consumers ('000 kwh)	292 570.0	297 751.0	296 969.0	305 906.0	308 400.0
Notes:					
Nominal GDP (% change)	n.a.	6.9	-3.1	1.1	-2.9
Nominal GDP (ratio to electricity consumption)	9.3	9.5	9.3	9.3	8.9

Source: Central Bank of Barbados; IMF's World Economic Outlook.

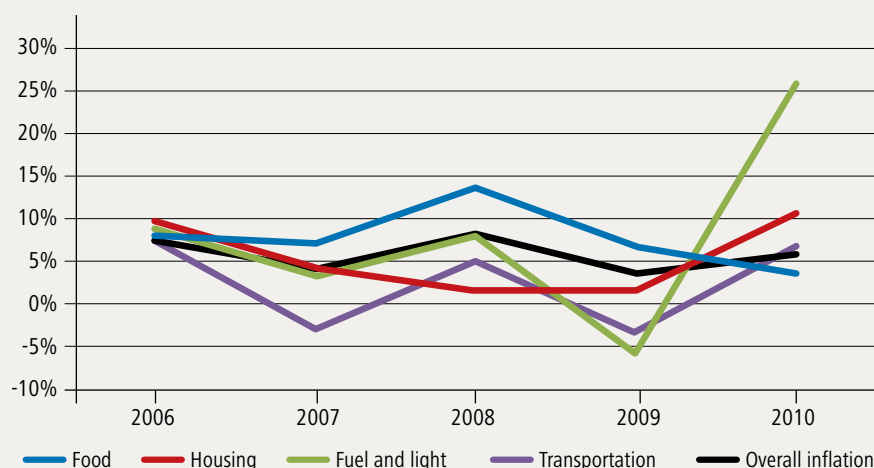
Note: US\$ 1=BBD 2

Part of the reason for the island's enviable record in relation to HDI has been the diversification of its economy from primary production to, essentially, a services-driven economy, in which the two main foreign exchange earning services are tourism and international business and financial services. Like most economies around the world, Barbados has been severely affected by the global financial and economic downturn. Nominal GDP in 2010 was estimated at US\$ 3.7 billion, about 3 percentage points lower than in 2009, and just barely above the level of output obtained in 2006 (Table 8). This is in contrast to the relatively strong growth reported in 2006 and 2007, when the average change in GDP was approximately 5 per cent per year. Since this period, total nominal value-added has declined on average by about 1 per cent per year. The International Monetary Fund's (IMF) World Economic Outlook (September 2011), however, expressed the view that economic activity should rebound in 2011 and 2012, with real GDP growing by 2 per cent per annum over this period, and returning to its long-run mean of 3.5 per cent in 2015 and 2016.

The slowdown in economic activity reported between 2008 and 2010 had a negative effect on investment. Table 8 shows that gross capital formation declined from 20 per cent of GDP in 2006 to just 14 per cent in 2010. The slowdown in investment can largely be attributed to a significant fall-off in foreign direct investment. In 2006 and 2007, the Central Bank of Barbados (CBB, 2011) reported that the island received a cumulative US\$ 0.9 billion in foreign direct investment. However, total foreign direct investment flows over the next three years fell to just US\$ 313.7 million, with foreign direct investment flows for 2009 and 2010 at US\$ 18.6 million and US\$ 78.8 million, respectively.

Government's capital expenditure – a key component of domestic capital formation – also contracted over the period, as authorities attempted to restore fiscal equilibrium. At the end of the fiscal year 2010/2011, the fiscal deficit was estimated at 8.8 per cent of GDP, marginally higher than that for the previous fiscal year. Due to the continued deterioration in the fiscal accounts, the national debt at the end of 2010 was estimated at 96.8 per cent of GDP, with the majority of this debt held by

FIGURE 10. INFLATION AND KEY COMPONENTS OF THE RETAIL PRICE INDEX



Source: Central Bank of Barbados Online Statistics

domestic institutions and individuals (67.5 per cent of GDP). The government's Medium-Term Fiscal Strategy (2010-2014) envisions a stabilisation and recovery of its finances by the end of the planning horizon, and so fiscal consolidation is likely to be its key objective over the short- to medium-term.

Between 2006 and 2010, average inflation in the island was 5.8 per cent, about 2 percentage points above the historical average for the island (Figure 10). This figure was largely driven by food prices, which account for almost 30 of the basket used to calculate the retail price index for Barbados. Over this review period, food prices rose by almost 8 per cent per annum, reaching as high as 13 per cent in 2008. Price increases for most of the other key components of the basket used to calculate the retail price index remained subdued until 2010, when rising oil prices resulted in a spike in the transport, fuel and light categories.

The labour market outcome mirrored its GDP, as mentioned earlier. Unemployment rates have been rising in the island since the end of 2007, and at the end of 2010 more than one in every 10 persons was unemployed (Table 9). In contrast to previous recessions, males relative to females were affected more significantly, with the male unemployment rate rising from just under 7 per cent in 2008 to almost 11 per cent in 2010. This figure largely reflected the significant slowdown in investment and construction activity, as mentioned earlier. While the female unemployment rate also rose during the review period, the deterioration in the unemployment situation for females was comparatively less severe.

1.1.7 SUSTAINABLE DEVELOPMENT POLICIES, PLANS, LEGISLATION AND PROJECTS

Barbados' long-term policy framework since its independence has been driven by a series of long-term development plans. The Ministry of Finance and Economic Affairs acts as the key catalyst for the implementation of the policies outlined in this study. The most recent document, Barbados' National Strategic Plan (GOB, 2005), sets out a vision for the island for the period 2006 to 2025, namely "becoming a fully developed society that is prosperous, socially just and globally competitive by the end of the first quarter of this century [2025]". To achieve this objective, a substantial rise in the average annual rate of economic growth was set as a key target: at least 5 per cent per annum. Such growth was expected to be supported by rising levels of productivity, innovation, entrepreneurship and the development of new service export industries.

The vision for the island was also expected to be pursued through the achievement of a number of strategies related to macroeconomic fundamentals. A central element of this macroeconomic policy framework identified was fiscal sustainability as well as productivity gains. By maintaining fiscal sustainability, the island should be able to shift public resources from debt service to developmental objectives. At the heart of this fiscal agenda was a targeted debt to GDP ratio not exceeding 60 per cent. Productivity gains, on the other hand,

TABLE 9. LABOUR MARKET STATISTICS

Year	Labour force ('000)	Unemployment rates (%)			Participation rates (%)	
		Male	Female	Total	Male	Female
2006	143.4	7.7	9.8	8.7	73.6	62.8
2007	143.7	6.5	8.5	7.4	74.3	61.9
2008	143.8	6.9	9.5	8.1	73.3	62.5
2009	142.7	10.1	9.8	10.0	72.3	62.2
2010	142.1	10.9	10.6	10.8	71.7	62.0

Source: Central Bank of Barbados Online Statistics

were to be supported by reduced energy costs, productivity-based pay schemes and diminished bureaucratic impediments to doing business.

In 2010, the long-term strategic development plan was supplemented by medium-term development and fiscal strategy documents. The content of the medium-term development and fiscal strategy documents (GOB, 2010a; GOB, 2010b) are largely consistent with the long-term strategic development plan. However, intermediate targets for key economic objectives were provided. Key targets outlined in the Medium-Term Fiscal Strategy (GOB, 2010b) include:

- real GDP growth of at least 3 per cent per annum;
- debt to GDP ratio of 70 per cent by 2017/2018; and
- a balanced budget by 2014/15.

The strategy notes that these economic goals should not be achieved by compromising social policy objectives or jeopardizing the well-being of citizens, in general, and the most vulnerable, in particular. In 2004, the Barbados Sustainable Development Policy was laid in Parliament. The policy was the output of the National Commission on Sustainable Development (NCSD), which was appointed in 1994 and fully formalised in 1996, to catalyse the island's sustainable development vision. A highly consultative stakeholder process was used to inform the drafting of the policy, the major objectives of which are to:

- formulate a national definition of sustainable development;
- provide a national framework for decision-making based on agreed principles of sustainable development;
- promote principles of sustainable development and encourage all persons to adopt and apply these principles in every aspect of decision-making; and
- sensitise and educate all persons in Barbados about key issues and conflicts between

development and the environment, and the need to make wise consumption and production choices.

GOB (2010c), however, notes that the implementation of these objectives has not progressed as expected due to numerous challenges, which include limited capacity in relation to human, financial and technical resources. It was suggested that the work of the NCSD would benefit significantly from the appointment of a dedicated staff comprising of both administrative and technical staff. It was also noted that there were also challenges in relation to sustainable development and environment data, lack of legal authority, as well as education and communication.

The Social Protocols, articulated by the Social Partnership comprising government, private sector and trade unions, are another key planning-policy-governance framework guiding Barbados' development. The Social Partnership first formalized their relationship in 1993 by signing an agreement entitled "Protocol for the Implementation of a Prices and Income Policy 1993-1995". This Protocol was designed mainly as a package of measures to reverse the gradual erosion of the country's competitiveness by addressing specific economic problems and their social consequences. The Social Partnership involved a commitment to:

- maintain an exchange rate of BBD 2 to US\$ 1;
- the expansion of the economy through competitiveness;
- the promotion of access to employment; and,
- a reduction in the incidence of social dislocation caused by high unemployment.

These were the main inducements for developing today's Social Partnership in Barbados. The protocol committed the partners to improved productivity and increased efficiency, thereby reducing wastage

and enhancing national performance so as to attract investment and create employment opportunities. The achievement of these objectives was based on the mutual commitment of the parties to clearly defined initiatives, including the establishment of a framework for workers' security of employment and a reduction in labour disputes.

Significantly, the recent Protocols, the last being signed in May 2011 (Social Protocol VI), underline the country's commitment to pursue sustainable development and a green economy. In general, the Social Partnership is a critical governance instrument in propelling Barbados' current and future stability, resilience and competitiveness.

Since 1970, Barbados has produced Physical Development Plans that seek to identify land use practices, community facilities and physical infrastructure that would support the island's development goals. The concept of sustainable development is explicitly woven into the most recent Physical Development Plan (GOB, 2003), which:

- places an emphasis on the protection of the natural environment and cultural heritage;
- establishes procedures and criteria for environmental impact assessments;
- attempts to focus new growth into a defined urban corridor;
- protects agricultural lands from incompatible urban development;
- seeks to maintain Bridgetown as the primary location for doing business; and
- promotes tourism by promoting the modernisation of older beach front properties and by enhancing opportunities for developments that uplift visitor experiences through the creation of national parks.

In relation to energy efficiency, the National Sustainable Energy Framework (GOB and IADB, 2010) identifies a number of strategies to encourage investments in renewable energy and energy efficiency to reduce energy costs, improve energy security and enhance environmental sustainability. The framework recommends building a sustainable policy framework based on five core principles:

1. **Adopt a win-win approach** – measures that increase sustainability and reduce the cost of energy;
2. **Place reliance on cost-benefit analyses** – a measure will only be pursued if the sustainability benefits exceed the economic costs;

3. **Pursue international support** – the government should work to secure concessional finance, grants and carbon credits;
4. **Adopt a stance of technological neutrality** – promote policies that increase sustainability and reduce costs rather than favouring a particular technology; and
5. **Build on existing strengths** – those elements of the country's energy system that work should be supported and developed. In relation to financing these national development objectives, regional funding agencies were expected to play a key role. Since 2009, seventeen projects were approved for funding by IDB, including the:

- Barbados Competitiveness Programme (US\$ 11.8 million);
- Sustainable Energy Investment Programme (US\$ 10 million);
- Coastal Risk Assessment and Management Programme (US\$ 42 million);
- Support for Sustainable Energy Framework for Barbados (US\$ 45 million);
- Agricultural Health and Food Control Programme (US\$ 28 million);
- Modernisation of the Barbados National Standards System (US\$ 7.29 million); and
- Water and Sanitation Systems Upgrade (US\$ 53 million).

In addition, the Caribbean Development Bank provided loans to finance the Harrison's Cave Redevelopment Project (US\$ 12.85 million), a low-income housing project (US\$ 36 million) as well as a policy-based loan (US\$ 25 million) received in 2010 to help ease the financial strain of the recent 2008-2010 recession. The World Bank has only financed two projects in Barbados since 2001, both of which aimed to support the country's National HIV/AIDS Strategic Plan.

1.2 BARBADOS' GREEN ECONOMY SCOPING STUDY



One of the many GESS stakeholder meetings. Photo: Natural Heritage Department

1.2.1 BASIS OF A SCOPING STUDY

The genesis of the scoping study was a challenge given by the late Prime Minister, the Honourable David Thompson, in 2009, and builds on goal four of the National Strategic Plan 2006-2025, Green Economy: Strengthening the Physical Infrastructure and Preserving the Environment (GOB, 2006). At that time, Mr Thompson announced his vision of Barbados becoming “the most environmentally advanced, green country in Latin America and the Caribbean” (GOB, 2011).⁴ Against this development goal, the government engaged UNEP in the establishment of a partnership to support the country's transformation. The first phase of the agreed partnership was the undertaking of a scoping mission and the design of a Green Economy Scoping Study (GESS).

The purpose of the scoping mission was to review with the government of Barbados its plans for greening the economy, and to develop a plan of action for possible UNEP support in the form of advisory services to support this transition. To this end, the scoping mission aimed to sustain a dialogue with government agencies, including ministries of the environment and finance, and policy and academic research institutions to review their advances and goals for moving towards a low carbon and resource efficient economy in Barbados. Moreover, the mission had the objective of exploring synergies between the GESS development process and the ongoing

and planned initiatives in sustainable finance and sustainable consumption and production (SCP). The government of Barbados and UNEP reached the following broad areas of agreement:

- The overall context in which the GESS would take place, putting special emphasis on the Barbados National Strategic Plan 2006-2025 and the Medium-Term Strategic Framework 2010-2014, which already include many green economy initiatives. The document would focus on the interface between macroeconomics and the environment, providing technical and policy recommendations on how to enhance the returns and net benefits that might result from making this transition.
- Defining priority sectors for collaboration on green economy. The government of Barbados indicated the priority areas for inclusion in the scoping study. These included: tourism, agriculture, transportation and housing/buildings. In addition, due to their transversal nature, the government requested including the cross-sectoral issues of water resources, energy and waste in the analysis. These sectors were chosen based on their strategic importance to Barbados' economy and for their greening potential. Initial meetings were held with representatives from the respective ministries to begin determining key priorities and initiatives within each sector, including potential gains from directed investments or policy reforms. While there was interest in including additional sectors, it was agreed to maintain the focus on a limited number of sectors, while keeping the options open to expand coverage if additional funding and time constraints permitted.

1.2.2 DEFINING BARBADOS' SCOPING STUDY

Essentially a scoping study attempts to provide an assessment of the magnitude or importance of a particular problem and policies that have been utilised to assess the problem. In most instances, this is done via a review of relevant literature, an analysis of historical data, and the incorporation of other preliminary data collection techniques that can

be used to develop a set of policies to address the identified problem.

1.2.3 TERMS OF REFERENCE FOR BARBADOS' GREEN ECONOMY SCOPING STUDY

The GESS is undertaken within the parameters defined by the Terms of Reference (TOR) (see Annex 1). The overall objective of the GESS is to support and complement national initiatives towards greening the economy through macroeconomic assessments and policy analysis. The GESS is expected to improve the understanding of how government policies and public and private investment can help achieve the fundamental macroeconomic objectives of income growth, economic development and/or diversification, and job creation, following a path that also contributes to social equity and environmental improvement.

The specific objectives of the GESS are to:

1. Analyse opportunities and challenges of a green economy focusing on five priority sectors (tourism, agriculture, transportation, fisheries and building/housing);
2. Investigate the cross-cutting issues of water resources, energy, and waste;
3. Evaluate trends, patterns and gaps in green investments by tracking the impacts on GDP of public and private investment expenditures in the aforementioned sectors while simultaneously taking into account the three cross-cutting issues indicated above;
4. Quantify the direct and indirect benefits of such green investments, with reference to economic growth, employment creation, and environmental improvement along with other spillover effects;
5. Identify opportunities and challenges (barriers) to green investments, including an estimation of the additional investment required to achieve existing or desirable policy targets; and
6. Develop recommendations on key enabling conditions and related policy reforms in order to support and facilitate green investments (inter alia, taxation, subsidies, laws, standards, tariffs, procurement policies), along with its possible socioeconomic repercussions.

As stipulated in the TOR, the expected outcomes were:

1. Macroeconomic assessment of the potential benefits and challenges of investment in priority economic sectors (tourism, agriculture, building/housing, fisheries and transportation) that offer the largest potential to promote a transition to a green economy and which includes an analysis of the socioeconomic outcomes;
2. Set of policy recommendations to address policy and capacity gaps and needs, through specific policy reforms, programmes and projects; and
3. Contribution to the formulation of a national strategy to “build a resource efficient green economy for Barbados” (Stuart, 2011).

In order to fulfil the above objectives, an integrated assessment approach was employed, which involved integrating three interrelated elements: (1) analytical modelling and analysis; (2) participatory methods; and, (3) the decision-making process. This approach therefore required the experts, decision-makers and industry experts to interface with each other to arrive at an integrated assessment of the particular sector or problem.

1.2.4 METHODOLOGICAL APPROACH AND PROCESS

Generally, the GESS was undertaken in the manner prescribed in the TOR. However, during the course of the study, it was determined that the GESS should also cover:

- The fishing industry as a separate sector;
- Land as a cross-cutting resource issue, given its scarcity and relevance to the sectors initially identified as well as its relevance to resource issues like waste and water; and
- An assessment of the three (3) Rio Multinational Environmental Agreements in the analysis of the enabling activities.⁵

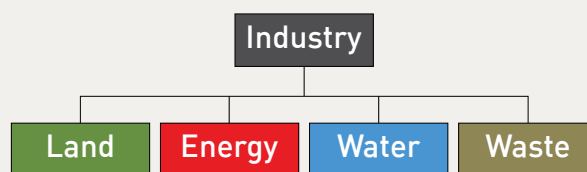
The essential goal of including the cross-cutting issues was to address the resource use problems that impact on most industries in a holistic manner (see Figure 11). Indeed, these cross-cutting issues are key inputs/outputs for most industries in Barbados. Green policies to support industry are therefore likely to be aimed at one, if not all of these inputs. In this way, potential synergies and business opportunities could be identified. The project team was composed of a Technical Co-Chair and an Administrative Co-Chair for project oversight, who would be responsible for the overall completion of the project. There was also a technical lead for the project whose task was

to ensure the overall congruence of the document. In addition to these persons, sector specialists were also employed to lead the research and analysis: a resource economist, a resource management and efficiency specialist, an urban planner, a fiscal analyst, an agriculture economist, an energy specialist and tourism and fisheries experts.

A programme officer along with two research assistants gave support to the technicians. A technical staff from the University of the West Indies (UWI) was joined by UNEP experts who provided general guidance, support and feedback. From the project inception, the team met on a monthly basis, which was chaired by either the Technical Co-Chair or the Administrative Co-Chair chaired all meetings. A number of other meetings were held for specific technical matters such as review of data requests made by team members, the methodology being used and the inception report.

The GETSC was established by the government of Barbados to have technical oversight of the project, and monthly meetings were held. The UWI-CH GESS Team, the Technical or Administrative Chair, along with the UWI-CH GESS Programme Officer, attended these meetings and reported to the Committee on the progress and obstacles faced with respect to completing the GESS. A number of presentations were made to the GETSC members to illustrate programmatic and policy thrusts within their organizations that are relevant to the greening of the economy. Among them were:

FIGURE 11. RELATIONSHIP BETWEEN CROSS-CUTTING ISSUES AND INDUSTRY ANALYSIS



- Housing from a green point of view;
- Ministry of Agriculture - general overview;
- Organic cabbage fertility trial;
- Going green: a guidance framework for a green economy;
- Ministry of Tourism sector presentation to the GETSC;
- The BIDC – a green corporate citizen; and
- Survey on greening in the manufacturing sector.

A number of meetings with key government agencies were held to provide guidance to the UWI-GESS team. It was intended that such meetings would be held with the ministries with primary responsibilities for the five focus sectors – Agriculture (which includes the Fisheries Division), Housing, Transport and Tourism. Moreover, members of the team met with the Energy Division due to the high level of activities being undertaken at the national level in the energy sector.

In addition to meeting with clients, stakeholders from each sector were brought together to discuss their vision of a green economy, the obstacles



Green Economy Technical Steering Committee consultation – Applying the SCORE methodology. Photo: Natural Heritage Department

Wind power in agricultural landscapes – Part of Barbados' energy heritage. Photo: Travis Sinckler



to achieving that vision and the strategies for overcoming the obstacles identified. These meetings were meant to focus primarily on moving Barbados towards a green economy. At the same time, consultants were expected to draw on past and other current consultative processes in the various sectors. Technical seminars were conducted and aimed to facilitate the articulation of the requisite enabling environment for greening the economy. Moreover, a Panel Discussion Series was developed with an orientation towards generating solutions and is meant to engage industry players – experts and technocrats in both the public and private sectors.

The topic areas of the panel discussions that have been held so far are as follows:

- What is a green economy?
- Can local production be clean and green?
- Driving a green economy through public finance and fiscal policy reform.

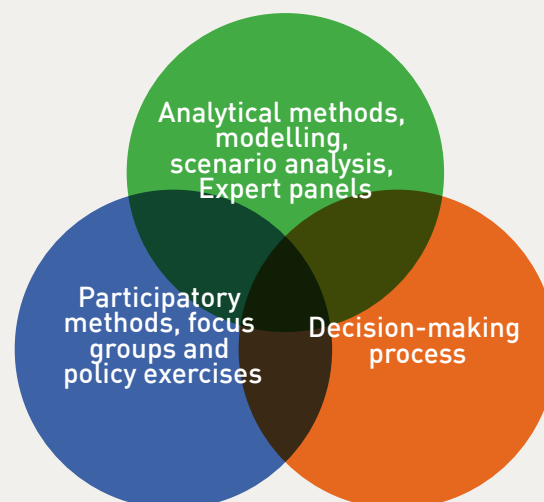
1.2.4.1 INTEGRATED ASSESSMENT

Carrying out an assessment of the type required of this study cannot be done without drawing on skills and methods from a wide variety of disciplines. Even though the report has a particular focus on five key sectors of the economy (agriculture, fisheries, construction, transportation and tourism), consideration must be given to the fact that they are fundamentally linked to the social, economic and environmental fabric of the island. Consequently, as argued by Weyant et al in the overview and comparison of approaches and results to assessing climate change, an integrated assessment of greening the economy seems to be the most appropriate approach to use as it is a convenient framework to combine knowledge from a large number of disciplines (van der Sluijs, 2002a). This approach enables us to:

- Study the potential future paths for human and natural systems,
- Investigate important issues of policy formation, and
- Identify research priorities that enhance the ability to identify cogent policy solutions.

Integrated assessments are, therefore, intimately related to the policy development process and consist of three inter-related processes: (1) the use of analytical methods, modelling, scenario analysis and expert panels; (2) the use of participatory

FIGURE 12. INTEGRATED ASSESSMENT PROCESS



methods, focus groups and policy exercises; and, (3) the decision-making process (Figure 12). All three aspects of the process are interrelated and are fundamental aspects of the assessment process and policy development.

Integrated assessment approaches have a long history of use in relation to climate change. The United States Department of Transportation, for example, commissioned an inter-disciplinary report on the environmental effects of stratospheric flight by supersonic aircrafts (Grobecker, Coroniti & Cannon, 1974). The project investigated the impact on people, plants and animals. Teams of researchers exchanged quantitative data that were then used to generate estimates of the environmental and economic impacts of various scenarios of stratospheric flight. The physical scientists focused on possible depletions of ozone, changes in ultraviolet reach to the surface of the planet and variations in the surface temperature of the earth due to the formation of stratospheric aerosols. Biological and economic aspects of the study then focused on the implications for agricultural, foreshore and marine productivity and the consequent implications for human health and economic outcomes.

One of the criticisms of this expert panel approach to integrated assessment is that it did not adequately allow for the consideration of a wide variety of policy scenarios and the likely effectiveness of various policy measures. In the 1980s, therefore, computer simulation models were incorporated into the process of undertaking integrated assessments. These models allow the expert panel to evaluate the environmental, economic and social consequences of various policy

options so that optimal values of key policy variables (i.e. carbon taxes) can be identified. Alcamo, Shaw & Hordijk (1990) outlines the development of the Regional Acidification Information and Simulation (RAIN) model for Europe, which was used to evaluate the effectiveness of various control strategies. Sub-models in the areas of sulphur dioxide (SO₂) emissions, costs of control strategies, atmospheric transport of sulphur, forest soil and groundwater acidity, lake acidification and the impact of SO₂ were linked to conduct scenario analysis. Once costs and disposition goals were identified, the optimal SO₂ reduction strategies were identified. The model played a major role in the negotiations leading up to the United Nations Convention on Long-range Transboundary Air Pollution (van der Sluijs, 2002b).

The computer-based integrated assessment models continue to play a key role up until now, particularly in relation to the international climate policy debate (Alcamo, 1994; Hulme, Raper, & Wigley, 1995). However, these models tend to ignore the key role by various stakeholders in relation to the implementation of environmental policies emerging at the international level. A participatory approach to integrated assessment has therefore become a key aspect in recent integrated assessment. It allows technical experts to benefit from the knowledge of stakeholders as well as engender commitment to the project ideals. The participatory approach can be achieved through the use of focus groups, town hall meetings or, in the case of this project, stakeholder consultation. Within Europe, the European Urban Lifestyles Sustainability and Integrated Environmental Assessment (ULYSSES) Project allows for focus groups of citizens to debate issues related to climate change as well as to consider mitigation options supported by expert information (van der Sluijs, 2002b).

1.2.4.2 THE SCORE APPROACH

The main analytical approach used in this report was SCORE (strengths-challenges-options-responses-effectiveness) analysis (Graves, 2006). The SCORE approach is conceptually quite similar to SWOT analysis, in that it attempts to provide an assessment of strategic issues. However, it is more ideally suited to identifying potential gaps. One further difference between this approach and a SWOT analysis is its application: SCORE analysis is dynamic – comparing each dimension against the others and assessing the success of the strategy in the future – while SWOT analysis is quite linear.

Unlike the traditional SCORE approach, however, an attempt was made to utilize expert opinion in order to rank alternatives and identify investment gaps. Within the SCORE approach, strengths are those factors, either in the form of resources or capabilities, which can be used to enhance greening of the particular industry. For example, in relation to tourism, one may argue that Barbados has a good reputation among visitors or a high level of repeat visitors that can be leveraged to add momentum to green economy initiatives. It is important that these strengths are not conceptualized simply as those that Barbados has. It is equally essential to examine if there are any shared strengths and support originating outside of the country, whether regionally or internationally. The key questions to be addressed therefore are:

- What are the key strengths of the country in relation to greening the economy?
- What support resources do we have?
- What support resources are available from other countries?

Addressing the questions above is a fundamental part of taking advantage of potential opportunities and developing credible policy options.

The second element of SCORE's analytical framework is the identification of challenges, which are factors that are likely to hinder the movement towards greening a particular industry. These challenges should go beyond the identification of resource limitations (which is a fundamental constraint for all small economies) and consider what processes are in need of change, particularly with respect to relationships with partners and stakeholders. This section of the analysis should also attempt to identify the capabilities and services required along with what is needed to develop them.

A systematic identification of the challenges can be done by applying a score based on a 10-point Likert scale in relation to frequency of occurrence and its likely impact. The combination of these two factors then provides a ranking or importance. A challenge would receive a value of 1 if it has a very low frequency of occurrence, and 10 if the frequency of occurrence is very certain. Impact is based on the expert's opinion of the likely importance of the challenge if it becomes manifest in relation to the goal of greening the economy.

In order to identify investment gaps, a systematic scoring approach is employed. For each identified strength or challenge, an importance score is

“The Social Partners fully subscribe to the concept of a low carbon, resource efficient green economy and the goal of Barbados becoming the most environmentally advanced green country in Latin America and the Caribbean ...”

Extract from “Protocol VI of the Social Partnership”, 2011-2013

provided based on a 10-point Likert scale, where 1 means not important at all and 10 very important. The second element of the gap analysis would be to assign a score for Barbados' current performance in relation to building on its strengths or minimising the effects of challenges. Again, a 10-point Likert scale is employed where 1 suggests that the country has not built on the particular strength/attempted to address the challenge, while 10 indicates that the performance of the country in some areas has been ideal. Subtracting the performance score from the strength score then identifies the performance or investment gap (a positive value suggests that greater investment is required in relation to building on the given strength or addressing the identified challenge).

The third and fourth elements of the SCORE approach are the identification of opportunities and its effectiveness in relation to greening the economy. The identification of opportunities should attempt to not only identify the opportunities in relation to, for example, greening the construction industry, but also seek to identify the risks likely to arise from pursuing these opportunities, and, if possible, what opportunities could arise from these apparent risks. Effectiveness, on the other hand, relates to whether or not an opportunity maximizes the use of resources. The effectiveness assessment should also attempt to examine whether or not the option is predictable, simple, automatically adjusts to the human factor, appropriate and integrated (i.e. it maximizes synergies across the various sectors of the economy).

A systematic approach to identifying the most important opportunities can be undertaken by ranking each opportunity in relation to its success frequency and attractiveness. Using a 10-point Likert scale, an opportunity receives a score of 10 if it has a high likelihood of success, and 1 if it is not likely to be successful. Similarly, if an opportunity were likely to be effective in the pursuit of greening the economy, the initiative would receive a value of 10, or 1 if it were not likely to have a significant impact on the goal of greening the economy.

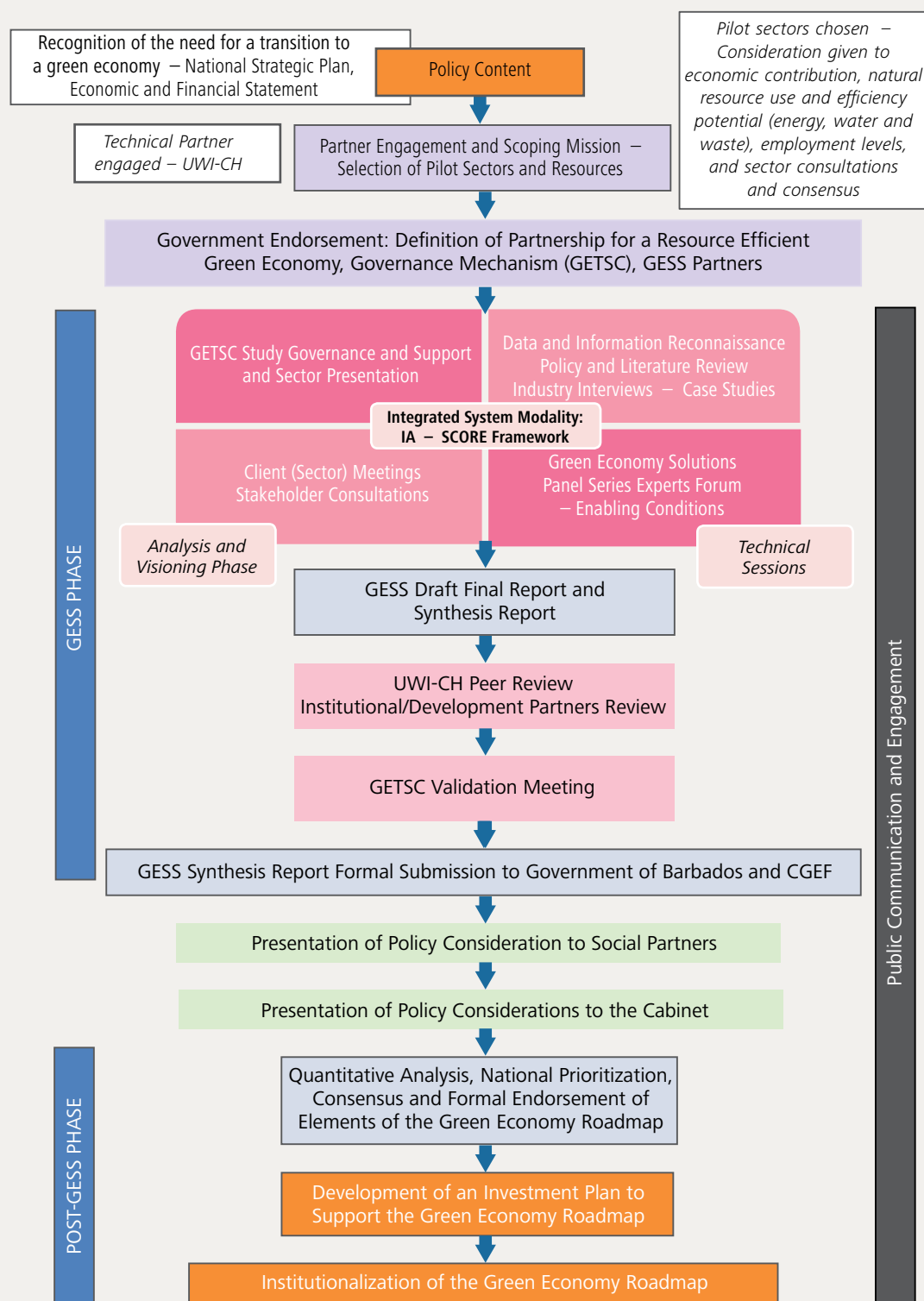
The fifth and final element of the SCORE approach is the identification of responses to the pursuit of green economy initiatives. What responses could we expect from key stakeholders, such as business, citizens, regional partners and international agencies? Such an assessment is important, as would acknowledge that policy changes can often result in perverse incentives and/or an increase in the propensity to avoid regulatory costs if the system is particularly burdensome. It is important that, where possible, the quantitative

estimates of these expected responses are provided. Such estimates can be based either on research by the consultant or from previous studies on the subject. The overall methodological approach is depicted in Figure 13.

1.2.5 STRUCTURE OF THE REPORT

The remainder of this report is structured as follows. Following the introduction, Section 2 examines the concept of the green economy and its applicability to small open economies. Section 3 then goes on to examine the potential opportunities for greening selected sectors in the Barbados economy, identifying investment gaps and potential returns in terms of growth, while Section 4 provides a discussion of the necessary enabling conditions for transitioning to a green economy. Section 5 outlines a potential roadmap for a green economy in Barbados, and Section 6 presents the conclusions of the study.

FIGURE 13. UMBRELLA METHODOLOGY UTILISED FOR THE GREEN ECONOMY SCOPING STUDY



Source: Schematic diagramme designed by the Policy Research, Planning and Information Unit, Environment Division, Ministry of Environment and Drainage, Government of Barbados, 2011.

2.1 THE CONCEPT OF GREEN
ECONOMY

2.2 RELATIONSHIP BETWEEN
REGIONAL AND INTERNATIONAL
ENVIRONMENTAL FRAMEWORK AND
GREEN ECONOMY

2.3 APPLICABILITY OF THE GREEN
ECONOMY CONCEPT TO SMALL OPEN
ECONOMIES

2.4 BARBADOS' DEFINITION OF A GREEN
ECONOMY



TRANSFORMATION TO A 2 GREEN ECONOMY



CONCEPT OF A GREEN ECONOMY

The topic of green economy has become the object of a great deal of discussion and fostered a burgeoning body of literature and research in which its concept, definition, philosophical underpinnings and practical implementation are debated. The multiple interpretations of the concept have attracted questioning as to what exactly is meant by a green economy, even from people who embrace the concept (Sheng, 2010). The growth in discussion could also be a result of the 'environmental crisis' and so it is not surprising that the green economy is being placed at the core of the Rio+20 Conference (IISD Reporting Services, 2011). The conference had as one of its themes "a green economy in the context of sustainable development and poverty eradication".

The shift to a discourse centred on green economy is being seen, particularly within UN Agencies, as a pathway and driver to sustainable development (UNEP, 2011e). The perception being held is that the environment is the determining factor of economic production, value, stability and long-term prosperity; that the environment becomes the enabler of economic growth and, through such growth, human well-being (UNEP, 2011e). In other words, according to this particular conceptualisation, a green economy is nested within and is an integral part of sustainable development. The convergence of a green economy and sustainable development is clearly seen in the various working definitions of green economy enunciated by UNEP:

.... one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities (UNEP, 2010a).

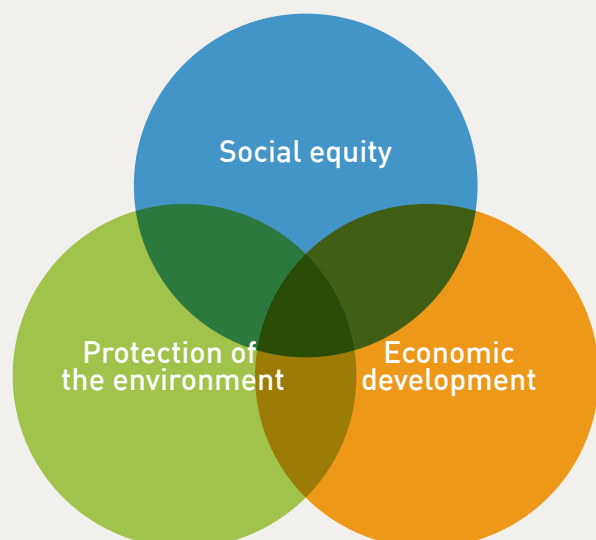
A green economy is a system of economic activities related to the production, distribution and consumption of goods and services that results in improved human well-being over the long term, whilst not exposing future generations to significant environmental risks and ecological scarcities (UNEP, 2010b).

These echo the three pillars of sustainable development – environmental protection, social development, and economic development (Figure 14). Indeed, the United Nations Conference on Environment and Development in 1992 (also known as the Rio Earth Summit that helped popularised the concept of sustainable development) foresaw

a three-pronged approach to achieving sustainable development: i) developed countries would change their production and consumption patterns (their economic model); ii) developing countries would transition to sustainable development methods and paths; and iii) developed countries would enable and assist transitioning developing countries. Sustainable development would not only involve ecological practices that enabled meeting the needs of future generations, but also a change in production and consumption patterns whereby resources are used in such a way as to ensure that the needs of everyone now and in the future are met. It is evident that in crafting the definition of green economy, there is a conscious effort on the part of the UN system to establish its leadership within the arena of sustainable development.

In spite of all this, the term 'green economy' remains problematic. Some developing country delegations to the first preparatory meeting of the Rio+20 process expressed concerns that the concept may be misused or taken out of context at the global level (UNCTAD, 2011). One of the risks identified was that the term 'green economy' would be promoted in a purely 'environmental' manner without fully considering development and equity dimensions. The Group of 77 and China saw no valid argument for abandoning the concept of sustainable development for "an imprecisely defined, abstract concept". Other concerns were that the term 'green economy' could be inappropriately used by developed countries to

FIGURE 14. ELEMENTS OF SUSTAINABLE DEVELOPMENT





enforce trade protectionist policies that discriminate against products of developing countries (UNCTAD, 2011). Overall, at the global level, there is a need to identify the value added by a green economy over and above that of sustainable development.

In response to these concerns UN agencies have further sought to link green economy not only with sustainable development, but also with contemporary issues such as security. Thus, green economy interventions are to be a means of responding “to the multiple crises that are impacting food security, water security, energy security, job security and indeed national security” (Chouchani, 2010).

At its core, nevertheless, a green economy still has to be understood as an economic system – and one that is compatible with the natural environment, environmentally friendly, ecological and, as added by some, socially just. The problem is that certain economies, if left to themselves, are not naturally inclined to be any of the above. Thus, it is argued that there is a need to impose these values on a given economy, which could be described as ‘the greening of the economy’ (Sheng et al., 2011).

The principles on which greening an economy are to be based are reasonably well-established, i.e. using renewable resources at or below regenerative capacity, limiting pollution to within the absorptive capacity of nature, and maintaining ecosystems stability and resilience. However, a green economy is more than a system possessing the aforementioned attributes. It is further conceptualised as comparable to a service economy: an economic system that is characterised by investment transactions; production; the provision and consumption of not only environmentally friendly, but also of environmentally enhancing goods and services as well. There is a departure, therefore, from its conceptualisation as being a highly regulated system premised on constraints to one that perceives the aforementioned attributes as creating opportunities. Here, policy tools such as environmental pricing and standards become instruments to incentivise economic agents to produce, trade and consume environmentally friendly and environmentally enhancing goods and services. Nonetheless, as Sheng et al. (2011) notes, it is not automatic that a green economy would contribute to social goals without specific policies and institutions.

Other commentators have expressed reservations over the way a green economy is conceptualised and presented. Addressing the question posed in Viewpoints (Sheng et al., 2011), “is the concept of a green economy a useful way of framing

policy discussions and policy making to promote sustainable development?”, a select panel of 30 academics, practitioners and experts manifested significant convergence in their views. Most agreed that the term ‘green economy’ was a useful concept but repeatedly questioned its actual meaning. Of most concern to them was the possibility that the social dimension and related aspects of the economy, such as wealth distribution, could be obscured.

Many emphasised the ecological/environmental basis of a green economy and the associated need to recognise the value of goods and services provided by the environment and to incorporate these into production and consumption values. A caveat to this was noted by one of the contributors and echoed by Slaper and Krause (2009): care has to be taken as to what constitutes ‘green’ and that effort has to be exerted to ensure that ecological impacts are not merely displaced in space or time. Indeed, Slaper and Krause, in their discussion of what green means in an economy, highlight how definitional difficulties complicate the measuring of both green production and green jobs, which are fundamental indicators of growth in a green economy.

It is clear from the views of commentators (Sheng et al., 2011) that a green economy is made up of many different ideas and that there is a need to decompose it into manageable parts. It would probably be helpful, therefore, to accept Sheng’s suggestion that there is a green economy family of ideas, which would include ideas such as a low carbon economy, a circular economy, sustainable consumption and production, green growth, sustainable development and the ‘Green New Deal’ (UNEP, 2009).

How then does this assist in the definition of a green economy for Barbados? Two things are clear from the literature: transitioning to a green economy requires the involvement of people and government. As Bryant states, “The people involved in building local green economies can make important contributions to policy discussions and become involved in co-constructing policy” (Sheng et al., 2011). Secondly, the role of government in setting the policy framework and ensuring that the necessary incentives are in place is critical. A green economy in itself would be a hollow phrase if it is not backed by political signals and incentives and promoted through targets and indicators that punish polluters and reward sustainable behaviour (Sheng et al., 2011). It is for this reason that having an appropriate governance framework that works to promote, rather than just support, a green economy is a necessary transitioning condition.

Building on existing literature, the broad components of Barbados' green economy should encompass the level of available natural resources use, ensure that such use is not only in a sustainable manner, but also contributes to the maintenance of important environments and to the rehabilitation of degraded environments (i.e. coral reefs), where considered necessary. One such component relates to the nature of resources used to create particular types or forms of productive capitals (e.g., infrastructure, buildings, homes, machinery), products, goods and services. Then there are the forms of social relationships upon which productive activities are premised, both the implicit and explicit social contracts. Lastly, there is the consumption component that relates to questions of the nature of demand (satisfaction of needs and of wants without entailing excess use) and the desirability of products, goods and services as well as post use behaviour (nature of disposal) (UNEP, 2011d).

The consumption component depends on the adoption of particular social and moral norms that privilege certain forms of desirable behaviour over others as well as the use of economic incentives to signal and reinforce what constitutes socially desirable behaviour. This applies as much to the individual consumer as well as to the producers and suppliers, who are themselves intermediate consumers of input goods and services. One of the means that could be used to promote the formation of social and moral norms would be the introduction of requirements for the production and publishing of sets of social, economic and environmental accounts both at the corporate and national level as (United Nations, European Commission, IMF, Organisation for Economic Co-operation and Development and World Bank, 2003).

At the national level, there are examples of countries that have embarked upon this. India and Brazil have signalled that they are looking at adopting the approach used in The Economics of Ecosystems and Biodiversity Study as a means of developing green national accounts, reflecting the value of ecosystems and biodiversity and their use to their economies (TEEB, 2010). Other countries (e.g., Namibia, the Philippines and the Netherlands) have adopted forms of the United Nations' System of Integrated Economic and Environmental Accounting (SEEA) as a way of extending their system of National Accounts to reflect the impact of resource use on their economies (United Nations, 2000).

Moving towards the development of a set of national accounts that reflect the value of natural resources,

ecosystems and biodiversity should be seen as an integral part of Barbados' transition towards a green economy and as a means of monitoring that progress. In so doing, the government signals its commitment to environment and sustainability, and sets an example to the private sector as to how they too should be reporting their activities as good corporate citizens. At the same time, such reporting can form the basis for informing the public and be used as a means of influencing opinion and behaviour.

Likewise, the private sector needs to be encouraged to demonstrate that they are also conducting their business in an environmentally friendly and socially responsible manner. The drawing up of corporate social and environmental responsibility reports is a way for them to demonstrate this (Deloitte and Touche and World Business Council for Sustainable Development, 1992). As with sets of national accounts, there are numerous models that have been used, and the field of environmental and corporate accounting is well established (UNCTAD Secretariat, 1998). Thus, the challenge is to encourage and assist enterprises to adopt such methods. The agriculture and fisheries sub-sectors are directly dependent on natural resources, and the environment is a primary input into the tourism product. In this context, there is a good case for the inclusion of corporate social and environmental accounting and reporting using methods such as the Triple Bottom Line (Elkington, 2009).

Given that a green economy incorporates ideas such as low carbon usage and sustainable production and consumption, the realisation of these objectives depends on the nature of the resources used and the manner in which they are utilised. This, therefore, should explain why for some a green economy must have a focus on renewable energy, water management, land management, green buildings and clean transport. Even though Barbados is a very small net contributor to greenhouse gas (GHG) emissions, it should seek to maximise its use of renewable energy and promote energy use efficiency in all sectors of the economy. Thus, ground transport in the transportation sector should also be the target of such efforts and not merely activities that consume electrical energy.

Water is a finite resource and is an essential input to almost all productive activities as well as being a necessity in the maintenance of ecosystem services. In a growing economy, green or otherwise, the demand for water is likely to increase. This creates increased competition for this already scarce resource, which will have to be mediated. In a green

economy, water use must be kept within sustainable limits, while recognising that the environment is also a legitimate consumer. The concept of closing the water cycle as a means of resource conservation, efficient recycling and reuses needs to become an integral part of ensuring that scarcity does not lead to unsustainable resource exploitation (UN, 2009).

In Barbados, land, like water, is a factor of production, which is also very limited and undergoes increasing pressures for use conversion. Land use and management cannot be viewed in isolation, especially as conversion can adversely affect the availability of other resources as well as productive opportunities and options. Thus, in a green economy, land use policies should seek to prioritise uses that contribute to the maintenance of natural resources and ecosystem services. In addition, an approach to land use development and planning based on industrial ecology principles, where the development of productive infrastructure is required, should be adopted. This ought to include reuse of already developed areas as a priority.

Furthermore, green land use policies should be complemented by a green approach to the built environment, whereby features such as prioritising the minimisation of resource use and exerting efforts by indicating a plan to lower the embodied energy⁶ of materials used in construction, as well as of the finished building, to use materials from sustainable resources and to reuse materials become pre-requisites for new construction. At the same time, policies should be developed to incentivise the retrofitting of the existing built environment so that there is a move towards upholding of the same standards of resource use and efficiency as for new build (UNEP, 2011d). Moreover, adoption of existing approaches such as the green building certification scheme, Leadership in Energy and Environmental Design (LEED), should be considered. There will also be a need to develop metrics that can be used to assess the relative resource use of different alternatives as a means of evaluating trade-offs between options.

The adoption of alternative means of ground transport that do not rely on the use of fossil fuels will perhaps be the most challenging of the aspects of a green economy to achieve. This will entail appraising both private and public transport systems and transitioning them to more sustainable solutions. With respect to public transport there is clearly a need to move away from the current means of transport based on the use of fossil fuels. A green transportation system would be one in which use of



Harrison's Cave electric tram. Photo: Ken Uyeda/Blackbird Design/Calgary Canada

renewable energy sources are maximised, emissions of pollutants are minimised and non-motorised modes of transport are incorporated while serving the needs of the travelling public. Any adverse impacts would be either mitigated or offset by the derived benefits.

With respect to private transport, a green economy would encourage the use of reliable, safe, and comfortable public transport systems to minimise the use of private vehicles by the commuting public. In the case of businesses which have to use ground transport either to source or deliver goods and services, greening transportation would entail a commitment to trip consolidation so as to minimise travel distances and the number of journeys. Transport operators, in particular, would need to think, behave and work smarter in order to change the consumption pattern of this sector.

The above formulation sets out a basic conceptualisation of what would be some of the primary components of Barbados' green economy. It is clear from this that the role of the public sector will be key in not just providing leadership, but also in setting the policy framework, putting in place incentivising mechanisms and monitoring protocols.

The Green Economy Scoping Study (GESS) for Barbados team has spent some time trying to determine how expansive its scope should be. In the narrowest sense, the GESS could limit itself to considering a core of commercial activities that could be seen as income and revenue generating while promoting greening and reducing human impact on the environment. In the broadest sense, it could concern itself with the full set of contextual activities that must be carried out if all commercial activities are to be impacted. These contextual activities encompass policy development, planning, legislation and implementation in all areas related to



Coastal rehabilitation – Climate adaptation technology intervention by the government. Photo: Anne Gonzalez

sustainable development. Clearly, that is too broad a scope for the GESS. It has therefore focussed on core commercial activities while drawing upon or referring to contextual activities that are enabling, even though not comprehensive in their ambit and impact.

Some countries have been slow to adopt green economy initiatives given the lingering perception that green policies reduce the ability of locally domiciled firms to compete. Porter and van der Linde (1995) state that this perception arises from a static view of environmental regulations – in an economy without technology, a firm would simply choose the production approach that minimizes costs. In this static viewpoint, environmental regulations would raise the cost of doing business and therefore result in a loss of market share of domestic enterprises. Porter and van der Linde (1995), however, note that in the real world the most competitive firms are not necessarily the largest ones or those with the cheapest access to resources, but the firms that improve and innovate. In our dynamic world, environmental standards can lead to innovations that more than offset compliance costs. It is even possible that such innovations might result in absolute advantages for locally domiciled firms (Montero, 2002).

There is also the perception that the green economy concept is not sufficiently oriented towards conservation of ecosystem services, especially maritime ones. For recall, ecosystems provide services that are ultimately important for the realisation of a green economy. These services include regulation of floods, carbon sequestration, extreme events, soil erosion, fertility and water filtration; provision of food, medicines, fresh water and other raw materials, and habitats for species

and genetic diversity; provision of non-material benefits such as recreation, tourism, spiritual endeavours and aesthetic enjoyment; and playing a supporting role for nutrient cycling, photosynthesis and soil formation (TEEB, 2010).

As a small island, Barbados is dominated by marine and coastal ecosystems. A close look at Barbados' ecosystems reveals that their integrity is at stake. Two negative forces, external and internal, threaten that integrity. One of those external forces is climate change. Carbon dioxide, the main GHG that contributes to climate change, although emitted in greater quantities elsewhere, is increasingly being generated and emitted within this region and, if not reduced, will negatively impact the marine and coastal ecosystems of Barbados and the Caribbean. Island nations such as Barbados could experience a loss of marine biodiversity, fisheries and their shoreline (Munday, et al., 2009). Coral reefs, in particular, which are among the most bio-diverse ecosystems, are highly sensitive to increases in sea surface temperature. In fact, a 20°C increase in sea surface temperature, associated with CO₂ concentrations of 500 ppm, threatens most coral reefs around the world, particularly, those within the Caribbean (Hoegh-Guldberg, et al., 2007).

This means that the bio-diverse ecosystems in the Caribbean are among the most threatened in the world. In fact, the Intergovernmental Panel on Climate Change (IPCC) predicts a collapse of the coral biome during this century. The collapse will negatively impact on tourism and fisheries and increase the vulnerability of coastal zones. In other words, the collapse will have physical, economic and social (poverty) consequences (ECLAC, 2011). To counter these potential negative effects, adaptation and mitigation measures are called for.

At this point in time, to the best of our knowledge, there are no cost estimates for adaptation in the case of Barbados. However, projections of the economic impact of hurricane damage due to climate change to Barbados' tourism, infrastructure, agriculture, fisheries, public health, and ecosystems between 2050 and 2080 varies between US\$ 100.4 million (low scenario) to US\$ 566.4 million (high scenario). That is, between 3.9 per cent of GDP and 21.8 per cent of GDP (ECLAC, 2011). The integrity of the Barbados' ecosystems is also menaced by internal evolution (ECLAC, 2011). Undoubtedly, adaptation measures are needed to maintain the integrity of ecosystems of Barbados. However, these policies could place a significant burden on already heavily burdened fiscal accounts.

2.2

RELATIONSHIP BETWEEN REGIONAL AND INTERNATIONAL ENVIRONMENTAL FRAMEWORK AND GREEN ECONOMY

Another dimension, which must be taken into consideration in the transformation to a green economy in Barbados, is the country's obligations under the various MEAs to which the country is a party and how the rights and obligations contained therein are binding on its nationals. These MEAs provide a framework for international cooperation on regional and transboundary environmental issues as well as protect the rights of Member States, Barbados included, in international environmental law. They are underpinned by a number of principles of international environmental law (i.e. polluters pay principle), which are fundamental to the process of transitioning to a green economy. These international agreements are summarized in Table 10.

In addition to MEAs, Barbados also endorsed a number of non-legally binding initiatives. These include the:

- 1992 Rio Declaration on Environment and Development, and Agenda 21;
- 1994 Programme of Action for the Sustainable Development of Small Island Developing States, also referred to as the BPOA;
- 2002 Johannesburg Plan of Implementation of the World Summit on Sustainable Development, referred to as the JPOI; and
- 2005 Mauritius Strategy for the further Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States.

In acknowledgement of the importance of fisheries management and the need for cooperation, especially regarding trans-boundary fishery resources, the Caribbean states established the 2002 Caribbean Regional Fisheries Mechanism (CRFM). CRFM is designed to establish a regional fisheries body to promote cooperation in the sustainable use and management of the fisheries of member states. The agreement has been guided by general principles such as the need to maintain biodiversity; manage fishing capacity and fishing

methods so as to facilitate resource sustainability; promote awareness of responsible fisheries exploitation; recognize the contribution of small scale and industrial fisheries to employment, income and food security, nationally and regionally; promote aquaculture as a means of enhancing employment opportunities and food security, nationally and regionally; and encourage the use of precautionary approaches (Article 5) (CRFM, 2002). In May 2011, a draft CARICOM Common Fisheries Policy was unanimously approved at the Fourth CRFM Ministerial Council. Since 2003, this instrument was an evolving work in progress set in motion by the CARICOM Heads of Government.

In accordance with the 2005 Rome Declaration on Illegal, Unreported and Unregulated (IUU) Fishing (IUU, 2005), the members of CRFM in July 2010 developed the Castries Declaration on Illegal, Unreported and Unregulated Fishing.⁷ The policy declaration highlights the region's determination and commitment to cooperate and protect the economic interests of the CRFM member states by prevent IUU fishing, which undermines the efforts to conserve and manage fish stocks. In addition to this, a multi-disciplinary workshop was conducted in April 2011 between CARICOM government representatives, regional organizations – like the OECS Secretariat, the University of the West Indies, and the recently established Caribbean Network of Fisher-folk Organizations – and CRFM to review, refine and finalize the draft agreement establishing the Common Fisheries Policy for CARICOM countries. This policy would allow CARICOM countries to collaborate and cooperate in conservation, management and use of marine/aquatic resources, thus achieving their fisheries development objectives.

TABLE 10. BARBADOS' PARTICIPATION IN MULTILATERAL ENVIRONMENTAL AGREEMENTS

Agreement	Provisions	Status
Convention of International Trade in Endangered Species	Ensures that international trade in specimens of wild animals and plants does not threaten their survival	A-1992
Convention on Wetlands of International Importance Especially as Waterfowl Habitats	Maintain the ecological character of wetlands	R-2005
Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean	Protect rare and fragile ecosystems and habitats within the Caribbean	A-2002
International Plant Protection Convention	Prevent spread of pests and diseases	Ad-1976
Convention on Biological Diversity	Sustainable use of biological resources	R-1993
Cartagena Protocol on Bio-Safety	Safe handling, transport and use of living modified organisms	A-2002
Convention on the Protection and Development of the Marine Environment in the Wider Caribbean (1983)	Protection and development of the Caribbean marine environment	A-1985
Protocol Concerning Cooperation in Combating Oil Spills in the Wider Caribbean	Relates to oil spill incidents that affects the marine and coastal environment of the Caribbean	A-1985
Protocol of 1973 to the International Convention for the Prevention of Pollution from Ships as Amended	Control pollution	A-1994
International Convention on Civil Liability for Oil Pollution Damage	Liability for damage caused by oil pollution	A-1994
Protocol of 1992 to Amend the International Convention on Civil Liability for Oil Pollution Damage	Idem.	A-1998
International Convention for the Establishment of an International Fund for the Compensation of Oil Pollution	Idem.	A-1994
Protocol of 1992 and 2003 to the International Convention for the Establishment of an International Fund for the Compensation of Oil Pollution	Idem.	A-1998
International Fund for the Compensation of Oil Pollution	Idem.	2005
International Convention relating to Intervention on the High Seas in Cases of Oil Pollution Casualties	Idem.	A-1994
Protocol relating to Intervention on the High Seas in Cases of Pollution by Substances other than Oil	Idem.	A-1994
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter	Disposal of waste at sea	DI-1994
1996 Protocol to the International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter	Idem.	A-2006
International Convention for the Control and Management of Ship Ballast Water and Sediment	Idem.	A-2007
United Nations Convention on the Law of the Sea	Rights and responsibilities of nations in relation to the world's oceans	R-1993
Agreement Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Species	Management of marine resources	R-2000
Basel Convention on the Control of Trans boundary Movement of Hazardous Waste and their Disposal	Management of waste	A-1995
Rotterdam Convention on the Prior Consent Procedures for Certain Hazardous Chemicals and Pesticides in International Trade	Idem.	S-1998
United Nations Convention to Combat Desertification	Address anthropogenic impacts on the global climate patterns	A-1997
Vienna Convention for the Protection of the Ozone Layer	Framework for the international effort to protect the ozone layer	A-1992
Montreal Protocol on Substance that Deplete the Ozone		A-1992
United Nations Framework Convention on Climate Change	Stabilise greenhouse gas concentrations	R-1994
Kyoto Protocol	Binding targets to reducing greenhouse gas emissions	R-2000
Stockholm Convention on Persistent Organic Pollutants	Management of organic pollutants	A-2004
Convention for the Protection of World Culture and Natural Heritage	Protection of world heritage	Ac-2002

Source: Compiled by authors.

Notes: A (Accession); Ac (Accepted); Ad (Adherence); R (Ratification); RE (Regional MEA); S (Signature)

2.3 APPLICABILITY OF THE GREEN ECONOMY CONCEPT TO SMALL OPEN ECONOMIES



Cheapside Market in historic Bridgetown – A hub of local economic activity. Photo: Dave Quan/Inkstone Design/Calgary Canada

Small states – countries with a population of 1.5 million or less – share special developmental challenges that should be taken into account. While these challenges may make the transition to a green economy even more relevant, they can also hinder the process of greening the economy. In this regard, a green economy transition in these states may take a different path to that followed in more developed states.

As a result of the small size of domestic demand, the unit cost of production in most small states will be relatively high, as demand restricts the use of a minimum efficient scale or plant. The country's size will also likely limit the amount of domestic competition since only a small number of firms might find it feasible to engage in a particular area of production. These size limitations might prevent

small states from diversifying into a wide range of activities. It also implies that while some green technologies might be economically viable in larger countries, a similar characteristic might not hold in small states.

Besides a limited population, most small states are not normally endowed with abundant natural resources and even if they do have natural resource endowments, the country may not have the capital necessary to exploit the resource. These characteristics also imply that they have to depend on trade with other countries to satisfy local consumption and for a large proportion of inputs used in domestic production. Thus, although the country might have high tariffs, conventional indicators of openness such as exports and imports as a proportion of GDP will usually

exceed world averages. Many small states, for example, are dependent on imported fossil fuels to meet most of their energy needs. The adoption of green technologies in the area of energy and other resource-intensive industries can reduce this dependence as well as build resilience.

Small states are usually quite susceptible to natural disasters and other meteorological conditions. The recent case of the effects that Hurricane Ivan had on Grenada is a prime example. The IMF, in its 2005 Article IV Consultation Report on Grenada (available at www.imf.org), notes that while the average cost of natural disasters is around 2 per cent of GDP, hurricane Ivan in Grenada is estimated to have led to damages valued at over 200 per cent of GDP. While a greener economy would not prevent disasters from occurring, it could help a country bounce back faster after an event.

One of key advantages of a small state, however, is that they usually possess a greater degree of social homogeneity and cohesion that encourages the formation of social capital that indirectly contributes to economic growth. This characteristic helps with respect to building consensus for green economy and should be leveraged by small states.

The characteristics of small states also have direct implications for monetary, exchange rate and overall macroeconomic policy. The narrowness of domestic output implies that output tends to be very inelastic with respect to relative price changes, as labour and other factors may not be easily redeployed into the production of other goods and services. Helleiner (1982) notes that expenditure switching measures, such as changes in the exchange rate, are unlikely to address any balance of payments difficulties that small nations may encounter. Armstrong and Read (1998) add that since currency markets in these countries are likely to be relatively thin, exchange rates may be relatively volatile and influenced by structural problems.

Given the openness of the economy, such volatility is likely to feed through to the domestic economy and impact on production costs and overall price stability. Exchange rate variations can also result in a redistribution of income, as devaluation tends to benefit exporters and disadvantage the purchasers of imported goods, while an appreciation negatively affects domestic exporters and assists the consumers of imported goods.

It is against this backdrop that the first Global Conference on the Sustainable Development

of Small Island Developing States was held in Barbados in April 1994 to evaluate how SIDS could address these issues. The Barbados Plan of Action (UN, 1994; ECLAC, 2011), the policy document adopted by countries represented at that Conference, identified specific actions and measures that should be fully embraced at the national, regional and international level to aid the process of sustainable development in the following areas:

- i. Climate change and sea level rise;
- ii. Natural and environmental disasters;
- iii. Management of waste;
- iv. Coastal and marine resources;
- v. Land resources;
- vi. Energy resources;
- vii. Tourism resources;
- viii. Biodiversity resources;
- ix. National institutions and administrative capacity;
- x. Regional institutions and technical cooperation;
- xi. Transport and communication;
- xii. Science and technology;
- xiii. Human resource development; and
- xiv. Implementation, monitoring and review.

UNEP (2010)⁸ also provides numerous examples of SIDS adopting green strategies in order to enhance resource efficiency. For example, in order to reduce its energy dependence, the Government of Tunisia passed a law on energy management and put in place financing mechanisms for a transition to renewables between 2004 and 2005. Consequently, between 2005 and 2008, the government saved US\$ 900 million in energy bills, a figure net of the US\$ 200 million initial investment in clean energy infrastructure. Further recent initiatives in this country have focussed on solar energy, facilitated by the formulation of their first national Solar Energy Plan, with the goal of increasing the share of renewables in energy generation to 4.3 per cent by 2014. It is expected that energy savings resulting from this Plan is likely to reduce energy consumption by as much as 22 per cent by 2016, with a reduction of CO₂ emissions in the order of 1.3 million tonnes.

To enable the further spread of this resource efficiency green growth strategy, most SIDS will require assistance in the areas of financing the transition, particularly given the level of national indebtedness (Cas & Ota, 2008). The transition itself, is not likely to be smooth given the vulnerability of small states to external shocks (Streetan, 1993) and the limited capacity of markets (Srinivasan, 1986).

2.4 BARBADOS' DEFINITION OF A GREEN ECONOMY

Barbados' National Strategic Plan (GOB, 2005), Goals 3 to 6, planted the seeds for the conceptualisation of green economy. The seeds were watered when in March 2009, the Prime Minister and Minister of Finance articulated his vision to see Barbados to become “the most environmentally advanced green country in Latin America and the Caribbean.”⁹ In this connection, the Government of Barbados (GOB) has defined green economy as:

an integrated production, distribution, consumption, and waste assimilation system that, at its core, reflect the fragility of our small island ecosystems as the basis for natural resource protection policy intervention, business and investment choice, human development programming, and for the facilitation of export market development strategies.

This definition, as would be expected, is more focused on the key challenges that face SIDS. However, it is unrealistic to assume that the emerging green economy can address all of these ills, but could contribute to addressing some of these challenges. As a small island developing state, the efficient management of the country's natural resources will always be a critical issue and, at its heart, the message is that green economy is one where improvements in economic and social well-being can be achieved without adversely impacting the environment.



Children on educational tour of Harrison's Cave – 2011 Caribbean Excellence in Sustainable Tourism Award. Photo: Dave Quan/Inkstone Design/Calgary Canada

3.1 AGRICULTURE

3.2 FISHERIES

3.3 BUILDING/HOUSING

3.4 TRANSPORT

3.5 TOURISM



3 THE POTENTIAL FOR GREENING VARIOUS SECTORS



KEY MESSAGES

Critiques of conventional farming practices identify the following major negative impacts: damage to soil structure; environmental degradation; creation of potential health hazards in food; reduction in food quality; high use of energy; intensive animal production systems; and exorbitant social costs.

The stakeholders' vision for greening agricultural industry reflects a desire to revitalise the industry as well as enhance resource efficiency, especially with respect to water, energy, waste and land use.

Public and private sector investments can enable the sector to meet domestic demands for fresh produce (conventional and organic) and other value-added products including, packaged and graded produce, processed mixed vegetables, increased exports, as well as provide greater support to the agro-processing industry.

The opportunity for forging stronger linkages with the tourism/hospitality and processing/distribution sectors should contribute to the strengthening of the economy with respect to foreign exchange earnings/savings, new employment opportunities, and enhancement in the skills levels of the sector.

There is a need to develop medium to long-term strategic plans for the agriculture industry. Policymakers should lead on the coordination of planning and implementation of such strategies. Improved communication between ministries and stakeholders, in addition to reinforcing implementation, is also required.

3.1.1 BACKGROUND

Agriculture in Barbados is still, to a large extent, dominated by the sugar cane industry. In terms of acreage planted and the generation of foreign exchange and domestic earnings, the sugar industry leads in the agriculture sector. In 2010 the contribution of sugar and non-sugar agriculture and fishing was estimated at US\$ 5.5 million and US\$ 18.7 million, respectively, or combined 1.6 per cent of GDP. Most of the domestic production of sugar is exported to the EU under the African, Caribbean and Pacific/European Union (EU) Protocol. In 2010, the island shipped more than 22,000 tonnes of raw sugar to the EU or about 88 per cent of total production.

During the last three decades, the amount of land under sugar cane cultivation declined together with the area harvested; in fact, during the period 1997-2009 the area under sugar cane declined sharply by 34 per cent. Sugar exports declined by 47 per cent during 1996-2009, and production of molasses contracted by 39 per cent during the corresponding period. The conversion ratio of sugar cane to sugar fell sharply during the same period. The yield per acre of sugar cane harvested fell from 25.2 tonnes (2000) to 21.3 tonnes (2008). The industry has been accumulating losses since 1994 and so its survival depends on government subsidies. The gap between export prices and the cost of production is increasing yearly as well.

During 2005, sugar production costs reached US\$ 49.20 per tonne of sugar cane, and by 2009 field production cost rose to US\$ 72 of which approximately 75 per cent was attributed to labour and machinery. Prices paid to farmers have also been declining consistently since 1994. In 2010 farmers received US\$ 50.00 per tonne of sugar cane, at a time when their production cost was US\$ 80.00 per tonne. Accumulated losses by farmers have conducted to disinvestment and an accelerated decline in production. Land used for sugar cane production continues to be relinquished at the rate of 400 acres per year. However, alternative uses of these lands tend to accelerate soil erosion.

Table 11 provides a breakdown of production of selected non-sugar crops. The statistics suggest that the production trend for most of these crops is somewhat erratic. Indeed, relative to 2006, only cassava, eddoes, yam, onion and pumpkin reported any significant growth. In contrast, production of cotton (seed and lint), sweet potatoes, beets,



Farm to table gourmet – Green economy is promoting the local sustainable agri-supply chain. Photo: Travis Sinckler

cabbage, okra and tomato fell significantly over the period under review.

In terms of livestock and dairy products production, this segment is dominated by the production of poultry, with the island producing about 14 million kgs of poultry per year (Table 12). Unlike the production of root crops and vegetables, livestock and dairy production has been fairly consistent over the sample period, with most segments of the industry reporting growth.

During the past two decades some initiatives were undertaken by the government to strengthen the policy framework for sustainable agriculture. These measures are summarized in Table 13.

The Medium-Term Development Strategy (MTDS) 2010-2014 sets out planned actions by the Government of Barbados to reposition the sector:

- Support for the introduction of new technologies to expand the production of food for domestic and external consumption and to add value to the sector through product development;
- Contribute to the food and nutrition security of the nation through the production of nutritious food at reasonable prices and on a consistent basis;
- Protect and reduce the risk to the hardness of the agricultural sector and facilitate food safety through the provision of adequate infrastructure and services for testing, monitoring and inspection, as well as for the attainment of certain minimum standards with respect to the country's animal, plant and fish stocks;
- Facilitate access to domestic and export markets for agricultural commodities through the implementation of projects and programmes focussed on providing the infrastructure and enabling environment necessary for the sale of

TABLE 11. ESTIMATED PRODUCTION OF SELECTED CROPS ('000 KGS)

Crop	2006	2007	2008	2009	2010
Corn	137.0	n.a.	180.6	71.2	74.3
Cotton:					
Seed	101.4	59.5	79.8	11.1	19.6
Lint	32.1W	19.2	26.0	3.8	6.0
Peanuts	21.3	9.3	23.7	41.4	15.5
Cassava	374.7	448.1	466.2	625.6	399.5
Eddoes	156.8	151.4	40.5	19.8	228.3
Sweet Potato	2 200.9	1 334.6	884.0	888.1	1 176.3
Yam	793.8	646.5	279.6	655.7	806.6
Beans	370.7	252.0	167.7	165.9	222.1
Beets	92.4	109.8	28.9	51.2	30.5
Cabbage	641.9	253.5	437.5	292.6	60.4
Carrot	317.7	305.4	252.8	198.0	263.6
Cucumber	1 324.2	1 450.0	811.6	1 141.0	1 148.1
Melon	309.6	477.4	185.1	250.5	240.8
Lettuce	438.9	417.5	143.6	551.4	339.1
Okra	525.2	658.1	423.6	235.9	302.8
Onion	444.2	287.3	333.2	571.9	497.9
Pepper (Hot)	136.5	114.2	124.4	175.9	76.1
Pepper (Swt)	477.5	419.5	220.9	278.7	317.5
Pumpkin	120.9	159.5	249.3	185.6	179.7
Tomato	1 040.6	1 224.2	815.3	718.5	717.5
Total non-sugar ('000 kgs)	9 924.8	8 718.4	6 068.5	7 118.8	7 122.5
*Sugar ('000 tonnes)	33.7	34.7	31.6	33.3	25.5

Source: Ministry of Agriculture

TABLE 12. LIVESTOCK AND DAIRY PRODUCTION ('000 KGS)

Commodity	2006	2007	2008	2009	2010
Beef	169.6	136.1	144.4	150.8	161.2
Mutton	79.0	72.4	85.1	89.3	106.1
Pork	2 636.9	2 502.0	2 636.8	2 746.7	2 745.4
Poultry	13 571.2	14 934.0	14 388.0	14 692.8	14 090.9
Veal	12.6	6.3	8.3	9.6	5.8
Eggs	1 986.6	2 305.0	1 902.5	2 002.2	2 231.0
Milk	5 569.9	6 762.3	6 694.4	7 013.5	6 700.9
Turkey	275.4	280.3	239.5	219.0	271.6

Source: Ministry of Agriculture

TABLE 13. INITIATIVES AIMED AT ENABLING SUSTAINABLE AGRICULTURE DEVELOPMENT

Area	Legislation
New/Upgraded legislation – Institutional capital enhancement	Plant Protection Act (2007)
	Animals (Disease And Importation) Act (1999)
	Plant Varieties Protection Act (2001)
	Fisheries Act (2000)
	Markets and Slaughterhouse Act (under revision)
	Soil Conservation and Scotland District Act (1998)
	National Parks Act (1998)
	Town and Country Planning Act (2007)
	Cane Fires Prevention Act (1995)
Fiscal incentives to spur production	Incentive
	A rebate of US\$ 500 per hectare for the return of idle land for cotton production - applicable to farms 0.2 to 2.0 hectares
	A rebate of US\$ 250 per hectare for the return of idle land for cotton production - applicable to farms over 8.0 hectares
	A rebate of 50% on the cost of certification as an organic cotton farm
	A technical assistance fund of US\$ 500 000 to assist producers, processors and investors in areas of feasibility studies and market research
	A rebate of 50% on the cost of establishing an approved irrigation system to a maximum of US\$ 72,000 where two or more farmers share common facilities
	A rebate of 75% on the cost of establishing an approved irrigation and mulching system - applicable to registered agricultural cooperatives and farmers' organizations
	A subsidy of US\$ 500 per hectare to registered farmers to assist in defraying the cost of returning idle land to production
	A rebate of 50% for the components of an approved environmental control system for poultry and livestock facilities up to a maximum of US\$ 25,000 per unit
Resource protection and management	A rebate of 30% on the cost of the establishment of approved soil conservation measures up to a maximum of US\$ 5,000
	A rebate of 30% on the cost of the design and construction of biogas digesters up to a maximum of US\$ 3,500 per holding to mitigate the effect of livestock production on Barbados' ground water supply, and to promote a mechanism for recycling wastewater, gas, and organic slurry
Organic farming	A rebate of 50% on the cost of the certification of organic farms up to a maximum of US\$ 2,000 per farm. Where two or more farmers collaborated to achieve international organic certification a grant of 60% of the cost of certification up to a maximum of US\$ 10,000 will be provided
	A rebate of 30% on the cost of approved organic inputs made from local materials, up to a maximum of US\$ 500 per hectare. The range of products include compost, pesticides, mulches, planting material, fertilizers, soil ameliorants, and compost using local material made available to a registered farmer's organization or agricultural cooperative upon submission of an acceptable business plan
	A technical assistance fund of US\$ 100,000 to facilitate the development of organic production in Barbados through, inter alia, the development of an internationally acceptable protocol for certification of organic farming in Barbados
New crop technology	A rebate of 40% on the cost for the components of greenhouses and hydroponic systems for crop or horticultural production up to a maximum of US\$ 30,000 in order to stimulate the investment in proven technology that can lead to increased productivity
	A rebate of 30% on the cost of an extended life weed fabric or any other mulch system up to a maximum of US\$ 2,000 per hectare, whichever is the lesser
	A rebate of 25% on the cost of the components of greenhouses and hydroponics systems for crops or horticultural production up to a maximum of US\$ 250,000 per cooperative/partnership
	Provision of US\$ 2,000,000 through the Agricultural Development Fund to establish a pilot project at the Home Agricultural Station for research, production and training in agricultural practices such as greenhouses and hydroponic systems
	A grant of US\$ 5.00 per approved fruit tree for a maximum of 1,000 trees per holding located within the boundaries of the Scotland District
	A 50% discount for the purchase of a minimum of 300 trees of approved species from the Ministry of Agriculture
	A rebate of 50% on the costs of the management of trees purchased at discount price in accordance with the guidelines of the Ministry of Agriculture

Source: Ministry of Agriculture, Food, Fisheries & Water Resource Management.



Sturges local farmers market: important element to promoting food and nutrition security. Photo: Anne Gonzalez

agricultural produce, in order to increase the returns to farmers;

- Enhance the competitiveness and productivity of the agricultural sector to better enable it to compete in both the domestic and international markets, and to increase output;
- Promote sustainable development;
- Ensure the sustainable availability and production of fish and fish products by assuring the efficient management and development of the fisheries resources;
- Facilitate an enhanced level of participation in agricultural production by providing access to critical means of production, e.g., land, water, capital and inputs;
- Develop strong, vibrant rural communities; and
- Enhance the capacity of the sector to assist in transforming and repositioning itself by, inter alia, the creation of an appropriate legislative framework.

The policies outlined in the (MTDS) 2010-2014 could establish a strong framework for greening the sector if they are implemented effectively.

The proposed transformation of the sugar industry into a sugar cane industry offers bright prospects for the survival of the subsector. The Cane Industry Restructuring Project (CIRP) focuses on the production of specialty sugar, ethanol, molasses, and energy from bagasse through cogeneration (CIRP, 2008). In the short-term, urgent public policy intervention to halt the further transfer of land out of sugar is absolutely necessary. Successful

implementation of the CIRP will require policy initiatives to drive the following:

- Continuing research on cane varieties;
- Research into specialty sugar markets;
- Increase in yields per acre;
- Increase in acreage planted and yield;
- Enhancement of best practices;
- Increase in factory efficiency;
- Attracting skilled youth into the industry; and
- Modernization of cultivation technology.

In light of the challenges noted above it is reasonable to conclude that if nothing is done to restructure the industry in the medium-term, sugar production will continue to decline to the point where it cannot be rescued.

Climatic conditions

Weather has a significant impact on agriculture on the island. Every year, the industry (and the island) faces the possibility of devastation during the hurricane season (June – November). In addition, as a water scarce country, a prolonged dry season has historically put significant pressure on available local water resources.

A diverse, locally adaptable set of agricultural techniques, practices and market branding certifications, such as Good Agricultural Practices (GAP), Organic/Biodynamic Agriculture, Conservation Agriculture, and food supply protocols exemplify ways in which green policies can be used to support agriculture. Farming practices and technologies that are instrumental in greening include:

- Restoring and enhancing soil fertility through the increased use of naturally and sustainably produced nutrient inputs, crop rotations, and livestock and crop integration;
- Reducing soil erosion and improving the efficiency of water use by applying minimum tillage and cover-crop cultivation techniques;
- Reducing chemical pesticide and herbicide use by implementing integrated biological pest and weed management practices; and
- Reducing food spoilage and loss by expanding the use of post-harvest storage and processing facilities.

Hong (2009) defines greening agriculture is based on a production system based on a green environment, in which there are investments of green materials, energy and capital, and the application of green technology. The focus on the

agricultural practices and technology employed has also been engaged by others in their attempt to define the 'greening of agriculture' UNEP (2011c). According to them, greening of agriculture refers to the increasing use of farming practices and technologies that simultaneously:

- Maintain and increase farm productivity and profitability while ensuring the provision of food on a sustainable basis;
- Reduce negative externalities and gradually lead to positive ones; and
- Rebuild ecological resources (i.e., soil, water, air, and biodiversity – natural capital assets) by reducing pollution and using resources more efficiently.

Organic farming is increasingly being viewed as a solution to several of the negative externalities that are directly caused by conventional farming methods. Several definitions of organic farming exist, but they usually reflect the ideological position of the organizations articulating them. The definition of organic farming given by the United States Department of Agriculture (USDA) embraces key aspects of universally accepted green practices:

Organic farming is a production system that avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives. To the maximum extent feasible, organic farming systems rely on crop rotations, crop residues, animal manures, legumes, green manures, off-farm organic wastes, and aspects of biological pest control to maintain soil productivity and tilth, to supply plant nutrients and to control insects, weeds and other pests. The notion that soil is a living system and that the farmer, in harmony with nature, should seek to promote and enhance biodiversity, biological cycles, and soil biological activity, is a central feature of the definition (USDA, 1980).

Two systems of food production are utilised in Barbados, the traditional/indigenous and the conventional/productivist (IAASTD, 2009). The traditional/indigenous system is primarily centred on production for family consumption, with part of the produce being sold to buyers in the market. On these farms there tends to be a high degree of biodiversity and some use of outside inputs. However, this segment of agriculture in the region has been contracting, however, due to the rising price of land as well as the ability of farmers and their children to earn higher incomes elsewhere in the economy. On the other hand, the conventional/

productivist system tends to be characterised by a high degree of mechanisation, an orientation towards a monoculture, as well as significant use of external inputs (e.g., synthetic fertilizers and pesticides), and production for a broader market, including that for exports.

Critics of conventional farming practices identify major negative impacts including:

- Damage to soil structure;
- Environmental damage;
- Creation of potential health hazards in food;
- Reduction in food quality;
- High use of energy;
- Use of intensive animal production systems which are ethically unacceptable; and
- Exorbitant social costs (Bray, Sanchez, & Murphy, 2002; Padel, 2001; Tovey, 1997)

The International Federation of Organic Agriculture Movements (IFOAM) formulated a standards code that is similar to the USDA definition of organic farming to:¹⁰

- produce food of high nutritional quality in sufficient quantity;
- work with natural systems rather than seeking to dominate them;
- encourage and enhance biological cycles within the farming system by involving microorganisms, soil flora and fauna, plants and animals;
- maintain and increase the long-term fertility of soils;
- use, as far as possible, renewable resources in locally organized agricultural systems;
- work as much as possible within a closed system with regard to organic matter and nutrient elements;
- give all livestock conditions of life that allow them to perform all aspects of their innate behaviour;
- avoid all forms of pollution that may result from agricultural techniques;
- maintain the genetic diversity of the agricultural system and its surroundings, including the protection of plant and wildlife habitats;
- allow agricultural producers an adequate return and satisfaction from their work, including a safe working environment; and
- consider the wider social and ecological impact of the farming system.

The principles outlined by IFOAM provide a sound basis for organic farming practice. In Barbados, a small group of local farmers practice organic farming. They operate lots ranging between two to four acres. However, these farmers encounter major challenges, including a dearth of research and development to support their activities, high cost of certification, and difficulties insulating their small farms from the impact of contamination by up-wind farm operators and household use of conventional chemical herbicides and pesticides.

3.1.2 RESOURCE USE AND EFFICIENCY MEASURES

Given the scale of agricultural activity worldwide using it as a primary input into agricultural production processes, it is easy to see why water appropriates between 60 to 70 per cent of the world's water resources (WMO, 1997). One of the major goals by industry actors and governments over the past several years has been to increase the productivity of the agricultural sector, and this is encapsulated in the slogan 'more crop per drop [of water]'. In agriculture, water is required not just in the growing phase but also in the processing, packaging and retail stages. This implies that the quality of water required could differ, depending on the particular stage. Another issue worth consideration is that farming enterprises are often responsible for sourcing, abstraction, delivery and distribution of water to satisfy their needs as well as handling the wastewater generated by their operations. This is especially the case where agricultural activity is not highly reliant on rainwater supply.

Some of the water challenges facing agriculture concern availability and dependability associated with abstraction of the resource and matching this with water demand. Meeting the demand for water is dependent on meteorological, land, crop and technological factors, but other factors such as the farmer's knowledge and expertise and access to information and support can also be constraints. What this means is that water management in agriculture, whether crop production, horticulture, orchard development, animal husbandry, silviculture or greenhouse vegetable production, can be very challenging (Kirchmann & Thorvaldsson, 2000).

Furthermore, one of the major deficiencies in the agricultural sector is a lack of data on actual

water usage, including levels of abstraction and delivery. Although there are a number of licensed abstraction wells in Barbados, there is no up-to-date information on their status, characteristics or usage, no requirement for record keeping, no monitoring of quantity or quality of water. Furthermore, there is no information on the amounts of water used or delivered to crops, or the method of delivery, and so information on crop water requirements is reliant on figures from other parts of the world.

With few exceptions, such as sugar cane, most crops in Barbados require some form of irrigation. In an effort to conserve water, the focus has been on promoting drip irrigation and this campaign has been successful. However, this has not removed the practice of over irrigation and it is certainly the case where there is a need to match water application to the growing stage and water needs of crops. The Ministry of Agriculture has identified this as an area that needs attention along with access to dependable supplies of water. It is also the view of the Ministry that more needs to be done to develop rainwater capture systems that specifically support agriculture. Although there is a need for some experimentation and research, particularly to match localised growing and crop conditions to water needs, most of the techniques and technology required to support irrigated agriculture and to improve its water use efficiency are relatively well-known and widely available. The barrier to achieving greater efficiency in the use of irrigation technologies, however, is the inability to convince farmers of the benefits of transitioning to these technologies through presenting a sound economic case to them and the broad dissemination of pertinent information to producers in the sector. Moreover, greater efficiencies could be realised if appropriate support services were available (Dobermann, 2007).

In Barbados, energy is primarily used for the operation of irrigation systems, agriculture machinery and in animal husbandry. It has been noted that the sugar industry has potential as a producer of ethanol for energy production and electricity, directly (Holder, 2003). This would, however, require a shift in the type of cane planted to a variety that has higher fibre content. It is envisioned that the sugar processing facility would generate between 166-173 GWh of electricity per year (more than 10 per cent of domestic demand) as well as 23 million litres of ethanol that can be added to gasoline as an additive (Holder, 2003).

There is also potential for the use of biogas,¹¹ the process of anaerobic digestion or fermentation of

biodegradable materials such as biomass, manure, sewage, municipal waste, green waste, plant material and crops. Unlike manure, the effluent by-products from the digestion process can also be used in the agricultural process to enhance plant growth (Holder, 2003). The gas can be used for cooking or for electricity generation and would also assist in reducing emissions from the local agricultural industry, as methane is collected and utilised.

Agriculture also produces waste material, the disposal of which can be problematic in some cases, such as animal waste and waste from sugar processing. However, the solution is not to consider the materials as waste but rather as a resource, which, like all raw materials, requires some processing to turn it into a useful product. Solid waste management for the agricultural sector, therefore, requires the development of a supply chain that links farmers with producers, creates markets for the waste and the processed materials, and facilitates the storage and collection of materials. This has to be supported by the necessary testing, certification and standards that ensure quality, reliability and traceability. Animal manure, depending on the type, can be used either as a fertilizer or in anaerobic biodigestors to produce methane as a source of energy and fertilizer (Neves, Converti, & Penna, 2009). Within a relatively small and closed agricultural sector such as Barbados, it should be possible to promote such linkages.

Land preparation and tillage practices in agriculture have impacts on groundwater recharge, surface water run-off and ponding/flooding, erosion and loss of topsoil (USDA, 2008). Thus, there is a need to integrate land and water management in order to minimise adverse impacts and maximise yields. The application of fertilizers, pesticides and other compounds to control pests and diseases as well as to promote growth can cause problems associated with groundwater contamination. A policy of promoting organic agriculture and the training of farmers in best management practices would mitigate some of the adverse impacts on water quality. Since the 1970s, the island's land use policy has been governed by a Physical Development Plan (recently amended in 2003), which aims to ensure sustainable land use policies are followed, without necessarily impacting on economic development (see Annex 2 for further details).

In general, data on water, land, energy and chemical usage in agriculture in Barbados is inadequate. Such information are partially available for utility



Biodigestors in a local farm. Complementary fiscal policies can allow small farmers to convert animal waste to clean energy.
Photo: Anne Gonzalez

companies and trade statistics), but ideally data on actual usage, inventories, wastage and the like should be provided at the farm level. This would allow policymakers to track the effectiveness of policy interventions and identify areas for further support.

3.1.3 INVESTMENT GAPS

The stakeholders' vision for greening agriculture reflects a desire to revitalise the industry as well as enhance resource efficiency. There are a number of strengths that the industry can leverage in order to achieve this vision. For many years, focus has been placed on encouraging the growth of small farming as a means of addressing poverty and other social concerns. In Barbados, incentives to help small farmers include:

- Measures to assist with the sale of fresh agricultural produce;
- A programme to assist cotton production through providing information about the production process along with incentives;
- Promotion of agriculture in rural areas through the provision of agricultural training and investment in equipment and machinery; and
- Establishment and development of the cottage industry in rural areas.

The stakeholders' vision for greening agricultural industry reflects a desire to revitalise the industry as well as enhance resource efficiency.

TABLE 14. STRENGTHS AND CHALLENGES IN GREENING THE AGRICULTURE SECTOR

Strengths	Challenges
1. A strong interest in 'wellness' exhibited at the individual and community levels	1. Maintenance of a strong commitment to enhancing wellness, individual and community levels
2. The sociability/friendliness displayed by the Barbadian people	2. An emerging anti-social subculture
3. The availability of a highly literate workforce	3. The capacity of families, social institutions and government to maintain support for education and training of youth
4. Technical and financial support by the Caribbean Agricultural Research and Development Institute, the University of the West Indies, as well as the Food and Agriculture Organization and the Inter-American Institute for Cooperation in Agriculture	4. The ability of regional institutions to garner adequate resources to deliver relevant training and technical assistance
5. Strong education and training institutions at the primary, secondary, tertiary, and vocational levels	5. The financial capacity of the international organizations
6. Fairly well established research and development infrastructure in sugar cane breeding	6. Ability to attract and retain high quality teachers / instructors and maintain the quality of plant and other facilities
7. A highly trained public service	7. Neglect of succession planning
	8. Decline in professional standards

Source: Stakeholder discussions and authors' analysis

Many of the national and regional agricultural research institutes have focused on improving farmers' livelihoods and incomes, with little attention being paid to social and environmental aspects (IAASTD, 2009). For example, the stated objectives of The Regional Fund for Agricultural Technology (FONTAGRO) are to:

- Add a permanent flow of new resources for regional agricultural research,
- Accelerate applied research at the national level by supplying public goods-type technologies of cross-country relevance, and
- Promote research cooperation and collaboration among organizations at the national and regional levels.

While one can argue that social goals are implicit in those objectives mentioned above, it is possible that these can be side-lined in favour of economic goals even though there is no explicit attempt being made to ignore them.

A wide variety of vegetables and root crops are produced locally employing open field and greenhouse systems. A major limitation of the open field approach is weather variability. The recent introduction of greenhouse technology facilitates all year production of some crops. Access to modern technology and employment of good agricultural practices should enable domestic producers to satisfy the local demand for vegetables, some root crops and fruits, as well as penetrate niche export markets for products such as hot peppers, and pepper sauce.

A vast gap exists between the mission statement of the Ministry of Agriculture, Food, Fisheries, Industry and Small Business (MAFFIS)¹² and the reality, as reflected in policy and strategy with respect to agriculture. There needs to be a differentiation between commercial and backyard farmers because their goals differ. Both groups are important to achieving progress towards food security. There is no evidence of a strategic plan and strategy to achieve the goals articulated in the mission statement of the MAFFIS. The farmers' umbrella organization has not developed a strategic plan for agriculture or any division within the organization. The deficiency in planning capacity reduces the ability of the leadership to represent the interests of the farming community effectively. The Head of the Crops, Fruit and Vegetable Division within the Barbados Agriculture Society (BAS) identified the following major challenges:

- Limited government support through policies and extension services;
- Slow response by government agencies to farmers request for technical support;
- Lack of training;
- Lack of access to capital;
- Inadequate use of technology;
- Low returns on investment;
- Low productivity;
- Inefficient marketing systems;
- Poor crop scheduling;
- Praedial larceny;
- Inability to attract talented and trained youth; and
- Minimal focus on production of value-added products.

The features outlined above facilitate cheaper imports, and a sector that is focused on short-term objectives.

The obverse of strength/opportunity is a challenge/impediment. Table 14 sets out the main challenges that could hinder the greening of Barbados' agriculture.

At the local level government could consider fiscal and other support for private sector providers of activities that promote 'wellness' as well as support the development of similar programmes in government institutions. With respect to the strengthening of relationships with regional and international institutions, care should be taken to ensure that the country observes the servicing of its commitments (financial and otherwise) to these institutions. Barbados could consider institutional strengthening of systems for monitoring and evaluating the implementation of assistance provided by regional and international institutions such as UWI, the Caribbean Agricultural Research and Development Institute (CARDI), the Caribbean Development Bank (CDB), the Food and Agriculture Organization (FAO) and the Inter-American Institute for Cooperation on Agriculture (IICA).

With respect to the capacity of CARDI and UWI to support Barbados' agriculture, the collective timely honouring of subventions to both institutions by member governments, as well as the appropriate leadership within both institutions, is vital to their ability to provide effective technical support to agriculture in the sub-region. In order to maintain and enhance the professional quality of staff in agriculture and the public service, in general, GOB

will need to strengthen quality control systems that would identify where training is required and trigger a review of training when necessary, and to provide adequate resources for laboratory facilities and other materials for promoting research and development.

Table 15 presents a systematic identification of the challenges employing a score based on a 10-point Likert scale in relation to frequency and impact as outlined in Addendum 1. The combination of these two factors provides a ranking of importance shown in column (4). A challenge receives a score of 1 if the frequency occurrence is low and 10 if the frequency of occurrence is certain. The scores are derived based on expert opinion and stakeholder discussions.

The results provided in the table suggest that the key critical challenges facing the island relate to an emerging anti-social subculture, the lack of an acceptable quality of research and development infrastructure, and the lack of the financial capacity of regional and international institutions. It is important that these issues be addressed going forward if, indeed, the goal is to create an enabling environment for agriculture.

The industry possesses substantial strengths that can be built upon to facilitate greening of the sector:

- Accumulation of considerable technical knowledge pertaining to the cultivation of sugar cane;
- An established research and development infrastructure;
- A vast quantity of human capital skilled in all aspects of sugar cane cultivation, harvesting and processing;

TABLE 15. ASSESSMENT OF SELECTED CHALLENGES IN THE AGRICULTURE SECTOR

Challenge	Frequency of Occurrence (1)	Impact (2)	Ranking of Importance (3) = (1) x (2)
Maintenance of a strong commitment to enhancing wellness at the individual and community levels	4	3	12
Emerging anti-social subculture	7	5	35
Maintenance of strong support for training of youth	3	1	3
Financial capacity of regional institutions	5	4	20
Financial capacity of international institutions	5	4	20
Maintenance of high quality education and training institutions	4	3	12
Acceptable quality research and development infrastructure	5	4	20
Maintenance of high quality public service	5	2	10

Source: Stakeholder discussions and authors' analysis

TABLE 16. INVESTMENT GAP ANALYSIS OF THE AGRICULTURE SECTOR

Investment Gap	Importance Score (1)	Performance Score (2)	Performance/ Investment Gap (3)=(1)-(2)
Water scarcity	7	4	3
Lack of R&D	9	7	2
Data deficiencies	4	1	3
Training farmers in crop rotation	5	5	0
Access to a wider pool of genetic resources	5	2	3
Capacity to produce materials locally	3	3	0
Lack of machinery	5	5	0
Institutional strengthening	10	3	7
Infrastructure	8	4	4
Training	8	4	4
Cultivation	9	3	6
Market development and intelligence	9	2	7

Source: Stakeholder discussions and authors' analysis

- Storage facilities and established distribution systems locally and overseas;
- Adaptation of the industry to thin top soils, a feature of the island's landscape;
- Private sector's contribution to the enhancement of the island's landscape as well as to environmental quality;
- Private sector's contribution of raw materials to the manufacturing sector, especially to rum production;
- High level of local value-added in agricultural output; and
- A thriving industry would reduce public expenditure allocated to cleaning the hedgerows of abandoned agricultural properties, thereby freeing up resources for use in other priority areas.

The ranking of investment gaps is presented in Table 16. An importance score is assigned to each challenge and opportunity based on a 10-point Likert scale, where 1 denotes insignificance and 10 means very important. The importance of the investment gap is quantified by subtracting column 2 from column 1. A positive value in column 3 indicates that greater investment is required to enhance a particular strength or minimization of an identified challenge.

Data from this table suggests that there is an urgent need to address investment gaps in relation to the following:

- Limited access to capital for upgrading of technology, physical plant and animals;

- Delay in the upgrading of the regulatory framework to meet international standards is an impediment to exports;
- Shortages of trained manpower;
- Weak extension services;
- Inadequate laboratory facilities for testing, research and development;
- Inefficient marketing systems; and
- Minimal technical capacity for planning by the Barbados Agricultural Society.

There are limited human resources in the agriculture sector, and so policymakers must accept that an increase in the staffing level is required. Currently, there are only five extension officers for the entire island, which means that the critical relationships between technical experts within the Ministry and farmers are not being forged. Without those relationships, the channels for providing the assistance required by farmers are extremely limited at best. One important area where the benefit of assistance would be quickly realised by both parties pertains to documenting field information and its communication to the experts to aid the research and development process, the end result being rapid implementation or remedies and new approaches at the farm/field level. Moreover, stakeholders in the industry are of the opinion that an opportunity exists for extension services to be delivered modern communication channels such as mobile phones.

3.1.4 POTENTIAL RETURNS IN TERMS OF ECONOMIC GROWTH, DEVELOPMENT AND POVERTY REDUCTION

Greening of a restructured sugar cane industry is likely to be the sole, viable long-term alternative with respect to the survival and reversal of this industry's outlook. Successful greening of the sector will require new private and public sector investment in infrastructure, training, research and development, and marketing (Landell Mills, 2011). The increased use of technology in all areas of industry operations should conduce higher productivity and attract a higher level of trained personnel. Greening the sugar cane industry creates an environment for reversing the high average age of workers in the sector through enhanced capacity to compete with other sectors for labour. The attraction of large quantities of new investment and the return of idle sugar lands to cultivation is expected to contribute to higher levels of output, employment and income generated by the sector as new external markets for high value-added products are penetrated. The impact of the industry is likely to be positive in the areas of foreign exchange earnings, employment and enhancement of the quality of rural life.

The prognosis suggests that major investments are required in the areas of infrastructure and cultivation. The major segment of the large investment gap in cultivation pertains to the transformation of the sugar industry. Elements of the investment gap pertaining to infrastructure, research and development, and training are no less critical to the greening process. Public and private sector investments in the identified elements should enable the sector to meet domestic demand for fresh produce (conventional and organic) and other value-added products, including packaged and graded produce and processed mixed vegetables, and to increase exports along with providing greater support to the agro-processing industry. The opportunity for forging stronger linkages with the tourism and hospitality industries, processing and distribution sectors should contribute to the strengthening of the economy, such as increased foreign exchange earnings/savings, creation of new employment opportunities and enhancement of skills in the agricultural sector.

A particular growth opportunity that has been identified is associated with the increased production of fertilizer, soil conditioner and animal

TABLE 17. ASSESSMENT OF OPPORTUNITIES IN THE AGRICULTURE SECTOR

Opportunity	Frequency of success (1)	Effectiveness (2)	Ranking of importance (3)=(1)*(2)
Fish offal as organic fertilizer	6	6	36
Use of household waste as fertilizer	6	6	36
Biodigestors at the farm level	6	5	30
Organic fruits and vegetables	5	5	25
Cooperatives	7	6	42

Source: Stakeholder discussions and authors' analysis.

feeds (Table 17). The Ministry of Agriculture has identified a need to increase the organic matter of soils as a priority and is promoting organic farming as a viable business opportunity. Key to the successful promotion of organic agriculture will be substitution of imported inorganic fertilizers and products with locally produced organic alternatives. The needed raw materials are available and there is already some local production. However, capacity building for large-scale production of organic products and the implementation of a national organic farm certification programme are essential for this sub-sector to grow. As a further development, stimulated supply could also result in the export of organically produced commodities. The move into organic farming would support economic growth in the local agricultural sector and contribute to poverty alleviation as well, particularly if smaller agricultural units could transform to organic energy-efficient greenhouses. This move, however, would require support in the form of locally produced fertilizers, animal feeds and soil conditioner. It would also create demand for other services that could be provided by the private sector.

The sector report (an input into the preparation of this document) identified the substantial package of fiscal incentives that are in place to support conventional and 'green economy' farming. Critical to the appropriation of opportunities accruing from the pursuit of 'green economy' initiatives is effective government leadership in the areas of policy implementation. Government support that facilitates the raising of capital by the private sector will be essential to the success of this new direction in agriculture. The harmonization of public policy implementation with respect to commerce and domestic production in agriculture is absolutely essential to instil confidence in the farming community.

The government's role with respect to marketing, access to information required for business decision-making and an effective extension services system are equally important. The government needs to give priority to the articulation and establishment of a regulatory framework that is compatible with international standards. Furthermore, the enforcement of measures to minimize the incidence of praedial larceny needs to be tightened promptly. It is expected that as long as there is an environment that is conducive to doing business, private sector interests will be induced to invest.

3.1.5 POTENTIAL FOR GREEN JOBS CREATION AND TRANSMIGRATION

Greening agriculture has the potential to generate large numbers of remunerative jobs in areas, such as construction of irrigation storage facilities, installation of irrigation equipment, repair and maintenance of equipment, and waste recycling. There will also be a demand for solar technicians, inspectors, and ecosystems and biodiversity specialists (UNEP, 2008). A viable and thriving agricultural sector would also attract new entrepreneurs into the sector. There would not only be the creation of new job opportunities, but also a transmigration¹³ of agricultural jobs from traditional agricultural practices to those that are based on the sustainable utilisation of the environment.

The creation of green jobs is not limited to direct employment in the agricultural sector, but would include a range of new support services to the industry as well. Consultancies and training in resource auditing and efficiency measurement would be among those support services.

Agriculture is a long-term venture in which the returns may not be realized within a single year – it can actually take three to five years before any profits are made. It therefore requires perseverance and long-term commitment. The general consensus is that agriculture is or can be economically viable. However, the systems and inputs needed to realize profits are lacking. In the 1900s, the agriculture industry operated on a larger scale with significantly more human resources and financial backing. Today, resources are dwindling, and until the political directorate recognizes that the industry is in jeopardy, it will continue to operate at a suboptimal level.

3.1.6 POTENTIAL FOR ENVIRONMENTAL IMPROVEMENT

Making material reuse and recycling more attractive and financially worthwhile could have environmental spillover effects such as curbing littering and fly tipping. The transformation of waste into useful materials would help to limit the generation of greenhouse gases and the formation of leachates and seepage into the groundwater aquifers. At an aesthetic level, a viable and thriving agricultural sector would maintain and enhance the landscape and its attractiveness to citizens and visitors alike. The increased use of biodigestors at the farm level would also play a role in diversifying energy sources as well as having environmental benefits arising from better management of farm waste that might otherwise pollute the environment.

3.1.7 CONCLUSIONS

The stakeholders' vision for greening agricultural industry reflects a desire to revitalise the industry as well as enhance resource efficiency. This vision is largely consistent with Barbados' definition of green economy identified earlier, and therefore suggests that there is stakeholder support for greening the industry. The growth of a vibrant agricultural industry can lead to both economic growth within agriculture and most other aspects of the economy in Barbados. The industry plays a critical role in relation to maintain green spaces that and the overall environment that visitors to the island expect of a tourist destination. Indeed, this has been one of the reasons advanced for the continued support provided to the sugar (cane) industry. Greening agriculture, however, creates avenues for growth also in energy production and waste management. To support this growth, however, a comprehensive and integrated development plan incorporating green principles will be required. Future research should therefore look at the issues related to payment for ecosystem services in the sector, an agri-insurance scheme for small-scale producers and potential waste-to-energy options.

3.1.8 SUMMARY

Agriculture in Barbados is, for the most part, dominated by the sugar cane industry, with production trends for most of the other non-sugar crops being erratic. The sugar industry has the largest share of total acreage planted, foreign exchange earnings and domestic earnings. Over the last three decades, however, the industry has contracted significantly owing to the loss of preferential market access to the EU. The production of livestock and dairy products is concentrated in poultry, primarily to meet local demand.

Agriculture is dependent on water as a primary input into its production processes and, given the scale of agricultural activity worldwide, it is easy to see why it appropriates around 70 per cent of the world's water resources. In an effort to conserve water and reduce input costs in the local industry, information about drip irrigation has been disseminated fairly widely throughout the industry, which has recorded a concomitant rise in the utilisation of this technology. However, there is a need to train farmers in relation to matching water application to the growth stages and crop needs. Energy, on the other hand, is primarily used for the operation of irrigation systems, agricultural machinery and animal husbandry. Agriculture also produces waste material, the disposal of which can be problematic in some cases, such as animal waste and waste from sugar processing. Land preparation and tillage practices in agriculture have impacts on groundwater recharge, surface water run-off and ponding/flooding, erosion and loss of topsoil.

It is envisioned that greening agriculture would be characterised by increasing use of farming practices and technologies that simultaneously enhance farm productivity, reduce negative externalities, and rebuild ecological resources such as soil, water, air, and biodiversity. Conventional farming practices tend to have major negative impacts, including damage to soil structure, environmental damage, creation of potential health hazards in food, reduction in food quality and high use of energy. It also involves intensive animal production systems, which are ethically unacceptable and exorbitant social costs.

Over the past two decades, the industry has benefit from several initiatives aimed at enabling sustainable agricultural development. New legislation passed included the Fisheries Act, Plant Protection Act, Soil Conservation and Scotland District Act, among others, while incentives have been provided for utilising efficient irrigation

systems, implementing soil conservation measures, underwriting the cost of obtaining organic farm certification as well as the cost of components for greenhouses and hydroponics, and numerous other measures. The results from the analysis done and recorded in this chapter suggest that the key critical challenges facing the sector relate to the lack of an acceptable level and quality of research and development infrastructure, the inadequate financial capacity of regional and international institutions, and the problem of praedial larceny.

Public and private sector investments in the many critical areas identified so as to close the huge investment gap should enable the sector to meet domestic demand for fresh produce (conventional and organic) and other value-added products, including packaged and graded produce along with processed mixed vegetables. Such investments would also increase exports and provide greater support to the agro-processing industry. This study also reveal the following:

- there is an urgent need to address investment gaps related to limited access to capital for upgrading of technology, physical plant and animals;
- delays are experienced due to manpower shortages in the Attorney General's Office with respect to upgrading the regulatory framework to meet international standards;
- there is a shortage of trained manpower in the sector;
- weak extension services;
- inadequate laboratory facilities for testing, research and development;
- inefficient marketing systems; and
- minimal technical capacity for planning by the Barbados Agricultural Society.

In relation to opportunities for growth, the greening of a restructured sugar cane industry is likely to reverse the negative outlook for that industry. While such a venture will require both public and private sector investments in infrastructure, training, research and development and marketing, a greener sugar cane industry would create an environment that recognizes and responds to the high average age of workers and the competitiveness of the industry. The other growth opportunities identified include the increased production of fertilizer, soil conditioners and animal feeds. Indeed, the adoption and promotion of organic agriculture would require substitution of imported inorganic fertilizers and products with locally produced organic alternatives. Such a switch therefore to organic

farming, supported by locally produced fertilizers and agricultural products, would buttress economic growth in the local agricultural sector and contribute to poverty alleviation.

Government's major role in relation to supporting the transition to a greener agricultural industry will be in the area of policy implementation. Some effort should be made to harmonize public policy with respect to commerce and domestic production. In addition, government support that facilitates the raising of capital by the private sector will be essential to the success of this new direction in agriculture. The enforcement of measures to minimize the incidence of praedial larceny also needs to be tightened promptly.

Greening agricultural industry can lead to both economic growth within agriculture and most other sectors of Barbados' economy. This industry does play a significant role in relation to maintaining green spaces and the overall environment that visitors to the island expect of a tourist destination. Indeed, this has been one of the reasons advanced for the continued support provided to the sugar (cane) industry. Greening the agriculture industry, however, also creates avenues for growth also in energy production and waste management, which would require the development of a comprehensive and integrated plan based on green principles.



Local farmer utilising small-scale low-cost technologies. Photo: Travis Sinckler

“... the importance of the island’s fishing industry to our social security cannot be over-emphasised, and thus the need for the employment of modern technology within the sector, as well as improved relations and continued dialogue among fisherfolk, processors, market managers and technocrats to achieve the goal of a sustainable fishery.”

Dr The Honorable Denis Lowe
Minister of Environment and Drainage
Feature address at the Official Opening of the Consett Bay Sustainable
Fishing Educational Exposition, 2 June 2010

KEY MESSAGES

Fisheries play a major role in food security and in the economic, nutritional and cultural well-being of Caribbean countries. The current status and trends of coastal and marine resources in the region point to increasing pressure from a number of sources. In Barbados, fisheries have been an important part of the national economy and culture from the earliest recorded times but are currently underperforming economically and socially.

The stakeholders' vision for greening the fisheries industry reflects a desire to have an economically viable as well as sustainable industry.

Investment gaps exist in relation to conservation of marine resources, capacity building, credit, communication and coordination among economic sectors, and collaboration between local and regional officials.

There are opportunities for linkages with other sectors, for example fish offal as a fertilizer or dolphin skin as fish leather, as well as the use of clean technologies and environmentally friendly practices to gain access to market.

Although few marine boundaries have been negotiated, it is clear that there must be considerable discussion and collaboration among people from the various territories on issues that cross jurisdictions due to close geographical proximity. There must also be a collective recognition that greening fisheries, particularly the ecological and harvest aspects, is a transboundary matter.

3.2.1 BACKGROUND

Fishing and fish have been an important part of Barbados' commerce and culture from the earliest recorded times (Welch, 2005). Fishery resources in Barbados supply a range of goods and services, including food, recreation opportunities and ecosystem services. They generate direct market benefits by way of jobs, income and other tax revenue, as well as foreign exchange through exports and foreign exchange savings from reduced food imports (Mahon, Parker, Sinckler, Willoughby & Johnson, 2007). During 2010, total fish landings were approximately 3,200 tonnes, with Flyingfish landings accounting for 75 per cent of this total due to Flyingfish landings (Table 18).

The fishing industry has historically served as a social safety net, providing work for those unable to find other employment. It is estimated that more than 6,000 people are engaged in the fishing industry in Barbados. This includes those who catch, sell, process and distribute fish. The primary stakeholders (Table 19) of the harvest sub-sector are fishermen and boat owners, with over three-quarters of these being active fishers. The majority of fishermen (99 per cent) and boat owners (91 per cent) are male. Females make up the majority of the post-harvest workforce accounting for 63 per cent of the primary post-harvest stakeholders, with vending, boning and scaling predominantly female dominated activities. Males predominate among processors, exporters, hawkers and skimmers (Fisheries Division, 2004).



Traditional fishing boats – An intervention to support local livelihoods and food security following the ravages of hurricane Janet in 1955. Photo: Creative Commons/myheimu

Additional livelihoods include cooks at fish fries (community-based grilling events) and restaurants. Numerous others make a living by supporting the industry through supporting services such as boatbuilding, and the sale and maintenance of boats, boat engines, fishing tackle and electronic equipment (Table 19). Others sell and service the vehicles and equipment involved in transporting, processing and exporting fish. The fishing industry is important in other ways as well. It provides an important input to the tourism industry – Flyingfish, Dolphinfish, Kingfish and tuna are perennial favourites with visitors. Recently, fish fries, such as those at Oistins and Half Moon Fort (Moon Town), have emerged as a major feature in the country's tourism product and attract large numbers of visitors who have the opportunity to interact with the many

TABLE 18. FISH LANDINGS BY TYPE (TONNES)

Commodity	2006	2007	2008	2009	2010
Flyingfish	921.6	1,288.0	1,813.8	2,292.0	2,424.0
Dolphinfish	475.7	693.0	347.9	870.0	465.0
Kingfish	39.2	34.0	20.6	19.0	29.0
Billfish	97.1	20.0	83.0	30.0	27.0
Tuna	265.2	181.2	57.0	141.4	72.0
Snapper	13.3	22.0	2.1	16.0	28.0
Reef fish	19.8	8.0	8.7	9.0	20.0
Shark	9.9	140.0	7.9	7.0	8.0
Swordfish	29.9	20.0	28.8	15.0	10.0
Other varieties	106.8	109.0	55.1	137.0	98.0

Source: Fisheries Department/Ministry of Agriculture and Rural Development.

TABLE 19. STAKEHOLDER COMPOSITION BY FISHERIES SUB-SECTOR

Sector	Stakeholder	% of Industry
Harvest		
Primary stakeholder	Fishermen	63
	Boat owners	37
Secondary stakeholder	Boat-builders	0
	Ice suppliers	0
	Fuel suppliers	0
	Ancillary service providers	0
Post-Harvest		
Primary stakeholder	Vendors	37
	Boners	39
	Hawkers	8
	Skinner	8
	Scalers	6
	Processors	1
	Exporters	1

Source: Barbados Fisheries Management Plan 2004-2006

locals that patronise them (Mahon, Parker, Sinckler, Willoughby & Johnson, 2007).

The composition of the local registered fishing fleet and its associated characteristics is provided in Table 20. Except for the largest iceboats and longliners, most fishing vessels are built locally, and most are made of wood. Iceboats are replacing launches as the preferred vessel for pelagic fishing (McConney, Mahon & Pomeroy, 2007).

In 2007, Mahon et al. highlighted the apparent value of Barbados' fisheries and their significant importance to the national economy. In general, only

the ex-vessel value (the value of landed raw fish delivered by a fisher) of fish landings is reflected under fisheries in the GDP estimates of Barbados.

However, Mahon et al. (2007) note that this value is only 20 per cent of the total value of the fishing industry, when value-added is considered. The value-added component ranges from 0 per cent in the case of sea eggs to 88 per cent of the total value in the case of Flyingfish, and is higher for offshore catches, which are either processed and exported, or are cooked and served at fish fries and restaurants, than it is for inshore catches, which are most often sold directly to consumers (Table 21). The overall value-added for different local fisheries was estimated at over US\$ 25 million in 2006 compared with the ex-vessel GDP estimate of US\$ 7.5 million (Mahon, Parker, Sinckler, Willoughby & Johnson, 2007).

Mahon et al. emphasize that fisheries may also have considerable value in several other ways including the value of the support services to the fishing industry, the value of fishing and fish products in attracting visitors to the island, the value of fish as food in maintaining the health of Barbadians and therefore reducing health costs, and the value of fisheries in the culture and identity of Barbadians. The true economic value of fisheries resources is for the most part unknown in Barbados, as in the rest of the world.

The Centre for Resource Management and Environmental Studies (CERMES), at the University of the West Indies, Cave Hill Campus, is currently involved in a collaborative research project, Economic Valuation of the Fisheries of Barbados, with the Barbados Fisheries Division, the overall purpose of which is to estimate the economic contributions of the fisheries sub-sector to the national economy. The project will provide new information on the economic importance and value of



TABLE 20. REGISTERED FISHING FLEET COMPOSITION AND ASSOCIATED CHARACTERISTICS

Boat type	Length	No. (2009)	Propulsion	Fish type and gear
Moses	3-6m	564	Oars or 10-40 hp outboard engines	Reef and coastal: hand and trolling lines, fish traps and cast nets
Launches or dayboats	6-12m	251	10-180 hp inboard diesel engines	Flyingfish and large pelagic; hand and trolling lines, gill nets and hoop nets
Iceboats	>12m	185	Inboard diesel engines	Flyingfish and large pelagic; hand and trolling lines, gill nets and hoop nets
Longliners	>12m	36	Inboard diesel engines	Tunas and swordfish, with a by-catch of large pelagic; pelagic longline gear but some carry all gear associated with iceboats

Source: McConney et al., 2003.



Oistins Bay – A primary fish landing site in the South of Barbados. Photo: Travis Sinckler

TABLE 21. VALUE-ADDED FOR DIFFERENT FISHERIES (US\$)

Fish type	Ex-vessel value	Value-added	Overall value
Flyingfish	1 794 249	13 324 338	15 118 587
Dolphinfish	2 502 692	3 001 173	5 503 865
Tuna	701 425	1 217 695	1 919 119
Billfishes	307 805	327 302	635 107
Swordfish	96 522	61 518	158 040
Kingfish	133 459	92 141	225 600
Snappers	82 150	122 964	205 115
Shark and Barracuda	44 721	42 317	87 037
Lobster	3 934	3 888	7 821
Jacks	29 626	16 898	46 524
Bonito	4 885	4 684	9 570
Reef fishes	44 657	28 028	72 685
Sea eggs	1 387 500	0	1 387 500
All others	201 048	28 890	229 938
Total	7 334 672	18 271 837	25 606 508

Source: Mahon, R. et al., 2007.

two contrasting fisheries in Barbados. This research will be valuable in future initiatives towards greening the sector as it may help to identify or confirm the fisheries and areas within the harvest and post-harvest sub-sectors that could provide the most profit or have the greatest impact from greening.

Several policy and legislative instruments guide the sustainable development and management of the fisheries sub-sector and the surrounding marine environment (Table 22) These instruments are essential to integrating the fisheries sub-sector in the Barbadian green economy. The Barbados Fisheries Act of 1993 was developed to

provide for the management and development of fisheries in Barbados. The accompanying Fisheries (Management) Regulations (1998) address closed areas and seasons, fishing methods and equipment to be adopted, and protective measures for lobsters, turtles, sea eggs and tuna. Some provisions are also made for the protection of corals. According to Section 3(3) of the Fisheries Act, the “objective of fisheries management and development shall be to ensure the optimum utilisation of the fisheries resources in the waters of Barbados for the benefit of the people of Barbados”. Furthermore, Section 4 makes provisions for the Fisheries Management Plan as it speaks to “schemes for the management and

TABLE 22. INITIATIVES AIMED AT ENABLING THE SUSTAINABLE DEVELOPMENT AND MANAGEMENT OF THE FISHERIES SUB-SECTOR AND MARINE ENVIRONMENT

Legislation	Details
Barbados Fisheries Act	Provides for the management and development of fisheries in Barbados
Markets and Slaughter-Houses Act	Allows the Minister to regulate markets and slaughterhouses
Territorial Waters Act	Defines the territorial waters of Barbados
Marine Boundaries and Jurisdiction Act	Establishes the exclusive economic zone for the island
Coastal Zone Management Act	Provides a comprehensive statutory basis for coastal management and planning
Marine Areas (Preservation and Enhancement) Act	Supports the preservation and protection of marine life in certain submarine areas of Barbados and for the establishment of underwater parks and art centres
Marine Pollution Control Act	Developed to prevent, reduce and control pollution of the marine environment of Barbados from whatever source

Source: Authors' analysis.

development of fisheries in the waters of Barbados". The Barbados Fisheries Management Plans (1997-2000; 2001-2003; 2004-2006) summarise the fisheries of Barbados and their management. They provide a scheme for the individual fisheries inclusive of an assessment of the fishery (ecology, fishing methods, economic, resource status) and management and development measures (opportunities, constraints, management units, possible additional management measures).

Successive national Fisheries Management Plans (FMPs) are guided by the Code of Conduct for Responsible Fisheries that sets the stage for more sustainable fisheries (greener fisheries) in both the harvest and postharvest sectors. The FMPs take into account the promotion of fisheries management, the protection of the environment and atmosphere through well-developed and designed vessels, safety measures for vessels, quality assurance of products, development of seafood legislation and standards and the marketing of value-added seafood products such as fish silage which otherwise would be wasted. The plans do not pay much attention to aquaculture, although it is encouraged as a means of diversification of income and diet in the Code of Conduct.

The Markets and Slaughter-Houses Act (1958) could enable the efficient and sustainable use of fish markets via Sections 3 and 12. In Section 3, the Minister can lawfully "establish, manage and regulate public markets for the sale of marketable commodities therein and to provide all such matters and things as may be necessary for the convenient use of such markets." In Section 12, authority is given to the Minister to "provide slaughter-houses and such plant, machinery or apparatus as may be necessary for treating or disposing of waste matter or refuse resulting from the slaughtering of animals therein." Additionally in Section 26, sub-section (r) the Minister may make regulations pertaining to the management and use of markets and slaughterhouses. Therefore provisions exist within this Act for implementation of best practices via waste management and conservation.

Apart from these fisheries-specific policies, there is also supportive legislation that is relevant and important to marine resources and fisheries management. The Barbados Territorial Waters Act of 1977 defines the territorial waters of Barbados as extending 12 nautical miles around the island. Section 3 (2) of the Act provides that these waters, including the underlying seabed and subsoil, form part of the territory of Barbados and are, therefore,

subject to full territorial sovereignty. Foreign vessels have a right of innocent passage through the territorial waters but not if the captain or other person in charge of the ship engages in any calculated act of pollution or acts likely to cause harm to Barbados' resources or its marine environment.

The Marine Boundaries and Jurisdiction Act (1979) establishes a 200-mile EEZ in which sovereign rights are vested in the government of Barbados in respect of the exploration, exploitation, conservation, protection or management of the natural living and non-living resources of the sea-bed, subsoil and superjacent waters; and the preservation and protection of the marine environment and the prevention and control of marine pollution. Under section 6, provision for the exploitation of resources in Barbados' Exclusive Economic Zone is made in accordance with UNCLOS that assigns rights and responsibilities of States for their respective zones and preventing other territories from utilising their resources.

Barbados has all other rights in and jurisdiction over the EEZ recognized in international law. The Coastal Zone Management Act (1998) provides a comprehensive statutory basis for coastal management and planning in Barbados. Article 4 provides the legal basis for the Coastal Zone Management Plan that establishes and clearly sets out Government's coastal management policy and technical guidelines for the use and allocation of coastal resources. Article 15 provides restrictions for marine areas. The provisions for coral reef protection are more specific with some provision for fisheries (Sections 22-27). This is an important document for fisheries management and an ecosystem approach to management as it provides the legal basis for preventing and reducing habitat degradation. The Act also encompasses the designation of Marine Protected Areas and Marine Parks.

The Marine Areas (Preservation and Enhancement) Act (1976) preserves and protects marine life in certain submarine areas of Barbados and establishes underwater parks and art centres. It provides primarily for marine protected areas (MPAs). The only regulation in existence regarding MPAs is the Marine Areas (Preservation and Enhancement; Barbados Marine Reserve) Regulations of 1981. However, it specifically refers to the Barbados Marine Reserve, now known as the Folkestone Marine Reserve.

The Marine Pollution Control Act (1998) was developed to prevent, reduce and control pollution of

box 1 BEST PRACTICE GOOD GOVERNANCE TO SUPPORT A SUSTAINABLE FISHERIES POLICY FRAMEWORK IN BARBADOS

The agriculture sector has been identified as a key driver in the Barbadian green economy. The sector has been leading the way via the development of economic incentives to ensure good environmental practices such as water conservation- via research into organic crop production and drought resistant plant varieties; and through investment into green technologies such as solar energy for ice-making in the fishing industry.

The development of a green economy must include community participation and stewardship and again these attributes are hallmarks of the agricultural industry, more specifically, the fisheries sub-sector.

Co-management In Barbados, the fisheries sub-sector has developed a framework for the management of fisheries resources and associated habitats that has embraced a dynamic multi-stakeholder approach to management. This framework ensures that non-state actors are integrated into several levels of management and decision-making.

The objective of the government is to promote co-management within the fisheries sub-sector so that stakeholders are involved in implementing measures aimed at protecting and preserving fisheries resources. The framework facilitates the strengthening of fisher-folk organizations through technical and developmental assistance and actively promoting co-management and community-based management approaches.

The multi-sectoral Fisheries Advisory Committee, which counts the Chief Fisheries Officer as an ex-officio member, is mandated by law to advise the Minister. This Committee has been very

successful in:

- identifying key persons from among stakeholders to act as change agents;
- developing strategies to effect behavioural changes among fisherfolk;
- preparing and distributing user-friendly information on the fisheries management issues;
- mounting extension programmes that focus on the educating fisherfolk and the public on fisheries management issues and best practices; and
- establishing strategic alliances between the industry and relevant agencies, i.e. the Coast Guard, that ensures the protection of fishermen on the high seas.

A strong legal framework

A complement to the participatory approach is a strong legal framework that the Government of Barbados anticipates will be an addition strategic component of the Barbadian green economy. The note-worthy legislative instruments include:

- The Fisheries Act (Cap. 391 section 4) which provides the legal authority for preparation of a Fisheries Management Plan, and lays out the terms for “schemes for the management and development of fisheries in the waters of Barbados”. It is developed using a multi-stakeholder approach, with the Chief Fisheries Officer being charged with the responsibility of its development and keeping such schemes under review.

The Plan forms the basis for fisheries policy, management (both conservation and development), administration and the formulation or implementation of fisheries-

related legislation. It may be reviewed at any time during the plan period.

- The Fisheries Act (1993, amended 2000) which is based on the Organization of Eastern Caribbean States (OECS) harmonized legislation. It covers the formulation and review of fisheries management and development schemes; the establishment of a fisheries advisory committee; fisheries access agreements; local and foreign fishing licensing; sport fishing; registration of fishing vessels; construction and alteration of fishing vessels; fisheries research; fisheries enforcement and the obligation to supply information. It also specifies conservation measures such as prohibiting the use of any explosive, poison or other noxious substance; closed seasons, gear restrictions and the creation of marine reserves. The Act is supported by the Fisheries (Management) Regulations (1998), which lays out specific restrictions and outlines the accompanying penalties.

The Fishing Industry continues to be a major contributor to both food security and socioeconomic well-being. It has, over the fifteen (15) year period since the promulgation of the Fisheries Act, shown the inevitable peaks and troughs with respect to production, but has significantly boasted consistent growth during the past three recessionary years. Also during this period, an expansion has taken place both in the number of fishing platforms using longline fishing techniques to capture exportable large pelagics, as well as improved and/or increased marketing facilities, with concomitant increases in small fish processing businesses.

the marine environment of Barbados from whatever source. It recognizes that much of the marine pollution affecting coastal waters originates from land-based sources and activities, and supports the Coastal Zone Management Act as it addresses pollution sources that negatively impact on the marine environment and marine biodiversity. There are no regulations for marine pollution control as yet.

National and sectoral plans have been prepared in the past few years with a view to achieving a comprehensive framework for the sustainable development of natural resources in Barbados. They are therefore relevant to the fisheries sub-sector and its greening.

The National Biodiversity Strategy and Action Plan (NBSAP) for Barbados were prepared in 2002 as a requirement of the CBD. The NBSAP integrates biodiversity management and conservation aspects of the various existing sectoral plans and serves to minimise overlap and increase the efficiency of use of human, financial and equipment resources. The NBSAP comprises twelve objectives, all relevant in some way to fishery resources. However, the fisheries sub-sector is only directly referenced in the final objective: To promote the conservation and sustainable use of biodiversity in various sectors (agriculture, health, fisheries and tourism). Distinguishing fisheries from agriculture indicates the government's awareness of differences among economic sectors.

There is further strong support for greening the fishing industry and green economy within the vision statements of the NBSAP for the specific goals for the role of biodiversity conservation in the development process in Barbados – sustainable development, environmental preservation, responsible economic decision-making and protection of national biological heritage.

The following plans make provisions for the sustainable management of the majority of the human activities that impact the conservation of biodiversity and sustainability of resources in both the marine and terrestrial environment:

- The Physical Development Plan (Amended 2003) provides policies for the use of land and the criteria and controls over the types of development that are allowable in different parts of the island. Development in accordance with environmental management and the environmental health of the nation is a strong focus of the Plan.

- The Fisheries Management Plan was discussed previously in conjunction with the Fisheries Act.
- The Barbados Coastal Management plan exists in three volumes: 1) Policy Framework; 2) Atlantic Coastal Management and 3) Caribbean Coastal Management Plan. The plans are all linked by sustainability and effective implementation framework strategic objectives and associated policy objectives both of which are relevant to fisheries.

The government of Barbados acceded to the Montreal Protocol in October 1992 and is listed as a Party to Article 5. The country has also ratified all the amendments to the Protocol. Barbados has further implemented the Refrigerant Management Plan (RMP) and effectively eliminated the consumption of CFCs in the Barbados Refrigeration and Air-Conditioning market. The government of Barbados has placed all ozone depleting substances (ODSs) under the Customs (List of Prohibited and Restricted Imports and Exports) Order of 2009 and the 2010 Amendment Order. This action effectively prohibits trade in ODSs with a global phase-out date on or before 1 January 2010 and imposes a licensing restriction for trade in ODSs and ODS consuming equipment with future Phase-out dates under the Protocol (i.e. HCFCs). Consequentially, trade in HCFCs and HCFC consuming equipment requires the trader to acquire an Import/Export license in advance of arrival at (departure from) Barbados' shores.

The National Strategic Plan of Barbados (2006-2025) provides the model for the realisation of Barbados' vision of becoming "a fully developed society that is prosperous, socially just and globally competitive" by 2025. There are six strategic goals proposed for achieving the national vision. Goal 4 advances the building of a green economy through the "protection, preservation and enhancement of our physical infrastructure, environment and scarce resources as we seek to advance our social and economic development." The goal has six accompanying objectives of which three are relevant to greening fisheries – promotion and facilitation of the sustainable use of Barbados' renewable resources and the wise management of the non-renewable resources; maintenance of a safe and reliable water supply; and certainty of an efficient and reliable energy sector. Many of the strategies for achieving these goals are enabling conditions for greening Barbados' fisheries.

The goal of the NSP promotes finding the right balance between development and the preservation of physical surroundings through the:

- implementation of ecosystem-based management approaches and other new approaches to fisheries management;
- reduction of wastage in the fisheries sub-sector; improving/promoting energy efficiency in markets, boats and processing plants; and
- increase in the implementation of water conservation measures at markets and within the processing sector,

which will protect, preserve and enhance fisheries habitats and marine resources and thus facilitate the realisation of Barbados' sustainable fisheries. However, to achieve this and build a greener fisheries sub-sector, a number of policies will have to be put in place.

Within the Medium-term Development Strategy of Barbados (2010-2014), the aim for the agriculture sector (in which fisheries is subsumed) is greater domestic food production through new and improved methods of farming and to substantially reduce the importation of food by 2014. While the focus of this aim seems to be relevant to cultivation and livestock production, ensuring the "sustainable availability and production of fish and fish products by assuring the efficient management and development of the fisheries resources" is one of the many strategies and areas outlined for intervention. It is meant to facilitate the repositioning of the agriculture sector to effectively achieve the aim and tackle the challenges of a high import food bill, high global energy costs, rapid climate change and decrease of agriculture exports by some major food suppliers.

Additionally, support for the addition of value to the sector through product development can be applied to fisheries in pursuing value-added products such as the substitution of Flyingfish roe for caviar, the production of leather and leather products from fish skins, and the production of processed fish products for local consumption and export. The NSP and Medium-term Development Strategy therefore provide a broad policy environment for greening the fisheries industry.

The concept of green policies to support fisheries is not new, but is embedded within sustainable development and, thus, sustainable fisheries. Based on the regularly accepted definitions of sustainability and sustainable development, sustainable fisheries may be defined as resources that can be harvested to meet the needs of today's generation without compromising the ability of future generations to harvest fish for their needs (FAO, 1995). This requires the restoration and conservation of fish

stock, preservation of the marine environment, while allowing the fishing industry to remain economically viable and fishing communities to maintain social and cultural heritage. A green fisheries policy includes ecosystem-based management of coastal and marine social ecological systems that enhance livelihoods and well-being within the fishing industry and related marine economic sectors, while allowing individuals and communities to maintain their social and cultural heritage. A green fisheries sub-sector:

- is managed in a way that takes into consideration all coastal and marine resources in an ecosystem (fishing techniques, management approaches);
- helps to protect sensitive marine species, and essential and vulnerable habitats
- promotes rebuilding depleted marine resources to meet the food security needs of both current and future generations;
- is conducted in ways that are energy efficient, and minimize (1) the release of greenhouse gases, (2) harmful chemicals, (3) waste production and (4) water wastage; and
- operates in a socially, economically, equitable and responsible manner so as not to negatively impact on people dependent on the sector (adapted from UNEP, 2011d).

3.2.2 RESOURCE USE AND EFFICIENCY MEASURES

In general, most Caribbean coastal resources are considered to be under stress from overexploitation, degradation of coastal and marine ecosystems, limited or poor management, and climate change and are therefore not making an optimum contribution to socioeconomic development in the region (Fanning, Mahon, & McConney, 2009; Agard, et al., 2007). All the major commercially important fishery species and species groups are reported to be either fully developed or over-exploited. It is likely that the status of Caribbean fisheries is similar to that of fisheries globally with respect to the exploitation level and their need for being rebuilt after being overfished (Agard et al. 2007).

In Barbados, for those fisheries where data is available, they are generally overfished or overexploited (shallow-shelf reef fishes, sea eggs, turtles), thought to be fully exploited in some areas (deep slope and bank reef fishes), or show inter-annual variability (Flyingfish) (McConney, Mahon & Oxenford, 2003). In spite of this situation, there is

little on-going effort aimed at assessing the fishery resources of Barbados with the objective of placing management plans on a more technically sound base (McConney et al. 2003).

Fish processing typically consumes significant quantities of water and discharges significant quantities of organic material, both as effluent and as solid waste. However, there is little use of hazardous substances, with the exception of cleaning fluids. As water is used extensively in fish processing, water-saving measures are very common and suggests that there are “cleaner-production” opportunities in this industry.¹⁴ The first step in reducing water consumption is to analyse water use patterns carefully to identify leaks and wasteful practices. The next step is to determine optimum water consumption rates necessary to maintain processing operations and food hygiene standards. Water reuse can be considered where it does not compromise product quality and hygiene.

Water conservation measures are currently being implemented at the fish markets. There has been a directive from Cabinet to install infrared sensors at the processing bay at the Bridgetown Public Market and other markets across the island (I. Kirton, pers. comm.). This is particularly important in promoting economic efficiency in operation costs through reduced water utility costs. Expenditure on water at the Bridgetown Public Market is substantial, amounting to approximately BBD 150,000 per month. It is imperative that in order to move towards greening the fisheries sub-sector, a water consumption audit be undertaken at fish markets and processing facilities in order to determine consumption patterns and identify ways in which consumption can be reduced and conserved.

Fish harvesting operations are heavily dependent on fossil fuels and attempts at reducing dependency on them have reaped very little success. In general, photovoltaics are not commonly used on fishing vessels for daily operations. A few boat owners have installed solar panels on their fishing vessels for battery charging and some attempts to use solar panels on the Fisheries Division’s vessel were made, but unfortunately, the vessel is no longer in operation (C. Parker, pers. comm.). Photovoltaic technology use would be particularly beneficial for generating greener electricity for electrical appliances on iceboats and longliners that typically spend days to weeks at sea. In 2001, 11,000 W of solar PV were installed at the Skeete’s Bay fishing complex to power a solar icemaker producing about one ton of ice per day. The total cost of this system that is the largest stand-alone

photovoltaic system in Barbados was US\$ 86,726. It uses twenty-four 200Ah, 12V lead acid batteries for energy storage, enough storage to allow the two half-tonne ice machines to continue to run overnight (GOB, 2001). There are also plans to have solar panels installed at Conset Bay Fish Market.

Additionally, from discussions had during the Fisheries Industry Stakeholder Consultation Meeting in July 2011, it is apparent that fitting fishing boats with engines that are too powerful and so result in an erosion of efficiency gains, continues to be a problem in the fishing industry. This perverse effect of current duty-free concessions for boat engines granted by the Fisheries Division needs to be reviewed since too many boat owners seem to be always trying to obtain the engine with the highest horsepower under concession.

It is evident that the engine type used (powered by non-renewable versus renewable energy) is not a foremost concern when consideration is being given to greening the fisheries sub-sector. This is because the current cost of using renewable energy is prohibitive, and so the ubiquitous use of fossil fuels in the industry will most likely continue for some time. Notwithstanding, there is scope for more consideration to be given to the use of four-stroke and/or direct injection two-stroke engines instead of the two-stroke engines that are prevalent in the industry. These alternatives can help in the reduction of pollution of the marine environment through reduction in the risk of oil spillage. Moreover, both are more fuel-efficient than the type that is currently used most, even though, in general, four-stroke engines are more fuel efficient and quieter than direct injection two-stroke engines (EPA, 2008).

It is necessary to compare technology in detail regarding the engine types, as the options are not straightforward. Some factors that should help with this decision include:

- The size of the fisheries and the degree to which the country would try to reduce emission near-shore. If there were a predominance of a certain type of boat used near to shore (i.e. Moses), too many boats would impact on marine biodiversity;
- Environmental sensitivity should be the focus and not fuel efficiency. Near-shore vessel pollution was higher but for longline vessels, the impact is minimal to near-shore;
- Safety would be a concern for fishermen as two-stroke engines are more resistant to seawater and are easier to fix at sea; and
- Concessions for engines.

In terms of waste, the Bridgetown Public Market produces about 2-3 tonnes of fish offal daily. Instead of being dumped, fish offal could be used to produce fish silage or meal for fertilizer (A. Cummins, pers. comm.). In the past silage was produced by a fish processor and some farmers. A feeding trial was also undertaken by the Central Livestock Station that resulted in good growth rates for the pigs under study with no tainting of meat when crude fish silage supplemented commercial feed. As the poultry industry also has the technology to use waste, the potential for supplementing feed should be further explored. Furthermore, the use of the skin of Dolphinfish and Triggerfish to produce leather points to another recyclable material that could provide significant economic benefits. Funding, research and development are required to exploit these economic opportunities, which need to be followed by creative product marketing.

There has been a small-scale initiative to recycle engine oil so as to reduce waste and improve economic efficiency in boat operations. At the Bridgetown Public Market, old engine oil is stored and collected by the Mount Gay Rum Distillery to be recycled (I. Kirton, pers. comm.), however, to have a significant impact on the industry, this initiative would have to be expanded to handle the volume that would be generated by the island's fishing fleet. Fisherfolk would have to be educated about the benefits of this initiative that should probably be incentivised to encourage participation.

There are in excess of 30 fish landing sites around the island with facilities of varying standards, not all of which are used year round. The landing sites are categorized as primary (markets), secondary (sheds) and tertiary (beaches), based on the type of physical infrastructure present. The majority of catches are landed at the seven primary landing sites – Bridgetown Public Market, Oistins Fish Market, Skeete's Bay Fish Market, Conset Bay Fish Market, Payne's Bay Fish Market, Weston Fish Market and Speightstown Fish Market – which are characterized by market buildings and other facilities such as chill or cold storage, ice, lockers and haul-out areas. The Bridgetown Public Market has a harbour. Oistins, Speightstown, Conset Bay and Skeete's Bay have jetties. Fish tolls, catch, fishing effort data (includes type of gear used, fishing techniques, what fish were killed and location and days at sea) and price statistics are collected at all fish markets. Secondary landing sites are characterized by the presence of a shed and slabs for cleaning and cutting fish. There are three secondary landing sites at Pile Bay, Half Moon Fort and Martin's Bay. Caretakers are

employed by the Fisheries Division to clean the sheds and collect catch and effort data. There are also many other recognized landing beaches and bays, or tertiary sites, without physical infrastructure where boats are moored or beached and fish landed.

In a country with little resources, resource efficiency should be paramount in a green economy. The GESS is therefore an opportunity to look at resource efficiency gains from the fishing industry. Beyond the fisheries sub-sector, the Ministry of the Environment and Water Resources is emphasizing clean technologies use. Therefore, certain economic sectors such as fisheries could be developed in advancing clean, energy-efficient policies.

3.2.3 INVESTMENT GAPS

Stakeholders were generally of the opinion that sustainability was a key element of the future growth of the fishing industry.¹⁵ The fisheries industry has numerous strengths that can be leveraged in order to support greening of the fisheries industry (Table 23). Many communities in Barbados have developed around the fisheries industry and there is therefore tremendous community support to see the development and continued growth of the industry. To these end, there have been many projects aimed at supporting community-based fisheries management as well as coral reef monitoring.

The stakeholders' vision for greening the fisheries industry reflects a desire to have an economically viable as well as sustainable industry.

The community-based characteristic of the industry meshes quite seamlessly with the concept of heritage tourism. As a result, the Weekend Fish Fry at Oistins has become a popular tourist attraction that provides benefits to both visitors and locals alike. The Oistins example and other similar initiatives enhance the economic benefits from the fisheries industry as well as add some diversity to the island's tourism product. These initiatives are woven into various development plans for the industry, many of which have long embraced the concept of sustainability and can be leveraged to support the further greening of the fisheries industry.

The challenges of, or priorities for, greening the fishing industry are numerous and have been

TABLE 23. STRENGTHS AND CHALLENGES IN GREENING THE FISHERIES SUB-SECTOR

Strengths	Challenges
1. The fishing industry is part of the social fabric of many communities	1. Conservation of marine resources, which is a fundamental requirement for sustainable development and the transition to a green sector
2. The industry has begun to exploit linkages with the tourism industry	2. Capacity building, essential for greening fisheries development
3. Legislative framework built around the concept of sustainable fisheries	3. Credit, which is a major constraint to new investment in greener technology;
4. A fairly well established research infrastructure to support the industry	4. Communication and coordination among economic sectors, which is part of an ecosystem approach to fisheries
5. Highly trained labour force	5. Collaboration between local and regional officials, which is necessary for managing and developing transboundary marine resources
	6. Collaboration between local and regional officials, which is necessary for managing and developing transboundary marine resources

Source: Stakeholder discussions and authors' analysis.

reiterated during numerous stakeholder consultations and meetings. They are varied and encompass the harvest and post-harvest sectors as well as the accompanying supporting services and overarching resources and ecosystem that are the basis of the industry. These challenges may be categorised according to five main themes (Table 24).

Table 24 presents a systematic identification of the challenges employing a score based on a 10-point Likert scale in relation to frequency and impact as outlined in Addendum 1. The combination of these two factors provides a ranking of the importance of each challenge, as shown in Column 4: the higher the score, the greater the ranking of importance. The scores are derived based on expert opinion as well as stakeholder discussions.

In general, many fish stocks are overfished, particularly shallow-shelf reef fished, sea eggs and turtles (McConney, Mahon & Oxenford, 2003). Emphasis should therefore in the future be placed on conservations of fishery resources. These conservation efforts should take into account the economic and social role the industry has in many communities around the island. It will therefore be important to take into account stakeholder views and wherever possible involve a wide cross-section of stakeholders in the planning process. (McConney et al., 2003).

International regulations on seafood quality and handling became more important to Barbados since 1997 with the requirement that all facilities through which fish for export pass be inspected and

passed by registered inspectors. Certification for good quality and public health is necessary for fish to be exported to most countries (Mahon & Jones, 1998). In addition, some markets now require export certification to verify that the harvest process did not violate any international fishery management regulations as well as to ensure traceability in the chain of custody.

Since 2006 the GOB approved significant changes in food control to meet international standards in order to facilitate international trade. In order to export to Europe, though, a number of institutional arrangements need to be put in place. It is considered that this will require a major shake-up in the current system of operations. Thus, there are a number of issues in Barbados regarding fisheries exporting including:

- Fragmented certification across ministries (health, agriculture, etc.). There is currently no single agency to rely on to certify that food is safe for consumption,
- Requisite legislation not in place. Even though Barbados might not be targeting certain markets, the legislation should still be implemented.
- Upgrade of laboratories is needed.
- In order to resolve these issues the following could be considered:
- Create an agency with the key personnel being a veterinary officer, a fisheries officer, and the chief agricultural officer.
- Implement legislation that meets international standards.



Flyingfish (*Hirundichthys affinis*) – The local delicacy is governed by the Fisheries Act (Cap. 391). Photo: Travis Sinckler

TABLE 24. ASSESSMENT OF CHALLENGES FACING THE FISHERIES SUB-SECTOR

Challenges	Frequency of occurrence (1)	Impact (2)	Ranking of importance (3) = (1) x (2)
Conservation of marine resources	9	9	81
Capacity building	8	6	48
Credit	9	9	81
Communication and coordination	7	9	63
Collaboration	7	8	56
Post harvest losses	9	9	81

Source: Stakeholder discussions and authors' analysis

- Focus on current and more lucrative markets (i.e. exporting tuna to the U.S.A., thereby allowing the longline fishing industry to become a million dollar industry), universally preferred products and market expansion. There needs to be an expansion of current export practices.
- Target other ethnic or diasporic markets (niche markets).
- Pay attention to the quality and safety of fish being supplied to tourists in Barbados since consumption by tourists is counted as income generating activity in the export market.
- Build a communications network for this industry to inform of changes in standards in international markets.
- Create an eco-label and specific regulations for Barbados fish products (branding and adding value for greening fisheries).
- Develop and promote a regional certification scheme for training in fish handling and food quality throughout the region.
- Fish processors, in general, are interested in meeting standards of EU markets but other even more lucrative markets exist for them.

The EU has one of the highest levels of food standards and there is a possibility that the United States could switch towards implementation of similar EU standards. This would negatively impact exports of products from Barbados, thus, it seems prudent and the best approach for government and producers in the fishing and agricultural sectors to progressively aim towards satisfying EU standards, even though it might take longer to achieve such standards. With such standards in place, tourists will be assured of obtaining the same quality of fish in Barbados as they do in their home country and this, in turn, will help to establish both the national fisheries and tourism industries as green sectors.

The ranking of investment gaps is presented in Table 25. An importance score is assigned to each investment gap based on a 10-point Likert scale, where 1 denotes insignificance and 10 means very important. The investment gap is quantified by subtracting column 2 from column 1. A positive value in column 3 indicates that greater investment is required to enhance a particular strength or minimize an identified challenge.

The following sections outline the potential of a green fishing industry to impact economic growth of the fisheries sub-sector and its contribution to the national economy, development and poverty reduction. It also highlights the potential that greening of the sector has for the creation of green jobs and transmigration as well as for environmental improvements. These benefits are outlined according to whether they constitute a challenge or priority area.

3.2.4 POTENTIAL RETURNS IN TERMS OF ECONOMIC GROWTH, DEVELOPMENT AND POVERTY REDUCTION

The economic and social contribution of fishing and the economic activities based on fishing are frequently undervalued. With an estimated 180-200 million people directly or indirectly dependent on fisheries and aquaculture in 2008, the global fisheries and aquaculture sector contributed significantly to livelihoods and food security for many of the world's coastal and rural poor. In addition, small-scale fishing, which presently constitutes a small proportion of the sector, is expanding.

TABLE 25. INVESTMENT GAP ANALYSIS OF THE FISHERIES SUB-SECTOR

Investment gap	Importance score (1)	Performance score (2)	Performance/ Investment gap (3)=(1)-(2)
Institutional development	9	2	7
Standards legislation	9	2	7
Market development	6	4	2
Target diaspora	7	2	5
Quality and safety	8	4	4
Eco-labelling	8	2	6
Regional certification	7	2	5

Source: Stakeholder discussions and authors' analysis.



Small-scale fishing (SSF) is a primary livelihood for millions of households in coastal and rural communities in developing countries (such as Barbados) and plays an important role in the achievement of key developmental objectives such as food security, poverty alleviation and pro-poor growth,¹⁶ particularly in Small Island Developing States (SIDS) (FAO, 2003). The growing threat to sustainable fisheries represented by overcapitalisation, overfishing and environmental degradation is a global concern but even more so for the many small-scale fishers and fish workers in developing countries, who are dependent on fishery resources as the principal means for making a living.

Over half the catch in developing countries is produced by SSF and 90-95 per cent of the small-scale landings are destined for local human consumption. In general, SSFs are estimated to provide over 90 per cent of all fisheries jobs (Weeratunge, Synder, & Poh Sze, 2010; Berkes, Mahon, McConney, Pollnac, & Pomeroy, 2001; Badjeck, Allison, Halls, & Dulvy, 2009). One of the major challenges within the Barbados fisheries sub-sector is reduction of post-harvest losses due to waste. Forty per cent is lost through spoilage. Inedible waste from fish processing may be converted to fishmeal and oil, and used to produce fish silage (for a range of livestock), and compost and other products. Processes for the production of fertilizers and other useful end products from fish waste have been developed in various parts of the world, and are being used (Gill, 2000).

The technology for fish silage production is simple – essential equipment is low-cost and the scale of production can vary. These are distinct advantages in developing countries. Commercial application

this technology, however, will depend on linkages to producers and on its opportunity cost versus that of other conventional protein sources, as well as on the existence of other means of processing to meet environmental regulations. Fish silage is currently produced in Cuba, Morocco, Vietnam, the Pacific Islands and on a large-scale in Denmark and Poland for feeding beef cattle, sheep, goats, horses and camels and ducks (Perez, 1995).

In Barbados, fish offal could be utilized as fertilizer, in compost, or dried and made into pellets for feed (Table 26). The Barbados poultry industry already has the technology to convert its waste into a commercial asset, so it is possible for the fishing industry to follow suit with the necessary technical assistance and funding required to recycle its waste products into viable products.

The option of turning Dolphinfinh skin into fish leather also exists. This creates an opportunity for fishermen or others to develop a fish leather company. Currently, the Barbados fisheries sub-sector does not as yet utilise the opportunities it has to convert its waste, and so it is timely and prudent to explore the various possibilities for economic growth, development and poverty reduction.

The use of clean technologies and environmentally friendly practices are gaining importance in international fish trade agreements. Given that the European Union, the United States of America and Japan import more than 75 per cent of the fish that is traded internationally, it is very likely that these practices will sooner than later gain such importance that they become criteria for market access. Barbados, therefore, needs appreciate the importance of the said practices and to adopt energy efficient practices so that opportunities for trade are not lost.



Local fishing boats. Photo: Ken Uyeda/Blackbird Design/Calgary Canada

TABLE 26. ASSESSMENT OF OPPORTUNITIES IN THE FISHERIES SUB-SECTOR

Opportunity	Frequency of success (1)	Effectiveness (2)	Ranking of importance (3)=(1)*(2)
Process fish offal into higher value added products	8	8	64
Dolphinfish skin into fish leather	7	5	35
Clean technologies	7	7	49

Source: Stakeholder discussions and authors' analysis

The contributions that can be made by fisheries to economic growth and poverty reduction are therefore summarised as follows:

- Conservation of marine resources:
 - The global fisheries crisis is an external driver towards greening the fishing industry as policy advisers and policymakers become more aware and informed of the potential value (economic and social) of the fishing industry.
 - Capable young people may be more willing to enter the fishing industry seeking the planned professional certification of green fishing occupations
 - International pressure favours sustainable management and livelihoods, but current fisheries legislation is inadequate for the proper management of the fishing industry
 - Variability in the abundance and availability of marine resources will be exacerbated by climate change, make green planning more difficult
- Capacity building
 - Government procurement policies and draft fisheries legislation can be tailored to support green economy initiatives
 - Training, outreach and capacity enhancement need to be enriched
 - Training institutions exist with potential to offer training for green technology access and the transfer of skills
 - Technologies for processing fish silage and producing fish leather are available; and it is consistent with small business and green job promotion to facilitate such entrepreneurship.
 - Control of entry into fisheries to achieve sustainable levels of harvest is possible through the enforcement of appropriate legislation currently in draft, and through execution of comprehensive fisheries management plans
- Credit
 - Taxation, incentives and fiscal reform require practical and technical guidance to support greening projects
 - Credit is not easily available to persons involved in the fishing industry
 - Opportunities exist to diversify fisheries once venture capital or development funds and technical support are available to facilitate research and development.
 - Tariffs, trade competitiveness and investment policies must be explained to stakeholders who are used to protectionism and demand it despite the changing world trade regime.
 - Change requires new attitudes towards environmental practices; funding policies and incentives (tax and duty concessions) need to be re-designed and monitored to support desired changes.
- Communication and coordination among economic sectors
 - Governance in the fisheries sub-sector has become more participatory through the provision made in the Fisheries Act for a Fisheries Advisory Committee (FAC). However, lack of communication hinders participatory governance.
 - Vertical integration and harmonisation of the various stages of the fishery value chain may be possible. Its success would promote a more equitable distribution of post-harvest benefits.
 - Policies are needed to promote sustainable use of water.

- Higher food standards may provide assurance to stakeholders in the tourism industry and lead to a strengthening of ties with the local seafood industry, which could reduce imports of competing fish products
- There is the need to apply the business model for a marine management agency to marine protected areas; this model should be developed in combination with an implementation plan.
- Barbados is moving too slowly towards an ecosystem approach to fisheries (EAF) and related approaches.
- Collaboration for managing and developing transboundary marine resources
 - Trade tariffs currently favour value-added, locally manufactured seafood products. Their production can be strengthened.
 - Seafood has been part of Barbados' policy on food security, but can be strengthened through placing more emphasis on policies that address the import and export of fishery products.
 - Lucrative niche markets for fishery product exports are believed to exist.
 - The CARICOM Common Fisheries Policy may provide opportunities for improved products and quality as well as resource conservation.
 - Engagement in transboundary resource management increases available options.
 - A code of conduct for responsible fishing would provide guiding principles for Barbados' fisheries management plans.

3.2.5 POTENTIAL FOR GREEN JOBS CREATION AND TRANSMIGRATION

Fish can be processed into a wide array of products to increase their economic value and allow the fishing industry and exporting countries to reap the full benefits of their aquatic resources. These include conventional products such as frozen packaged fish and fish fingers as well as newer products such as surimi and surimi-based products. Value-added processes generate employment and export earnings. This is more important nowadays because of societal changes that have led to the development of outdoor catering, convenience products and food services requiring fish products ready to eat, or requiring little preparation before serving (FAO, 2012).

There are a number of examples of the integration of fishing villages/towns and fisheries-based culture with tourism uses. Fish fries – Oistins and Moontown (Barbados), Gros Islet and Anse La Raye (St. Lucia), and fish festivals (Oistins Fish Festival) are examples of such integration. On weekends, the year-round Oistins Fish Fry provides opportunities and income to local craft people, fishermen, vendors and farmers who sell their products to thousands of Barbadians and visitors. The real economic value of this has not yet been estimated but it is believed that it is contributing significantly to national GDP.

There are also more subtle interactions between the local fisheries culture and tourism and is reflected in the level of interest paid by visitors in the local fishing culture and practices. Indeed, attractively painted and interestingly named boats on a beach, fish on sale in markets, fishers casting their nets or landing their catch are all part of this fishing culture that enthralls the visitor and enriches their experience, while making Barbados distinctive as a nation. The value of these aspects of fisheries has not been estimated thus far but can be, and would probably be high.

There is a variety of supporting services for fisheries – boat building and maintenance; boat and engine sales; maintenance of the wide range of motors and equipment on boats, at landing sites, in processing plants and in use by vendors; and the sale of fishing gear. All of these supporting services can adopt green practices in their use of energy and water and in the production of waste. Moreover, greening of the fishing industry will require that supporting services reorient their skills and knowledge towards green practices in the harvest and post-harvest sectors.

In terms of green jobs and transmigration, the pertinent issues that impact them are summarised as follows:

- Conservation of marine resources:
 - Bright, capable young people may be more willing to enter the fishing industry seeking the planned professional certification of green fishing occupations.
- Capacity building:
 - The fishing industry has demonstrated its ability to develop technologically but this is uneven across the various components of the industry; furthermore, support for fishery industry participants to take advantage of entrepreneurial opportunities has not been a priority of governmental or non-governmental agencies.

- Our well-educated, technically capable workforce is able to mobilize knowledge and develop capacity.
- Training institutions exist with potential to offer training for green technology access and the transfer of skills.
- Technologies for processing fish silage and producing fish leather are available; and it is consistent with small business and green job promotion to facilitate such entrepreneurship.
- Public demand (including from tourists) for higher standards of post-harvest, marketing and distribution will accelerate the demand for green job creation.
- Existing solid waste management and recycling schemes can be applied to fisheries, especially with many support mechanisms already in place.
- Credit:
 - Opportunities exist to diversify fisheries once venture capital or development funds and technical support are available to facilitate research and development.
 - Private sector entrepreneurship in fish processing and export is evident even without incentives for innovation, but funding constraints and consumer preferences may be used as excuses to avoid the cost and effort of going green.
 - There is a drive towards use of alternative and renewable energy and raising the level of efficiency nationally, but use of alternative energy, which can reduce long-term operating and production costs, requires up-front capital investment that many small to medium enterprises may find prohibitive.
 - Tariffs, trade competitiveness and investment policies must be explained to stakeholders who are used to protectionism and demand it despite the changing world trade regime.
- Communication and coordination among economic sectors
 - Policies are needed to promote sustainable use of water; this should be part of development of a national water policy.
 - New opportunities (such as silage production) may cause conflict with established producers (of feeds) concerned about decreasing market share.
 - Higher food standards may provide assurance to stakeholders in the tourism industry and lead to a strengthening of ties with the local seafood industry; this, in turn, will reduce imports of competing fish products.
- Collaboration for managing and developing transboundary marine resources:
 - Lucrative niche markets for fishery product exports are believed to exist.
 - Meeting local tourism demand to a greater extent should be re-cast as exporting and given incentives to maximize advantages of local firms.
 - The CARICOM Common Fisheries Policy may provide opportunities for improved products and quality as well as resource conservation.
 - Meeting EU standards should have positive implications for and connections with exporting sectors other than that for seafood products .

3.2.6 POTENTIAL FOR ENVIRONMENTAL IMPROVEMENT

Many SSFs in developing countries, like those in Barbados, are vulnerable to both internal and external threats. The current volatility of fuel prices constitutes a major part of overall costs in small-scale fishing in developing countries. The depletion of fish stocks, and a collapse of the economic activities based on these resources would have more severe consequences in small-scale fishing communities in developing countries where there are fewer alternative livelihoods than in developed countries. Therefore achieving/moving towards sustainable fisheries and hence greening the fishing industry is vital. At a time when fisheries resources are being depleted through indiscriminate fishing practices and climate change poses a growing threat, failure to effectively address the issues confronting small-scale fisheries places the livelihoods of millions of people at risk.

The main issues in relation to the potential for environmental improvement are given as follows:

- Conservation of marine resources
 - International pressure favours sustainable management and livelihoods, but current fisheries legislation is inadequate for the proper management (conservation and development) of the fishing industry.
 - Variability in the abundance and availability of marine resources will be exacerbated by climate change, making green planning more difficult.
- Capacity building:
 - Control of entry into fisheries to achieve sustainable levels of harvest is possible through enforcement of appropriate legislation currently in draft and through execution of

comprehensive fisheries management plans, and this should be encouraged in green restructuring of the fishing industry.

- Potential for increased economic returns to the sector and national economy must be articulated in fisheries management and other plans so as to guide private development.
- Credit:
 - Change requires new attitudes towards environmental practices; funding policies and incentives (tax and duty concessions) need to be re-designed and monitored to support desired changes.
 - Communication and coordination among economic sectors:
 - There is the need to apply the business model for a marine management agency to marine protected areas; this model should be developed in combination with an implementation plan.
 - Barbados is moving too slowly towards an ecosystem approach to fisheries (EAF)¹⁷ and related approaches.
- Collaboration for managing and developing transboundary resources:
 - Engagement in transboundary resource management increases available options.
 - A code of conduct for responsible fishing would provide guiding principles for Barbados' fisheries management plans.
 - The increased costs of meeting higher seafood quality standards may likely be offset by sales benefits in markets that are very demanding of quality standards or utilize eco-labelling.
 - Dependence on regionally and internationally shared resources demands more attention to developing successful fishery management and access agreements than the insular approach that presently obtains.

3.2.7 CONCLUSIONS

The stakeholders' vision for greening the fisheries industry reflects a desire to have an economically viable as well as sustainable industry. While this vision is largely consistent with numerous development plans for the industry as well as the national definition of green economy, it is important that the justification and rationale for conservation efforts be effectively communicate to fisherfolk whose livelihood depends on the industry. There are opportunities for greening fisheries in relation to the greater utilisation of clean technologies, processing fish offal into high value added products

and the use of Dolphinfish skin as fish leather.

Water conservation measures are currently being implemented at the fish markets following a directive from Cabinet to install infrared sensors on taps at the processing bay at the Bridgetown Public Market and other markets across the island.

Greening the post-harvest sector and implementing best practices will, however, have no economic impact on the industry if the resource base and its ecosystem are not properly managed and protected. In this regard, the control of entry into fisheries to achieve sustainable levels of harvest must be considered, and the establishment of a marine management agency and a code of Conduct for responsible fishing should both be given priority. In addition, given that Barbados is essentially using a common resource with the rest of the Caribbean, there is a need to adopt a common fisheries policy throughout the region if attempts at greening fisheries are to be successful. Future research should look at the technical and economic feasibility of using fish skin as leather as well as the feasibility of establishing a regional eco-labelling scheme for sustainably harvested fish in the Caribbean.

3.2.8 SUMMARY

Fishing and fish have historically been an important part of the social and economic fabric of the country. These resources are often used to supply food, as well as provide recreational opportunities, ecosystem services, jobs, income and tax revenues. The fishing industry serves as an important social safety net, providing work for those unable to find other employment, and also supplements the incomes of those employed in other activities. The total value of local fisheries was estimated at about US\$ 25 million in 2006, and includes both the ex-vessel value (the value of landed raw fish) and the on-shore value-added components of GDP. In terms of overall value, Flyingfish and Dolphinfish account for more than 80 per cent of the total value of fisheries.

Fish processing consumes significant quantities of energy, particularly fish harvesting operations, while water resources are consumed in large quantities in the post-harvest process. The island has more than 30 landing sites, with facilities of varying standards. These sites can usually be categorized as either primary (markets), secondary (sheds) and tertiary (beaches) based on the type of physical infrastructure. The majority of the country's catches are landed at seven primary sites: Bridgetown Public



Local fisherman casting net. Photo: Dave Quan/Inkstone Design/Calgary Canada

Market, Oistins Fish Market, Skeete's Bay Fish Market, Conset Bay Fish Market, Payne's Bay Fish Market, Weston Fish Market and Speightstown Fish Market.

It is envisioned that any adopted concept of greening fisheries would be based on the notion of sustainable fisheries – resources that can be harvested to meet the needs of today's generation without compromising the ability of future generations to harvest fish for their needs. Greening fisheries require ecosystem-based management of coastal and marine social ecological systems that enhances livelihoods and well-being within the fishing industry and related marine economic sectors, while allowing individuals and communities to maintain their social and cultural heritage. Given that most Caribbean coastal resources are considered to be under stress from overexploitation, degradation of coastal and marine ecosystems, limited or poor management and climate change, the concept of greening fisheries holds significant potential for the region.

The institutional and governance framework for sustainable fisheries on the island is enshrined in the Barbados Fisheries Act of 1993, which was developed to provide for the management and development of fisheries in Barbados. The main objective of this legislation is to ensure the optimal utilisation of the fisheries resources in the waters of Barbados. Nevertheless, there are still numerous challenges in relation to greening fisheries. These include conservation of marine resources, capacity building, finance, communication and coordination among economic sectors, and collaboration in managing and developing transboundary marine resources. Results from the analysis conducted in this study suggest that greater investment in institutional development, development of standards for the industry and eco-labelling would be required.

There are opportunities too for greening fisheries in relation to the greater utilisation of clean technologies, processing fish offal into high value added products and the use of Dolphinfish skin as fish leather. Water conservation measures are currently being implemented at the fish markets following a directive from Cabinet to install

infrared sensors on taps at the processing bay at the Bridgetown Public Market and other markets across the island. This is particularly important in promoting economic efficiency by lowering operation costs, and as realised through reduced water utility costs. In terms of waste, the Bridgetown Public Market, the island's largest, produces about 2-3 tonnes of fish offal daily. Fish offal has tremendous potential as a fertilizer, in compost, or dried and made into pellets for feed. The Barbados poultry industry already has the technology to convert its waste into a commercial asset, so it is possible for the fishing industry to follow suit as long as they receive the necessary technical assistance and funding required to recycle its waste products into viable products.

Greening the post-harvest sector and implementing best practices will have no economic impact on the industry if the resource base and its ecosystem are not properly managed and protected. In this regard, the control of entry into fisheries to achieve sustainable levels of harvest must be considered, and the establishment of a marine management agency and a Code of Conduct for responsible fishing should both be given priority.

Additionally, consideration must be given to the complexity of the Caribbean region and the fact that most resources, exploited and non-exploited, are shared across different marine jurisdictions and resource-use regimes. Although few marine boundaries have been negotiated, it is clear that there must be considerable discussion and collaboration among people from the various territories on issues that cross jurisdictions due to close geographical proximity (Mahon et al., 2010). Finally, that there must also be a collective recognition that greening fisheries, particularly the ecological and harvest aspects, is a transboundary matter, even if certain aspects are undertaken as a national initiative.



Mr Watson (right) and friends in Conset bay East Coast – Building traditional fish pots (traps) according to regulations.
Photo: Travis Sinckler

KEY MESSAGES

The construction of commercial and residential buildings is having an impact on natural and human resources through the unsustainable use of land and energy, the removal of natural materials, transport of construction materials, liquid and solid waste generation, poor utilization and recycling of building materials and the use of hazardous building materials.

The stakeholders' vision for greening the housing/building industry reflects a desire to benefit socially from improved quality in community living, economically from the cost savings available from more efficient energy usage, building design and construction, and environmentally from a system of reuse and recycling within the industry and the retention of green spaces with a reduction of the building footprints on the land.

Investments are needed in training programmes for built environment professionals on renewable energy technologies, accompanied by an overarching policy framework.

Opportunities exist for community based recycling programmes that encourage reuse of construction and other forms of waste do hold a distinct opportunity to contribute to economic growth through savings from reusing and recycling waste.

The country requires a strategy and policy for on-going education, outreach and information sharing in order to encourage behavioural change in the areas of reuse and recycling in the industry. Given the island's high literacy rate, such a strategy would be highly effective.



Traditional chattel house. Photo: Anne Gonzalez

3.3.1 BACKGROUND

In Barbados, the building or construction industry is a major contributor to the country's economic growth and development. In 2010, it is estimated that total value added by the industry amounted to US\$ 185.5 million or about 5 per cent of GDP. Over the years, there has been an expansion of the built environment through the construction of transportation infrastructure, and private and public buildings. Among the use types of these buildings were accommodation facilities associated with the tourism industry, luxury housing, sporting facilities,

residential housing, commercial facilities, healthcare facilities, education/cultural facilities, and industrial parks, which facilitate the expansion of the manufacturing industry. Trends in the construction industry particularly with respect to employment, and the production and consumption of building materials are captured in Table 27. This table also indicates the level of expenditure on new property developments by owners during the recorded period.

All of the principal urban settlement (including that of the capital, Bridgetown) is located within a continuous linear coastal urban corridor that extends along the entire length of the west and south coasts. This corridor extends inland as much as 4km in some areas to incorporate major suburban centres such as the Warrens and Six Roads Centres, located towards the central and eastern inland portions of the island, respectively. It is estimated that more than 25 per cent of the island's population lives within 2 km of the coast.

Traditionally, many Barbadians lived in villages and 'tenantries'. Tenantries are often comprised of wooden houses placed on temporary foundations, known locally as chattel houses, and were located on rented land on the borders of the large estates. In recent times, those persons who live in tenantries have gained much assistance by the passing of relevant legislation to encourage land ownership.

The construction of the traditional, wooden houses and chattel houses has been on the decline, moving from a 72.5 per cent share of all houses built in 1970 to a 39.98 per cent share in 1990 (Table 28). In 2000, that figure fell to 27 per cent of total dwelling units as indicated in Table 28, which shows the composition of the external walls of dwelling

TABLE 27. SELECTED INDICATORS OF THE CONSTRUCTION INDUSTRY, 2002-2008

Year	Building materials Imported (US\$ millions)	Cement sales Local ('000 Tonnes)	Cement production ('000 Tonnes)	Production for quarrying ('000 Tonnes)	New mortgages (US\$ millions)	Employment in construction and quarrying ('000)
2002	161.9	147.8	297.7	1 212.0	122.7	13.2
2003	171.1	150.6	325.1	975.0	114.0	12.3
2004	205.9	154.0	322.7	1 013.0	186.8	13.4
2005	256.4	199.3	340.7	948.0	196.4	13.2
2006	245.0	201.2	337.8	1 081.4	212.4	14.5
2007	260.9	191.1	316.5	1 181.8	201.9	15.4
2008	265.0	174.6	301.4	1 157.5	223.1	13.6

Source: Research and Planning Unit, Ministry of Economic Affairs, Empowerment, Innovation, Trade, Industry and Commerce. Barbados Socioeconomic Data 2009, Vol. II

TABLE 28. COMPOSITION OF DWELLING UNITS (2000)

Composition of external walls of dwelling unit	Number	% of total
Wood only	25 080	27
Concrete only	1 637	2
Concrete blocks only	40 964	45
Concrete and wood	2 035	2
Concrete blocks and wood	19 749	22
Other	1 941	2
Total	91 406	100

Source: Barbados Statistical Service (BSS, 2000)

units on the island as Barbadians continued the trend of converting their homes from wood to concrete. In addition, nearly all homes have both electricity (93 per cent) and running water (91 per cent).

Apart from a few enclaves, coastal property tends to be high income, high value real estate. The majority of homes in Barbados as a whole are owner-occupied, but there are fewer owner-occupied coastal properties. The existence of housing and commercial developments in flood plains and coastal watercourses must also be noted. Around the capital of Bridgetown, for example, there exists significant high density, low income housing on low gradient coastal land, which forms part of the Constitution River catchment.

The island has a fairly comprehensive sustainable land use policy, as outlined in the Physical Development Plan (GOB, 2003). This document outlines land use practices, community facilities and physical infrastructure that would support the island's developmental goals. The PDP has a particular emphasis on preserving the environmental and cultural heritage of the island (please see Box 3 for a more detailed discussion).

The Government of Barbados has in place a number of policies, programmes and plans for improvement of the housing/building industry. The Integrated Coastal Zone Management Plan for Barbados (1998)¹⁸ is the major policy framework for coastal zone management and was approved by the Government of Barbados in 1999. This plan document comprises the:

- Integrated Management Plan for the Caribbean Coasts of Barbados;
- Integrated Management Plan for the Atlantic Coasts of Barbados; and
- Integrated Coastal Management – the Barbados Policy Framework.

The plan offers policy guidelines for the location of building and infrastructural developments within the coastal zone. The fact that this policy framework exists is an asset. However, this document is yet to be adopted by the Barbados Government.

The island also has Draft Environmental Management Plan (1998),¹⁹ which is intended to promote a vision for environmental management that sustains and enhances the natural resources and environmental attributes of the island, minimizes threats to the environment and natural resources, and sustains and enhances the quality of the environment by minimizing threats from pollution and natural events. The Plan addresses the environmental problems and issues facing Barbados, including those areas directly affected by the settlement development such as drainage control and flood prevention, groundwater protection and others. It provides direction for appropriate intervention on these issues including an appropriate institutional and legal framework, the benefits to be achieved by good management of the issues and the consequences of mismanagement. The Draft Environmental Management Act is intended to be the legal framework for the preparation, approval and implementation of the Plan. However, its approval is an outstanding matter for the Government of Barbados, particularly as it relates to the greening of the housing/building industry.

With respect to the housing/building industry, the island's Physical Development Plan (PDP) 2003 has articulated the following key planning principles for its overall settlement development strategy:²⁰

- emphasis on the protection of the natural environment and cultural heritage resources;
- establishment of criteria and procedures for Environmental Impact assessments;
- a national development strategy which aims to minimise the negative environmental and social impacts of scattered urban development, by concentrating new growth into a defined urban corridor;
- protection of agricultural lands from incompatible urban development;
- promotion of a strong, diversified economy through land use policies, which encourage a wide range of employment opportunities in mixed centres and corridors and in key employment areas in a variety of locations throughout the island;
- maintenance of Central Bridgetown as the nation's primary location for financial institutions, offices, shopping and other commercial activities; and

box 2 BEST PRACTICE SUSTAINABLE ENERGY FRAMEWORK – 30 YEARS OF SOLAR WATER HEATER INDUSTRIAL DEVELOPMENT THROUGH POLICY REFORMS

Aims The Barbados Solar Water Heater programme was initiated to address the following issues:

- Improving Barbados' energy security by reducing its reliance on petroleum products for energy generation in light of its continued positive economic development;
- Improving quality of life by reducing household and commercial expenditure on energy; and
- Meeting Barbados' obligations under UNFCCC and improving air quality by reducing emissions of greenhouse gases and other atmospheric pollutants, particularly those associated with energy generation.

History Solar water heaters were first introduced in the 1970s, and by 1981, there were three companies producing heaters. The heaters have grown in popularity over the years and continue to retail on the local market. Currently there are three companies manufacturing solar water heaters in Barbados- Solar Dynamics Ltd, Sun Power Ltd and Aqua Sol Ltd.

Government support and incentives The solar water heating industry has progressed in no small part due to support by the Government of Barbados. An Income Tax Amendment introduced in 1980 and reintroduced in 1996, after a three-year hiatus, allowed householders to deduct the cost of installing a solar water heater and other home improvements expenses. In 2008, this was modified as follows:

"The Income Tax Act provision for the cost of energy audits is currently up to BBD 2,000.00 to be deducted as part of the general Income Tax Allowance for Home Improvement of BBD 10,000 in any one year. A separate allowance called the Energy Conservation and Renewable Energy Deduction of a maximum of BBD 5,000.00 per year over each of five (5) years to cover the costs of an energy audit and fifty per cent of the cost of retrofitting a residence or installing a system to produce electricity from a source other than fossil fuels was proposed. This applies also to businesses whether incorporated or unincorporated."

Other incentives to the solar water industry have included:

- Fiscal measures such as tax credits, rebates and subsidies for the manufacturing process, including duty-free importation of raw materials
- Regulatory measures
- Financial incentives to the manufacturer such as the provision of low-interest loans.

The Government of Barbados has also over the years purchased large orders of heaters for housing development projects.

There are now approximately 40,000 solar water heaters in Barbados, with more than 30,000 domestic installations. The most recent estimate indicates that the total number of dwelling units in Barbados is estimated was 91,406 that show a significant penetration by the industry into the domestic market. It has been estimated that the cumulative cost of solar water heater incentives, up to 2002, was US\$ 10.75 million with energy savings estimated to be in the range of US\$ 133.5 to US\$ 137 million. Savings on primary oil consumption were estimated to be US\$ 0.3 to US\$ 4.2 million - equivalent to 30 to 40 per cent of the present domestic consumption. The benefits of the solar water heating thrust in Barbados have far exceeded the costs incurred over the past 25-30 years.

The success of the solar water heater experience in Barbados can be attributed to strong government support in the form of financial and fiscal incentives, external events in the international energy market, and innovative dedicated entrepreneurs.

The experience has certainly shown that renewable energy technologies can be economically viable. It is a model indicative of the range of options available to governments should they wish to support the development of these technologies and underscores the need for an analysis of benefits and costs which takes into account impacts on environmental services.



Managing the growth of a new urban centre – Warrens. Photo: Travis Sinckler

- promotion of the tourism industry by encouraging redevelopment and modernisation of older beach front properties, and providing opportunities for other visitor experiences in the National park.

The broad national land use policies that are outlined in the PDP 2003 do not specifically address the green building issues of water efficiency, energy efficiency and sustainably grown and produced building materials, but the underlying principles are supportive of sustainable outcomes for all land users.

Barbados has adopted a National Sustainable Development Policy that seeks to ensure all construction activities are carried out in a sustainable manner.²¹ To further realise this aim the government has formulated a Building Act (pending legislation) that governs the building and construction industry. The Act aims to establish a set of building standards to ensure a safe, comfortable and healthy environment for all occupants. To further achieve a sustainable built environment the government has outlined a set of policy recommendations. These include: encouraging manufacturers to produce sustainable materials that are manufactured in a sustainable manner; encouraging the integration of traditional building design features (i.e. chattel house) in the built environment; investigating the use of energy efficient building materials and design that will lead to reduction in the demand for energy and

the provision of sidewalks, access for the disabled and cycling paths in new road developments.

The National Strategic Plan 2006-2025 of Barbados sets out comprehensive policy guidelines to further ensure the provision of quality housing solutions, for low and middle income groups. To this end, the government intends to continue the National Housing Corporation's (NHC) Primary Homes Programme; the land-bank programme, Joint Venture Programme, Community Aided Self Help (CASH) scheme (which seeks to promote efficient use of scarce land resources by increasing housing density) and promote infill housing developments through the NHC's Derelict Housing Programme which encourages the re-use of vacant lots and residences.²² This latter approach towards the efficient use of residential land is supported by parallel policies in the Physical Development Plan 2003.²³

In addition, the National Strategic Plan 2006-2025 is designed to rectify the dependency on fossil fuel by increasing the country's renewable energy supply, with a particular focus on raising the number of household solar water heaters by 50 per cent by 2025. Solar water heaters are now a widely used renewable energy technology in Barbados, with installations in nearly half of the island's dwelling units.

box 3 BEST PRACTICE SUSTAINABLE LAND MANAGEMENT IN A SMALL ISLAND GREEN ECONOMY

Due to its limited size (432 km²), Barbados has developed a comprehensive land use policy since 1970 called the Physical Development Plan (PDP). The PDP has a ten-year plan period, which was amended in 2003.

The legal basis for the preparation of the PDP is the Town and Country Planning Act, or Cap 240, which requires the preparation of development plans for the whole island or parts of the island. The Town and Country Development Planning Office, headed by the Chief Town Planner, has the responsibility for the implementation of, and adherence to, the PDP.

The PDP (amended 2003), contains two main economic development goals:

- To promote further diversification and expansion of the national economy, while at the same time promoting the efficient use of land and the protection and conservation of significant natural and heritage features; and
- To assist in the achievement of national economic development goals by ensuring that sufficient land is available to meet the needs of the various economic sectors.

Furthermore, the PDP (amended 2003), contains three main environmental goals:

- To conserve and manage natural resources for valued ecological functions and to provide an improved quality of life for the residents and future generations of Barbados;
- To advance public awareness and appreciation of the essential linkages between the environment, quality of life and sustainable development; and

- To limit the unnecessary and inefficient use of fossil fuels, by promoting environmentally friendly sustainable modes of transportation.

The PDP as a planning instrument is not governed by rigid zoning policies. Instead, it is a flexible guideline with a few exceptions when necessary in the interest of public health and safety to enforce strict guidelines. In a perfect world, economic efficiency would expect that a scarce resource would be diverted to uses which result in maximum net benefits to the society. However, the Barbadian land-use model may best be described as a hybrid model in which a market-driven approach is supported and complemented by a plan-led one.

The land space of Barbados has been divided into three main physical planning units:

1. The Urban Corridor where there is a presumption in favour of urban settlement and development;
2. The Agricultural Green Belt where there is a presumption in favour of agricultural development interspersed with rural villages and hamlets;
3. The National Park area where the presumption is in favour of resource conservation, amenity and open space development.

The PDP amended 2003, contains specific strategies consistent with the overall objectives of the three broad planning units, viz:

1. New settlement growth is confined to the Urban Corridor. This will ensure the preservation of a predominantly urban landscape;
2. The Agricultural Green Belt is protected from incompatible

urban development. In addition, a minimum amount of agricultural lands have been designated for protection from conversion to non-agricultural use. This will ensure the preservation of a predominantly rural landscape;

3. The designation and implementation of a National Park and Open Space system, including gullies. This will ensure the preservation of a predominantly open space and recreation area.

In addition to the TCDPO, and in recognition of the possible threat that unsustainable land use practices can pose to Barbados' social and economic development, government continues to address the problem via some key governmental institutions:

- The Soil Conservation Unit which addresses issues relating to land degradation within the vulnerable Scotland District;
- The Drainage Unit which focuses on flood related matters;
- The Coastal Zone Management Unit, which deals with all coastal related matters including the evident increase in beach erosion, which is now a major threat to coastal plant communities around the island's coastline.
- The Natural Heritage Department (NHD) which was established in 2005, with part of its mandate to ensure that land-use practices occurring within the proposed National Park are consistent with sustainable land management; and
- The National Botanical Gardens Unit, which was established primarily, to promote and showcase best land-use practices on environmentally sensitive landscapes.

TABLE 29. SUMMARY OF REGULATORY AGENCIES WITH RESPONSIBILITIES FOR HOUSING/BUILDING INDUSTRY

Department /Ministry	Main responsibilities	Legislation
Ministry of Transport and Works	<ul style="list-style-type: none"> Registration of building practitioners; Development of necessary policies and legislation are developed; Development of effective programmes for the construction and maintenance of public infrastructure; and Establish, improve and maintain building standards 	Public Works Act CAP 32
Building Authority, Ministry of Public Works (not legally empowered)	<ul style="list-style-type: none"> Mandatory use of the Building Code; Establishment of the Building Authority; Develop building regulations for the operation of the Authority and for the system of building control; Staffing of the Authority; Registration of building practitioners; Recruitment of Review Consultants to review designs and undertake periodic inspection of the construction process for specified classes of buildings; Charging of application fees; and Enforce discipline and penalties for infractions of the Act. 	Barbados Building Act (Pending)
Drainage Division, Ministry of Environment, Water Resources	Establish, implement and sustain an effective and efficient drainage management and flood prevention programme with the objective of mitigating and alleviating the flood challenges countrywide	<ul style="list-style-type: none"> Prevention of Floods Act – 1951 (CAP 235) Prevention of Floods (Amendment) Bill – 1992 Prevention of Floods (Amendment) Act 1996-12 Highway Act (CAP 289)
Government Electrical Engineering Department	Regulate electrical supply to all installations in Barbados	
Barbados Fire Service	Fire prevention island-wide	Fire Service Act Cap 163
Environmental Protection Department, Ministry of Environment and Drainage	Monitoring and control of conditions likely to affect the quality of land, air and water and the general health and environmental well-being of the inhabitants of Barbados.	<ul style="list-style-type: none"> Health Services Act 1969 Health Services Regulations Building Regulations 233/1969
Town and Country Development Planning Office, Prime Minister's Office	Building development and engineering works on all lands (including change of use and subdivision of land) within the island and within the territorial waters of Barbados, including all coastal and marine development within the 200 nautical mile territorial limits.	<ul style="list-style-type: none"> Town and Country Planning Act Cap 240 Town and Country Planning Development Order 1972 Preservation of Trees Act 1981
Urban Development Commission, Ministry of Social Care, Constituency Empowerment, Urban and Rural Development	<ul style="list-style-type: none"> Provision of social and infrastructural amenities to the urban poor; Promotion of healthy community life 	Urban Development Commission Act 1997
Ministry of Housing and Lands	<ul style="list-style-type: none"> Acquisition of land for public purposes Maintenance of a land bank Provision of affordable housing solutions 	<ul style="list-style-type: none"> Land Acquisition Act CAP 228 Crown Lands (Vesting and Disposal) Act Cap 225
National Housing Corporation	<ul style="list-style-type: none"> Provide affordable housing solutions, including the administration of: <ul style="list-style-type: none"> Rentals (units; lots; office spaces/properties) Sale of land and property (of Land; auctions (when a buyer is in default) Sale of Terrace Units (tenants occupying the unit for more than 3 years are eligible to purchase; tenants occupying the units for more than 20 years have to cover legal costs only) Loans (chattel mortgage; legal mortgage; promissory note) Transfer of title under the Tenancies Freehold Purchase Act Maintenance of units 	National Housing Corporation Act 1973
Barbados Water Authority	Exclusively responsible for the provision of potable water across the island	<ul style="list-style-type: none"> Underground Water Control Act Cap 283 Barbados Water Authority Act Cap 274
Sanitation Services Authority	<ul style="list-style-type: none"> Removal of solid waste from homes island wide and government agencies A commercial arm which offers a paid service to the private sector for the moving of waste 	Sanitation Services Authority Act Cap 382

Source: Compiled by authors.

The government realises the importance of energy efficiency. Therefore, through its National Energy Policy (2006), a number of measures are advanced to help achieve this outcome. First, the government lends its support to the use of energy efficient materials (thermal barriers, roof insulation, window tint and ceramic roof coatings) in private dwellings. To further encourage energy efficiency in the home, the government offers tax incentives for all home energy audits. It is also the government's aim to promote energy conservation in the public sector through the Public Sector Energy Conservation Programme, which encourages energy efficient design of public buildings, the use of energy efficient electrical appliances, lighting and cooling systems.²⁴

Since the 1970s, Barbados has experienced significant changes from a plantation economy to an upper middle-income country where residents enjoy a high standard of living. As a result of the changing population needs, there has been an increase in the demand for housing. Therefore, the government in its Medium-Term Strategy 2010-2014 restates its commitment to ensure that all Barbadians, especially low to middle income earners, have access to adequate and quality shelter. To this end, the government intends to improve housing and working conditions on a sustainable basis and to create opportunities for home ownership for all Barbadian residents, through the provision of a wide range of housing types, prices and tenures.²⁵

In an effort to achieve these goals, the government has launched the following programmes and strategies:

- 500 Lot Programme
- H.E.L.P (Housing Every Last Person)
- Rent to Own Programme
- Zero Lot Line concept
- Sale and Transfer of Terrace Units
- Low and Middle Income Housing
- Housing solutions
- Assisting the needy
- Starter homes

In summary, there are a number of national policy initiatives in support of comprehensive waste management and energy efficiency that support green building. However, there is no specific integrated national green building policy, programme or strategy for the housing/building industry. The regulation of building and design standards is currently shared by a number of agencies.

However, there is the potential for the integration of green building initiatives through the work of the Barbados Building Standards Authority (BBSA). The purpose of the BBSA is to safeguard people in and around buildings, and to promote energy conservation and efficiency and the suitable provision of facilities for disabled people. The BBSA will administer the standards system, enforcing regulations as approved by parliament.

The enforcement of the standards of the Barbados National Building Code 1993 is one of the primary functions of the BBSA. However, the empowering legislation, the Barbados Building Act, is yet to be approved by government. The proposed Barbados Building Act will provide the legislative framework for the establishment and operation of the Barbados Building Standards Authority and the mandatory use of the Barbados National Building Code 1993.

The regulatory agencies with shared responsibility for policy implementation within the housing/building industry is summarised in Table 29.

The institutional framework required for the greening of the housing/building industry is an area that needs to be addressed further in consultation with key stakeholders. The key industry players (both private and public) would have to establish a vision of greening as a single common goal for the housing/building industry. This would serve as a platform so that appropriate strategies may be developed, an implementation framework identified and practical solutions implemented and monitored towards a sustainable housing/building industry for Barbados.

Greening the building industry implies buildings that are resource efficient, produce minimal waste, built with non-toxic substances, have healthy indoor environments and are located to allow for use of public transport.²⁶ One significant international trend in the greening of the construction industry is the development and implementation of greener building codes and standards to regulate the industry.

Greener buildings are commonly assessed according to the following criteria:²⁷

- Energy efficiency: incorporating a combination of technologies and design to minimise use of energy;
- Water efficiency: using more efficient water fixtures indoors along with landscaping and an efficient irrigation system outdoors;

- Sustainable site development: selecting locations for buildings that minimise impacts on ecosystems and undeveloped land, and maximising the use of native landscape as well as local and regional transit connections;
- Materials selected: using sustainably grown and produced building materials, and reusing and recycling existing materials through deconstruction, where appropriate; and
- Indoor environmental quality: using non-toxic building materials; non toxic heating, ventilating and air conditioning (HVAC) systems; and natural daylight to produce clean, healthy air.

3.3.2 RESOURCE USE AND EFFICIENCY MEASURES

The two main concerns related to water in the housing/building industry are the prevention of pollution of freshwater supplies and the increasing demand resulting from expanding urban development (UN, 2004). Efforts to prevent pollution of freshwater supplies largely centre on a Ground Water Protection Zoning Policy, implemented since 1964. The island is divided into five water protection areas. Zone 1 is closest to the production wells or areas earmarked for such and so has the most stringent restrictions on development activities. Zone 5, on the other hand, has the least restrictions.

The boundaries for the zones were determined based on the travel times of pollutants. Enforcement is through the Town and Country Development Planning Office, which impose various development conditions. The Environmental Protection Department (EPD) and the Barbados Water Authority (BWA) also play a role in enforcement, but carry a further responsibility of running a nationwide water quality-monitoring programme.

As the number of households rise on the island, there is the likelihood that there will be a commensurate increase in the pressure placed on protected land areas, which are currently registered as Zone 1 and Zone 2 under the current zoning policy. Presently, the safety of the water supply in these areas is ensured by limiting encroachment in Zone 1 areas and through the chlorination of the water supply. Any plan to expand urban settlements should trigger careful analysis of the groundwater flows and of the ability of biological agents to survive in these environments. Furthermore, all construction projects in these areas must be conducted with full enforcement of regulations to mitigate against

seepage as well as continuous monitoring for seepage and any illegal housing structures.

Two sewerage projects are currently in progress, one to cover the South Coast and the other the West Coast. The treatment plant for the South Coast has been completed and work has been ongoing for house connections. Work on the West Coast Sewerage Project got underway in 2002. Since then, work has been suspended while studies were undertaken and approval granted for the redesign of the system to facilitate wastewater treatment and water reuse. The government is still in the process of examining financing options and no date has been publicly announced for the resumption of work.

Water demand issues are being tackled, primarily, by initiatives to change consumption patterns. Efforts to date have included a public education campaign launched by the BWA in 2004. This programme involved the distribution of free low water use showerheads and kitchen faucet aerators to customers not in arrears; approximately 30,000 were distributed. The BWA, EPD and the Ministry of Tourism also devised a collaborative programme to implement a water conservation and management project in the tourism and hotel sector.

As would be expected, the buildings that house Barbadian families, businesses, sporting and recreational facilities as well as civil and private organizations are among the largest users of resources on the island. In 2009, the largest category of electricity sales was domestic users, accounting for 32.2 per cent of total sales or 306.6 million Kwh. The Barbados Light and Power Company Limited (BL&P), the only provider of electricity on the island, has continued to upgrade its capital infrastructure to accommodate this demand. Barbados' overreliance on imported fossil fuels is one of the island's major environmental concerns and so the island continues to explore renewable energy options.

With respect to the housing/building industry, there has been a specific focus on increasing the use household solar water heaters. Solar water heaters were first introduced to the island in the 1970s and since then the heaters have grown in popularity (see Annex 2 for further discussion). In 2002 it is estimated that Barbados saved 15,000 metric tons of carbon emission and over US\$ 100 million in energy savings from the 35,000 solar hot water systems that had been installed at the time (Husbands, 2009).

box 4 BEST PRACTICE THE SOLAR HOUSE. DEMONSTRATING FUTURE SUSTAINABILITY IN SOCIAL HOUSING INITIATIVES – LESSONS FOR THE TROPICS

In June 2007, the Government of Barbados, in its thrust to advance the use of solar technologies, established a Solar House in the island's historic Queen's Park, as a public demonstration of the practical use of alternative forms of energy.

This project has become an integral part of the Government's education and outreach efforts for promoting renewable energy and energy conservation. It represents a basic template of how homeowners may potentially reduce their carbon footprints, while benefiting from direct savings in energy costs at the household level.

The components featured in the Solar House include:

- appliance energy meters for monitoring energy consumption per appliance;
- solar water heaters;
- wall and ceiling insulation which contributes to internal cooling;
- solar cells which convert sunlight into electricity and which are contained in photovoltaic modules;

- radiant barriers which reduce the radiant heat entering the building; and
- double-glazed windows which trap heated air between two layers of glass, thus reducing the heat entering the building, and eliminating the need for artificial air conditioning.

Some of the solar powered elements on display are solar toys and gadgets; a slow solar cooker; a unit which displays the energy levels generated; twelve (12) deep cycle batteries which store the sun's power; a power conversion centre which changes the electric current from DC (direct current) to AC (alternating current); and regular household appliances which operate on the AC.

Since its inception, the Solar House has attracted more than 3,000 visitors both locals and tourists, and represents an excellent educational tool for schools and tertiary institutions on the island.



Demonstration Solar House in Queen's Park, Bridgetown. Photo: Travis Sinckler

As of 2008, approximately 40,000 solar water heaters were in operation in Barbados – 75 per cent of which represent domestic installations.²⁸ The Barbados government has implemented several schemes to further stimulate the installation of solar water heaters. For example, from the US\$ 10,000 allotted per year under the 2008 modified Income Tax Allowance for Home Improvement, up to US\$ 1,000 can be used for energy audits. In addition, under the Energy Conservation and Renewable Energy Deduction, a reduction of 50 per cent on the cost of retrofitting a residence or installing a system to produce electricity from a source other than fossil fuels has also been proposed. This incentive is also available to lessees, once it is proven that the owner of the property granted approval.

Job stimulation efforts include the activities of the Barbados Training Board where vocational training opportunities are available for local skills enhancement in areas such as solar water heater technicians.²⁸ In 2007, as a demonstration project, the Government of Barbados established a Solar House, with a view to featuring the future of sustainability.

The main building materials used in construction are wood, concrete and steel. Further study of the energy used in the production and importation of these materials is required in order to determine if the use of these materials is sustainable from the perspective of national energy costs. Several studies on the volume and characterisation of waste generated in Barbados have been carried out over the last 25 years. Based on a study carried out between April to November 2005,³⁰ there has been, over time, a decrease in the share of organics (64 per cent), but this has been offset by an increase in plastics (14 per cent) in the overall composition of the waste generated.

Interestingly, construction and demolition material waste has not shown any decrease due to the economic downturn and along with waste from hotels has seen growth in the volumes generated. These figures reflect waste received at the Mangrove Pond Disposal Site and do not take into account the waste disposed at the other sites. The Vauclose Waste Transfer Station (materials recovery, composting facility and chemical waste management) came into operation in 2009 and, as a result, the amount of solid waste going in to the landfill has been reduced.³¹ This includes construction and demolition waste, wood pallets, plastics, glass and metals. The Physical Development Plan (GOB, 2003)

estimated that for the period 2004 – 2010 some 270 acres of additional residential land would be required to meet the needs of new households. The actual land converted from agriculture to meet the needs of residential land users during this period need to be reviewed in the context of greening the sector. Greening of the housing/building industry in Barbados requires that careful consideration be given to the formulation of more effective strategies that will advance the regulation of the competition between land for building and land for agriculture and recreation.

The introduction and practice of greener land management procedures must address the current reality that a) the housing/building industry is regulated largely by the professional organizations for engineers, architects and architectural technologists, seeing that these are the professions that guide housing and building design choices; and b) the current planning system lacks transparency as it relates to the approval of lands for development by the government minister responsible for planning, inasmuch as the minister does not have to make public his or her reasons for the approval of development decisions that are at variance with the recommendations of the Chief Town Planner.³²

In summary, the introduction of greener standards in the management of energy, solid waste, water and land will need to be integrated under an overarching policy framework for the greening of the housing/building industry.

3.3.3 INVESTMENT GAPS

Stakeholders were generally of the opinion that greening the housing and building industry could result in benefits for the society and economy as a whole. First, the enabling conditions for the achievement of a sustainable housing industry include the current commitments of the government for energy conservation as outlined in their 2008 Manifesto:³³

- Provide significant incentives to encourage ownership of fuel-efficient vehicles, particularly motor cars;
- Provide incentives for greater use of solar energy in providing the electricity needs of consumers and businesses. The goal is to implement a package of incentives to cover up to 50 per cent of the cost of installing solar electric systems. Barbados is already a leader on solar hot water

The stakeholders' vision for greening the housing/building industry reflects, in summary, a desire to benefit socially from improved quality in community living, economically from the cost savings available from more efficient energy usage, building design and construction, and environmentally from a system of reuse and recycling within the industry and the retention of green spaces with a reduction of the building footprints on the land.

systems and we are well placed to become a leader in solar electricity as well;

- Create a Smart Energy Fund of US\$ 10 million to provide low interest loans to households seeking to purchase solar panels to power their homes;
- Introduce a tax rebate for the cost of installing a solar electric system; and
- Ensure all new government or government related facilities will be fully fitted with solar electric systems.
- Phase out the use of incandescent light bulbs from all government buildings by 2010 and private households by 2012.
- Phasing out the use of incandescent light bulbs from all Government buildings.

Second, the energy conservation initiatives of the Ministry of Transport and Works (MTW) can serve as a model for other Government Ministries.

Third, at the operational level, the Government in 2007 explicitly expressed support for environmental certification programmes such as International Standard Operations (ISO) 14001, Green Globe and Leadership in Environmental and Energy Design (LEED) or equivalent. To this end, it was proposed that the costs incurred by a company to achieve internationally recognised environmental certification should be a tax write off at a rate of 150 per cent of the costs incurred.³⁴

Barbados already has some fine examples of successful green initiatives, involving waste, water and energy conservation that can be built upon:

- The Rum Refinery at Mount Gay - ISO 14001 Certified
- Almond Resorts, Bougainvillea Hotel, Dover

Beach, Southern Palms, Divi South Winds – Green Globe and/or Green Hotel Certified

- Atlantis Submarine – the first attraction in the world to achieve double certification from Green Globe Inc. and Green Certifications Inc.
- Green team training seminars across the membership of the Barbados Hotel Tourism Association
- Native Sun NRG (biodiesel enterprise)
- Harrison's Cave using solar energy to power trams

Fourth, in 2007, the Government of Barbados introduced three (3) greening initiatives for the residents of Barbados.

1. Green Homes

The then Ministry of Energy and Environment committed to establishing a "Green Homes" checklist that is considered appropriate to small tropical islands like Barbados. The checklist would include a range of greening, recycling and energy conservation features such as:

- Low flow toilets
- Onsite water storage
- Solar water heating
- Fluorescent lighting
- Passive ventilation and cooling
- Alternative energy use

Householders are allowed to deduct BBD 5,000.00 for Income Tax for expenses incurred in greening their homes.

2. Composting

Householders are encouraged to compost their organic garden and yard waste and use it to fertilise their plants. To this end, the Government in 2007 proposed to review, and after consultation, to reduce the import duties on household compost units.

3. Recycling

Building on the success of the recycling programme for plastic bottles, the Government proposed in 2007 to expand the range of products on which a deposit fee will be placed to enhance their ability to be recycled.

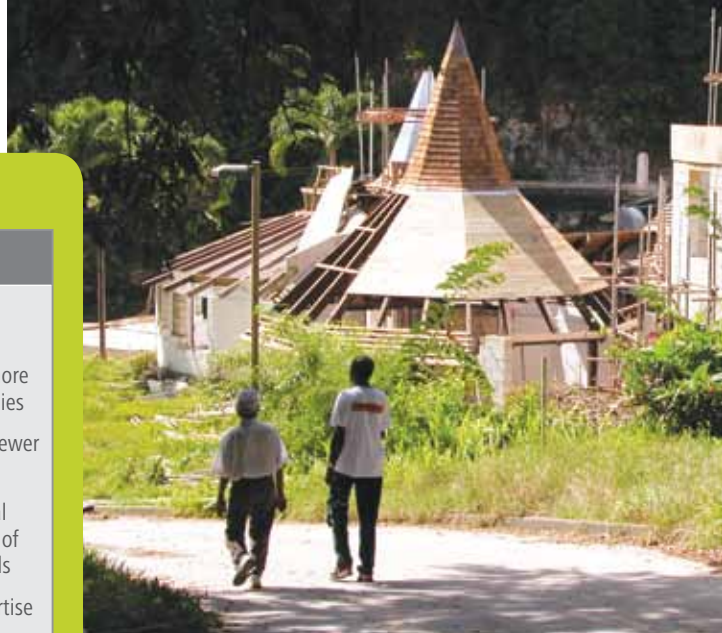
In addition to the foregoing initiatives, a number of opportunities have been created for green businesses since 2006 when the then Minister of Finance granted a number of concessions geared towards promoting a more sustainable society. The products and systems include:

- Energy efficient systems such as thermal barriers, windows, tint, wall and roof insulations

TABLE 30. STRENGTHS AND CHALLENGES IN GREENING THE BUILDING/HOUSING SECTOR

Strengths	Challenges
<ul style="list-style-type: none"> • A strong commitment to energy conservation • Existing models of energy conservation within the public sector • Existing tax incentive structure supports sustainable building practices • The regulatory authority to incorporate green concepts into the building industry already exists • There is a willingness among public regulatory agencies to support the goal of greening the building industry 	<ul style="list-style-type: none"> • Lack of financial and economic resources • Lack of awareness of newer and more environmentally friendly technologies • Higher local operational costs of newer technologies • The non-inclusion of environmental costs when considering the extent of reliance upon and use of fossil fuels • Lack of training and regional expertise in newer technologies • Perceptions by industry managers that low cost housing is in direct conflict with sustainable housing, a view often held without a detailed cost analysis • Cultural preferences for the detached housing unit that hinders the design and sale of alternative dwelling arrangements that would contribute to land conservation

Source: Stakeholder discussions and authors' analysis



Harrison's Cave – Barbados' No. 1 natural attraction during its redevelopment. Environmental design considerations were a significant feature. Photo: Travis Sinckler

- Solar electrical systems like PV cells, inverters, charge controllers
- Solar radios
- Biofuel such as ethanol production, biodiesel
- Solar thermal devices e.g., cooker, dryer air conditioning
- Fuel cells
- Geothermal heat pumps; and
- Hybrid vehicles

Fifth, under the current institutional framework, the Town Planning Act Cap 240 section 16, allows the Chief Town Planner (CTP) to incorporate greener building issues by "having regard to any other material considerations."³⁵ While section 17 of the same legislation allows the CTP the discretionary power to "require such further information as he thinks fit"³⁶ in the determination of planning applications. Currently, this the incorporation of sustainable building elements is not done on a regular basis since the staff of the Town and Country Development Planning Office is not have the trained staff to assess and monitor these areas. Nonetheless, this is an institutional feature, which may be built upon as needed to promote the integrated regulation of greener building practices.

Finally, there is a willingness among public regulatory agencies to collaborate in the development of a

project that seeks to integrate all the elements of greener building. Moreover, there is international funding available to finance greener building projects, for example, through the Global Environmental Fund Small Grants Programme (Table 30).

An initial assessment of the challenges to greening the housing/building industry suggests that they are very similar to those uncovered at the Barbados First National Communication on Climate Change, when the barriers to the implementation of renewable technologies in Barbados were identified. The anticipated barriers include:³⁷

- Lack of financial and economic resources;
- Lack of awareness of newer and more environmentally friendly technologies;
- Higher local operational costs of newer technologies;
- The non-inclusion of environmental costs when considering the extent of reliance upon and use of fossil fuels;
- Lack of training and regional expertise in newer technologies;
- Perceptions by industry managers that low cost housing is in direct conflict with sustainable housing, a view often held without a detailed cost analysis; and
- Cultural preferences for the detached housing unit that hinders the design and sale of

TABLE 31. ASSESSMENT OF CHALLENGES TO GREENING THE BUILDING/HOUSING SECTOR

Challenges	Frequency of occurrence (1)	Impact (2)	Ranking of importance (3) = (1) x (2)
Relatively high cost of newer technologies	5	8	40
Lack of overarching policy framework	7	8	56
Lack of training programmes and regional experts	8	9	72
Demand for low-cost green housing solutions	9	9	81
Cultural preference for detached housing units	6	6	36
Financial and economic constraints	9	7	63
Cultural perceptions	9	9	81
Limited home-grown technologies	6	6	36

Source: Stakeholder discussions and authors' analysis

alternative dwelling arrangements that would contribute to land conservation.

These challenges were explored further in consultation with industry stakeholders and participants identified the following additional challenges:

- The Barbados Building Code has not been operationalized. This delay in the mandatory use of the building code possibly exposes the built environment to poor building and design standards from industry players.
- The current building code also needs to be expanded to include greener building standards for all buildings. These standards should address the cross-cutting issues of energy, water, waste and land with the objective of expanding or introducing sustainable industry practices; and
- Inefficiencies in the operations of Government and the private sector. This situation hinders the conversion of natural resources into viable commodities and products, and exacerbates financial losses in areas of energy generation and consumption, in particular.

With reference to efficient waste disposal, it was felt that there are existing solutions that can be implemented immediately. These solutions are under-utilised because they are not considered to be highly lucrative ventures. Table 31 presents a summary of selected challenges in the greening of the housing/building industry. A score is attached to each challenge based on a 10-point Likert scale in relation to frequency and impact as outlined in Addendum 1. The combination of these two factors provides a ranking of importance shown in column 4. A challenge receives a score of 1 if the frequency of occurrence is low and 10 if the frequency of

occurrence is certain. The scores are derived based on expert opinion and stakeholder discussions.

Turning to the issue of energy use, as with most other small islands, Barbados is highly dependent on the import of fossil fuels to meet its energy requirements. The combined effect of high costs of imported fossil fuels, a high domestic demand for fuels and diseconomies of scale in electricity production makes energy not only extremely expensive but also elevates financial risks over the long-run.

The high energy prices and energy security requirements have made it difficult, if not impossible, for the energy industry to raise investment capital for large-scale alternative energy projects. In order for Barbados to meet 29 per cent of its energy needs from renewable energy (RE) sources by 2029, Castalia and Stantec³⁸ estimate the capital costs in RE and energy efficiency (EE) technologies to be around US\$ 465 million (present value, DCR=6 per cent). Although this is a significant amount, the report also predicts that the investment would mean a potential saving of US\$ 280 million (present value, DCR=6 per cent) when compared with a business as usual scenario.

The Energy Smart Fund is expected to help bridge this large investment gap by providing low interest loans to small and medium enterprises to invest in RE and EE technologies. However, the fund currently excludes homeowners. Many households in Barbados have limited access to credit, so that expensive equipment is not affordable, even if the equipment would pay for itself over time. Access to credit is made worse by the fact that the technologies are new and unfamiliar, so banks are unwilling to lend against them, and equipment suppliers have not yet developed hire purchase schemes or other consumer

TABLE 32. INVESTMENT GAP ANALYSIS OF THE BUILDING/HOUSING SECTOR

Challenges	Importance score (1)	Performance score (2)	Performance/ Investment gap (3)=(1)-(2)
Relatively high cost of newer technologies	6	7	-1
Lack of overarching policy framework	7	2	5
Lack of training programmes and regional experts	8	1	7
Demand for low-cost green housing solutions	9	7	2
Cultural preference for detached housing units	6	6	0

Source: Stakeholder discussions and authors' analysis

finance arrangements for them. At the moment, the Energy Smart Fund is specifically aimed at small and medium enterprises, especially hotels. Once the Smart Fund is up and running efficiently then it may be worth considering opening it up to households by creating a consumer finance instrument within the Fund. This could consist of a subsidized hire purchase scheme for economically viable, distributed, renewable energy generation technologies.

With regards to water use in the building/housing industry, the challenges and questions are:

- How can water usage, wastewater and solid waste generation be managed and optimized within the built environment?
- What technologies and approaches can be used to support supply water and under what conditions?
- What technologies and approaches can be used to manage and treat wastewater?

The answers to these questions lie not just with the built infrastructure itself but also depend on the surrounding environment. Thus, urban planning as a strategic framework for housing development has as much of a role to play as the individual structures. It has to be recognized that within the built environment there are a variety of water uses, some of which are only discretionary (i.e. gardening). Others are essential (e.g., washing, drinking and cooking) and require that the quality be high.

However, other essential uses, such as toilet flushing, do not require such a high quality of water. Non-discretionary use by its very nature will be difficult to reduce and it is for this reason that water usage tends to be inelastic.

Within the built environment, the use of water efficient appliances can make a difference in reducing consumption, and have successfully been introduced. This approach is now being extended to include appliances such as washing machines.

Promotion in this area requires a mix of regulations embedded in building codes coupled with incentivizing consumer choice. The installation of water efficient fixtures and appliances should apply equally to new and existing structures. With new structures, installations can be regulated under the building codes and owners of existing structures can be encouraged through the income tax system and rebate schemes.

The other area that would probably have as much impact is the reduction of leakages from fixtures and fittings within a property. This is squarely the responsibility of the property owner/manager. Ensuring that leakages are managed requires a mixture of information on water usage (water bills and monitoring), economic incentives (tariff structures) and awareness. Minimizing water use will also minimize wastewater generation.

Currently, the handling and safe management of wastewater, in the absence of a connection to a sewerage system, is an individual responsibility. Eventually, no one will be permitted to dispose of wastewater directly into suck-wells and some form of treatment will be required. The level of treatment will depend on the nature of the effluent generated, as well as the zonal location of the property, location relative to sensitive marine ecosystems and the potential impact to groundwater.

The options for wastewater handling include either individual or collective treatment options where, in the case of the latter, groups of properties are connected to and served by a single wastewater treatment system. In the majority of cases, it is likely that property owners/managers would minimize their involvement in the operation of the plants and not want to be responsible for their operation and maintenance. This represents a significant opportunity for the private sector to provide such services.

The strengths and challenges identified for the greening of the industry were used as a basis for determining those areas where greater investment would be required in order to realise green outcomes in the industry. Table 32 presents the outcome of this investment gap analysis. An importance score is assigned to each challenge and opportunity based on a 10-point Likert scale, where 1 denotes insignificance and 10 means very important. The importance of the investment gap is quantified by subtracting column 2 from column 1. A positive value in column 4 indicates that greater investment is required to enhance a particular strength or minimise an identified challenge.

As reflected in Table 32, the overall analysis revealed that those areas requiring greater levels of investment in order to green the housing/building industry are a) training programmes and regional experts, and b) an overarching policy framework. The industry stakeholders noted that Barbados has a good compliment of technical officials (e.g., architects, contractors, engineers) whose expertise should be enhanced through retraining and technology transfer to improve the physical structure and quality of the new housing stock. They also indicated that the building code should be updated to include high-rise housing. There was also a call for research on the social, cultural and economic impacts of high-rise communities so as to document the pitfalls and successes of these types of developments.

In terms of the sector's contribution to climate change, it was noted that proper site selection could enhance the country's resilience as houses are constructed in close proximity to various amenities. This would help to significantly reduce the energy used for transportation and lessen emissions from private vehicles as long as public transportation is reliable and safe. The construction of high-rise buildings not only reduces land consumption but it also preserves existing green spaces and presents the opportunity to develop communal green spaces. When asked who benefits and who loses when we "go green", the stakeholders replied that inefficient users lose out on energy and financial savings. However, they noted that those persons who "go green" and employ resource and energy efficient strategies are the main winners. They noted that those who "go green" and employ resource and energy-efficient strategies are the winners, while the country also benefits.

Turning to wastewater management, the aspects that have to be addressed in moving forward are

two-fold. On the one hand, workable contractual arrangements must be developed between property managers and occupants in order to cover costs and define responsibilities where communal housing concepts are adopted. On the other hand, there are regulatory aspects with regard to standards of treatment, certification, inspection and reporting. This is something that will have to be developed and overseen by the EPD, and the required standards must be such that they do not impose an undue or excessive economic and regulatory hardship on owners and occupants. Moreover, questions about how treated water can possibly be reused as well as what can be done with the residual waste generated, or if it should be discarded, are matters that would need to be addressed. Incorporation of green technologies into new buildings should not be problematic. However, the installation of wastewater treatment systems in existing properties could be challenging both economically and structurally.

With regard to solid waste management in homes, income levels, attitudes and lifestyles probably play a significant role in determining how much solid waste is generated, and thus the actual built environment may only be a secondary influence. The same would be true for other types of buildings, where it is the activities that go on within the buildings that is the prime determinant. Outside of the buildings, the way in which they are situated and their relationship to the surrounding environment can play a role in facilitating the collection of solid waste and encouraging the separation and diversion of waste at source.

The other factor that is of relevance is the way in which components in the built environment relate to each other and their physical proximity. Clustering, industrial parks and commercial centres introduce an element of scale that can allow the sharing of facilities such as harvested rainwater, wastewater treatment systems or on site solid waste management facilities. It can also have an impact on storm water management and even its collection and utilisation. Stormwater collection may be regarded as another form of rainwater harvesting, as is the case in Singapore. This, however, would require the development of best practice guidelines, regulatory requirements and appropriate incentives to developers. At the same time, such requirements should act as incentives rather than barriers to be circumvented.

The demolition of existing buildings, sometimes for the purposes of clearing a site for new construction,

TABLE 33. BENEFITS OF GREEN BUILDINGS

Economic benefits	Social benefits	Environmental benefits
Energy and water savings (reduced utility cost leads to long-term savings)	Improved health (due to improved ventilation and use of non-toxic and low emitting materials)	Emission reduction (due to increased use of renewable energy sources)
Increased property value (resulting from lower operation costs and easy maintenance)	Healthier lifestyle and recreation	Water conservation (harvesting rainwater and recycling wastewater yields significant water savings)
Decreased strain on the infrastructure (resulting from reduced demand on local power and water supply)		Storm water management (permeable surfaces and green roofs control and channel storm water runoff)
Increased employment productivity (resulting from healthier indoor environmental conditions)		Waste reduction (the deconstruction and recycling of building materials reduce waste production)

Source: City of Bloomington, 2011.

significantly contributes to the amount of construction and demolition waste going to the landfill. In some parts of the world, it is a requirement that such waste generated on a site be reused in the new construction. This effectively diverts the waste at source without the intermediate step of going to and being processed at the landfill sites. Consideration could be given to including such a requirement into building regulations and codes. It is also possible that construction debris can be employed to reclaim disused quarries in order to remove these safety hazards from the landscape and potential illegal waste disposal sites.

There is an important role that the design and form of the built environment can play in encouraging and supporting resource use efficiency (water, wastewater and solid waste). Nonetheless, it is complex and will require careful development. Having said that, there are potentially significant employment opportunities associated with this sector in the provision of a range of services to home/property owners and property managers. This would not only be in traditional trades but also in areas such as audits and assessments, new skill requirements for architects, engineers, town planners and regulators as well as in the use and deployment of information, technology and communication (ICT) to support and track resource use efficiency and allow for its technical and economic assessment.

3.3.4 POTENTIAL RETURNS IN TERMS OF ECONOMIC GROWTH, DEVELOPMENT AND POVERTY REDUCTION

Greening the building industry offers several economic, social and environmental benefits as shown in Table 33.

An investment in residential and commercial energy efficiency and water efficiency enables residents and companies to benefit financially. Water efficient buildings reduce the demand and the cost of supplying water. Countries that experience water stress and scarcity can use a number of water efficiency methods to overcome these challenges. These methods include rainwater harvesting, credit programmes for water and energy conservation, water sensitive designs and water recycling. Additionally, residents are encouraged to use water efficient appliances, toilets, urinals, showerheads, taps, washing machines and dishwashers to achieve water conservation within the household. The West Coast sewage project was estimated to cost approximately US\$ 350 million. This was prior to the decision to upgrade the system for water reuse,³⁹ so the final figure is likely to be in excess of this early estimate.

Research indicates that construction and demolition generate approximately one-third of global waste. Building efficiency offers solutions for environmental and health issues (such as noise pollution, chemical pollution and the removal of hazardous building

TABLE 34. ASSESSMENT OF OPPORTUNITIES IN THE BUILDING/HOUSING SECTOR

Opportunity	Frequency of success (1)	Effectiveness (2)	Ranking of importance (3)=(1)*(2)
Convert derelict sugar factories into waste-to-energy plants	8	9	72
Education and technology	7	6	42
Provisions and subventions	7	7	49
Recycling communities	8	8	64

Source: Stakeholder discussions and authors' analysis

Housing development integrating solar water heating systems.
Photo: Travis Sinckler

materials) caused by the construction/demolition process. Another major environmental issue associated with the building sector is the depletion of natural resources. Architects and designers play a critical role in ensuring energy conservation, managing the consumption of materials and the efficient use of resources. The recycling of building materials and components is a method used to save energy and reduce waste and emissions.

Greening construction not only has environmental benefits, sometimes at little cost, but it also helps to improve employee productivity and work quality as well as public health through the reduction of air and noise pollutants. Investing in greening buildings, therefore, can lead to savings in terms of a company's labour costs. In some instances, the savings in labour related costs outstrip energy savings: "even a 1 per cent increase in productivity resulting from investment in greener buildings yields a labour-cost saving several times higher than the energy-cost savings."⁴⁰

The Barbados Public Sector Energy Conservation Programme (GOB, 2007) has been tried. The experiences of the programme need to be used as a platform for moving forward, and could be re-launched with a clear set of deliverables, timelines, agency responsibility and monitoring systems in place. The aim would be for government to lead by example through the greening of all public buildings. Similarly, there are significant national savings to be had from the further development and implementation of a green procurement policy for all government and quasi-government agencies, which should include an upgrade to procurement of greener building materials.

A specific stakeholder observation was made with regard to energy generation: There are numerous derelict sugar factories on the island, which hold potential for conversion into nodes for waste-to-energy operations to service the housing/building industry (Table 34). This is of course provided that economies of scale can be realised by decentralising waste to energy facilities. In addition, stakeholders opined that community based recycling programmes that encourage reuse of construction and other forms of waste do hold a distinct opportunity to contribute to economic growth through savings to be had from reusing and recycling waste. Table 34 presents a summary of the assessment.

3.3.5 POTENTIAL FOR GREEN JOBS CREATION AND TRANSMIGRATION

Green jobs tend to lessen the environmental impact of various economic activities, while assisting in the reduction of energy consumption, the use of raw materials, minimizing GHG emissions and improving water efficiency across the various sectors of the economy (Table 35). As it relates to the building and construction sector, there are numerous opportunities to improve a building's performance, since buildings produce a considerable amount of greenhouse-gas emissions and waste, and utilize at least 40 per cent of the total energy consumed. In an effort to attain a high building performance, green jobs would be created to improve energy efficiency and reduce greenhouse-gas emissions. In 2008, researchers noted that there

TABLE 35. GREEN JOBS PROGRESS TO-DATE AND POTENTIAL FOR THE FUTURE

Item	Green potential	Green job progress to-date	Long-term green job potential
Greening buildings	Excellent	Limited	Excellent
Retrofitting	Excellent	Limited	Excellent
Lighting	Excellent	Good	Excellent
Efficient equipment and appliances	Excellent	Fair	Excellent

Source: Adapted from UNEP, 2008.

are approximately 4 million green jobs in the United States and Europe combined which are related to energy efficiency and they voiced the expectation that there will be an increase of 3.5 million in green jobs depending on investments made to improve energy efficiency in buildings.⁴¹

In developing countries, greening programmes such as the Kuyasa Low-Income Housing Upgrade in Cape Town, South Africa helped to create green jobs for the unemployed and the underemployed.⁴² The programme noted the progress towards the creation of green jobs in the building industry and their potential in the future.

In Barbados, the potential for green jobs lies in retrofitting, lighting, installation and maintenance of efficient appliances and the use of low energy construction material in a sustainable building/housing industry. This is also the case at the regulatory level since new standards of practice would need to be devised and monitored to ensure acceptable levels of compliance. This would entail revisions to the curricula of Barbados' tertiary institutions that would be involved in training at the technical and managerial levels.

It will also be necessary to establish a Green Building Council to facilitate training and certification in the area, particularly as it relates to Leadership in Energy and Environmental Design (LEED) certification. Certification in areas of Building, Design & Construction, Operations & Maintenance, Interior Design & Construction, as well as Neighbourhood Development, will be required to upgrade the skills and knowledge but also allow the to bid on sustainable projects being undertaken in the Caribbean.

Stakeholders acknowledged that one of the main building blocks towards achieving the goal of greening the building/housing sector is attracting foreign investment, and they affirmed their confidence in the attractiveness of Barbados' information and technology infrastructure to aid in

this process. The introduction of green technologies in the design and construction of buildings and communities is therefore perceived as movement towards realising a greener building/housing sector, an opportunity that should be embraced by all stakeholders, including consumers. Thus, attracting foreign investment has the potential to open doors for the access and transfer of clean/green technologies.

3.3.6 POTENTIAL FOR ENVIRONMENTAL IMPROVEMENT

Barbados requires a strategy and policy for ongoing education, outreach and information of targeted publics to be put in place in order to facilitate change in behaviours within the industry. The island has a highly educated population with a literacy rate of approximately 99 per cent because, in post-independence years, education was used as vehicle to empower and enfranchise the masses, and to propel the country towards economic development.

Understanding that access to education is a linchpin to its development, successive governments embarked on a number of measures to ensure that it continues to create a cadre of highly skilled and trainable individuals.⁴³ Many industry stakeholders perceive this characteristic as giving Barbados a distinct advantage in its move towards a green economy. The greening process will require retooling of industry practitioners in order to take full advantage of the social, economic and environmental benefits.

A starting point for the social benefits of greening the housing/building industry could be the fostering and extending of recycling communities. The Future Centre Trust has become the first recipient in Barbados of a contribution from the Coca-Cola Foundation, in the amount of US\$ 45,000, for a



Government's policy leadership has seen growth in the use of renewable energy technologies in businesses. Photo: Travis Sinckler

community recycling grant to assist in the development of community-based programmes in the country. The extension of these efforts through joint public-private sector arrangements could significantly reduce the impacts of construction waste on the landfill.

The following are some of the potential areas through which the environmental benefits of greening may be realised in Barbados:

- The launch of private-public sector building projects that integrate environmental and social benefits into their housing/building solutions. These building projects should reflect the sustainable building tenets of resource efficient, minimal waste production, the use of non-toxic building materials and the creation of a healthy indoor environment.
- The use of construction waste in building operations thereby reducing the solid waste outputs from the industry. This of course would need to be regulated through the design, implementation and monitoring of green standards.
- Conduct life cycle evaluations and consider extending the use of green building materials that have already been introduced such as "plycem".

The Ministry of Housing and Lands has as its priority the delivery of affordable housing with a focus on low-income earners. Although the concepts of affordable housing and sustainable housing may be combined, in practice, some greening approaches should be included in these housing projects. The Urban Development Commission (UDC) in 2010 launched a "Go Green" community project that was well received by the community residents. This

project, however, was primarily a beautification project which did not reflect the sustainable building tenets of resource efficient, minimal waste production, the use of non-toxic building materials, and the creation of a healthy indoor environment. Nonetheless, the project realised the benefits of environmentally aesthetic landscaping. It is worthy to note that the UDC's building repair programmes currently involve the use of "plycem", a fire and mould resistant concrete board. This is a feature that should be further assessed, in terms of a life cycle evaluation, for its suitability as a greener building practice to be expanded.

Under the Public Sector Energy Conservation Programme, the Ministry of Transport and Works (MTW), which has responsibility for the registration of all building practitioners, has taken the initiative to green its administrative buildings, headquarters and the depots. MTW has taken an energy efficient approach to greening, adopting a two-pronged approach in dealing with its energy consumption – the use of alternative sources of energy, and increased energy efficiency through conservation efforts. The Ministry has also made an application to the Chief Town Planner for the installation of a wind turbine to provide alternative power at the Chance Hall Depot in St. Lucy, which will further reduce energy costs.

The Ministry of Transport and Works, in conjunction with the Ministry of Energy, is currently implementing the recommendations coming out of an energy audit that was conducted in 2007. Among the conclusions drawn from the audit is that savings could be derived from implementing the following:

- Retrofitting buildings to utilize more natural ventilation wherever applicable;



The Caribbean Tourism Organization's 2011 Sustainable Award-winning Harrison's Cave at night. Photo: Ken Uyeda/Blackbird Design/Calgary Canada

- Purchasing and installing more high-efficiency air-condition units;
- Tinting windows to reduce heat radiation from the sun;
- Changing incandescent light bulbs to energy-saving compact fluorescent bulbs;
- Changing all toilets to low flush toilets; and
- Installing water-saving devices wherever possible.

The goal of green policies for building and housing will also need to confront issues related to natural disasters. Since 1851, the island has been affected by over 58 tropical storms, with 3 of these classified as severe hurricanes (category 3 or higher) on the Saffir-Simpson Scale. Some areas of the island are also at risk for flooding and land slippage. The adoption of green policies for building will also need to incorporate codes and guidelines on risk of natural disasters, storm surge and sea level rise.

3.3.7 CONCLUSIONS

The stakeholders' vision for greening the housing/building industry reflects, in summary, a desire to benefit socially from improved quality in community living, economically from the cost savings available from more efficient energy usage, building design and construction, and environmentally from a system of reuse and recycling within the industry and the retention of green spaces with a reduction of the building footprints on the land. This vision is by and large consistent with the national definition of green economy outlined earlier and therefore provides some rationale for greening the building and housing

industry. The integrated settlement development has to be purposefully practiced to realise a green vision for the building/housing sector.

There are many factors to be considered. For example, land offers opportunities for green open space to be incorporated into selected settlement arrangements (such as high rise), which may bring significant social value from an aesthetic and recreational viewpoint. Also, the hard surfacing of land areas as settlement development expands and agricultural land is converted can lead to reduced water infiltration and possible flooding in low lying areas. Moreover, building development in close proximity to a reliable, comfortable and safe green public transport network can reduce the energy used in transport.

In this vein, it must be reiterated that data needs to be captured and analysed on: a) the change of use of land from agriculture; b) agricultural land needs for food security; c) watershed and comprehensive drainage within new settlement developments; and d) the feasibility of incorporating non-motorised transport modes within urban and rural areas. Further research should investigate the social, cultural, as well as economic impacts of high-rise communities, development of best practice guidelines for harvested rainwater, wastewater treatment systems, analysis of investment data for public and private sector investments in energy efficiency, evaluation of the economics of alternatives to local sand resources, exploration of the opportunities to extend community-level recycling programmes, and the undertaking of a socio-environmental cost-benefit analysis on green low cost housing options.

3.3.8 SUMMARY

The building or construction industry is a major contributor to the country's economic growth and development. The total value-added of the industry in 2010 was US\$ 185.5 million or about 5 per cent of GDP. In addition, the industry employs almost 15,000 persons, almost 2,000 more than Barbados' main industry, tourism. Over the years, there has been an expansion of the built environment through the construction of transportation infrastructure along with private and public buildings. Urban residential housing is located within a continuous linear coastal urban corridor that extends along the entire length of the west and south coasts. Traditionally, most persons lived in wooden and chattel houses (73 per cent in 1970). This ratio has, however, fallen dramatically in recent years due to rising standards of living. In 2000, the year for which the most recent estimate is available, 45 per cent of houses were made entirely of concrete blocks.

The construction of commercial and residential buildings puts a strain on natural and human resources through energy use, land use, the removal of natural materials, transport of construction materials, liquid and solid waste generation, poor utilisation and recycling of building materials and the use of hazardous building materials. In 2009, the single largest category of electricity consumers was domestic users, accounting for 32 per cent of total sales or 306.6 million kWh. The country, however, has an enviable record in relation to the penetration of solar water heaters, with an estimated 40,000 systems in operation, 75 per cent of which are in residential use. The island is divided into subdivided into five water protection areas, with Zone 1, being closest to the production wells, having the most stringent restrictions on development activities, and Zone 5, being the furthest away, having the least restrictions. Enforcement of development restrictions is the responsibility of the Town and Country Development Planning Office, which is supported by the Environmental Protection Department and the Barbados Water Authority. Development on the island is guided by the Physical Development Plan, which attempts to match the demand for land to the island's development objectives.

The prospect of green building offers the possibility of improving resource efficiency, reducing waste and the use of toxic substances, and enhancing water efficiency and sustainable site development. In addition, it offers the possibility of raising the consciousness of practitioners in the construction

industry and house owners that they become more discriminating in their selection of green materials when building, and experiencing general meliorations in indoor environmental quality. Most stakeholders in the industry had a strong desire to realise the potential social and financial benefits from improved quality in community living, increased cost savings accruing from greater efficiency in energy usage and energy efficient building design and construction.

The constraints in relation to greening the industry have not changed since Barbados' First National Communication on Climate Change was presented to the United Nations Framework Convention on Climate Change in 2001. Then, challenges to the implementation of renewable technologies were noted as the lack of financial and economic resources, lack of awareness of newer technologies, higher local operational costs of newer technologies, the non-inclusion of environmental costs when considering the extent of reliance upon and use of fossil fuels, and lack of training and regional expertise in newer technologies. Today, two other challenges have surfaced, namely, the perceptions by industry managers that low cost housing is in direct conflict with sustainable housing; and cultural preferences for the detached housing unit, which hinders the design and sale of alternative dwelling arrangements that would contribute to land conservation.

To address these challenges, stakeholders felt that training programmes to further develop the expertise of local building professionals (architects, engineers and contractors) should be developed, and an overarching policy framework be devised. Furthermore, they were of the view that greater efforts should be directed towards educating the public on the various incentives (i.e. provisions in the Income Tax Act) and grants (i.e. by the Energy Division) that are already available for greening initiatives, because they could contribute positively to achieving the green economy objectives in the building/housing sector. Stakeholders noted that the country has a good compliment of building professionals whose expertise should be built upon through training and technology transfer so as to improve the built environment and quality of the new housing stock. It was also indicated that the building code should be updated to include high-rise housing, and calls were made for the private lending agencies to play their part by approving or underwriting loans based on environmental risk.

Green construction not only has environmental benefits, but it also helps to improve employee productivity and work quality as well as public



Development in the coastal zone is managed through the Physical Development Plan. Photo: Dave Quan/Inkstone Design/Calgary Canada

health, in general, along with decreasing air and noise pollutants. In this regard, four key opportunities for greening the industry were identified: 1) conversion of derelict sugar factories into waste-to-energy plants, 2) education and technology, 3) provisions and subventions, and 4) recycling communities. Community-based recycling programmes, in particular, encourage reuse of construction and other forms of waste and could lead to growth and savings. In the process of the green transition, there is the potential for green jobs in areas of retrofitting, lighting, sales and maintenance of efficient appliances, and the provision and use of low energy construction materials in a sustainable building/housing industry.

The country, however, requires a strategy and policy for on-going education, outreach and information sharing in order to encourage behavioural change. Given the island's high literacy rate, such a strategy

should be highly effective. The launch of private-public sector building projects that integrate environmental and social benefits into their housing/building solutions can result in efficiency gains in natural resource usage, lower waste production and the creation of a healthy door environment. The Urban Development Commission (UDC) in 2010 launched a "Go Green" community project that was well received by community residents. While this project was largely focused on beautification, it is possibility that this endeavour be scaled up to include the green building/housing principles highlighted in this study.

“If we are to achieve long-term sustainability, then we have to manage our water and land resources more carefully. We have said much about food security over the years, but we continue to allow buildings – houses and commercial properties – to eat up viable arable land.”

**Mr Cedric H. Murrell, President of the Congress of Trade Unions
and Staff Associations of Barbados**

**Address at the Official Launch of the Government of Barbados – United Nations
Environment Programme Partnership for a Resource Efficient Green Economy in
Barbados and the Green Economy Scoping Study, 9 March 2011**

KEY MESSAGES

It is estimated that the transport industry accounted for 33 per cent of all the fuel imported.

The stakeholders' vision for greening the transport industry reflects a desire to reduce the island's dependence on fossil fuels, without significantly increasing the cost of transportation.

A package of investment and policy reforms is needed, which would lead to the development and implementation of fuel performance and air and noise pollution standards, improvement of traffic management, use of mix modes of transports, and internalization of climate change considerations in the choice of transport.

To address congestion, a system of on-street parking charges and regularization of length of stay should be considered.

Efforts to green the transportation sector lead to the creation of green jobs. This is particularly the case in the area of providing affordable and reliable public transport options.

There is a need to pursue an approach that takes into account all the contributing elements in order to increase effectiveness: demand management, behavioural change, safety, different modes of transport, involving stakeholders in the planning process, sequencing of public works, affordability, and the interaction between the transport network and land use.

3.4.1 BACKGROUND

Barbados has a dense road network system that plays a critical role in the country's social and economic development. The transport network consists of more than 1,600 km of paved public roads, two active marine ports - the Bridgetown Port and Port St Charles, both regulated by the Barbados Port Authority - and one airport (the Grantley Adams International Airport). In 2010, the total value-added for Transportation, Storage and Communications Industry was US\$ 308.1 million, or approximately 8 per cent of GDP. This represents a return to growth after contracting in the previous two years, reflective of the overall slowdown in the Barbados economy.

The highway network consists of seven major highways that radiate from Bridgetown. Numbers 1 to 7 signifies these – Highway 1 (H1) heads due north from Bridgetown along the west coast and numbering continues sequentially in a clockwise direction. Other highways are the Ernie Bourne Highway, the Ronald Mapp Highway, the Adams-Barrow-Cummins (ABC) Highway and the Spring Garden Highway. In 2010, an assessment released by the Economic Intelligence Unit (EIU) of the United Kingdom ranked Barbados 6th in the world with 3.7 km of road for every km of land, and the top spot in the Western Hemisphere for road network density. Apart from the highways, the road network consists of roads that are, generally, relatively narrow.

According to statistics from the Barbados Licensing Authority, the number of vehicles on the island's roads stood at 131,680 in 2009. It is estimated that between 2008 and 2010 the number of vehicles grew at a compounded annual rate of 3.8 per cent. The number of vehicles registered for the period January to July 2011 was 112,995, with an estimated total of vehicles in use for 2011 being 150,000 (Table 36). There has been a significant rise in vehicular accidents commensurate with the increase in vehicular use. In 1999, Barbados ranked 12th globally for road accident victims per 100,000 people; and 23rd globally for actual road fatalities per 100,000 people, a position shared with Estonia, Georgia, Greece, Tunisia and the United States and (WHO, 2009).

Currently, there are three bus services operating on the island. Two of the services are privately owned and consist of a fleet of small buses called route taxis, commonly referred to as ZRs, and a fleet of minibuses. The government-operated system is managed by the Barbados Transport Board and

TABLE 36. REGISTERED VEHICLES (JANUARY TO JULY 2011)

Type/Name of vehicle	Total no. of vehicles
Articulated vehicle	222
Crane	9
Dumper	14
Hearse	30
Heavy good vehicle (over 3 600 kg)	4 507
Hired limo	65
Hired motor cycle	41
Hired vehicle	2 467
Light goods vehicle (under 3 600 kg)	8 353
Maxi taxi	676
Maxi taxi (The Barbados Transport Board)	5
Minibus	161
Minibus – charity	139
Minibus 2011	33
Minibus – Hotel	2
Motorcycle w/ sidecar	2
Omnibus	442
Private motor car	90 400
Private motor car (ATV)	39
Private motorcycle	2061
Route taxi	208
Route taxi 2011	79
Segway transporter	4
Self-driven motor vehicle	6
Taxi	1 677
Tour coach	98
Tractors and forklift	788
Trailer (less than 7 m)	445
Trailers (over 7 m)	22
Total no. of vehicles	112 995

Source: Ministry of Transport and Works

consists of large omnibuses. According to the National Transport Plan Study carried out in 1996, low levels of service and congestion marked the traffic network in Barbados in the late 1990s. This was a result of the rapid growth of vehicles beyond network capacity.

The number of vehicles on the streets in Barbados has grown at a compounded annual growth rate of 6.8 per cent for the period 1999 to 2009. This rate has fallen off to an estimated 3.8 per cent per annum, as noted earlier. However, when compared to the acceptable international standard of 2.5 per cent

as a sustainable growth rate, the growth rate of vehicles in Barbados is not sustainable, particularly given the vulnerabilities of being an island state.

On the matter of road safety, the island has legislation in place for compulsory seat belt use in vehicles in order to limit the number of injuries and deaths due to vehicular collisions. MTW is now officially representing the Government as it participates in the United Nations Decade of Road Safety 2011-2020. In fact, MTW has already submitted a proposal for a structured approach to this programme, which is to be rolled out in 2012.

In response to existing emission-related issues, as well as other economic, social and environmental concerns common to most countries, there is now a focus on the deployment of sustainable or greener transportation options within the industry. Sustainable transportation is intimately associated with the concept of greening transportation. The movement towards having a sustainable transportation system (GEF, 2009) comprise initiatives aimed at:

- Reducing the role of the private vehicle as the main mode of transportation;
- Promoting and improving existing public transport;
- Introducing mode switching (shifting travel from the private vehicle to other sustainable modes, such as public transport, park and ride systems, carpooling, cycling and walking);
- Utilizing existing vehicular infrastructure;
- Building comprehensive infrastructure for pedestrian and cyclist;
- Implementing vehicle emissions standards and introducing greener vehicles (electric, hybrid, solar, natural gas, bio-fuel and fuel-cell vehicles) which achieve better energy efficiency;
- Developing guidelines for the disposal of old vehicles for the recycling, recovery and reuse of vehicles and their components;⁴⁴ and
- Integrating sustainable transportation policy into the overall planning policies (particularly policies for land use and environmental management).

The government of Barbados has in place a number of policies, programs and plans for improvement of the transport industry. The Integrated Coastal Zone Management Plan for Barbados (1998),⁴⁵ for example, is the major policy framework for coastal zone management and was approved by the government of Barbados in 1999. This plan document comprises the:

- Integrated Management Plan for the Caribbean Coasts of Barbados;

- Integrated Management Plan for the Atlantic Coasts of Barbados; and
- Integrated Coastal Management – The Barbados Policy Framework.

The plan offers policy guidelines for the location of roads and other infrastructural facilities as well as other land users within the coastal zone. The fact that this policy framework exists is an asset. However, this document is yet to be adopted by the Barbados Government.

The Physical Development Plan (PDP) 2003 has articulated the following objectives for national infrastructure, thereby providing a basis for the island's transportation policies:⁴⁶

- reduce the dependency on private car transport by encouraging mixed use development within existing commercial centres;
- improve amenities for pedestrians and the disabled;
- encourage the use and effectiveness of public transport making it more attractive to users in terms of dependability, convenience, accessibility and travel times;
- encourage the continued attractiveness of Bridgetown, Speightstown and other town centres by enhancing parking supply through effective parking strategies;
- provide adequate air and seaport facilities to meet growing demands from tourism and economic development, and ensure that new development does not compromise the potential to expand airport services; and
- ensure the effective conservation of water resources by continuing to control all development within water protection areas;

In an effort to create a safe environment for pedestrians the PDP 2003 outlines policies related to the provision of sidewalks and other pedestrian facilities.⁴⁷ The policies stipulate:

- minimum standards for sidewalks on all classes of roads, new and existing, and
- the provision of wheelchair access for all new sidewalks.

Also outlined in the PDP 2003 are parking policies that mandate:

- adequate parking has to be provided for all new developments, redevelopments and major development improvements; and
- all new parking facilities are required to provide parking for the disabled.

box 5 BEST PRACTICE BEYOND ENGINEERING – SUN POWERED TRANSPORT AND WORKS

The issue & rationale The Ministry of Transport and Works (MTW) is the Government of Barbados' third largest energy consumer in terms of both electricity and petroleum products. In the face of the economic recession and with the ever-increasing price of crude oil - in excess of US\$ 100 per barrel, the Ministry's heavy reliance on energy and its need to become a more efficient user of this resource has become increasingly important. The national importance of energy efficiency, and the potentially significant contribution that the MTW could make to this end, was highlighted when the Ministries of Finance and Environment respectively requested that public sector agencies find ways to reduce costs and the use of hydrocarbon based energy products and services.

The MTW was one of first Ministries to accept this challenge, and as a initial step collaborated with the Energy Division under its Public Sector Energy Efficiency Programme to undertake a pilot energy audit. This exercise, which commenced in 2007, resulted in several recommendations that formed the basis for the establishment of a focussed alternative energy and energy efficiency programme.

A solar electric system for the administrative wing

By April 2011, MTW completed the installation of a grid tied solar system comprised of eighty (80) photovoltaic panels. This solar electric system had a rated capacity of 15.2 kW (kilowatts) and utilised four (4) 3.8 kW inverters to power the Administrative wing of the MTW. The connected load from the solar panel of 14.4 kW met its objectives by facilitating significant energy cost savings. The system cost was approximately BBD 225,000 and it is expected that this cost will be recovered in eight (8) years due to projected annual savings of BBD 35, 000.

Building regulatory capacity Given the nature of the initiative, the Government Electrical Engineering Department (GEED) of the MTW, which is responsible for electrical inspections and installations of all buildings in Barbados, had a significant regulatory and supervisory role to play in the development of the grid tied solar system.

The installation of their own system, along with the increased national demand for alternative energy systems, has caused MTW to be more aware of, and to examine its capacity for, regulating alternative energy systems. The realisation that some job specifications

within the GEED will need to be changed to match this new demand has prompted the roll-out of training in Regulating Solar Systems for officers within the Unit.

Way forward – solar powered streets? Other alternative energy initiatives being considered by the MTW include the installation of solar powered streetlights on highways. It is estimated that such an initiative would produce savings up to two-thirds of the BDS \$10 million spent on powering existing streetlights. A pilot project for solar streetlights is being considered for Barbados' capital Bridgetown. MTW is also exploring the use of solar traffic lights, road marking studs, and motion sensor lights at the Ministry's depots across the island.

Wind in the pipeline The Ministry is also looking to use wind energy to reduce its expenditure and has applied to the Chief Town Planner for the necessary permission to install a Wind Turbine at the Chance Hall Depot in St. Lucy.

Challenges One challenge of the initiative is that there was no initial consideration of the product lifecycle of the components utilised in the programme. However, MTW notes the need to determine the most economical and environmentally sound manner to handle the disposal of specialised equipment, such as photovoltaic cells, and other materials.



Hybrid street lighting systems in use at the UWI Cave Hill Campus. Photo: Travis Sinckler



Addressing city congestion via dedicated parking facilities in Bridgetown. Photo: Travis Sinckler

In addition, the PDP 2003 presents policies to promote the use of public transport. It encourages high density residential development along urban corridors in an attempt to utilize existing and future transport and transit infrastructure. To further mitigate the potential negative environmental impacts of the transport sector, the Physical Development Plan stipulates that an Environmental Impact Assessment is required of all new roads over 200 metres in length and for all road and intersection improvements.⁴⁸

Within the PDP 2003, there are consistent policy objectives and guidelines on the one hand, such as those promoting the use of public transport and the containment of settlement development by utilizing existing vehicular infrastructure. On the other hand, while the broad objectives for national infrastructure consistently embrace the notion of sustainability, the policy guidelines do not consistently promote the greening of the sector. For example, the policy guidelines address the provision and widening of traditional sidewalk but not land use allocation and guidelines for shaded walkways, the possibility of cycle paths or park and ride systems all of which could be important elements of introducing mode switching in the transport industry.

Furthermore, the land use guidelines make provision for increased communal parking areas in Bridgetown and regional centres, which may run counter to the explicit greening objective of reducing the role of the private vehicle as the main mode of transport.

Understandably, the PDPs land use policies were prepared in the late 1990s and finally approved in 2003. These land use policies are likely dependant on a clearer articulation by the key players within the transport industry of specific measures for greening towards an integrated and sustainable transport system for Barbados.

The National Sustainable Development Policy (NSDP) 2004 has also outlined policy recommendations aimed at reducing the environmental impact of the transport sector. The recommendations of the NSDP include:⁴⁹

- full documentation of the environmental hazards of all the constituents of blended fuel;
- development of a Clean Air Policy;
- development of safe standards for atmospheric pollutants;
- development of appropriate economic instruments/incentives, legislation and regulations towards ensuring the successful implementation of policy objectives and programmes developed to facilitate energy efficiency in the transport sector, and improved air quality in general;
- efficient and timely the maintenance of heavy duty diesel vehicle;
- promoting energy efficiency in the transport sector, by giving consideration to the feasibility of using electric cars as well as liquid petroleum gas (LPG), compressed natural gas (CNG), and hydrogen powered vehicles;
- development, introduction and use of appropriate scientific technologies and practices to improve efficiency in the transport sector and its sustainability, in particular with regards to maintaining a clean and safe environment;
- conducting of studies on mass transit options in high traffic areas;
- classification of areas where hydrocarbons are stored as potential hazardous sites and taking these locations into consideration when considering future development activities.

The policies of the NSDP 2004 are comprehensive and clearly articulated in support of the greening of the transport industry.

Incorporated within the National Strategic Plan of Barbados 2006-2025, the government has created strategies specifically aimed at reducing traffic congestion.⁵⁰ These strategies include:

- enhancement of the reliability of the transit system;

- exploration of the use of water transport to and from the town centres;
- development of a Bus Rapid Transit system;
- increase in the number of car parks to reduce congestion created by illegal parking; and
- establishment of an express bus service in major avenues during peak hours.

The policies developed within the NSP 2005 – 2015 are also supportive of the greening process for the transport sector. This comprehensive plan provides a series of targets and indicators for the sector some of which are included in the Section 3.3 of this report.

According to the government's Medium-Term Development Strategy 2010, the Ministry of Transport and Works committed to the continuation of several initiatives which seek to create a safer, more efficient and attractive national transport system.⁵¹ These specific initiatives are to:

- re-examine the feasibility of the construction of footbridges along the ABC Highway;
- continue to carry out improvements to dangerous junctions to enhance visibility thereby eliminating accidents and possible fatalities;
- undertake traffic experiments in traffic design aimed at enhancing flows in specific areas;
- complete the feasibility study of the extension to the Ernie Bourne Highway;
- encourage the use of low emission vehicles by using emission test metres on vehicles which are being inspected as well as on the road;
- continue the process of establishing the Barbados Building Standards Authority; and
- continue with the development of Permanent Park and Ride Facilities.

Based on the foregoing initiatives, there is evidence of a strong platform of stated policies to support the greening of the transport sector. What may be inadequate is an overarching framework for the implementation of the planning, design, operational and monitoring components of the process required for the greening of the transport industry. Although there is a Transport Authority, this entity has responsibility only for the public transport system. There are many other dimensions to an integrated and sustainable transport system the implementation of which may be left to the timing, resources and initiative of individual agencies in the absence of an comprehensive institutional framework. The regulatory agencies with shared responsibility for policy implementation within the transport industry are summarised in Table 37.

The collaboration among the agencies that share responsibility for transport is built largely on strong personal relationship among senior officials and, in general, is not always formally structured. The 1996 National Transport Plan⁵² revealed that there was inadequate coordination and sharing of information between the critical agencies within the transport sector. At that time, the agencies, responsible for transport policy and coordination at different levels, were the Ministry of Transport and Works, the Royal Barbados Police Force, the Ministry of International Transport and Urban and Rural Commissions, and the Town and Country Planning Department. Subsequently, the Transport Authority was established in accordance with one of the recommendations of that study. Still the institutional framework required for the greening of the transport industry is an area that needs to be addressed further in consultation with key stakeholders.

The key industry players (both private and public) would have to establish greening as a single common goal for the transport industry so that appropriate strategies may be developed, implemented and monitored towards a sustainable transport system for Barbados.

3.4.2 RESOURCE USE AND EFFICIENCY MEASURES

Water consumption in the transportation sector is primarily in relation to new road construction and road improvement projects. Water used for this purpose, either by MTW or private contractors, is paid for by MTW. Water is also used for irrigation of landscaped areas within large roundabouts along the ABC Highway and MTW is billed directly by the Barbados Water Authority. It is acknowledged that the potable water used in irrigation and road construction, including road wetting for dust control, is a costly and wasteful practice. The use of brackish and other levels of non-potable water need to be explored for this purpose.

With regard to flooding resulting from road construction, the Drainage Division of the Ministry of the Environment and Drainage along with the Town and Country Development Planning Office (TCDPO) are the agencies responsible for devising and implementing mitigation measures.

TABLE 37. SUMMARY OF REGULATORY AGENCIES WITH RESPONSIBILITIES IN THE TRANSPORT SYSTEM

Department /Ministry	Main responsibilities	Legislation
Transport Authority	Plan, monitor and regulate the public transport system. Main functions: <ul style="list-style-type: none"> • issue, cancel, suspend licenses of drivers and conductors of public service vehicles • issue, suspend or revoke permits in respect of public service vehicles • restrict the use of motor omnibuses, minibuses and route taxis to specified routes • to regulate and restrict the number of motor omnibuses minibuses and route taxis on specified routes • supervise the conduct of business in the passenger terminals • publish current information on public transport services • establish timetables to be observed by drivers and conductors of motor omnibuses minibuses and route taxis • determine the sitting of lay-by and the location of bus stops for the picking up and setting down of passengers using motor omnibuses, minibuses and route taxis 	Transport Authority Act 2007-2028
Ministry of Transport and Works	Construction and maintenance of all government roads, bridges and buildings . Main functions: <ul style="list-style-type: none"> • plan, design and develop a comprehensive road network system; • provide policy guidelines, planning and technical services in the areas of traffic management, works and electrical services; • plan, design, construct and maintain public buildings; • develop, regulate and maintain the road transport and ancillary facilities conducted through the Licensing Authority and the Barbados Transport Authority and private operators, as well as the provision of support services; • ensure that necessary policies and legislation are developed; • develop effective programmes for the construction and maintenance of public infrastructure; and • establish, improve and maintain building standards. 	<ul style="list-style-type: none"> • Public Works Act CAP 32 • Highway Act (CAP 289)
Drainage Division, Ministry of Environment, Water Resources	Establish, implement and sustain an effective and efficient drainage management and flood prevention programme with the objective of mitigating and alleviating the flood challenges countrywide	<ul style="list-style-type: none"> • Prevention of Floods Act – 1951 (CAP 235) • Prevention of Floods (Amendment) Bill – 1992 • Prevention of Floods (Amendment) Act 1996-12 • Highway Act (CAP 289)
Government Electrical Engineering Department	Regulate electrical supply to all installations in Barbados	
Barbados Fire Service	Fire prevention island wide	Fire Service Act Cap 163
Environmental Protection Department, Ministry of Environment and Drainage	Monitoring and control of conditions likely to affect the quality of land, air and water and the general health and environmental well-being of the inhabitants of Barbados.	<ul style="list-style-type: none"> • Health Services Act 1969 • Health Services Regulations • Building Regulations 233/1969
Town and Country Development Planning Office, Prime Minister's Office	Building development and engineering works on all lands (including change of use and subdivision of land) within the island and within the territorial waters of Barbados, including all coastal and marine development within the 200 nautical mile territorial limits.	<ul style="list-style-type: none"> • Town and Country Planning Act Cap 240 • Town and Country Planning Development Order 1972 • Preservation of Trees Act 1981
Rural Development Commission	Its main functions include the facilitation of road improvement and the lighting of streets in rural districts of Barbados	Rural Development Commission Cap 238
Ministry of Housing and Lands	Its main functions include the acquisition of land for the purpose of infrastructural improvement	Land Acquisition Act CAP 228
Royal Barbados Police Force	Its main responsibilities include the enforcement of laws and regulations to ensure road safety for all users – vehicular, cyclists, pedestrian	All relevant legislation

Source: Compiled by authors.

Comprehensive drainage plans are required wherever there are potential negative impacts from road construction and appropriate conditions appended to any approval to carry out development. In some instances, conditions may be imposed requiring use of surface finishes such as infiltration technologies to allow for water infiltration. However, this practice is not consistently promoted by TCDPO outside of sensitive environmental areas. Nonetheless, it should be noted that sections of a number of public spaces use infiltration technologies, for example, the car parking areas of the Ministry of Housing and Lands and Queen's Park.

In 1998, it was estimated that the transport industry accounted for 33 per cent of all the fuel imported. In order to reduce this dependence on fossil fuels, an integrated approach to public transport was recommended in the National Transport Plan (1996),⁵³ and consequently, the Barbados Transport Authority was established. However, the optimization of routes and the rationalization of resources is an area that is in need of attention in order to contribute to the delivery of an efficient public transportation system.

To this end, the Barbados Transport Board is continuing its efforts to improve bus scheduling by piloting a programme that involves the use of a global positioning system (GPS) to track the movement of 18 omnibuses over a given time period. This will help in the development of time schedules as well as a reduction in fuel usage. The Barbados Chamber of Commerce and Industry (BCCI) has piloted a shuttle system for employees of selected businesses in Bridgetown and the results of this effort should be examined to guide future efforts in this direction.⁵⁹ Water taxis or ferries are supported in stated policy for servicing the links between Bridgetown, Oistins and Speightstown. However, private investors are yet to confirm these options as feasible.

Though supported in stated policy, there is no operational strategy that encourages the importation and use of greener vehicles. There are a small number of pilot programmes by the public (MTW) and private (BCCI) sectors that are worthy of examination as guidance for expanding the use of alternative energy vehicles. Among these are the introduction of a hybrid vehicle (Toyota Prius) by Nassco Ltd., the introduction of a natural gas vehicle by Courtesy Garage Ltd. and the locally engineered solar shuttle tour vehicle that was piloted in 2005. MTW uses a number of measures to manage the waste generated by the transportation sector. These include the following:

- Use of a separator –to address the issue of oily wastewater ending up in drains;
- Recycling - scrap metal from MTW's workshop(s) is taken away without charge by private individuals, who have a market for its sale. Similarly, old vehicles are auctioned to interested buyers who may use them in part or whole as scrap metal; and
- Re-use - waste from the road building/repair process is used to make foam bitumen, which is reused in the road building process. Consideration is being given to a crumb rubber⁵⁴ project involving private enterprise.

With regard to air pollution, MTW perceives this challenge as emanating from the fuel mixes used in some vehicles and the absence of requisite standards to manage this problem. At any rate, there is no equipment to assist in the enforcement of standards. This problem is further compounded by the fact that there are competing companies retailing fuel, each with their own special additives, which they mix into the fuel. Furthermore, noise pollution by vehicles is also a matter of concern but, as with air quality, enforcement of a national standard is being stymied.

Notwithstanding, the Environmental Protection Department (EPD), the government department responsible for setting national standards to mitigate air and noise pollution, relies on standards produced by international organizations, such as the WHO, but its work lacks efficacy because of the lack of equipment. Thus, the EPD, MTW and the Barbados National Standards Institution (BNSI) need to coordinate their efforts to effectively confront and regulate this situation. The policy and rationale should be provided by the EPD; the standards should be set by BNSI and the enforcement of these would fall to MTW.

In many instances, there is inadequate land for the incorporation of pedestrian and bicycle systems into existing residential communities and employment centres. The amount of investment that the government has made in the last five years in sidewalk improvements needs to be documented. MTW has also had a number of inquiries from the public with respect to the designation of bicycle routes, given that cycling is a sport in which Barbados participates at the international level. However, the Ministry regards this type of forward planning as the responsibility of the Town and Country Development Planning Office (TCDPO). A coordinated effort is therefore required to address

this matter because of its significance as an option in the greening mix for the transportation sector.

The option of including shaded walkways and cycle paths, as a feasible option to diversify transportation, would need to be developed as part of a broader, integrated framework among the key stakeholders in the transportation sector. TCDPO, if included in the vision for sustainable transportation, could drive this approach through the preparation of new local area and community plans. TCDPO has the ability to improve accessibility within and among residential communities and employment centres through both its forward planning and development control activities. Within selected urban centres and new residential estates, the option of shaded walkways and cycle paths could be explored as a means of mixing modes of accessibility. In many instances, new communities are designed and developed by private investors and TCDPO could set the guidelines for new developments that are consistent with sustainable outcomes for transportation and other land uses.

The Ministry of Housing and Lands, which has the responsibility for all land acquisitions for public uses, keeps record of all land acquisitions for road expansion and improvements. Transport network expansion is for the most part constrained in Barbados by the cost of land that continues to rise. This situation may inadvertently aid the greening of the sector since one of the principles of greening is maintaining current network capacity as a measure towards more sustainable transportation systems.

3.4.3 INVESTMENT GAPS

Stakeholders in the transportation industry envisioned that greening the transportation industry would entail a reduction in dependence on fossil fuels, without significantly impacting on the cost of transportation. Such a transition is dependent on those factors that will enhance the development of the green initiatives within the transport sector includes the body of national policies and strategies as outlined earlier that support the greening of the industry. Additional factors will be outlined in this section.

Barbados has signed up to be a part of the Eastern Caribbean Gas Pipeline project. If this project is implemented the cleaner fuel option of CNG will be more widely available for all energy needs. The project involves the installation of pipelines on the ocean bed for the importation of liquefied or

The stakeholders' vision for greening the transport industry reflects a desire to reduce the island's dependence on fossil fuels, without significantly increasing the cost of transportation.

compressed natural gas from the Republic of Trinidad and Tobago with landing points at Spring Garden, St. Michael and Checker Hall, St Lucy. An application has already been made to the TCDPO to assess this proposed development and the draft terms of reference has been prepared for the conduct of an environmental impact assessment. The current status of the project is unknown but this venture would certainly support the greening initiatives in the transport industry.

The solar power industry in Barbados is finally moving beyond the water heater platform. This means that technological advances within the industry should favour the use of solar power for transport installations and other initiatives in the transport industry.

The Barbados Entrepreneurship Foundation Inc. with the motto "Delivering Sustainable Growth" was launched in November 2010. The number one goal of this organization is to make Barbados the No. 1 Entrepreneurial Hub in the world by 2020. One of the first major objectives of the group is to delivery free WiFi Internet access throughout Barbados by 2011. When this is achieved it will provide a significant platform from which to launch initiatives that avoid the number of vehicular road trips. WiFi access supports telecommuting which means that businesses may consider that option for employees, thereby potentially significantly reducing road traffic, reducing the cost of office accommodation and other benefits by using the current technology for business.⁵⁵

The major development in the solid waste sector has been the construction and commissioning of the Vaucluse Waste Transfer facility, adjacent to the Mangrove Pond Landfill site. The facility was developed at a cost of US\$ 30 million and is operated as a joint public private partnership. The site receives and sorts waste into landfill waste, chemical waste, organic materials, construction and demolition waste, recyclable metals and tires. The existence of the facility, along with the private scrap metal businesses, offers support to the waste management initiatives within the transport industry.

TABLE 38. STRENGTHS AND CHALLENGES IN GREENING THE TRANSPORTATION SECTOR

Strengths	Challenges
<ul style="list-style-type: none"> • Body of national policies and strategies • Well-developed renewable energy industry with regards to solar technologies • Waste management initiatives already exist • Stakeholder support for emissions standards and regulations are in the development pipeline • Plans to develop alternative energy options exist 	<ul style="list-style-type: none"> • Traffic congestion • On-street parking • Bus scheduling • Limited public awareness of green initiatives • Air pollution • Cost of water • Finance for investment • Human resource capacity

Source: Stakeholder discussions and authors' analysis

TABLE 39. ASSESSMENT OF CHALLENGES TO GREENING THE TRANSPORT SECTOR

Challenges	Frequency of occurrence (1)	Impact (2)	Ranking of importance (3) = (1) x (2)
Traffic congestion	9	10	90
On-street parking	8	7	56
High fossil fuel costs	7	10	70
Bus scheduling	6	7	42
Limited public awareness of green initiatives	9	10	90
Air pollution	7	7	49
Cost of water	8	6	48
Finance for investment	8	8	64
Human resource capacity	7	7	49

Source: Stakeholder discussions and authors' analysis

Emissions standards and regulations are in the pipeline. In terms of governance, the current vision for sustainable transport within MPW will be a significant driver for the implementation of a sustainable industry. This Ministry has informally adopted the motto “Beyond Engineering” and this will maintain focus on sustainable measures and outcomes in the industry. However, other enabling conditions as they relate to the following factors for the greening of the transport industry are currently in the primary stages of development (Table 38):

- Capital infrastructure
- Training and capacity enhancement
- Development, access and transfer of clean technology

- Taxation, incentives and fiscal reform
- Financing
- Government procurement policy
- Tariffs, trade (Competitiveness) and investment policies

Table 39 presents a systematic identification of the challenges employing a score based on a 10-point Likert scale in relation to frequency and impact as outlined in Addendum 1. The combination of these two factors provides a ranking of importance shown in column 4. A challenge receives a score of 1 if the frequency of occurrence is low and 10 if the frequency of occurrence is certain. The scores are derived based on expert opinion and based on stakeholder discussions.

Traffic congestion has become a chronic condition for Barbados. According to the National Transport Plan study carried out in 1996,⁵⁶ the traffic network in Barbados in the late 1990s was marked by low levels of service and congestion. This was a result of the rapid growth of vehicles beyond network capacity. The number of vehicles on the streets in Barbados had grown at a compounded annual growth rate of 6.8 percent for the period 1999 to 2009. This rate has fallen off to an estimated 3.8 per cent per annum as noted earlier. However, when compared to acceptable international standards of 2.5 percent as a sustainable growth rate, the growth rate of vehicles in Barbados is not sustainable.

High levels of congestion are exacerbated in Bridgetown where the roads are narrow, on-street parking is often practiced and there are limited off-street parking facilities. Recommendations to address this situation have included on-street parking charges and for the length of stay to be better regularized. Though there has been increased policing of on-street parking practices in recent years the situation remains challenging. Also, efforts to address the on-street parking situation included, a few years ago, a project for the introduction of parking metres. However, the metres were purchased but never implemented because of unforeseen administrative challenges.

The government's investment cost in the efforts to relieve congestion needs to be calculated.⁵⁷ To date, these measures have been focused on traffic management and associated engineering fixes, such as the establishment of a traffic control centre, the upgrading of the Adam/Barrow/Cummins Highway from two to four lanes, the upgrading of the Bridgetown Bypass Road, additional roundabouts and several junction improvements in critical areas.

An integrated approach to public transport was recommended in the National Transport Plan Study 1996⁵⁸ and consequently the Transport Authority, has been established. However, the optimization of routes and the rationalization of resources is an area that is need of attention in order to contribute to the delivery of an efficient public transport system. From the perspective of the MPW, the greening of the transport industry includes the delivery of a reliable safe, cost effective public transport system. To this end, the Transport Board is continuing its efforts to improve bus scheduling by piloting a programme that involves the use of a global positioning system (GPS) to track the movement of 18 buses over a given time period. This will help in development of time schedules as well as fuel usage. One challenge

that was noteworthy in the implementation of this programme was the lack of cooperation from some drivers due to limited understanding of the benefits to be derived.

Currently, there is no government-initiated car-pooling or car sharing policies or programmes that seek to reduce the number of motor vehicles on the road during the normal weekday. The Barbados Chamber of Commerce (BCC) has piloted a shuttle system for employees of selected businesses in Bridgetown and the results of this effort should be examined to guide future efforts in this direction. Water taxis or ferries are supported in stated policy for servicing the links between Bridgetown, Oistins and Speightstown. However, private entrepreneurs are finding this to be a very costly business venture and this transport option is still to be explored. Another one of the major challenges to greening the transportation sector is the shortage of funding. Indeed, greening will require new infrastructure and the purchasing and retrofitting of vehicles so that they are made compatible with the type of energy and systems used. In addition, the retraining and retooling of workers to take up jobs in the retrofitting and maintenance of greener vehicles will involve technology transfer and capital expenditures.

The ranking of investment gaps is presented in Table 40. An importance score is assigned to each challenge and opportunity based on a 10-point Likert scale, where 1 denotes insignificance and 10 means very important. The importance of the investment gaps is quantified by subtracting column 3 from column 2. A positive value in column 4 indicates that greater investment is required to enhance a particular strength or minimise an identified challenge.

Across the board, new technologies require significant injections of capital. Also, there will be a need for new human resource capacity to implement and maintain the green programme actions. Moreover, there is a persistent need that persons be appropriately trained. On the issue of investment capital, it is important to remember that MTW and other regulatory agencies may have control over policies, regulations and standards but not over the allocation of financial resources, a responsibility held by the Ministry of Finance.

Other areas requiring further investment that were identified through incorporating stakeholder contributions are as follows:

- Air Pollution Standards. Emissions standards and regulations are currently being developed. The

TABLE 40. INVESTMENT GAP ANALYSIS OF THE TRANSPORT SECTOR

Challenges	Importance Score (1)	Performance Score (2)	Performance/ Investment gap (3)=(1)-(2)
Traffic congestion	9	5	4
On-street parking	7	6	1
High fossil fuel costs	8	7	1
Bus scheduling	6	6	0
Limited public awareness of green initiatives	9	3	6
Air pollution	7	2	5
Cost of water	7	5	2
Finance for investment	8	3	5
Human resource capacity	7	5	2

Source: Stakeholder discussions and authors' analysis.

finalization and implementation of standards and monitoring mechanisms for vehicular emissions testing was strongly supported by stakeholders because they believed that such would redound to the benefit of human health and a reduction of national energy costs.

- Governance. The current vision within MTW for a sustainable transportation sector will be a significant driver for the implementation of a sustainable transport industry. This Ministry has informally adopted the motto "Beyond Engineering" and they intend to maintain this focus on sustainable measures and outcomes in the industry. In addition, the development of an integrated framework for greening the transportation sector is essential.
- Mode mixing. A non-motorized transport project within the Bridgetown area should be trialled. Similarly, some form of mode mixing should be trialled in the Warrens Centre area. There is anecdotal information of a proposal for a monorail in Warrens but no supporting documented evidence has been made available.
- Fiscal measures. Taxation should be used to encourage desired behaviour. Duty-free concessions for the importation of alternative energy vehicles were also recommended.
- Disaster management. The issue of mass evacuation in Barbados was raised and it was revealed that the Royal Barbados Police Force and the Barbados Transport Board have storm surge evacuation plans for Bridgetown. Further investment in this area is still recommended in terms of vulnerability reduction.
- Climate change adaptation. Given the importance of international transportation to Barbados' economy the government has to be mindful of

how vulnerable this sector can be to climate change. Due to various health and terrorists threats that international transportation faces, governments are becoming proactive and are seeking to strengthen their adaptive capacity. This same approach is needed with climate change. ECLAC (2011) outlines key factors for adaptive capacity in international transportation in small island countries. For Barbados, climate change adaptation measures need to be reviewed for the air and seaports as well as the two main coastal highways giving access to Bridgetown.

- Partnerships. Stakeholders opined that public-private-partnerships should be harnessed to play a significant role in the greening process because of the benefits these collaborations could engender. Public-private partnerships can also aid in addressing the need for more research and development and training for entrepreneurs.

3.4.4 POTENTIAL RETURNS IN TERMS OF ECONOMIC GROWTH, DEVELOPMENT AND POVERTY REDUCTION

Worldwide, countries rely on various modes of transportation (cars, trucks, trains, boats and planes) to facilitate economic growth and development. These transportation modes play a pivotal role in all aspects of human activity (employment, labour, manufacturing, agriculture, building/construction and the delivery of goods and services). Indeed, housing patterns within cities, states and countries

TABLE 41. IMPACTS OF THE TRANSPORT SECTOR ON SUSTAINABILITY

Economic impacts	Social impacts	Environment impacts
Traffic congestion	Mobility disadvantaged	Air and water pollution
Mobility barriers	Human health impacts	Habitat loss
Accident damages	Community interaction	Hydrologic impacts
Facility costs	Community liveability	Depletion of non-renewable resources
Consumer costs		
National fuel costs		

Source: Litman and Burwell (2006)

TABLE 42. ASSESSMENT OF OPPORTUNITIES IN GREENING THE TRANSPORT SECTOR

Opportunity	Frequency of success (1)	Effectiveness (2)	Ranking of importance (3)=(1)*(2)
Green vehicles	7	7	49
On-street parking charges	8	7	56
Integrated approach to public transport	7	9	63
Carpooling policy	3	7	21
Incorporation of pedestrian and bicycle systems	3	7	21
Standards for fuel mixes	7	8	56
Use of separators by government garages/workshops	7	6	42
Recycling scrap metal from workshops	7	7	49
Greater recycling in road construction	7	7	49

Source: Stakeholder discussions and authors' analysis

are shaped by the transportation systems that serve them. However, dependence on the traditional transport modes, which tend to be vehicle-centred, has created several economic, social and environmental issues, as summarized in Table 41.

The transport industry is now commonly regarded in many countries as a significant contributor to GHG emissions. On a global level, the transport industry accounts for 24 per cent of the CO₂ emissions and two-thirds of transport emissions are from the member countries of the OECD (UN, 2007). Increased use of the automobile not only contributes to GHG emissions, but it also exacerbates traffic congestion, which imposes significant economic costs on individuals, businesses and taxpayers. In the Netherlands, for example, it is estimated that

0.5 per cent of the GDP is spent every year on congestion and associated delays. Low employee productivity is another issue associated with traffic congestion, given that a considerable amount of time is spent commuting and in traffic jams.

Given the challenges and investment gaps discussed earlier, there exists an opportunity to green the transportation sector by pursuing an integrated approach to public transport (Table 42), an approach that takes into account all the contributing elements in order to increase effectiveness. In this regard, policymakers should take into consideration demand management, behavioural change, safety, different modes of transport, involving stakeholders in the planning process, sequencing of public works, affordability and the interaction between the

box 6 BEST PRACTICE SUSTAINABLE TRANSPORT – ENABLING ENTREPRENEURIAL INNOVATION TOWARDS SOLAR TECHNOLOGY DEVELOPMENT IN A SMALL ECONOMY

Sustainable transport is a key element to supporting sustainable development since this industry is responsible for up to 30% of fossil fuel use in many developing countries. While these fossil fuels have buoyed the development of many oil-producing countries, this is not the only story. Over the past 100 years or more fossil fuels have triggered global expansion in the production and use of electricity and in so doing fuelled the development of most of the critical technologies, which have transformed our world beyond the imagination of global citizens living at the beginning of the last century. Yet this energy source is now considered to be the principle threat to our climate, through the emission of GHGs.

Small Island Developing States (SIDS) such as Barbados are among the most vulnerable to the sea level rise, which is anticipated if Green House Gases continue to be emitted at the same levels. As an emerging green economy, it is therefore imperative that Barbados must secure or develop new technologies that use more renewable energy, or alternatively, ensure that we can use our fossil resources more efficiently.

In the Financial Statement and Budgetary Proposals of 2008 presented by the Prime Minister and Minister of Finance on Monday, 7 July 2008, a number of policy interventions in support of renewable energy were proposed. With respect to its transport, it was noted that:

“Government will also lead the way in retrofitting its buildings and facilities, and in revamping its fleet of vehicles in as feasible and economical a manner as possible in order to conserve its own use of energy, particularly of fossil fuel energy.”

Additionally, as with many other areas that are deemed to be

important in Barbados’ achievement of sustainable development, the **Barbados Sustainable Development Policy** speaks to the issue of transport, addressing the need to reduce environmental damage associated with various aspects of the transportation sector, whilst ensuring that its valuable economic and social contributions are not undermined. Within the context of these broader goals however, the policy has identified specific recommendations that will place a special emphasis on improving the efficiency and reliability of the public transport system. Significantly, the policy speaks to:

- Developing appropriate economic instruments/incentives, legislation and regulations which ensure the successful implementation of policy objectives and programmes developed to facilitate energy efficiency in the transport sector, and improved air quality in general;
- Promoting energy efficiency in the transport sector including giving consideration to the feasibility of using electric cars as well as inter alia Liquid Petroleum Gas (LPG), Compressed Natural Gas (CNG) and hydrogen-powered vehicles whilst ensuring the provision of facilities for efficient on-going maintenance of these vehicles;
- Developing, introducing and using appropriate scientific technologies and practices with a view to improving the efficiency of the transport sector and its sustainability, in particular with regards to maintaining a clean and safe environment.”

In an attempt to offer transportation options that will equal existing automotive technologies, the Solar Transport Project Inc. was started in 2003 with funding from the Barbados Small Business Venture Capital Inc. to demonstrate commercial applications for solar

vehicles in Barbados and other small island states. Utilising a combination of imported electric vehicle technology and Barbadian solar know-how, two 10-passenger vehicles were put on the road in 2005 and offered tours of the city and special functions. Between 2005 and 2010, several thousand persons were given tours of the historic city of Bridgetown.



Electric trams specified and designed during the Harrison’s Detailed Design Project for use in the environmental sensitive Harrison’s Cave. Photo: Anne Gonzalez

The Solar Transport Project

Inc. has also embarked on a campaign making Barbados’ capital, Bridgetown, a solar urban centre with a focus on sustainable transport. In 2009, the company was invited to showcase its vehicle to the neighbouring small island state of Trinidad and Tobago to transport delegates at the Commonwealth Heads of Government Meeting.

The company has also designed a solar golf-cart/neighbourhood vehicle and is current developing partnership frameworks to encourage private sector investment to support its deployment. The vision is to develop a solar vehicle to replace 5 per cent of the transportation in Barbados over a 20-year period and transfer such technologies to other SIDS.

transport network and land use. Taking such an approach avoids creating even more problems when trying to address a single problem.

Greener vehicles are those modes of transportation that has less harmful effects on the environment relative to traditional (internal combustion engine). These include hybrids, electric, ethanol, hydrogen, natural gas, and biodiesel. There are only few hybrids sold in Barbados at present, the most popular being the Toyota Prius ®. There have been demonstration projects in relation to natural gas vehicles and biodiesel, but these are not widespread. In addition, the Harrison's Cave (a popular tourist attraction) has built and operated its own electric fleet for undertaking tours. There are a number of critical factors to consider in transitioning to more environmentally friendly vehicles including the potential burden on the electricity grid and on agriculture for the production of biofuels. At a basic level, policy could focus on increasing the penetration rate for fuel-efficient vehicles by reducing the duty on cars with a lower engine displacement and weight, while raising the duty on cars with a high engine displacement and weight.

Fuel mixes impact on engine performance and, concomitantly, fuel efficiency. A potential opportunity therefore exists in relation to setting standards for fuels that focuses not just on environmental standards, but also on quality and performance. This would include such factors as octane rating, distillation characteristics, vapour pressure, sulphur content, oxidation stability and corrosion protection.

High levels of congestion are exacerbated in Bridgetown where the roads are narrow, on-street parking is often practised, and there are limited off-street parking facilities. Recommendations to address this situation include applying on-street parking charges and better regularisation of length-of-stay permits. Though there has been increased

policing of on-street parking practices in recent years, the situation remains challenging. Efforts to address the on-street parking situation included a project for the introduction of parking metres a few years ago. However, the metres were purchased but never utilised because of unforeseen administrative challenges.

In its efforts to relieve congestion, the government's investment needs to be quantified. To date, measures have focused on traffic management and associated engineering fixes. They include establishment of a traffic control centre, upgrading of a section of the Adams-Barrow-Cummins (ABC) Highway from two to four lanes, upgrading of the Bridgetown Bypass Road, construction of additional roundabouts, and several junction improvements in critical areas. These traditional engineering approaches, however, tend to favour increased motor vehicle travel (Litman, 2006). This, of course, runs counter to strategies associated with sustainable transportation that seek to reduce trips generated by automobile travel and to diversify travel options.

3.4.5 POTENTIAL FOR GREEN JOBS CREATION AND TRANSMIGRATION

Efforts to green the transportation sector lead to the creation of green jobs. This is particularly the case in the area of providing affordable and reliable public transport options. This takes place in the context of a very significant industry, in general. Statistics indicate that there is an estimated 1.6 million jobs in the public transport sector in North America and the EU (UITP, 2011).⁶⁰ Within this context, green jobs have emerged for managing public transport services; manufacturing of fuel efficient, low-emission vehicles; retrofitting diesel vehicles to low-emission vehicles; developing

TABLE 43. PROGRESS AND POTENTIAL OF GREEN JOBS

Area	Greening potential	Green job progress to-date	Long-term green job potential
Fuel efficient cars	Fair to Good	Limited	Good
Public transport	Excellent	Limited	Excellent
Rail	Excellent	Negative	Excellent
Aviation	Limited	Limited	Limited

Source: Adapted from UNEP, 2008.

alternative energy vehicles; and producing and maintaining infrastructure. There are also substantial green employment opportunities in retrofitting diesel omnibuses to reduce air pollutants, and in substituting cleaner compressed natural gas (CNG) or hybrid-electric omnibuses. The same researchers estimated the potential of green jobs in the transport industry globally and their growth prospects, both of which are indicated in Table 4.3.

It is anticipated that, in Barbados, opportunities for green jobs would centre, primarily, around the provision and maintenance of fuel-efficient vehicles, and the management of an integrated public transportation system. A more specific analysis of a desirable system is limited due to the absence of detailed studies that point to the most appropriate mix of green modes of transport for the Barbadian context.

The avoid-shift-improve strategy can be an important approach to overcoming traditional transport challenges (UNEP, 2001). The avoid component of the strategy involves decreasing the number of trips. This would entail blending both land use and transportation planning, integrating telecommunication technologies into public transport and localising production and consumption. The second component of the strategy seeks to create a shift from unsustainable modes of transportation to environmentally friendly modes such as public transport, walking and cycling. The final component involves improving vehicle and fuel technologies that subsequently lead to a reduction in GHG emissions and use of natural resources. Adequate funding, however, is needed to accomplish the goals of the avoid-shift-improve strategy. In the face of often limited availability of funding for greening the transport industry, one recommendation is for the traditional financing framework to be reformed so that:

- Funding is available to all aspects of greening transportation – technology, capacity building, operations and infrastructure (see Annex 2 for a discussion of the solar transport).
- Investments are made in sustainable transport modes rather than unsustainable modes.
- Public funding is accessible at the international, national and local levels for investments in greening transport.
- Private finance is leveraged, through the appropriate design of markets and the creation of consistent, long-term incentives to invest in greening transport, and through the application of public-private sector models of collaborative

effort to invest in and operate greening transport systems (such as Bus Rapid Transit (BRT)⁶¹ systems).

- Financing flows from different sources are designed to complement each other, rather than work towards different goals (UNEP, 2011).⁶²

In Barbados, the potential for jobs within a greener transportation sector will rest primarily on technology transfer and the development of opportunities for the retooling of technicians and managers.

3.4.6 POTENTIAL FOR ENVIRONMENTAL IMPROVEMENT

The transportation sector is perceived as consisting of various modes of transport – private and public vehicles, including bicycles, cars, lorries, omnibuses, among others, along with roads, trails, sidewalks and fuels for motorised vehicles. The introduction of alternative fuel vehicles carries the environmental benefit of lower emissions and fewer toxic contaminants than gasoline and diesel vehicles. As a result, alternative fuel vehicles reduce impacts on air quality, global warming, the environment and public health.

With regard to water management, there is a thriving trade in car washing services. However, it is not thought likely that this effluent makes a major impact on potable water quality or contributes significantly to the volume of wastewater, even though it would make some contribution to the level of pollution of wastewater through its content of detergents and transport of particulates washed from vehicles. There are also garages and vehicle servicing undertakings and these would have more of an impact due to the nature of their business activities. The impacts are associated with stormwater run-off from these premises and the potential for the transport of effluent and particulate waste products generated. They have the potential to negatively impact on water quality and to contaminate the groundwater environment. Just how serious a problem this is it is not possible to determine with the information available.

Roads are usually designed to accommodate stormwater and to keep it off the roadway. In Barbados, the most common form of handling this is via suck wells and direct filtration into the subsoil. An unexplored issue relates to the extent to which



Traditional gabion technology used for road stabilisation programmes in the Scotland District. Photo: Anne Gonzalez

stormwater run-off from road surfaces actuates and transports oils, greases and particulate matter (i.e. from brake pads) into suck wells. Such has the potential for contaminating groundwater.

Road construction activity, whether of new roads or the maintenance and upgrading of existing roads is an on-going activity. These activities give rise to construction and demolition waste. Efforts should be made to ensure that such material is reused in construction rather than being transferred to landfill sites. The Ministry of Transport and Works is already practising this. The disposal of construction waste in the landfill adds to the carbon footprint of the construction and demolition waste. Similarly, vehicle repair and service centres generate waste from used products such as batteries, tyres, automotive oils, brake fluids and derelict vehicles. Almost all of this can be classified as special waste and requires careful management even though most of it can be recycled rather than disposed in the landfill.

Greening transportation system seeks to utilise the existing vehicular infrastructure. This augurs well for Barbados, which has limited land resources. In this context, the limited expansion of existing roadways and a shift from the automobile as the main mode of transport has huge potential for improving the environment.

There are significant health and community benefits to be realised from the introduction of non-motorised modes of transport as part of a greener transportation mix for Barbados. Recent studies have revealed that more than 50 per cent of the adult population is overweight or obese. More than 50 per cent of working adults get no exercise apart for moving to and from work.⁶³ Both overweight/obesity and inactivity are risk factors for chronic diseases. The government's spending on health in 2012 was over ten times higher than spending on health in 1976, growing from over BBD 35 million to over BBD 405 million. Most of this spending is on the treatment of chronic diseases, which have progressed to epidemic proportions over the last 30 years. A greener transport industry that aggressively incorporates non-motorised modes of transport could play a role in tackling this epidemic as it lures commuters into practising healthier living through greater physical activity, thereby augmenting curative and preventive programmes in this high-risk health area of the Barbadian population.

3.4.7 CONCLUSIONS

The stakeholders' vision for greening the transport industry reflects a desire to reduce the island's dependence on fossil fuels, without significantly increasing the cost of transportation. This vision is largely consistent with the national definition of green economy and therefore provides some validation for greening the transport industry. Given the importance of transportation, both direct and indirect, it is important that efforts to green the industry are not made at the cost of economic activity. It is expected that greening the industry would involve some reduction in the use of private vehicles and an expanded role for public transit options, mode switching; infrastructure for pedestrians and cyclists, reduced vehicle emissions, as well as the development of guidelines for the recycling, recovery and reuse of old vehicles and their components.

The introduction of green approaches would yield environmental benefits associated with a lower level of emissions and discharge of fewer toxic contaminants into the environment than as obtains with the current reliance on gasoline and diesel vehicles. It is anticipated, therefore, that the use of alternative fuel vehicles would reduce negative impacts on air quality, the physical environment, water quality, public health and the economy as a

whole, and would increase Barbados' contribution to the reduction of global warming. Further research should assess the cost of retrofitting/greening the existing bus fleet, design and implement a mode-switching programme, develop a master plan that guides the use and integration of a non-motorised mode of transportation, conduct a cost-benefit analysis of alternative fuel options for the transport industry, develop government incentives to encourage research and development and the development of climate change adaptation plans for the air and seaports.

3.4.8 SUMMARY

Barbados road network consists of more than 1,600 km of paved public roads, two active main ports (the Bridgetown Port and Port St Charles) and one airport (the Grantley Adams International Airport). According to the statistics of the Barbados Licensing Authority, the vehicle stock for island stood at 131,680 in 2009, which implies that there is approximately 1 vehicle for every two persons on the island. Barbados is ranked 12th globally for road accident victims per 100,000 people, and 23rd globally for actual road fatalities per 100,000 people, a position shared with the Estonia, Georgia, Greece, Tunisia and the United States. There are three bus services operating on the island – two are privately owned. The industry is characterised by low levels of service and congestion.

The transport industry consumes 33 per cent of all the fuel imported. Water consumption in the transportation sector is primarily for new road construction and road improvement projects. Some water is also used for irrigation of landscaped areas within large roundabouts along the ABC Highway. With regard to flooding resulting from road construction, the Drainage Division of the Ministry of the Environment and Drainage along with the Town and Country Development Planning Office (TCDPO) are the agencies responsible for devising and implementing mitigation measures. However, inconsistency in planning and enforcement on the part of the TCDPO results in persistent challenges with flooding being faced in high rainfall areas, especially during the wet season.

The Ministry of Transportation and Works (MTW) has been using a number of methods to measure the waste generated by the transport industry. These include use of a separator, recycling and reuse. Moreover, there is inadequate land space to

integrate pedestrian and bicycle mobility systems – sidewalks, trails, paths, and other amenities – into most existing residential communities and employment centres. Furthermore, the main causes of air pollution are the fuel mixes used by some vehicles and the absence of equipment to enforce a national air emissions standard. Noise pollution by vehicles is also a matter of concern but, as with air quality, enforcement of a national standard is being stymied. The Environmental Protection Department, the government department responsible for setting national standards to mitigate air and noise pollution, relies on standards produced by international organizations, but its work lacks efficacy for the aforementioned reason.

Greening the transport industry should address existing issues in relation to emissions without harming economic activity. Furthermore, greening transportation systems require the integration of sustainable transportation policy into the overall planning process for the industry. Sustainable transportation systems, therefore, attempt to reduce the role of private vehicles as the main mode of transport; promote and improve existing public transit; introduce mode switching; utilise existing vehicular infrastructure; build comprehensive infrastructure for pedestrians and cyclists; seek to reduce vehicle emissions through enforcement of standards and by facilitating the switch to greener vehicles; and contribute to the development of guidelines for the recycling, recovery and reuse of old vehicles and their components.

The main challenges identified in relation to a green vision for transportation outlined above include traffic congestion, high fuel costs, limited public awareness of green initiatives, finance for investment and human resource capacity. The retraining and retooling of workers to take up jobs in retrofitting and maintenance of green vehicles will involve technology transfer and capital expenditure. The vulnerability of the transportation system is another challenge and is heightened by the reality that the two main coastal highways are barely above sea level. To address these challenges, therefore, further investment will be required in relation to air and noise pollution standards, traffic management, mode mixing, disaster management and climate change adaptation. It is believed that the provision of fiscal incentives and development of public-private partnerships within the transport sector would contribute significantly to the successful realisation of the espoused vision.

Another opportunity to green the transportation industry presents itself through the pursuit of an



St Lawrence Gap in the South of Barbados – Building pedestrian infrastructure is one aspect of greening the transport sector.
Photo: Anne Gonzalez

integrated transport strategy, an approach that takes into account all the contributing elements to increasing effectiveness. For instance, in order to reduce the number of vehicles on the road, there will be a need to enhance the quality and quantity of public transport. The greater utilisation of public transport will, in turn, reduce congestion and so the fuel import bill of the island will be lowered.

Furthermore, since fuel mixes impact engine performance, and, concomitantly, fuel efficiency, potential exists for setting standards for fuels that focus not just on environmental standards, but also on quality and performance. Congestion within Bridgetown is caused by on-street parking due to limited off-street parking facilities. In this regard a system of on-street parking charges and regularisation of length-of-stay permits should be considered as measures to address the problem as well as to finance initiatives aimed at greening transportation.

In Barbados, it is anticipated that opportunities for green jobs would centre, primarily, on the sale and maintenance of fuel-efficient vehicles, and the management of an integrated public transportation system. A more specific analysis

of a desirable system is limited by the absence of detailed studies that point to the most appropriate mix of green modes of transport for the Barbadian context. In relation to road construction activity, the construction and demolition waste generated can be used to reclaim quarries and/or be reused in the construction process, itself.

The transportation sector consists of various modes of transport – private and public vehicles, including bicycles, cars, lorries, and omnibuses, among others, along with roads, trails, sidewalks and fuels for motorised vehicles. The introduction of green approaches would yield, among others, environmental benefits associated with a lower level of emissions and discharge of fewer toxic contaminants into the environment than as obtains with the current reliance on gasoline and diesel vehicles. It is anticipated, therefore, that the use of alternative fuel vehicles would reduce negative impacts on air quality, the physical environment, water quality, public health and the economy as a whole, and would increase Barbados' contribution to the reduction of global warming.

KEY MESSAGES

For the Caribbean, the most tourism dependent region in the world, sustainability or greening is no longer an option but an imperative.

The stakeholders' vision for greening the tourism industry reflects a desire to build a sustainable product that has forward and backward linkages with other sectors in the economy and embedded within the community.

There is need for a business model that speaks to sustainable agro-tourism as well as internationally recognised standards for agricultural products. Having these two initiatives will provide farmers and other producers with access to local and international markets.

There are opportunities for savings through energy and resource efficiency in the hotel sector (average potential electricity savings near 40 per cent of total hotels' consumption).

Focused policy and financial interventions are required to create sustainable agro-based and cultural-heritage tourism models.



Crane Beach on the East coast. Photo: Ken Uyeda/Blackbird Design/Calgary Canada

3.5.1 BACKGROUND

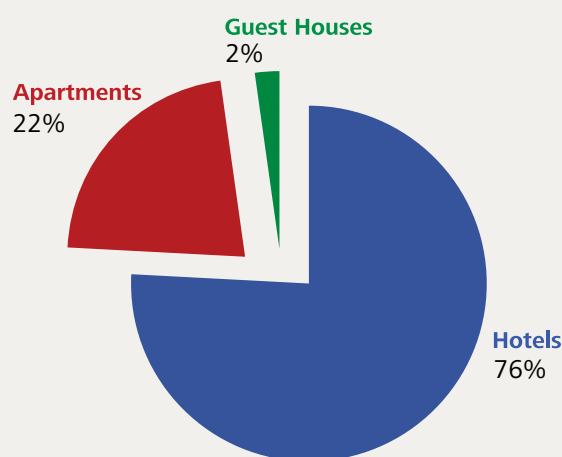
Barbados is one of the more mature Caribbean tourist destinations with large-scale tourism dating back to the late 50's and early 60's. In the earlier stages of the tourism product cycle, Barbados could be classified as offering a sun, sea and sand product. However, over the years, the various entities responsible for tourism product development specifically, the Ministry of Tourism (MOT) and the Barbados Tourism Authority (BTA), have worked very hard to diversify the product into more competitive niche offerings such as sports tourism, heritage tourism, gastronomy tourism and, more recently, health and wellness tourism. Tourism generates activity in numerous industries such as wholesale and retail, transportation and communications and construction to name a few. However, the direct contribution is usually assessed via the total value-added generated by hotels and restaurants. In 2010, the total value-added generated by hotels and restaurants were US\$ 553.7 million or approximately 15.1 per cent of GDP.

The current global economic recession has significantly affected tourist arrivals to the island. However, the industry is beginning to show signs of recovery. In 2010, stay-over arrivals were estimated at 532,180 or about 2.6 per cent higher than in 2009. Cruise arrivals also reported moderate growth,

with total arrivals in 2010 estimated at 664,747 or about 4.6 per cent higher than one-year prior. Since the early 1990s, the UK market has been the main source of stay-over visitor arrivals to the island, accounting for between 30 and 40 per cent of overall visitor arrivals. In recent years the UK market has struggled. In 2010, for example, arrivals from this market fell from 190,632 to 181,054, the third consecutive decline in arrivals from this source market. The outcome in 2010 was worsened by snowstorms and the eruption of an Icelandic volcano, which resulted in a loss of airlift during the peak tourist season (December – April). The situation was compounded by reduced seat capacity to the island owing to the loss of the British Midland Airways Ltd. service. Most of the remainder of stay-over arrivals come from the USA and Canada. Unlike the British market, arrivals from the US and Canada have been quite robust in recent years. In 2010, stay-over arrivals from the US and Canada rose by 10.4 and 13.5 per cent, respectively. The growth in the US market has been supported by additional airlift capacity owing to the additional service provided by JetBlue Airways, which began flying to the island in October 2009 (CBB, 2009).

Recognising that two of these three main markets have been severely affected by unemployment and uncertainty, the Barbados Tourism Authority (BTA) has ramped up its marketing in the Caribbean, which is now its third largest tourist market,

FIGURE 15. NUMBER OF ROOMS AT VARIOUS ACCOMMODATION ESTABLISHMENTS



specifically, Trinidad and Tobago. This market has shown significant growth, which is largely attributable to the entry of REDjet Airline on this route and the marketing efforts of the BTA. In addition, the MOT and the BTA have worked hard to develop air links between Barbados and Brazil that holds much promise through solidifying a business relationship with GOL Airline. The Ministry of Tourism reports that this diversification strategy is bearing fruit as Barbados has seen some growth in arrivals from the Brazilian market.

Total visitor expenditure in 2010 was estimated at US\$ 1.2 billion or about 6.3 per cent higher than in 2009. In terms of average daily expenditure, stay-over visitors from the UK and Western European countries tend to be higher than any other region (US\$ 217 per day compared to US\$ 195 per day for all other visitors). Moreover, visitors from Canada and the UK tend to take a longer holiday on the island than visitors from other places – the average length of stay for visitors from these two source markets is 13 days (Wright, Burgess, Peter, Lescott, Skinner, & Agard, 2011).

Hotels supply most of the available accommodation on the island (Figure 15). Average room occupancy in 2010 was about 56 per cent, or 1 percentage point higher than in 2009. It is, however, important to note that the quarterly averages often vary significantly from the annual average. During the first and fourth quarters of 2010, the average room occupancy was about 61 per cent, while in the second and third quarters it was just about 51 per cent (CTO, 2010).

Although growth has been positive, caution needs to be taken in terms of carrying capacity. To date very few Caribbean islands, including Barbados,

have actually undertaken a study to ascertain how many tourists the natural and social environment can accommodate without causing significant and irreparable damage and loss. The development and long-term prosperity of the tourism industry depends on continual accessibility to pristine, natural and cultural resources, yet it is these same resources that are affected most by overexploitation and degradation (Dodds, Graci, & Holmes, 2010).

Currently, this sector receives support from a number of public as well as private national organizations, including the Ministry of Tourism, the Barbados Tourism Authority (BTA) and Barbados Tourism Investment Inc. (BTI) in the public sector, and the Barbados Hotel and Tourism Association (BHTA) and the Tourism Development Corporation in the private sector. These organizations have developed over the years to address specific needs associated with furthering the evolution of the sector. According to a publication of the Caribbean Tourism Organization (CTO), a regional tourism association, these institutions budgeted US\$ 22.1 million in 2006 to promote the country in various regions across the world (CERMES, 2009).

The current policy framework directly governing tourism development in Barbados is premised upon two documents: The Green Paper on the Sustainable Development of Tourism in Barbados – A Policy framework (MoT, 2001); and, the Tourism Development Act, 2002-07. The Green Paper is the successor to the draft Barbados National Tourism Policy (1997) and is the de facto document that provides guidelines, parameters and objectives that would guide tourism development in Barbados. According to the Green Paper, its main objective (MoT 2001, p. 30) is “to pursue sustainable tourism development through improvement and optimal use of human resources, services and technology, and through the conservation and managed use of our sociocultural, built and natural resources, in order to ensure a product of the highest quality whilst enhancing the quality of life of our people and furthering the economic development of Barbados.”

This policy has a total of nineteen specific objectives along the lines of awareness, human resources, organizational structure, standards, contribution to the economy, investment, marketing, community involvement, services, accommodation, the built environment, the natural environment, cultural heritage, land use, intersectoral linkages, technology, safety and security, airlift and cruise tourism (MoT, 2001). The presence of such a policy document suggest that consecutive governments in

TABLE 44. INITIATIVES AIMED AT ENABLING DEVELOPMENT OF SUSTAINABLE TOURISM

Legislation	Support provided
Tourism Development Act	Investors in tourism projects can write off capital expenditure and 150% of interest
	Duty-free importation of building materials and equipment during construction and rehabilitation
	Duty-free importation of supplies for refurbishment of hotels, restaurants, villas and sports and recreational facilities for tourism purposes
	Extended tax holidays/write-offs of capital expenditure and accelerated write-off of interest
	Investors in a tourism project can write-off 150% of the expenditure incurred to train staff
	Investors in a tourism project can write-off 150% of the expenditure incurred to market the venture
	Investors in a tourism project can write-off 150% of the expenditure incurred in the area of product development, tourism research, provision of an apprenticeship scheme, the organization and hosting of tourism exhibitions and trade fairs or development of nature trails and community tourism
	Investors in a tourism project can write-off 20% of the capital cost of the installation of a wastewater disposal system
Special Development Areas Act (applies to Carlisle Bay Redevelopment Area, Speightstown, St. Lawrence Gap and the Scotland District Conservation Area)	Exemption from income tax on interest earned on a loan made to an approved developer to finance any development work
	Income tax at a reduced rate
	Initial and annual allowances on an industrial building at 40% and 6%, respectively
	Initial and annual allowances on a commercial building at 20% and 4%, respectively
	Exemption from import duties and value-added tax on inputs for the construction of new buildings or refurbishment of existing buildings
	Exemption from charges on the repatriation of interest or capital for a period of 10 years
	Exemption from land tax on the improved value of the land
	Exemption from property transfer tax payable by vendors on the initial purchase of the property

Source: Barbados Tourism Investment Inc.

Barbados recognise the need for proper planning if the industry is to be sustainable.

The Tourism Development Act, Cap.341 (TDA) as the principal statute governing tourism in Barbados can be regarded as a primary instrument in assisting the sector in contributing towards Barbados being a green economy (see Table 44). Unlike the Hotel Aids Act (which it replaced) the TDA offers concessions not only to hotel owners and operators but also to operators of restaurants, attractions, sport and recreational facilities and any other project, which the Minister of Tourism deems to be tourism project. This is a notable change as it allows for greater competitiveness of the ancillary services that are crucial to a destination's attractiveness.

Two other policy initiatives are worthy of brief discussion, namely the White Paper on Tourism Development in Barbados and the Tourism Master Plan - both of which recognises the need for policy and practice to guide tourism planning and development and to be responsive to changes in the external and internal environments, to revisit (audit) the management of the resource base- human, natural and built, and to create an environment conducive to business investment and profitability. It is anticipated that these two documents will have a significant impact upon the tourism sector's participation in transitioning Barbados to a green economy. The White Paper will be a statement of Government's policy on tourism development over the medium to long term. The Paper will serve as

TABLE 45. IMPACTS ASSOCIATED WITH TOURISM DEVELOPMENT

Dimension	Possible positive impacts	Possible negative impacts
Socioeconomic	Employment creation, revitalization of culture, inter-cultural understanding, improvements in social/community organization, cultural conservation	Overcrowding of public spaces, commoditization of culture, acculturation, residents denied access, social problems (e.g., crime, prostitution and gambling)
Environmental	Protection and management of the natural environment, potential to raise revenue for environmental initiatives (e.g., recycling, site beautification)	Disruption of flora and fauna species; acceleration of climate change; substantial carbon footprint; introduction of non-native species; adverse effects on water quantity, quality and use; breached environmental carrying capacity; pollution – air, water, architecture
Economic	Increases foreign exchange and government revenue, employment, fosters inter-sectoral linkages and entrepreneurship, produces multipliers, assists in the development of remote areas	Displacement of industries, overwhelming dependence on tourism, leakages, inflation of prices, limited access to land, vertical integration, increased propensity to import, employment seasonality

Source: Adapted and modified from Swarbrooke (1999) and Liburd & Edwards (2010).

the overall policy framework within which the Master Plan (2012-2022) will be elaborated.

It should be noted that the White Paper has had significant and extensive input from the residents of Barbados and tourism stakeholders so that the final document would be reflective of their concerns while elaborating broad strategies to maximize positive impacts and minimize negative ones. To this end, it is anticipated that issues and mechanisms relating to resource efficiency, inter and intra generational equity, quality and standards, climate change and environmental sustainability, investment climate, human resource development, access, intersectoral linkages, disaster risk reduction, etc., will be priority issues of the White Paper.

From the late 1980s, the global tourism industry has been confronted with the need to mainstream the issue of sustainability into their planning and operations. This is due not only to the emergence and promulgation of the concept of sustainable tourism development but also to the fact that travel and tourism industry has shown exponential growth over the last six decades and is predicted to reach 1.6 billion by 2012 (UNWTO, 2010). The extant tourism literature suggests that increases in travel and tourism have seen concomitant changes in prosperity levels for many countries but also negative impacts — social, cultural, economic and environmental — when tourism is not well planned and managed. Among them are pollution, depleted natural resources, erosion, displacement of residents, inflation, excessive foreign ownership, loss of culture,

cultural commodification, leakages, and extensive changes in societal norms, just to name a few.

Managing and mitigating the negative impacts of tourism development appear to be more urgent for tourism-dependent small island developing states (SIDS), many of which are dominated by small, locally-owned tourism enterprises that often do not have the knowledge or capital to green their operations (Revell & Rutherford, 2003). SIDS are also highly susceptible to a number of risks that make them more vulnerable than some of their larger competitors. The risks range from economic to environmental and these, if not well managed, can have a deleterious effect on the socioeconomic fabric of many islands. The environmental risks include natural disasters, sea level rise, tsunamis, earthquakes and poor waste management, among others (see Table 45 for a list of possible impacts).

The industry's response at a global level to these wide ranging negative impacts has been the promotion of sustainable tourism development, as enunciated by the Rio Earth Summit in 1992. There, it was decided that tourism would be one of the five industries to pursue sustainable development due to the great disparities that arise between its benefits and its detriments. A variety of tools were developed which would aid in the achievement of sustainability. These include awareness creation policy documents, methodological guidelines, planning, management principles and techniques, as well as monitoring instruments.

At its most fundamental level, sustainable tourism development requires that attention be paid to the “integratedness” of the system, so that environmental, social, cultural and economic issues are given equal treatment in strategic decision-making. Thus, the end result of this approach to doing business should be preservation, conservation, improved quality of life and long-term national prosperity (Liburd & Edwards, 2010). This concept is closely associated to the concept of greening tourism outlined in UNEP and WTO (2011). The concepts are, however, quite different from eco-tourism, which is a segment of the overall tourism product that focuses on environmental sustainability while sustainable tourism applies to the entire product.

For the Caribbean, the most tourism dependent region in the world, sustainability or greening is no longer an option but an imperative. The industry faces a virtual smorgasbord of challenges such as climate change, food security, increasing levels of crime, and trans-border threats, competition from new and emerging destinations, changing consumer tastes, the introduction of the Airline Passenger Duty (APD), the growing popularity of cruises, transportation challenges, vulnerabilities to natural disasters, increase in the prevalence of HIV/AIDS, and currently the onslaught of the global economic crisis.

In recognition of the need to minimize the negative impacts related to tourism development, and to increase sustainability and competitiveness, the Caribbean Regional Sustainable Tourism Development Programme (CRSTDP) developed a Regional Policy Framework for a more Sustainable Tourism Development in the Caribbean in 2007. This framework is intended to be flexible in nature in that it can be adapted to suit the needs of each member country. The policy framework outlines six thematic areas that are critical to the sustainability of Caribbean tourism – tourism management capacity; marketing; transportation; the environment; linkages between tourism and other economic sectors of the economy; and health, safety and security (CRSTDP, 2007). Using this document as a guide, Caribbean destinations have an opportunity to work as sovereign states and as a regional bloc to strengthen the viability of Caribbean tourism.

3.5.2 RESOURCE USE AND EFFICIENCY MEASURES

Water use in hotels is determined as much by the facilities offered by a hotel and the market it operates in, as by its occupancy rate and, by extension, the volume of wastewater that it generates (Charara, Cashman, Bonnell, & Gehr, 2011). Based on a 2009 survey of 14 hotels (1,585 rooms and representing 29 per cent of the establishments with 20 or more rooms) the average consumption was 839 litres per guest per night with a range of between 323 – 1,220 litres per guest per night depending on the size of hotel (Charara, Cashman, Bonnell, & Gehr, 2011). It has also been shown that factors such as the level of awareness of staff and management about resource management and use efficiency are important. Research indicates that hotel management often does little to monitor the level of resource usage when the cost of those resources is relatively cheap, and where any restrictions on use are perceived as potentially having an adverse impact on guest experience.



Visitors sampling local fare on the Sturges Community Nature and Food Trail. Photo: Travis Sinckler

Certification schemes for tourist establishments that require management to examine resource usage have been seen as a way of encouraging hotels to become 'greener' in their operation. However, the evidence on whether this achieves the stated purpose is ambiguous but would seem to indicate that the usefulness is more in branding and marketing than anything else. This could be indicating that rewards in the form of tax breaks would need to be tailored in such a way as to avoid 'game playing'. There is some scope for the use of other economic incentives to improve water use efficiency (Cashman & Moore, 2012), but these would have to be developed in conjunction with the industry.

Hotels in Barbados are required to install rainwater-harvesting systems just as they are to have wastewater handling facilities. Those hotels which are not on the south coast and connected to the municipal sewerage system, and those which have opted for wastewater treatment facilities (these being a minority) usually contract out this operation to service providers. If stricter environmental regulations come into effect and there is no public sewerage system, as is the case on the west coast, then there will be a need for more wastewater treatment facilities. However, the restrictions on the uses that treated wastewater can be put to will also have to be reviewed. Similarly, the restrictions on rainwater uses within hotels will need to be examined, though uses such as toilet flushing will require retrofitting for some hotels.

Barbados' tourism product is quite energy intensive. Most tourists arrive on long-haul flights from Canada, the United States or the United Kingdom,. Even for the cruise tourism segment of the market, there is still a significant fuel dimension to the product. This characteristic implies that the overall attractiveness of the destination is closely correlated with international fuel prices. Domestically, the industry consumes about 17 per cent of the total electricity generated on the island, almost as much as commercial activities and much larger than that going to manufacturing activities.

The GOB joined its regional counterparts in endorsing the Caribbean Hotel Energy Efficiency Action Programme (CHENACT) that ran from 2009 to 2011. The Caribbean Hotel Association (CHA), Caribbean Alliance for Sustainable Tourism (CAST), Caribbean Tourism Organization (CTO) and UNEP were key players along with regional governments in this effort that is receiving financial backing from the IDB. It is a US\$ 2 million programme with the objective of reducing energy usage and costs in

hotels in the Caribbean region by promoting energy efficiency and the use of energy from renewable energy sources. This, in turn, was intended to improve the international competitiveness of the tourism industry through improved energy use.

The programme involved conducting around 50 energy audits of hotels throughout the region (but mainly in Barbados), with three hotels becoming demonstration projects with \$40,000 of RE and EE installed and monitored. The CHENACT programme had five components:

1. Designing the CHENACT Programme and developing an institutional strengthening plan. This component determined the Program's eligibility criteria, guidelines for energy audits, and EE policy and legislation for the tourism sector. Pilot EE measures were implemented in selected hotels on a cost-sharing basis.
2. Assessing the capacity of Energy Services Companies (ESCOs) in the Caribbean. The aim was to measure ESCO's ability to deliver a reliable, competitive and effective service to the tourism sector; and to prepare a strategy to enhance ESCO capabilities.
3. Designing a model for increasing energy efficiency in hotels that could be replicated throughout the region. Assessing financing options to expand the implementation of CHENACT findings.
4. Dissemination of the program's findings.

The findings of the initial audit report indicated significant opportunities for energy efficient savings in the hotel sector (average potential electricity savings near 40 per cent of total hotel's consumption). Some of the results and recommendations divulged so far were:

- That despite the size and age of a property, a hotel can have a low energy efficiency index (kWh per guest per night) through the use of efficiency equipment and good staff practices.
- Many property managers are unaware of the length of time their hot water switches are on for (staff training and/or the installation of mechanical timing devices would quickly rectify this).
- Over-lighting, particularly in newly refurbished hotels.
- Need for routine maintenance of equipment to ensure efficient operation. Electrical circuits are overloaded, solar hot water panels are broken, Air Conditioning (AC) condensers placed in soil and grass or direct sunlight, roofs damaged –

box 7 BEST PRACTICE ENGINEERING COASTAL ECOSYSTEM PROTECTION FOR SUSTAINABLE TOURISM – 28 YEARS OF GREEN TECHNOLOGICAL INTERVENTION, INSTITUTIONAL DEVELOPMENT AND LEGISLATIVE REFORM

The Coastal Zone Management Unit (CZMU), was established in 1996, having evolved from the original Coastal Conservation Project Unit created in 1983. Since 1983, the CZMU has become the preeminent coastal zone management institution in the Caribbean.

The CZMU performs a variety of coastal zone management functions inter alia: coral reef monitoring; updating the inventory of coastal resources; consultations with the Town and Country Development Planning Office regarding the evaluation and assessment of all coastal development; beach erosion and accretion monitoring and control; oceanographic data collection and assessment; exclusive economic zone and continental shelf delimitation; regulation of marine research; public education and outreach in integrated coastal zone management (ICZM); coastal conservation project designs and management; coastal engineering design assessments; and the review of any coastal projects. Given the scope and depth of these activities it is easy to see why the Unit can be credited with being so actively involved in the economic development of the country, throughout its twenty-eight year existence.

The tourism sector, as the largest foreign exchange earner for the island, drives our economy. As a result, Barbados' beaches, coastlines and nearshore waters are intricately connected to the livelihood of the island. As a result, the CZMU is committed to advancing the knowledge, use, development, conservation and management of the coastal zone and its resources, as the Barbados coast is essential to the lives of all Barbadians. To achieve its mandate the CZMU therefore relies on the strong interest and support of the Barbadian public and actively engages the public in appreciating and conserving the fragile coastal resources.

The CZMU has always focused on being a scientific organization with coastal and ocean sciences at the foundation of its work, and this strategy has allowed the Unit to consistently adapt to new challenges facing the island's shoreline over the last ten to fifteen years. Since its establishment, the CZMU has executed several major coastal management projects.

The CZMU is now embarking on the application of climate change adaptation measures and strategies to ensure that coastal resources and national coastal infrastructure (both public and private sector) do not suffer from the potential impacts of increased storm wave inundation – not only during the hurricane season and winter months, but also from the potential threat of increased sea level rise.

This is being achieved through a greater reliance on the use of both numerical and physical modelling, which are being applied to all large-scale coastal development applications. As part of engineering designs being submitted for evaluation, it is necessary to demonstrate the inclusion of considerations for a one (1) metre sea level rise, the increased intensity of hurricane waves and storm waves, the presence of storm surge considerations, and the potential impact that such events can have on not only the property being considered but adjacent properties. Such considerations were followed in the development of the recently completed government projects in the areas of Welches, Rockley/Hastings in Christ Church, and Hometown in St. James. These projects have not only succeeded in providing valuable protection to the coastline but have significantly provided distinct benefits in terms of aesthetic and amenity values in the area which can be enjoyed by nearby tourism enterprises, locals, and tourists.

In 2011, the CZMU embarked upon the next phase of the Barbados Government/IDB funded Coastal Conservation Programme - the Coastal Risk Assessment and Management Programme. The emphasis of this phase is to build on the work of the Unit, together with the integration of coastal vulnerability assessments and risk management within the ICZM framework. The intention of this project is to take Barbados, to the next level in the systematic approach to the effective management of its coastal resources and infrastructure, while taking changing climate into account.

unsuitable for PV systems, roofs inaccessible, old kitchen and laundry equipment, etc.

- Unrepaired water leaks increased water bills by 30-50 per cent.
- Many of the hotels are reading meters but there is little analysis and little knowledge of baselines and benchmarks for these readings.
- Installation of unsuitable CFL's. Understandably managers are now reluctant to spend again.
- More attention being paid to aesthetics (room upgrade) rather than back of house issues".

The opportunities for hotels to improve their resource use efficiency are well documented and many of the strategies have been shown to be cost effective with short payback periods (Cashman, Water Financing Experiences in the Caribbean, 2012). These strategies include:

- Carrying out a resource and energy use audit to identify potential areas of savings;
- Engaging in organizational change. This is important because doing so is often an essential follow-up action to conducting audits, just as it is to setting objectives, implementing recommendations and monitoring and reporting on progress;
- Changing the way the use of resources are regarded by management and staff through training, encouragement and team building;
- Introducing technological change that allows for the introduction of resource efficient equipment, fixtures and fittings, and looking for ways in which operations can be reconfigured to maximise resource use.

Hotels are significant producers of solid waste and as a consequence require regular municipal waste services. A portion of the waste is of an organic nature and other portions of it are potentially recyclable or recoverable. Introducing requirements to sort and separate materials at source would assist with diverting waste at source and it is for this reason that it is proposed that this become a statutory requirement. It would have the associated benefit of increasing the reliability of the supply of source material to recyclers and improving the viability of their operations. Such activities could be made cost neutral to hotels and should be extended to others involved in the tourist trade, such as restaurants.

Land use has changed significantly over the last 40 years. In the pre- and post-independence era, much of the land in the island was assigned to agricultural production. The 1996 Barbados Report

to Habitat II noted that about 46 per cent of land could have been classified as arable land in 1976. Moreover, sugar plantations accounted for 62 per cent of total rateable land and just 1.6 per cent to tourism. By 1995/1996 the estimate of rateable land used for tourism had more than doubled over the period. This level of tourism development had obvious implications on the ecosystem as did the redistribution of land ownership in the island. Future demand for land in tourism will be driven by the growth in sports tourism (e.g., golf, polo, among others). The Physical Development Plan (GOB, 2003) is the key policy instrument guiding tourism development in terms of its spatial distribution and provides a basis for managing potential negative impacts associated with inland tourism. There is also a Coastal Zone Management Unit (CZMU), established in 1996, that attempts to enhance knowledge, use, development, conservation and management of coastal resources.

Given that most tourism developments are located within 2 km of the coastline, these developments have had important impacts on the coastal ecosystem. The effects tend to be related to the clearing of land for construction, and the related supporting transportation infrastructure has resulted in erosion. Indeed, the Barbados Coastal Zone Management Unit was set up to restore beaches and to engage in coastal habitat restoration on the reefs, damaged by activities related to tourism developments and establishments.

Consultations with personnel at the MOT in June 2011 revealed that the TDA allows for concessions on the treatment of wastewater. There was also a recognition that the TDA needs to be revised to include issues related to resource efficiency, specifically water (rainwater usage) and renewable energy, and to in general be a more efficient tool in facilitating economic activity underpinned by sustainable tourism development objectives. In this regard, the Tourism Development Act, Cap.341 and other tourism related regulations are being reviewed to forge greater harmonization with international travel and tourism where possible and to create an enabling regulatory framework for a modern, adaptable and efficient economic sector.

3.5.3 INVESTMENT GAPS

The Travel and Tourism Competitiveness Report (WEF, 2009) suggests that sustainability or “greening” holds great potential for the creation of innovation and economic gain through the combination of the redesign of the financial and industrial world, the modification in the role of institutions and governments and finally embryonic consumer behaviours with regard to water consumption, food production and climate change. Stakeholders also had a similar vision to build a sustainable tourism product with strong forward and backward linkages with other sectors in the economy and community.

The stakeholders’ vision for greening the tourism industry reflects a desire to build a sustainable product that has forward and backward linkages with other sectors in the economy and embedded within the community.

Since the 2009 Tourism Competitiveness Report, the shift towards a greener tourism industry has accelerated immensely (Weaver, 2011). Both global, regional and local organizations and governments have recognized that they need to more aggressively address the issues such as poverty, economic volatility and climate change while preparing for the predictable water, energy and food crisis.

In the same study, Barbados ranks 30th out of 133 countries on the global competitiveness index and 3rd within the Western Hemisphere. This is highly commendable and suggests that the island is well positioned within the global tourism industry. Furthermore, within his index, Barbados was ranked 2nd for government prioritization of travel and tourism; where government spends a high percentage of GDP on the sector in such areas as developing effective destination marketing campaigns and collecting timely and relevant data. The competitiveness index also reveals that Barbados is 1st for “attitude of population toward foreign visitors” and 29th for environmental sustainability (WEF, 2009). Table 46 provides an overview of the main strengths of the island’s tourism product that could be used to explain the islands position in relation to global

competitiveness. The identified strengths suggest that there exist a number of strengths that can be built upon to facilitate green of the industry.

A particular strength of the island is in the area of heritage and community-based tourism. The island has heritage and community resources dating back several centuries that can be readily repacked for visitors to the island. In this regard, the MOT in collaboration with the Barbados Museum and Historical Society has focused attention on the intangible heritage through the development of the Freedom Footprints Tour that highlights the island’s link to slavery and is expected to attract mainly the Barbadian and African diasporas (Barbados Museum and Historical Society, 2011). There is also the Barbados Carolina Connection that had its beginnings in the 1997 twinning of the cities of Speightstown and Charles, South Carolina, in recognition of the strong historical links that exists between the two cities since the 17th century. Since the Twinning Agreement, the two destinations have been engaging in cultural exchanges among other initiatives aimed at strengthening this link. Barbados’ focus on cultural heritage preservation has culminated in having Historic Bridgetown and its Garrison area listed as a UNESCO World Heritage Site. This ascription has enormous social, cultural, environmental and economic value for Barbados but will require substantial training of taxi drivers, tour operators and residents.

The future development of Barbados as a green tourist destination is very much dependent on the ability of the island to overcome a number of key challenges. Of particular note are the potential effects of climate change (Table 47). “Climate change is the mother of all externalities: larger, more complex, and more uncertain than any other environmental problem” (Tol, 2009). The effects of these changes in climatic patterns are pervasive. ECLAC (2011) assessed the economic impact of climate change on tourism, the backbone of Barbados’ economy. The impact was obtained through the forecasts of tourism under different scenarios of climate change.

During the period 2010 to 2050 under an A2 scenario, the island could lose US\$ 3.8 billion in tourism expenditure and US\$ 2.7 billion under the B2 scenario. The authors undertook a cost-benefit analysis for the coral reefs that most likely will suffer a lot under climate change. The present value of coral reefs loss amounted to US\$ 1.3 billion and US\$ 667 million under A2 and B2 scenarios, respectively. Sea level rise would also lead to loss of

TABLE 46. STRENGTHS AND CHALLENGES IN GREENING THE TOURISM SECTOR

Strengths	Challenges
<ul style="list-style-type: none"> • Integrated management and planning at ports of entry • Efficient through flow • Recent major investments in ports of entry • Penetration rate of solar water heaters • Integrated Design and Planning process associated with Harrison's Cave Redevelopment is a model that should be documented and replicated • Historic Bridgetown and the Garrison listed as a world heritage site • Links with UK market • Capability to articulate our history and cultural heritage • Mature tourism product • Heavy investment in our people through health and education • Oistins has been identified as a model that can be replicated • Access to all beaches are free • Strong tourism organizations (BHTA, BTA) • Good communication infrastructure 	<ul style="list-style-type: none"> • Cost of achieving green certification • Heavy dependence on imports • Climate change • External environment • Measurement • Low occupancy rates • Domestic transportation system • Crime and safety issues • Inconsistent supply of local inputs • Cost of inputs

Source: Stakeholder discussions and authors' analysis

TABLE 47. ASSESSMENT OF CHALLENGES TO GREENING THE TOURISM SECTOR

Challenges	Frequency of occurrence (1)	Impact (2)	Ranking of importance (3) = (1) x (2)
Cost of achieving green certification	6	7	42
Heavy dependence on imports	9	4	36
Climate change	9	9	81
External environment	7	8	56
Measurement	8	7	56
Low occupancy rates	9	8	72
Domestic transportation system	5	6	30
Crime and safety issues	5	9	45
Inconsistent supply of local inputs	4	6	24
Cost of inputs	8	8	64

Source: Stakeholder discussions and authors' analysis

TABLE 48. INVESTMENT GAP ANALYSIS OF THE TOURISM SECTOR

Challenges	Importance score (1)	Performance score (2)	Performance/ Investment gap (3)=(1)-(2)
Cost of achieving green certification	7	3	4
Heavy dependence on imports	6	1	5
Climate change	9	5	4
External environment	8	5	3
Measurement	8	5	3
Low occupancy rates	9	2	7
Domestic transportation system	5	1	4
Crime and safety issues	7	5	2
Inconsistent supply of local inputs	5	4	1
Cost of inputs	8	7	1

Source: Stakeholder discussions and authors' analysis

tourism expenditure and higher rebuild costs of land and properties. The present value of the total loss will amount to US\$ 1.5 billion and US\$ 589 million under scenario A2 and B2, respectively. This means that loss due to coral reefs and sea level rise combined will be US\$ 7.6 billion and US\$ 5.1 billion under scenario A2 and B2, respectively.

Table 46 presents a systematic identification of the challenges employing a score based on a 10-point Likert scale in relation to frequency and impact as outlined in Addendum 1. The combination of these two factors provides a ranking of importance shown in column 4. A challenge receives a score of 1 if the frequency of occurrence is low and 10 if the frequency of occurrence is certain. The scores are derived based on expert opinion and stakeholder discussions.

Many hoteliers also noted the relatively low occupancy rates (less than 60 per cent) that characterize the industry. These low rates reduce profitability and limit the ability of the industry to finance green initiatives. The dynamism in the external tourism market with which the local industry competes as well as the cost of inputs also present a challenge to the tourism industry in Barbados and to its efforts to contribute to green economy on a consistent basis. Given the nature of tourism as an export, any change in global scenarios can have a knock on effect on travel to long haul destinations. In the recent past, Barbados and the rest of the region has been affected by policy changes - most notably, the Airline Passenger Duty; the global economic crisis, hurricanes and related threats, changes in consumer tastes and so on.

The implications of some of these threats are to be found both on the demand side and on the supply side. On the demand side, consumers have less to spend are therefore looking for value for money; those with more disposable income have become very judicious in their choice of destinations, increasingly desiring more unique and authentic experiences that are a combination of leisure, education and cultural engagement. On the supply side, the implications are that businesses have less capital to spend on environmental and other "green upgrades" particularly if they are unable to see an immediate impact on their bottom line. While it is important to take an incrementalist approach to the implementation of green initiatives, there needs to be consistency in the implementation if the gains are not to be eroded.

Tourism statistics continues to remain in the realm of arrival figures, visitor spend and contribution to GDP and employment. While these are very much needed to help us understand visitor flows and tourism patterns much more needs to be done from a within- destination perspective. In other words, other studies measuring and monitoring the destination resources are required of we are to know the value of the resources and the changes that are occurring over time. In this regard, carrying capacity studies need to be undertaken on an on-going basis. While methodologies vary and there are still debates surrounding carrying capacity, it is felt that this type of study remains crucial for ensuring that limits - environmental, social, cultural are not breached.

For tourism, this is pertinent as tourism's viability and competitiveness trades on these resources. As a corollary to measurement, monitoring and

TABLE 49. ASSESSMENT OF OPPORTUNITIES IN GREENING THE TOURISM SECTOR

Opportunity	Frequency of success (1)	Effectiveness (2)	Ranking of importance (3)=(1)*(2)
Marketing Barbados as a green destination	6	6	36
Develop heritage tourism sites	7	7	49
Building relationships between the tourism industry and firms providing inputs	4	8	32
Development of agro-tourism products	6	7	42
Creation of marine protected areas	8	8	64

Source: Stakeholder discussions and authors' analysis

evaluation are also important tools that need to be employed if there is to be continuous assessment of tourism's value. While monitoring tools and techniques differ depending on the phenomenon under study, Barbados can consider the use of technology in aiding with monitoring in order to reduce human costs. The past immediate Permanent Secretary, Mr Andrew Cox also points to the deficit in measurement and monitoring as a challenge to any implementation of a green economy.

Table 48 presents a ranking of investment gaps. An importance score is assigned to each challenge and opportunity based on a 10-point Likert scale, where 1 denotes insignificance and 10 means very important. The importance of the investment gap is quantified by subtracting column 2 from column 1. A positive value in column 3 indicates that greater investment is required to enhance a particular strength or minimise an identified challenge.

As Table 47 suggests, there is a need to address investment gaps in relation to the following:

- domestic transportation;
- low occupancy rates;
- climate change; and,
- the heavy dependence on imports.

Critical to a green economy is a decrease in the dependence of imports, including food, manufactures, labour, technology, etc. The Caribbean hotel industry in particular has always been criticised on its failure to utilise locally grown and made products. The response to this is that quality is often inconsistent and the costs are more than the imported materials. While there are individual efforts to purchase from local agricultural and manufacturing suppliers, there is no concerted comprehensive industry wide effort. There is a need

for a business model that speaks to sustainable agro-tourism as well as internationally recognised standards for agricultural products. Having these two initiatives will provide farmers and other producers with access to local and international markets.

While there are efforts as noted above by the BHTA, the MOT and the Coastal Zone Management Unit, environmental education needs to be mainstreamed so that there are changes across the board from the households to the businesses: the role of the educational institutions, the newly constituted Constituency Empowerment Councils, Non-governmental organizations, the media and so. In other words, there needs to be a consistent effort by all stakeholders. The growth and usage of social media can assist in creating general awareness and education. In addition, training should be on going with key first tier institutions and individuals, namely taxi-drivers and tour operators.

The region also faces the potential challenges of higher fuel prices and green taxes, originating in source markets (i.e. the UK Air Passenger Duty). In the first instant, nervousness in the global oil futures market destabilises prices. This is due, primarily, to civil strife and war within some countries in the major oil-producing region of the world, the Middle East, which either directly impact or has the potential to impact oil production and shipments. Added to these are the ensuing international tensions between powerful countries, especially when conflict is protracted, coupled with rapidly growing demand for fossil fuels by burgeoning economies like Brazil, China and India. In the second instant, there is a turning towards use of the tax system to deal with issues arising from climate change. Regional responses to these challenges are also being devised.

3.5.4 POTENTIAL RETURNS IN TERMS OF ECONOMIC GROWTH, DEVELOPMENT AND POVERTY REDUCTION

The greening of the tourism industry is likely to be one of the key strategies used in the future to ensure the future sustainability of tourism (Table 49). Some businesses in the sector, particularly hotels, are making strides in certifying their operations. Among the hotels that are Green Globe Certified are Accra Beach Hotel and Spa, Bougainvillea Hotel, Divi South Winds and Southern Palms. Atlantis

Submarine has won the accolade of being the first attraction in the world to receive double certification. Harrisons Cave is also GG certified. Other hotels, specifically Coral Mist and Blue Orchids, have a written environmental policy that speaks to the rationale use of resources, compliance with labour and employment laws and developing and maintaining linkages with the resident community.

The Barbados Hotel and Tourism Association (BHTA) also undertakes various environmental initiatives aimed at educating its membership. These initiatives range from education/information sharing through workshops, symposia and tours related to recycling, turtle protection, and disaster management. The

TABLE 50. POTENTIAL TOOLS FOR GREENING THE TOURISM SECTOR

Tools	Issues	Institutional examples
Environmental codes of conduct – provides guidelines for businesses to operate in a more sustainable fashion	<ul style="list-style-type: none"> • focuses primarily on the physical environment (not comprehensive enough) • voluntary in nature • ineffective sanctions 	<ul style="list-style-type: none"> • World Travel and Tourism Council • International Hotel Initiative (Charter for environmental action) • Pacific Area Tourism Association – code of environmentally sustainable tourism
Certification schemes – verification of a company's performance against a set of standards	<ul style="list-style-type: none"> • tend to focus on environmental issues • can be disadvantageous to poorer countries – lack of skills, monitoring and recording systems • environmental standards may be insensitive to local realities 	<ul style="list-style-type: none"> • Green Globe 21 • Smart Voyager (Galapagos Islands) • Certification for Sustainable Tourism (Costa Rica) • Green Deal (Guatemalan coalition of NGOs) • Fair Trade Tourism (South Africa) • Hospitality Assured (Caribbean Tourism Organization) • Tour Operators Initiative (2000) • Blue Flag
Triple bottom line reporting goes beyond narrow reporting on economic performance measures and reports on the social and environmental values that organizations add	<ul style="list-style-type: none"> • recognises that financial success itself is reliant upon all pillars of sustainability • efficiencies in cost savings • implementation costs may be too high for many businesses • measurement focuses on quantitative variables; limits to quantification 	Global Reporting Index (2002)
Indicators of sustainable tourism – measures, assesses, monitors progress using primarily quantifiable data	<ul style="list-style-type: none"> • requires data sets that may not be always available • recognizes the interconnectivity in the tourism system • methodology not always transparent or explicit; comparative methodologies become difficult • tension between place based and global indicators 	<ul style="list-style-type: none"> • UNWTO (1999) – developed for destinations • Association of Caribbean States (2001) – developed for the ACS member countries • Caribbean Tourism Organization-developed for member countries (2003)
Travelife Sustainability System	<ul style="list-style-type: none"> • provides support, advice and tools to help improve their environmental and social performance 	<ul style="list-style-type: none"> • Examples of certified hotels in Barbados: • Bougainvillea Beach Resort • Barbados Beach Club • Mango Bay • Fairmont Royal Pavilion

Source: Stakeholder discussions and authors' analysis.



Antillean bananaquit (*Coereba flaveola*) – Bird species found on the island. Photo: Gail Fitzmartyn/Calgary Canada

BHTA has also joined forces with the Coastal Zone Unit to construct the boardwalk on the South Coast. The structure's purpose is two-fold management of coastal erosion and the creation of a recreational space for visitors and residents. A similar project has been undertaken on the West Coast.

The MOT is also rolling out projects that are aimed at raising the level of environmental awareness among the industry stakeholders and school children. In this regard, there are the adopt-a-beach and adopt-a-school programmes and sundown walks to build awareness of the coastal environment. The efforts of the various organizations in strengthening environmental management practices in their operations should not go unacknowledged but there is a greater need by the various businesses across the tourism supply sectors (accommodation, food & beverage, transport, tour operators, attractions and retail) to mainstream green into their entire operations- supply chain, procurement practices, resource efficiencies, employee and management training, policy statements, and others. Table 50 provides list of tools that can be used to further the goal of greening in tourism.

There is also tremendous potential for shifting the tourism product inland as an adaptation to climate change, but also as a means to exploit its potential heritage tourism sites. For example, the Barbados Sugar Trail Tour (traces the history and story of the sugar industry) and the Defence of Barbados tour

(builds on the islands military and naval history) are heritage products that can be easily traded. In addition to the island's heritage potential, its rugged coastline, spectacular views and unique plant and wildlife also hold some potential for further nature-based tourism development. Developing hiking trails around these resources can significantly augment the island's tourism product offering in the future. In addition to trails, the Harrison's Cave, the Graeme Hall Nature Sanctuary and Folkestone Marine Park and Reserve are all worthy of mention:

- In March 1998, the government of Barbados through the Environmental Special Projects Unit (now the Natural Heritage Department) initiated a 16-month feasibility study of Harrison's Cave – the top tourist attraction in Barbados- and associated sites with the ultimate objective to assess the feasibility to develop an Integrated Nature Tourism Area that will provide a diversity of environmentally and socially sustainable tourism opportunities that focus on the natural and rural features of the upper area of the parishes of St. Thomas and St. Joseph, while also being financially sustaining (Axys Environmental Consulting (B'dos) Inc., Environmental Planning Group, Gillespie and Steel Associates and Bellairs Research Institute, 2000). The Cave attracts almost one third of the visitors on the island. The redevelopment programme concluded in 2010.

- The Graeme Hall Nature Sanctuary (GHNS) located on the south coast of Barbados is a privately owned property consisting of a well eco-tourism establishment and a restored section of the Graeme Hall Wetlands. In addition, there is a visitor's centre, a man-made lake and a mangrove swamp with its sanctuary of local and migratory species of birds. It is an ecosystem that fulfils an appreciable number of functions: "habitat, Refuge, Regulating Hydrological Flows; storage and retention of water, Hosting unique biological material, Capacitance and absorption of pollutants; Removal of breakdown of excess compounds; Maintaining ecological characteristics of the landscape; Monitoring coastal zone changes; Impacting community quality of life; Providing cultural attraction and being a repository of scientific information" (Williams, 2008).
- The Folkestone Park and Marine Reserve was established in 1981 by the Designation of Restricted Areas Order 1981, and the Marine Areas (Preservation and Enhancement) (Barbados Marine Reserve) Regulation. The Park and Reserve are located on the West Coast of Barbados and stretched a total distance of 2.2 km and consists of four zones – a scientific zone; two (2) water sports zones and a recreational zone. Within the Reserve 'there are four well-developed fringing reefs, several patch reefs and an off shore reef' (Cumberbatch, 2001); however the Reserve suffers from low fish stocks due to over-fishing and poor habitat quality.

The Folkestone Marine Reserve while having immense potential to add value as a green investment is subject to a number of challenges inter alia:

- The size of the reserve – the percentage of coastline it occupies is smaller than that which is typically suggested to be effective as a marine reserve. Further the dividing of this small space into various zones compromises its ability to function effectively as a protected area. The scientific zone is only one-eighth of the entire Park and Reserve.
- The external impacts-while fishing and water sports activities have been strictly prohibited and limited respectively, the Marine Reserve is subject to contamination through groundwater from domestic waste from suck wells and chemicals and pesticides used in agriculture and golf courses.
- The management focus- more emphasis placed on the recreational aspects of the FPMR rather

than on conservation. Recreational users are not given adequate information on environmentally sustainable activities and behaviours.

- Enforcement – ineffective and inconsistent enforcement of regulations in the Park and Reserve across the range of bodies that share responsibility for enforcement- NCC park rangers, the Barbados Coast Guard, the Barbados Police Force. The rangers have not been trained in areas such as regulation, legislation or enforcement techniques and the BCG understandably has more urgent national matters to attend to (Cumberbatch, 2001).

Marine resources are important resources for the island. Indeed, amenities like coral reefs with their multiple functions are heavy weight in the resource balance. Notably is that coral reefs are the refuge of fish as well as invertebrate life, they provide food to millions of people, they are important for the production of white sand, they protect the land against the elements of nature, they are very useful to tourism industry, they contribute to the overall economy and health of a country. In the specific case of Barbados, the dependence of the country on healthy coral reef ecosystems to maintain its shoreline and world famous white sand beaches, support near shore artisanal fisheries and the tourism industry on which the GDP is now largely dependent cannot be overemphasized. To palliate the phenomenon there is a need to call "for more effective conservation and management of the reef ecosystem in Barbados" (Coastal Zone Management Act 1988). Strong consideration should be given to the following:

- Review and implement the recommendations of the Axys 2007 (Axys Environmental Consulting (B'dos) Inc., Environmental Planning Group, Gillespie and Steel Associates and Bellairs Research Institute, 2000) study with respect to developing the proposed marine management areas and instituting the sustainable business and financial models;
- Strengthen key agencies involved in marine ecosystems conservation and management, including the Fisheries Division, CZMU, the Marine Police, Folkestone Park and marine reserve and the NHD; and
- Establish partnerships for promoting marine conservation among government, business and civil society.

3.5.5 POTENTIAL FOR GREEN JOBS CREATION AND TRANSMIGRATION

The tourism and hospitality industry there are a myriad of suppliers that ensures the smooth running of the industry. If the industry is to engage a phased approach to greening then communication with the supply chain becomes an imperative, so that some jobs may be redefined and others would need to be created. Already in Barbados there is a company that utilises and supplies environmentally friendly cleaning products in response to market demands.

Entrepreneurial opportunities can be created in the areas of organic farming, maintenance of energy and water efficient systems, manufacturing of biodegradable products, mobile applications for monitoring and sourcing, disposal of biodegradable and other refuse as the transition occurs, expansion of recycling companies adding to their portfolio hazardous waste and other non-biodegradable materials from restaurants, hotels, etc., agrotourism attractions, heritage attractions, eco-lodges, gastronomic and culinary experiences, education and training for green and so on. From a fiscal perspective, these entrepreneurs can be incentivised through access to low-interest loan schemes such as the Smart Fund. The Economic Partnership Agreement can be another mechanism through which training and technical assistance can be accessed to support green economy entrepreneurs and small tourism business owners and operators.

A focus on developing agro-tourism linkages with a greater emphasis on the “farmer” holds great employment potential. The MAFFIS and the BAS would be required to play a major role in this transformation. Already recently community initiatives such as local Farmers’ Market at Sturges, Holders’ Hill and Brighton, and Farm Tours piloted by the Grapefruit and Molasses Foodies should be scaled up and replicated. A targeted financial, capacity development, marketing and fiscal framework is needed.

3.5.6 POTENTIAL FOR ENVIRONMENTAL IMPROVEMENT

There is potential for environmental improvement through project and policy initiatives. A select few will be outlined here. The Tourism Development Act (2002) can be revised to include incentives and other provisions for integrating environmental management into the broad cross section of tourism supply services. Two, the CHENACT 1 programme has been very useful in making national and regional accommodation providers more aware of energy efficiencies by providing a framework within which energy use can be audited. The programme also provides an opportunity for Barbados to capitalize on since part of the activities focus on the creation on an Energy Efficiency Model for hotels in Barbados, which will be rolled out to the rest of the region. This Model should give the Barbados accommodation sector the edge as far as energy efficiencies are concerned.

3.5.7 CONCLUSIONS

The stakeholders’ vision for greening the tourism industry reflects a desire to build a sustainable product that has forward and backward linkages with other sectors in the economy and embedded within the community. This vision is by and large consistent with the national definition of green economy outlined earlier and therefore provides some rationale for greening the tourism industry. Investments in sustainable tourism solutions can contribute to the transformation to a green economy at the national and global level. There is a need for investment to reduce dependence on imports, including food, manufactures, labour and technology. In relation to climate change, the region also faces the potential challenge faced by potentially higher fuel prices and green taxes. The opportunities for hotels to improve their resource use efficiency are well known and many have been shown to be cost effective with short payback periods. The approaches include: carrying out a resource and energy use audit to identify potential areas of savings; organizational change in the importance and support for implementing and carrying through not just audits but in setting objectives, the implementation of recommendations and, monitoring and reporting on progress; behavioural change to the way the use of resources are regarded by management and staff through training, encouragement and team building; and,

technological change that allows the introduction of resource efficient equipment, fixtures and fittings, looking for ways in which operations can be reconfigured to maximise resource use. Further research should investigate the development of a system of tradeable permits as a market-based solution to environmental management for the tourism industry.

3.5.8 SUMMARY

Barbados is one of the more mature Caribbean tourist destinations with large-scale tourism dating back to the late 50's and early 60's. Over the years the various entities responsible for tourism product development specifically, the Ministry of Tourism (MOT) and the Barbados Tourism Authority (BTA) have worked very hard to diversify the product into more competitive niche offerings such as sport tourism, heritage tourism, gastronomy tourism and more recently working on expanding the health and wellness sector. Total visitor expenditure in 2010 was estimated at US\$ 1.2 billion or about 6.3 per cent higher than in 2009. In terms of average daily expenditure, stay-over visitors from the UK and Other Europe tend to be higher than any other region. Hotels provide most of the available supply of accommodation on the island, however, occupancy rates tend to be low (about 56 per cent).

The tourism industry tends to have a significant impact on a country's resources, particularly in small states. The main impacts are related to pollution, depleted natural resources, erosion, displacement of residents, inflation, excessive foreign ownership, loss of culture, cultural commodification, leakages and extensive changes in societal norms. Barbados' tourism product is quite energy intensive. Most tourists to the island arrive on long-haul flights from the UK, USA or Canada. Even for the cruise tourism segment of the market, there is still an important fuel dimension of the product. Water use in hotels is determined as much by the facilities offered by a hotel and the market it operates in as by its occupancy rate and by extension the volume of wastewater that it generates. It has also been shown that factors such as the level of awareness of staff and management towards resource management and use efficiency are important. Hotels are significant producers of solid waste and as a consequence require regular municipal waste services. A portion of the waste is of an organic nature and other portions of it are potentially recyclable or recoverable.

Green tourism is largely focused on integrated planning and management, inter- and intra-generational equity concerns, and an acknowledgement that there are limits to the environment, economy and society, which if breached can have detrimental consequences. The Caribbean Tourism Organization has developed a Regional Policy Framework for a more Sustainable Tourism Development in the Caribbean. There are six thematic areas: tourism management capacity, marketing, transportation, environment, linkages and health, safety and security. Given the inherent vulnerability of the tourism product on small island states, a green approach to tourism development holds significant potential in relation to sustainable development.

Barbados has a number of inherent strengths that can be built upon in order to pursue a green growth strategy. Indeed, the island was ranked 30th out of 1,333 countries on the global competitiveness index and first in terms of the attitude of population towards tourism. Furthermore, heritage and community-based tourism holds significant potential. The island has resources dating back several centuries that can readily be repacked for visitors to the island.

The exploitation of these strengths is, however, dependent on the island addressing a number of challenges in relation to greening the industry. One of the main challenges is the low occupancy rate that characterises the industry. These low rates reduce profitability and limit the ability of the industry to finance green initiatives. In addition, the dynamism in the external environment and the cost of inputs also present a challenge to future development of the tourism industry. Tourism statistics as well, a necessary input for both planning and budgetary allocations, is still largely under-developed.

Investments in sustainable tourism solutions can contribute the sustainable development transformation to a green economy at the national and global level. One necessary investment gap needed to facilitate the transition to a green economy is in the area of reducing dependence on imports, including food, manufactures, labour and technology. Business models for sustainable agro-tourism as well as internationally recognised standards for agricultural products are critical. In relation to climate change, the region also faces the potential challenge faced by potentially higher fuel prices and green taxes.

A focus on developing agro-tourism linkages with a greater emphasis on the “farmer” holds great employment potential. The MAFFIS and the BAS would be required to play a major role in this transformation. Already recently community initiatives such as local Farmers’ Market at Sturges, Holders’ Hill and Brighton, and Farm Tours piloted by the Grapefruit and Molasses Foodies should be scaled up and replicated. A targeted financial, capacity development, marketing and fiscal framework is needed.

The greening of tourism is likely to be one of the key strategies used in the future to ensure the future sustainability of the industry. Identified opportunities in this area include marketing Barbados as a green destination, development of heritage tourism sites, building relationships between the tourism industry and firms providing inputs, development of agro-tourism products and the creation of marine protected areas.

In relation to heritage tourism, the Barbados Sugar Trail Tour and the Defence of Barbados Tour are products that can be quickly implemented and yield significant growth opportunities. It is also possible to develop hiking trails to future nature-based tourism development. The island also needs to ensure that its already existing nature-based tourism products (Harrison’s Cave, Graeme Hall Nature Sanctuary and the Folkestone Park and Marine Reserve) are maintained and enhanced. Concerning the protection and development of coastal and marine ecosystems to support the “green brand”, strong consideration should be given to the following:

- Review and implement the recommendations of the Axys (2000) study with respect to developing the proposed marine management areas and instituting the sustainable business and financial models;
- Strengthen key agencies involved in marine ecosystems conservation and management, including the Fisheries Division, CZMU, the Marine Police, Folkestone Park and marine reserve and the NHD; and
- Establish partnerships for promoting marine conservation among government, business and civil society.

The opportunities for hotels to improve their resource use efficiency are well known and many have been shown to be cost effective with short payback periods. The approaches include: carrying out a resource and energy use audit to identify potential areas of savings; organizational change in the importance and support for implementing and carrying through not just audits but in setting objectives, the implementation of recommendations and, monitoring and reporting on progress; behavioural change to the way the use of resources are regarded by management and staff through training, encouragement and team building; and, technological change that allows the introduction of resource efficient equipment, fixtures and fittings, looking for ways in which operations can be reconfigured to maximise resource use.

Tourism, since the 1970s, has been a key driver of economic growth in Barbados. The potential advantages of pursuing a green growth strategy in tourism can enhance the long-term sustainability of the industry as well as act as a catalyst for the adoption of green processes and practices in support and other related industries. For example, the continued development of green hotels could add further impetus to the adoption of organic farming practices in the island to supply the needs of these hotels. In addition, greening transportation and building practices will need to be adopted if the island is to differentiate its product from traditional mass-market tourism. Already this process has started. However, there is a need to enhance the enabling conditions to continue growth in this area (discussed in Chapter 4).

“... at the regional level we realise that high oil prices have severely affected Caribbean competitiveness, with a negative fiscal and macroeconomic impact on our fragile economies. For example, Barbados spent US\$ 393,538 million last year on oil imports, or 6 per cent of GDP, which has impacted negatively on direct production costs and the overall competitiveness of the Barbadian economy We know that although many SIDS are energy deficient in conventional energy, limitless potential for renewable energy and energy efficiency resides in our countries. The fundamental issue thus is how do we, as Small Island Developing States with inherent structural problems and limited resources, convert this renewable energy potential into a tangible product that is accessible, affordable and adaptable?”

Honourable Freundel J. Stuart, Q.C. Prime Minister of Barbados
Opening address at the United Nations Sustainable Energy for All Conference,
Bridgetown, Barbados , 7 May 2012

4.1 ANALYSIS OF EXISTING MACRO
ENABLING CONDITIONS

4.2 ENABLING CONDITIONS
FOR IDENTIFIED SECTORAL
OPPORTUNITIES

4.3 CONCLUSIONS



ANALYSIS OF ENABLING CONDITIONS FOR TRANSITIONING TO A GREEN ECONOMY

4



ANALYSIS OF EXISTING MACRO ENABLING CONDITIONS

This section of the report addresses the enabling conditions necessary for Barbados' transition to a green economy. It is based partially on stakeholder consultations on the topic with representatives from the private, public and non-governmental organizations as well as an Enabling Conditions Experts' Workshop.

4.1.1 FINANCE AND INVESTMENT

One of the most important components of the emergence of a green economy will be the development and adoption of new approaches to financing green investments, i.e. green finance. The concept of green finance refers to market-based investing and lending schemes that explicitly take environmental factors into account. There are several areas that "green finance" can cover car loans, mortgages, environmental bonds, carbon credits, certified emissions reduction certificates, venture capital for alternative energy projects, eco-savings deposits and green credit cards, to name a few. For example, a bank may provide car loans to finance vehicles powered by alternative fuels at preferential rates. The consumer benefits from reduced financing costs, the bank benefits due to the increased demand for loans and an improvement in its public image, while society benefits due to reduced emissions.

Usually, governments have two ways of financing green economy related programs: either with tax-exempt bonds (government-owned approach), or by entering into turnkey relationships with private developers. These two approaches can be incorporated together: by doing so, the PPP takes advantages of both options, while minimizing drawbacks. Taking a solar project as an example: the idea of the hybrid approach is that the government provides the financing through a bond issuance. Normally a third party (such as an Energy Agency or an Improvement Authority) is introduced in order to act as a facilitator between the government, the solar developer and the sites where the technology is to be installed. This third party issues bonds supported by the credit of the government and,

therefore, significantly lowers the costs of capital for the projects. The project then uses a turnkey approach with the difference that the financing being provided at the lower cost of capital is obtained by government. This allows a cheaper financing for the solar development community as well as preserves the utilities capacity to borrow from the private capital lending sources for other projects.

While PPP are used for financing renewable energy technologies, Energy Performance Contracting (EPC) can be used for energy efficiency projects, such as building retrofit. EPC, or energy service performance contracting, is a mechanism to deliver energy efficiency products. It is a financing mechanism that includes energy savings guarantees and associated design and installation services provided by the Energy Service Companies (ESCOs). EPC can be broadly defined as a contract between ESCO and a client involving an energy efficiency investment in the client's facility, the performance of which is guaranteed by the ESCO, with financial consequences for the ESCO. Under EPC, ESCO provides finance for a specific set of measures for energy efficiency retrofit, such as planning, building, operation & maintenance, optimization, fuel purchase, (co-) financing and user behavior motivation.

There are numerous existing local, national and international mechanisms that can also be used as examples in the business of financing the transition to a green economy. Some of these mechanisms are outlined in Table 51. During the Enabling Conditions' Experts' Workshop, however, a number of challenges and opportunities were identified in relation to financing a green economy.

Table 52 highlights several grant facilities at the national and extra-national levels available to support a green economy policy imperative, including the GEF, GEF-SGP and IDB Regional Public Goods mechanisms. Experts did note that institutional limitations in terms of skill sets and inadequate numbers are major challenges in accessing available grant facilities. A re-tooled Public Investment Unit as the centralised project programming and monitoring unit in Government could alleviate this challenge. Given government's

TABLE 51. SUMMARY OF EXISTING AND RECOMMENDED ENABLING FINANCIAL MECHANISMS

Existing policy implementation mechanisms		Key findings from stakeholder meetings and experts' workshops
Local/National	Regional/International	Local/National
<ul style="list-style-type: none"> Government's Consolidated fund Enterprise Growth Fund (Agriculture Development Fund; Industrial, Investment and Employment Fund; Tourism Loan Fund; and Small Hotels Investment Fund) Ministry's Grant to Non-Profit Organization Energy Smart Fund IDB Country Strategy GOB-IDB Sustainable Energy Initiative Catastrophe Fund Central Bank Credit Guarantee Scheme Central Bank's Industrial Credit Fund 	<ul style="list-style-type: none"> IDB (Multi-lateral Fund of the IDB Group) Caribbean Development Bank-European Investment Bank DFID Climate Finance (Fast Start Financing, Clean Development Mechanism, Adaptation Fund) Global Environment Facility GEF Small Grant Programme The Caribbean Catastrophe Risk Insurance Facility (CCRIF) European Development Fund User Fee Systems for Marine Protected Areas 	<p>Strengths</p> <ul style="list-style-type: none"> There are a number of existing financial mechanisms (local, regional and international) that can be accessed. The commercial banking sector is well-managed; this places the sector in a position to provide lending, especially for green initiatives. <p>Challenges</p> <ul style="list-style-type: none"> Limited capacity to implement green projects. Small developing countries have limited capacity to readily access funds. <p>Opportunities</p> <ul style="list-style-type: none"> Consideration can be given to developing a series of projects that look at building green communities (e.g., solar panels on roofs, and small wind turbines). <p>Responses/Effectiveness</p> <ul style="list-style-type: none"> Government's limited fiscal space places a limit on the level of intervention.

Source: Stakeholder discussions and authors' analysis.

limited fiscal space, a rationalisation across Ministries could assist in this regard. Experienced and technically qualified project managers are essential to advancing effective public finance programming.

There is also a need to build such capacity in the private sector and with civil society institutions. Development partners and institutions should be approached in this regard. Additionally, Barbados is in the process of developing a Country Programme Strategy (CPS) for the GEF Small Grants Programme. This mechanism targets civil society and non-profit organizations. It is proposed that green economy, given its national priority status, be formalised as the umbrella focus of the CPS.

The opportunity exists, through the Ministry of Finance, to continue the focus of the IDB Country Strategy in its programme period to areas relevant to green economy. It is proposed that Resource Efficiency, Sustainable Tourism and Ecosystem Protection and Management be included in the next Country Strategy. The Enterprise Growth Fund Limited (see Table 40), as an umbrella financial mechanisms for business and industry across various

sectors should be integrated in any strategy for promoting resource efficiency.

In addition to the above recommendations consideration should also be given to alternative funding mechanisms such as resource-use fees, which attempt to capture some of the willingness-to-pay of the users of protected areas. Most protected areas charge user fees to individuals visiting the area. These fees range from tourism charges, resource extraction fees and payments for ecosystem services. Most protected areas receive many visitors interested in experiencing nature-based tourism products. However, these fees are often significantly lower than what is necessary to maintain and monitor the area. Krug et al. (2002), using the case of Namibia, found that visitors to parks are often willing to pay 2-3 times the current fee. In addition to entry fees, many countries charge some type of tourism tax that is then used to fund conservation activities. In the Turks and Caicos Islands a portion of the hotel tax is directed towards the maintenance of protected areas. In Costa Rica, it is important that the main beneficiaries of ecosystem services pay for these services. In this regard, utility companies, such as the national water authority and electricity

TABLE 52. SUMMARY OF EXISTING ENABLING MECHANISMS AND EXPERTS' ANALYSES OF STRENGTHS, CHALLENGES, OPPORTUNITIES AND RELATIVE EFFECTIVENESS – CLEAN TECHNOLOGY (DEVELOPMENT, ACCESS AND TRANSFER)

Existing policy implementation mechanisms		Key findings from stakeholder meetings and experts' workshops
Local/National	Regional/International	
<ul style="list-style-type: none"> • Legislation: Patents Act, Cap. 314; Trademarks Act, Cap. 319; Industrial Designs Act, Cap. 319A; Copyright Act, 1998-4; Geographical Indications Act, 1998-22; Integrated Circuits Topography Act, 1998-21; Protection Against Unfair Competition Act, 1998-20 and; Protection of New Plant Varieties Act, 2001-17 • Sugar cane breeding research facility • National Council for Science and technology and the National Innovation Competition • BIDC incubator system • Income Tax Act-Concessions for clean technology investments • The Second National Communication Project to the UNFCCC (will include a GHG inventory and mitigation actions) 	<ul style="list-style-type: none"> • CARICOM Act and Revised Treaty regarding the movement of capital and labour • UNEP/UNIDO Resource Efficiency and Cleaner Production Programme • UNEP Cleaner Fuels Initiative • Basel Convention Regional Centre for the Caribbean • COMPETE Caribbean • Signature to various MEA such as the UNFCCC and the Vienna Convention with various financial facilities to support technology transfer (CDM, GEF, Multilateral fund, and Global Mechanism of the UNCCD) • UWI Sir Shridath International Trade Policy Centre 	<p>Strengths</p> <ul style="list-style-type: none"> • In the private sector there is a good chance that the process of trial-and-error along with free-market principles will facilitate the selection of appropriate technology for a green economy • Standards in external markets will help drive clean technology transfers <p>Challenges</p> <ul style="list-style-type: none"> • The standards are either absent or not strong enough to 'force' cleaner technology upgrade • There is slow evolution and low adaptability of clean technology <p>Opportunities</p> <ul style="list-style-type: none"> • Standards and legislation can be developed to support clean technology transitions • SMEs must work together and have mechanisms for assistance- COMPETE CARIBBEAN's Cluster Facility can be utilised • Resource Efficiency Programme for the private Sector • Green Industrial policy driven by BIDC— including utilising existing industrial estates • Enable a Research and development culture to support GE with NCST, GOB. BIDC and UWI • Need to explore bilateral opportunities • Operationalize SIDS-Technical Assistance Programme (SIDS-TAP) in collaboration with development partners <p>Responses/Effectiveness</p> <ul style="list-style-type: none"> • Larger enterprises will have a competitive advantage in technology transfers and upgrades • Partner with UNEP in Establishing the Resource Efficiency and Technology Innovation Centre • Demonstration projects – in social housing and urban centres (such as Warrens)

Source: Stakeholder discussions and authors' analysis.

producing company pay for the use of protection services they receive.

It is possible to develop a formula that links the payment to measurable variables that are related to usage. For example, one possible option is a scheme whereby there is a payment transfer to those who, within a catchment area, contribute to the minimisation of storm-water generation and flows. A similar approach can be applied to beneficiaries of a sustainable marine environment, thereby transferring payments to those who might otherwise adversely affect it. The user fee system, as proposed in the Axy's (2000) study should be instituted.

Regarding the private financial sector, the Ministry of Environment and Drainage in collaboration with the TBBA and UNEP-FI should continue its effort to promote Environmental and Social Risks Management in the Financial Sector. Expansion of this programme should be considered to include the UWI Cave Hill School of Business as the academic partner and the issue of climate change should be integrated into on-going research efforts. Regarding the UWI, such collaboration would assist in broadening the reach of the programme to other CARICOM countries.

4.1.2 DEVELOPMENT, ACCESS AND TRANSFER OF CLEAN TECHNOLOGY

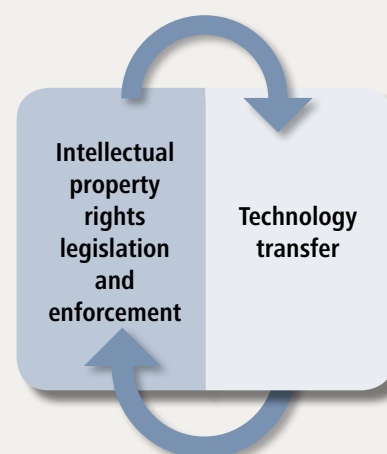
While Barbados is not a major contributor to global CO₂ emissions, new technologies that enhance resource efficiency provide numerous social, environmental and economic benefits for SIDS. For example, a significant reduction in its fuel import bill in half this would result in foreign exchange savings, reduce the cost of doing business and free-up resources to be used on other sustainable development objectives. Most international agreements identify technology transfer from developed to developing countries as a critical aspect of helping developing countries achieve their green economy goals. The Kyoto Protocol, which Barbados ratified and accepted in August 2000, in Article 2.1 encourages signatories to implement measures to enhance energy efficiency and adopt new and renewable forms of energy. Moreover, in the Johannesburg Plan of Implementation notes the importance of global cooperation to enhance access to clean technologies as a means of alleviating poverty.

For technology transfer to take place, however, issues related to intellectual property will need to be confronted on an on-going basis (Figure 16). Intellectual property rights are intangible rights that protect commercial valuable products produced by the human intellect. IPCC (2000) notes that one of the major requirements for successful technology transfers is the existence of strong intellectual property rights and enforcement. The existence of such a framework encourages firms to transfer their technology via trade, FDI, technology licensing and/or joint ventures.

Barbados has a comprehensive legislative framework in relation to the protection of intellectual property (see Table 53). The island is also in compliance with the WTO's Trade-related Aspects of Intellectual Property Rights (TRIPS) and is a signatory to numerous international treaties relating to intellectual property including:

- Paris Convention for the Protection of Industrial Property;
- Patent Cooperation Treaty;
- Convention Establishing the World Intellectual Property Organisation;
- Berne Convention for the Protection of Literary and Artistic Works;

FIGURE 16. FACILITATING TECHNOLOGY TRANSFER



- Nice Agreement Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks;
- International Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organisations;
- Convention for the Protection of Producers of Phonograms Against Unauthorized Duplication for their Phonograms; and,
- Nairobi Treaty on the Protection of the Olympic Symbol.

A number of other policy mechanisms are also provided in Table 52 along with potential opportunities for strengthening technology transfer in Barbados.

It is important to note that Barbados has shown significant progress in the Caribbean regarding the integration of small-scale renewable energy technologies in its energy matrix. Specifically, solar water heaters were introduced since the early 1970s and are now approximately 40,000 solar water heaters in Barbados, with more than 30,000 domestic installations. The most recent estimate indicates that the total number of dwelling units in Barbados is estimated at 91,406, which show a significant penetration by the industry into the domestic market. It has been estimated that the cumulative cost of solar water heater incentives, up to 2002, was US\$10.75 million with energy savings estimated to be in the range of US\$133.5 to US\$137 million. Savings on primary oil consumption were estimated to be US\$0.3 to US\$4.2 million - equivalent to 30 to 40 per cent of the present domestic consumption.

The current fiscal, financial standards and regulatory regime is also enabling the further use of PV

TABLE 53. SUMMARY OF EXISTING AND RECOMMENDED CHANGES TO TRADE, TARIFFS AND INVESTMENT POLICIES

Existing policy implementation mechanisms		Key findings from stakeholder meetings and experts' workshops
Local/National	Regional/International	
<ul style="list-style-type: none"> • Customs Act (Reduced duties on Resource efficient items) • Fair Trading Commission • Barbados Competitiveness Project (US\$ 11.8 million) • Agricultural Health • National Trade and Environment Sub-Committee • Modernization of the Barbados National Standards System (US\$ 5 million) • Agricultural Health and Food Control Programme (US\$ 28 million) 	<ul style="list-style-type: none"> • CSME • Bilateral and Regional Trade Agreements • Economic Partnership Agreement • COMPETE Caribbean • MEAs 	<p>Strengths</p> <ul style="list-style-type: none"> • Small businesses benefit from the provision of environmental services and the transfer of technology increasing their trade and ability to earn more income • Work is being done to promote the use of safer pesticides and fertilizers and encourage organic farming, including the production of natural pesticide <p>Challenges</p> <ul style="list-style-type: none"> • Trade facilitation systems- already technical barriers to trade prohibit exports • There are lists which specify maximum/minimum restrictions to the Common External Tariff (CET) limits and Government is limited by bound rates; they cannot reduce the tariffs without endorsement from CARICOM • Existing institutions need strengthening such as Pesticides Control Board, National Trade and Environment Sub-Committee • Photovoltaic solar component parts are expensive to import and coming from temperate countries they may not work as efficiently as products made in the region – this should be developed • Monitoring the use and impact of environment goods (green goods) • Global Climate Mitigation Policy and the impact on Tourism and Travel Sectors <p>Opportunities</p> <ul style="list-style-type: none"> • Branding Barbados through it Greening Achievements • Niche markets for natural products in the health and tourism sectors, • Pursuing the development a Caribbean Eco-label (Small Scale Fisheries as a pilot) • Development of the Environmental Services sector- align with efforts to establish the Resource Efficiency and Technology Innovation Centre • The possibility exists to trade in carbon credits through industry-wide and regional collaborations • Social Partnership playing a leadership role in fostering collaborations • Tariffs on efficient products can be reduced instead of increasing taxes on harmful or inefficient products • GOB instituting Harmonized system for chemical management • CSME and the movement of (Green Good) Environmental Goods and Services <p>Responses/Effectiveness</p> <ul style="list-style-type: none"> • Emergence of non-tariff Barriers to trade in developed country through GE policies might limit export potential of niche products • If tariffs are reduced Government's revenue may drop as a consequence, and the shortfall may be translated into reduced services which can impact on tourism, and this can backfire • Tariffs may prohibit small business persons from flourishing if products become more expensive • Social partnership engagement is crucial to success

Source: Stakeholder discussions and authors' analysis.

systems. However, experts expressed a general slow uptake and adaptability of new technologies to the Barbados situation. Additionally, there is a need for greater awareness, consultation and adoption of environmental standards. The BNSI is instrumental in driving this initiative from a technical standpoint. Additionally, the Social Partnership can be utilised from a governance and advocacy perspective in this regard.

In addition to the opportunities mentioned by the stakeholders in Table 53, the National Sustainable Development Policy (NSDP)⁶⁶ has also outlined policy recommendations aimed at enhancing the development of clean technologies. The recommendations of the NSDP include:

- Full documentation of the environmental hazards of all the constituents of blended fuel;
- Development of a clean air policy;
- Development of safe standards for atmospheric pollutants;
- Development of appropriate economic instruments/ incentives, legislation and regulations for ensuring the successful implementation of policy objectives and programmes developed in order to facilitate energy efficiency in the transportation sector, and improved air quality in general;
- Efficient and timely maintenance of heavy-duty diesel vehicles;
- Promoting energy efficiency in the transportation sector, by giving consideration to the feasibility of using electric cars as well as liquid petroleum gas (LPG), compressed natural gas (CNG), and hydrogen powered vehicles;
- Development, introduction and use of appropriate scientific technologies and practices to improve efficiency and enhance sustainability in the transportation sector, in particular, with regards to maintaining a clean and safe environment;
- Conducting studies on mass transit options in high traffic areas; and
- Classification of areas where hydrocarbons are stored as potential hazardous sites, and taking these locations into consideration when considering future development activities.

The creation of a viable market for rainwater harvesting (RWH) and wastewater treatment systems and the removal of the barriers already discussed would facilitate the transfer of clean technology, especially in the wastewater field. Packaged wastewater treatment plants could be imported as they involve sophisticated membrane technologies, but it is not clear whether the potential size of this

market would be such as to warrant the development of a local manufacturing capacity even if the market were extended to include other countries in the region. Measures to facilitate the transfer of the technologies would need careful consideration.

RWH has been successfully applied both in the agricultural sector in Barbados and to buildings (i.e. residences). Successful application depends on the application of a few basic design principles to ensure that they are effective and will perform under a range of conditions. While there are commonalities, the applications to agriculture and buildings do require different design approaches and information. Thus, there does need to be a wider spread of knowledge and expertise in order to support a higher level of interest and use of the technology. Generally, RWH systems are not as intricate as wastewater treatment plants and could therefore be developed using locally produced materials.

The basic technology for the construction and installation of biodigestors already exist and is readily accessible, but it would be necessary to ensure that the biodigestion systems are suitable to function under the prevailing conditions in Barbados. In other words, some technology transfer and adaptation to local conditions would be required in the same way that technologies for producing animal feeds, organic fertilizer and soil conditioning products have already been imported and assimilated into local operations.

Notwithstanding, the starting point should be inquiry into if there are more efficient technologies available that would give distinct advantages to local consumers or whether there are equally efficient technologies that could be developed locally. Access, though, can be limited by cost considerations, and this would have to be investigated. The technology required for the 'waste to energy' and 'landfill gas to energy' systems would have to be imported and initially supported from external expertise, and this could be achieved through a Public-Private Partnership.

The current efforts by the UWI, with support from the British High Commission and UNEP in the establishment of a Resource Efficiency and Technology Innovation Centre, should be supported by the GOB. This institutional intervention can drive the uptake of environmental technologies among SMEs while assisting the country in meetings its obligations under various MEAs (Sinckler, T., pers. comm.). Support in the development

special curricula and the development of targeted micro-credit facilities would be required. Strong collaborations as shown by the Social Partnership and development partners and agencies will be critical to its success. The RETIC can also be instrumental in driving a Eco-Innovation/Greening Research and Development agenda (Griffith, M., pers. comm.).

The stakeholder consultation process also identified opportunities within government to demonstrate various green/environmental technologies via its public investment programme. Social housing, public transport and agriculture were identified as applicable areas. The Ministry of Housing identified Eckstein Village as a possible demonstration site. The Ministry of Transport's move to "Green Warrens" via landscape design interventions in conjunction with the Beautify Barbados is another such example (Devonish, S., pers. comm.). Small-scale agro-technologies, such as "Row Covers", are also being tested as more economical alternatives to shade house by the Ministry of Agriculture (Bynoe, D., pers. comm.).

In the region, the issue of technology transfer between SIDS was first articulated in the 1994 Programme of Action for the Sustainable Development of Small Islands developing States through the call for a SIDS-specific Technical Assistance programme (SIDS/TAP). The facility was intended "to facilitate the exchange and transfer of experiences, knowledge, policies and practices among small island developing States intra-regionally and inter-regionally, and between small island developing States and other countries to enhance the quality and broaden the choice of sustainable development approaches of small island developing States" (UN, 1995).

In recent times, the outcome statement of the 2010 Commonwealth Small States Meeting (Commonwealth Secretariat, 2010) notes "... a number of specific opportunities have been identified for action, including the establishment of technology-based small states collaborative programs to audit, develop and harness more effectively intellectual property assets in countries." SIDS-TAP holds significant potential for assisting Barbados in accessing applicable clean technologies to enable its pursuit in developing a green economy. The government of Barbados in collaboration with the CARICOM Member States and strategic development agencies should give consideration to activating this facility.

4.1.3 TARIFFS AND TRADE POLICY

SIDS, by their very nature, are very open economies. Trade as a percentage of GDP exceeded 96 per cent of GDP in the case of Barbados. Using trade policy to address environmental problems can therefore elicit important behavioural change in the local marketplace. Green trade policy, depending on how it is structured, can, however, be used as a barrier to trade. Maestad (1998), for example, notes that the Montreal Protocol discriminates between signatories of the agreement and non-signatory countries. The economist also notes that green trade policy is often not as efficient at solving environmental problems as other policies.

Rather than using punitive tariffs, Barbados has tended to focus on trade liberalisation of goods used in environmental management systems (referred to herein as green goods). Such products usually attract duty-free access or reduced tariffs. In 2006, the Government of Barbados established tax and customs incentives for renewable and energy efficiency equipment. These trade concessions include:

- Reduced customs duties at the rate of 5 per cent for compact fluorescent lamps (CFLs), house and attic fans, ceramic coatings for roofs and window tint; as well as
- Full customs waivers for solar photovoltaic systems, solar thermal systems, biofuel systems, hydropower systems, wave and tidal power systems, fuel cell systems and geothermal heat pump systems.

Table 53 highlights the many other mechanisms that can also be drawn on to further encourage a resource efficient and equitable growth path. Stakeholders noted that the use of punitive tariffs to further green objectives is limited by the country's regional obligations. They therefore recommend that Barbados continue to focus on green trade liberalisation, subject to fiscal obligations.

Significant is the on-going investment in the upgrade of key trade facilitation system including:

- The Barbados National Standards Institute;
- Agriculture Health and Food Safety Systems; and
- Trade Logistics (Barbados Competitiveness Project).

Funded jointly by the IDB, these projects are critical to enhancing Barbados' overall efficiency and competitiveness and can be instrumental in propelling the country's Green Economic Macro and Sectoral Policies. The issue of developing and monitoring environmental standards should be given special attention in the modernisation of the BNSI. Similarly development and marketing of "greener" niche products particularly in the agro-sector can be significantly enabled on completion of the projects mentioned above.

There is also need for research on the liberalisation of Green Goods (Environmental Goods and Services). The National Trade and Environment Sub-Committee (NETSC) have been instrumental to date in this regard (Singh, A., pers. comm). Future emphasis should be placed identifying regional opportunities in the context of the CSME, the development of the Environmental Services Industry, Climate Change Implications on Trade in Environmental Good and Services Sector, and the development of an Environmental Goods and Services Index to monitor trade flows. In this regard, the presence of the UWI's Sir Shridath Ramphal International Trade Centre in Barbados presents a research partnership opportunity for the NETSC.

4.1.4 TAXATION, INCENTIVES AND FISCAL REFORM

Green fiscal policies can be used to elicit behavioural change and enhance the speed with which the country moves towards its green economy goals. UNEP (2011b) identifies five broad fiscal policy options:

- Environmental taxes (e.g., carbon taxes, tax exemptions and others);
- Pollution charges;
- Green subsidies;
- Elimination of environmentally harmful subsidies; and
- Public expenditure on infrastructure.

Barbados' fiscal regime tends to focus largely on options 1 and 3 (e.g., environmental taxes and green subsidies). Some 37 years ago, the GOB instituted a number of fiscal incentives to support renewable energy initiatives. The Fiscal Incentive Act of 1974 granted import benefits and tax exemptions to solar water heater producers. Under the 1984 Income

Tax Amendment, taxpayers can directly and fully deduct the cost of solar water systems from personal income taxes payable. In addition, all electric water heaters became subject to 60 per cent consumption tax, which makes them financially unattractive (FTC Barbados). Unfortunately, the Government does not have an estimate of the total value of waived taxes and customs duties over the intervening period to the present. This data would have been useful to assess the value and effectiveness of each particular incentive, thereby enabling current policy makers to identify areas for improved incentives.

In 2007, the Government of Barbados introduced three (3) greening initiatives for the residents of Barbados. These initiatives were in the areas of a) green homes, b) composting and c) recycling. The most relevant of these for the greening of the building/housing industry is the "Green Homes" checklist. The then Ministry of Energy and Environment committed to establishing a "Green Homes" checklist that is considered appropriate to small tropical islands like Barbados. The checklist would include a range of greening, recycling and energy conservation features such as:

- Low flow toilets
- Onsite water storage
- Solar water heating
- Fluorescent lighting
- Passive ventilation and cooling
- Alternative energy use

More recently, the 2011 Financial Statement and Budgetary Proposals proposed a number of initiatives with respect to renewable energy and energy efficiency. These measures include:

- An increase in the energy conservation and renewable energy deduction from US\$ 5,000 to US\$ 10,000 for individuals, and US\$ 25,000 for registered small business;
- An extension of the energy conservation and renewable energy deduction to lessees once it is proven that approval was granted by the owner of the property;
- The write-off of 150 per cent of costs associated with the conversion to alternative energy over a five year period for businesses whose filings with the Inland Revenue Department and VAT Division and whose compliance with NIS and Land Tax are up to date or who have in place arrangements to settle their arrears;
- A rebate of up to US\$ 5,000 to farmers who retrofit structures to house livestock with solar energy;

TABLE 54. SUMMARY OF EXISTING ENABLING MECHANISMS AND EXPERTS' ANALYSES OF STRENGTHS, CHALLENGES, OPPORTUNITIES AND RELATIVE EFFECTIVENESS – TAXATION, INCENTIVES AND FISCAL REFORMS

Existing policy implementation mechanisms		Key findings from stakeholder meetings and experts' workshops
Local/National	Regional/International	
<ul style="list-style-type: none"> Income Tax Act (Annual Budget) Fiscal Incentives Act (1974) Agriculture Incentives Scheme Tourism Development Act Returnable Containers Act 	<ul style="list-style-type: none"> CARICOM Common External Tariff 	<p>Strengths</p> <ul style="list-style-type: none"> Green economy policies are now a part of the Income Tax Act and the Agricultural Incentives Scheme Smart Energy Fund <p>Challenges</p> <ul style="list-style-type: none"> Whereas incentives have been put in place, more needs to be done to increase awareness of them Poverty and unemployment are factors that constraint what can/should be done <p>Opportunities</p> <ul style="list-style-type: none"> Government must encourage involvement in ventures that can generate revenue instead of spending taxpayers' money Focus more on production rather than usage <p>Responses/Effectiveness</p> <ul style="list-style-type: none"> Green taxes can encourage firms to move to lower tax jurisdictions

Source: Stakeholder discussions and authors' analysis.

- The discontinuation of the duty free concessions offered to the hotel and manufacturing sectors on the importation of electric water heaters;
- The provision of an energy grant of US\$ 5 million through the Welfare Department, with effect from October 1, 2011, to provide relief to the most vulnerable groups such as the elderly, disabled and the unemployed indigent to mitigate the high cost of electricity;
- The negotiation of a second energy policy based loan of US\$ 75 million to execute the preparation of renewable and energy efficiency programmes through the necessary legislation to supplement the initial loan of US\$ 75 million;
- Submission of draft renewable energy and energy efficiency policies to Cabinet along with proposals for the amendment of the relevant legislation; and
- Drafting of legislation on renewable energy policy to facilitate the generation of electricity by renewable energy systems and the sale of electricity to the grid.

Table 54 provides an assessment by stakeholders of the Government's policy approach to-date. Stakeholders especially noted that while much has been done to potentially elicit changes in consumer behaviour, the main challenge to the take-up rate remains public awareness and low investment capacity due to poverty.

In addition to the recommendations from stakeholders, consideration can also be given to including green objectives in regulations. For example, the Fair Trading Commission (FTC) regulates the electricity and telecommunications markets but not sectors such as water and wastewater services or public transport. The FTC does not have any specific mandate with respect to taking into consideration sustainability or the potential impacts associated with environmental degradation when exercising its regulatory functions. It is proposed that consideration should be given to requiring the FTC to take environmental costs and benefits into consideration when exercising oversight of regulated industries. Furthermore, as a matter of urgency, the mandate of the FTC should be extended to cover the provision of water and wastewater services. The effect of this would be to require the regulated industries to include aspects such as the environmental damage accruing from the use of a particular technology, thus leading to an internalising of externalities in the determination of the use of cost-effective and sustainable technologies.

Barbados has a long tradition of providing fiscal incentives to support various environmental and economic goals. One of the most successful in relation to eliciting behavioural change to date has been the tax rebate that individuals receive for

purchasing solar water heaters. As a result of this initiative, the penetration rate for solar water heaters now exceeds 50 per cent. Fiscal incentives, however, also imply a loss of revenue for government that needs to be taken into account, particularly given the current focus on fiscal consolidation around the globe. At present, Barbadians can write-off up to US\$ 5,000 per year for home improvements, inclusive of purchases of solar heaters.

While exact figures are unavailable for tax receipts forgone as a result of purchases of solar water heaters, write-offs for these home improvement allowances tends to be about 7 per cent of total tax deductions. Green fiscal incentives can therefore have an important impact on the level of receipts from Government's tax effort. Consequently, it may be prudent that applicants seeking access to Government incentives and tax break schemes be required to demonstrate a sound case for support, for example, by undertaking environmental audits that indicate where savings can be made in their operations. Furthermore, tied to these incentives and schemes, should be a provision for recipients to report on implementation progress, possibly through an on-line system. Thus, the burden of proof would be on those in receipt of support, with audits carried out by Government on a random basis.

There is a need to develop measures supportive of the preferred development pathways in agriculture, transportation, tourism and the built environment such that compliance or the adoption of new practices and technology do not become an additional burden. There are already measures in place that allow for tax rebates on capital investments of up to 150 per cent on environmentally friendly investments. It may be necessary to expand the definition such that services and other forms of support come within the ambit of the tax breaks. Where there is provision for reclaiming expenditure only when filing a tax return, consideration might be given to establishing a bridging fund mechanism that allows for up-front payments to reduce the financial burden incurred between expenditure and rebate. Also provision can be made to include technical and management support that would result in resource savings or increased levels of resource use efficiency, with the proviso that such savings have to be materially demonstrated by an audit.

In order to encourage the re-use and refurbishment of existing buildings, especially those of some historic, cultural or aesthetic value, it is suggested that a revolving fund be set up to encourage such practices

rather than developing green field sites. This can be coupled with the development of a greenfield tax to act as a disincentive and to provide a funding mechanism for supporting the revolving fund. Alongside, more innovative ways need to be developed to provide incentives for actions that improve the environment, such as expanding the definition under current income tax legislation to include activities or actions that would qualify for favourable taxation treatment. For example, replanting of hedgerows that limit run-off and soil loss would qualify. Furthermore, in order to encourage green businesses, a preferential corporation tax rate can be applied to qualifying businesses.

Consideration can also be given to introducing concessions applicable to system of collection depots, to which waste materials could be returned for reuse or recycling. The concessions should be accessible under the Small Businesses Development Act, the Fiscal Incentives Act and the Income Tax Act. In order to pay for this, a flat rate increase in the Environmental Levy is proposed in preference to other measures such as diversion credits and tipping fees. That said, the feasibility of introducing tipping fees needs to be considered but any introduction would have to take into consideration the effectiveness of regulatory enforcement of anti-fly tipping measures. However, the point must be made that although proceeds from the environmental levy usually go into the general fund, efforts should be made to demonstrate and to ensure that the funds generated are being used to support solid waste management efforts only.

Finally, while new taxes are always a controversial issue, many states have been introducing so-called green taxes to elicit behavioural change. For example, all EU member countries have some tax on motor fuels in addition to value-added taxes. In Barbados, motor fuel use excises have recently been increased significantly. However, widespread exemptions to the tax base remain. The excise tax on gasoline was increased by 50 per cent on 1 December 2010 to US\$ 0.2679 per litre, a measure expected to raise an additional US\$ 11.4 million per annum. The public sector, diplomats, non-governmental organizations (the definition here being unclear), and construction firms (diesel only) are currently exempted from the requirement to pay excises. The elimination of these exemptions would enhance the efficiency of tax collections and improve the government's fiscal position. The introduction of a new tax or a further increase in the excise tax is possible. As at 4 December 2011, the price of gasoline per litre in Barbados was US\$ 1.54

compared to US\$ 2.09 in the United Kingdom. A tax that equates the price of unleaded fuel in these two countries, based on the elasticities of demand used by Government in its budgetary forecasting, could net an additional US\$ 45 million. Obviously the distributional consequences of such a tax would have to be taken into account; however, these can be addressed via a system of needs-based rebates as well as through significant improvements in the quality of public transport on the island.

4.1.5 EDUCATION, TRAINING AND CAPACITY ENHANCEMENT

The importance of education, training, research, communication and sensitisation to green economy is paramount. Indeed, investing in training and education helps smooth the transition to a green economy for the work force through enabling workers to exploit new job opportunities and, generally, through enhancing the productivity of labour in current occupations. To date, the sentiment often expressed by businesses and workers is that there is a significant 'gap' in terms of know-how and so there is a need not only to increase awareness about the necessity to green the economy, but also to upgrade current skill levels so that opportunities presented by greening the economy can be seized (see Table 55).

Gaps in the level of awareness, knowledge and capacity to respond to new agro-industrial opportunities in the agriculture and fisheries sub-sector have been identified. It is clear that there is a gap in the national ability to provide the requisite level of training and support to these sectors. Thus, the feasibility of providing vocational training for the agricultural and fisheries sub-sectors to address these shortcomings needs to be considered. Without knowledge and training and the general professionalising of these sectors, transitioning them to become export as well as domestic market orientated will not be realised. Such training does not have to be undertaken by the government alone but it does need to create a supportive environment that motivates the private sector to supply such training and skills development.

Within the housing and building sector, there is an obvious shortage of professionals who possess the necessary knowledge and understanding to ensure that green or sustainable principles are



UWI Cave Hill's CERMES. Photo: Travis Sinckler

applied to the design, construction and operation of the built environment, and this has been amply emphasized in this report. This shortage also includes expertise in the spatial planning discipline. The country, though, has a pool of intelligent professionals, so that it is not a lack of persons that is the problem, rather, it is one of a lack of knowledge. Consequently, a programme of capacity building needs to be developed in partnership with professionals such as architects, engineers, planners and others to ensure that practitioners are equipped with the necessary skill sets, and that this programme becomes, in the short run, a continuing professional development requirement, and, in the long run, a requirement for professional accreditation. This, however, has to be complemented by a regulatory requirement that construction developments be in accordance with sustainable principles. Needless to say, enforcement of any such regulation would necessitate formation of a cadre of regulatory officers who understand what the statutory requirements are and have the skills to engage with professionals, contractors and artisans involved in all stages of building development in order to ensure that such requirements are met.

Other areas identified in this report as having potential to contribute to a transition towards a Green economy for Barbados include the development and adoption of renewable energy technologies (PV, wind, anaerobic digesters, etc.), wastewater treatment plants, rainwater harvesting, and auditing and evaluation of resource use efficiencies. While some skills already exist in the work force, these will not be sufficient to meet the expected demand for the range of technologies and services required for greening the economy.

Indeed, the report has highlighted examples where the uptake of new technologies is being hampered by a shortage of skilled personnel. Thus, one of the necessary enabling conditions will be to identify the nature and extent of demand for such skills and to

TABLE 55. SUMMARY OF EXISTING ENABLING MECHANISMS AND EXPERTS' ANALYSES OF STRENGTHS, CHALLENGES, OPPORTUNITIES AND RELATIVE EFFECTIVENESS – TRAINING AND CAPACITY (EDUCATIONAL) ENHANCEMENTS

Existing policy implementation mechanisms		Key findings from stakeholder meetings and experts' workshops
Local/National	Regional/International	
<ul style="list-style-type: none"> • Government Institutional Systems • National Development Scholarship • Samuel Jackman Prescod Polytechnic (SJPP Courses) • Barbados Community College (including its Industry Services Unit) • Barbados Vocational HRD Strategy 	<ul style="list-style-type: none"> • UWI Cave Hill Campus • CARIBSAVE Scholarship Program • OAS Scholarships • Chevening Fellowship and Scholarship Program • Bilateral Agreements • MEAs and the Global Environment Facility (National Capacity Self Assessment) • Barbados Accreditation Council • UN System (UNITAR, United Nations University, UNEP-FI, UNIDO and UNEP-DTIE) • Basel Convention Regional Centre for the Caribbean • City and Guilds- Green Skills Program 	<p>Strengths</p> <ul style="list-style-type: none"> • There is a remarkable plethora of information already from studies, research, policy, etc., to increase capacity • Specialized green economy related capacity building programs exist • Several Industry Associations exist that can facilitate sectoral capacity building programs • Several Institutional Strengthening projects are underway (BNSI, CZMU, NAFHSA, Statistical Service, etc.) <p>Challenges</p> <ul style="list-style-type: none"> • There are weaknesses in the cycle of policy development-implementation-evaluation-refinement • Key government agencies are institutionally challenged to move the Government's GE Agenda (Fisheries Division, Environmental Engineering Department, The Barbados Building Authority, Natural Heritage Department, Environmental Protection Department, Folkestone Park and Marine Reserve of the NCC, Policy Research, Planning and Information Unit) <p>Opportunities</p> <ul style="list-style-type: none"> • Training and capacity development regarding green economy is critical at the primary school level • green economy training and capacity building should be broken down and based on efficiency, sustainable resource use and other basic elements • Focus National Development Scholarships on green economy • Professional Associations (such as the BIA, BAPE, Contractors Association) should provide incentives and continuing professional development opportunities in line with Barbados Green Economic Policies) • Social Partnership can propel the development of a comprehensive capacity building program • Develop synergies with UNEP-FI and UWI Cave Hill School of Business in Environmental and Social risk Analysis- already piloted in 2009 <p>Responses/Effectiveness</p> <ul style="list-style-type: none"> • Need to generate public buy-in • Fiscal space is limited and impacts institutional strengthening exercises in government

Source: Stakeholder discussions and authors' analysis.

consider ways in which the necessary skills training and development can be provided. This may well require the development of partnerships with extra-regional institutions and support from UNEP and the United Nations Industrial Development Organization (UNIDO) in the establishment of a National Cleaner Production Centre to foster sustainable production and consumption, as well as the development of a national network of internships and local training providers.

A comprehensive Public Information and Communication Strategy based National Knowledge, Attitudes and Perception Survey should be established. The Social Partnership in collaboration with the Environmental Education Committee of the Ministry of Environment and Drainage should drive that Strategy. Elements of that Strategy should include:

- Public showcases
- Award schemes for communities and business
- School education
- Celebration of Best Practices
- Government demonstration projects
- Financial mechanisms (GEF-SGP, CSR strategies, and Ministry grants to non-profit organizations)
- Constituency Empowerment Councils
- GIS-driven monitoring and reporting structures
- National governance mechanisms

The GEF-Funded National Capacity Self-Assessment should also be honed to provide focus on priority institutions and areas relevant to a green economy (see Appendix). That committee, in tandem with the three Rio Convention Focal Points should ensure complementarity with the Government's green economy objectives.

There is evidence that this process has already begun; with solar PV installation courses taught by experts, being arranged by BNOC and William Hinds of the Energy Division, renewable energy modules are now being offered at undergraduate level at the University of the West Indies (UWI), the DIREKT and INEES projects at the UWI are encouraging renewable energy knowledge transfer between other SIDS and developed countries, and the establishment of two postgraduate master's courses in Renewable Energy and Renewable Energy Management are planned for 2012-13.

Elsewhere, evidence of private sector capacity building available: the Barbados Renewable Energy Association (BREA) was formed in the spring of 2011, and is a non-governmental

association promoting the application of RE and EE technologies in Barbados. There are currently around ten companies offering RE and EE solutions on Barbados. They serve both the public and private sector and their activities include; energy auditing; solar PV + thermal power installation; small-scale wind installation; system design; biodiesel production; and consultancy. It is hoped that the association will provide a collective voice to these RE + EE companies.

There is a need to put appropriate education and training arrangements in place such that the necessary skills and expertise can be developed. It is clear that the training needs span several levels, some of which can be met locally whilst others might require a regional approach. These levels include a focus on vocational training, trade schools, universities, and on-the-job training in the workplace. Solid Research and Development, engineering, and manufacturing capacities are a critical aspect of building green industries and jobs. Indeed, some occupations in the renewables sector or in energy efficiency require highly educated and even quite specialized personnel, including a variety of technicians, engineers, and skilled trades. And green employment is not limited to high-end skills. There are many positions that demand a broad array of skill and experience levels, especially in installation, operations, and maintenance (see Table 55).

4.1.6 STANDARDS AND REGULATION

Standardisation and regulations, if properly utilised, provide end-users of the service or good with confidence in their purchase. The consumer knows that the producer has used consistent standards when producing the product and this process has been subject to external assessment. Within recent years, collaborative standards initiatives (CSI) have been growing in importance as an instrument of global governance arena (Litovsky, Rochlin, Zadek, & Levy, 2007). These CSIs attempt to address shortcomings in market systems, and even regulations, by building consensus in relation to rule setting. Five core principles, as illustrated in Figure 17 underpin these CSIs.

At the local level, the Barbados National Standards Institution (BNSI) was established in 1973 as a joint venture between Government and the private sector to prepare and implement national standards; encourage education and training in standardisation;

certify products, commodities and processes that conform to national standards; and promote the use of standardisation as a tool for enabling sustainable development. To date, the BNSI has assisted a number of companies to achieve international certification: Harris Paints (ISO 9001-Quality Management Systems), BL&P (ISO 9001 - Quality Management Systems), The Rum Refinery of Mount Gay Ltd. (ISO 14001 - Environmental Management Systems) and Arawak Cement Company Ltd. (ISO 9001 - Quality Management Systems and ISO 14001 - Environmental Management Systems). There should be incentives put in place to encourage the greater uptake of certification schemes such as the ISO 14000 environmental management series and the European Union's Eco-Management and Audit Scheme (EMAS), even to the extent that it becomes a requirement in some instances. There is yet significant pent up demand for such certification schemes, despite the number of large companies that have already been certified; however, financing the process is one of the challenges being encountered.

Other standards such as Leadership in Energy and Environmental Design (LEED) for the built environment should also be mandated. Indeed, there needs to be a review of those areas of production, manufacturing and the provision of services where pro-green standards are upheld with the goal of adopting them after making any requisite modifications to make them more comprehensive. Moreover, it is critical that any such review be extended to those areas where no standards currently exist but which must embrace pro-green initiatives if greening the economy is to become a reality, for example, the transportation sector (see Table 45).



The BNSI is currently working on standards in relation to various green technologies and management systems. These include such areas as solar heating systems for domestic hot water, the method of thermal testing of solar collectors, energy management systems - specification with guidance for use (re. ISO 14001), and energy labelling of appliances and products. Through the CROSQ/IDB-MIF Project⁶⁷ the BNSI is also seeking to enhance the competitiveness of small and medium-sized enterprises through industry, country and region-wide standardisation. The project has four components: (1) awareness-raising, (2) development of technical standards and conformity assessment guidelines,

FIGURE 17. CORE PRINCIPLES OF COLLABORATIVE STANDARDS INITIATIVE



(3) training, and (4) the establishment of a national and regional information system, and the training of country experts involved in standardisation work.

Recognising the potential marketing benefits of environmental certification, many hotels in the island have also been pursuing the Green Globe Certification,⁶⁸ which operates under a worldwide ten-year license from Green Globe Limited, the owner of the Green Globe brand worldwide. This rating/certification attempts to promote energy efficiency, water conservation, reduction in the production of pollutants and generally contributing to healthier environments. To date only a small proportion of the total number of hotels on the island has pursued Green Globe Certification. The Green Building Initiative (GBI) is another organization that seeks to "accelerate the adoption of building practices that result in energy-efficient, healthier and environmentally sustainable buildings by promoting credible and practical green building approaches for residential and commercial construction".⁶⁹ Buildings can achieve one, two, three or four Green Globes® where one Green Globe "demonstrates movement beyond awareness and a commitment to good energy and environmental efficiency practices" to four Green Globes "reserved for select buildings that serve as national or world leaders in reducing environmental impacts and efficiency of buildings".

The Government in 2007 explicitly expressed support for environmental certification programmes such as International Standard Operations (ISO) 14001, Green Globe Certification and Leadership in Environmental and Energy Design (LEED) or its equivalent. To this end, it was proposed that the costs incurred by a company to achieve

TABLE 56. SUMMARY OF EXISTING ENABLING MECHANISMS AND EXPERTS' ANALYSES OF STRENGTHS, CHALLENGES, OPPORTUNITIES AND RELATIVE EFFECTIVENESS – STANDARDS AND REGULATIONS

Existing policy implementation mechanisms		Key findings from stakeholder meetings and experts' workshops
Local/National	Regional/International	
<ul style="list-style-type: none"> Barbados National Standards Institute (BNSI) Various Environmental-related legislation and associated regulations (such as Barbados Marine Reserve Regulations 1981 (28/1981), Fisheries Regulations, etc.) 1993 Barbados National Building Code and Barbados Building Act National Agriculture Health Food Control programme National Biosafety Framework Green Business Certification by Future Centre Trust (FCT) 	<ul style="list-style-type: none"> CARICOM Regional Organisation for Standards and Quality (CROSQ) (such as CRS 14: 2010- Requirements for Good Management Practices for Micro, Small and Medium Enterprises) MEAs including Cartagena Convention for the Protection of the Wider Caribbean Sea International Standards Organization (ISO 9000, 14000, etc.) Leadership in Energy and Environmental Design (LEED) Bilateral Agreements 	<p>Strengths</p> <ul style="list-style-type: none"> A standards review process is conducted by the BNSI every five years to assess the impact and effectiveness of standards developed. <p>Challenges</p> <ul style="list-style-type: none"> There is limited capacity for enforcement of standards/regulations <p>Opportunities</p> <ul style="list-style-type: none"> Local standards could be developed to complement the sometimes more rigorous international standards Local standards must be driven by national policy/priorities and be country specific Social Partnership should be involved in driving the uptake of standards <p>Responses/Effectiveness</p> <ul style="list-style-type: none"> There is the perception by the private sector and decision-makers that more rigorous standards will retard development/profitability, when in fact this is mostly a misconstrued perception

Source: Stakeholder discussions and authors' analysis.

internationally recognised environmental certification should be a tax write-off at a rate of 150 per cent of the costs incurred.⁷⁰

The Future Centre Trust, a local NGO, has also developed its own certification programme⁷¹ for business desirous of greening their operations. The Trust certifies a business as a "green business" if it meets certain benchmarked goals: waste reduction and recycling, energy conservation and renewable energy development, pollution control and management, water conservation, and education and outreach. After the initial certification, the Trust reassesses the company on an annual basis, thereby helping the company to develop a green strategy and action plan; offers recommendations on further green initiatives that can be undertaken, such as green training for employees; and provides businesses with a green business logo than can be used to promote green business within the organization. This is wholly a NGO driven initiative and the demand for the certification is robust.

There is the potential for the integration of green building initiatives through the work of the Barbados Building Standards (Table 56). The purpose of the Building Standards Authority is to safeguard people in and around buildings, and also to

promote energy conservation and efficiency and the suitable provision of facilities for disabled people. The BBSA will administer the standards system, enforcing regulations as approved by parliament. The enforcement of the standards of the Barbados National Building Code 1993 is one of the primary functions of the BBSA. However, the empowering legislation, the Barbados Building Act, is yet to be approved by Government. The proposed Barbados Building Act will provide the legislative framework for the establishment and operation of the Barbados Building Standards Authority and the mandatory use of the Barbados National Building Code 1993.

The regulations pertaining to the operation of wastewater treatment plants and the uses to which treated water can be put requires revisiting to ensure that they properly balance the needs of public health and the environment without being unnecessarily prescriptive. There is a need to ensure that the Water Reuse Act and Regulation is placed on the statute book. It is imperative that a National Water Policy and Water Resources Management and Development Plan are drawn up and put in place and supported by the necessary legislation. This would include separating responsibility for water service provision from water resource management, environmental regulation and putting in place a sound economic

and customer service regulatory framework. With respect to solid waste, and in particular reused and recycled products, there is a need to ensure that the necessary testing and certification standards and procedures are developed and in place and that they conform to international standards. This will include having the necessary testing standards, facilities and diagnostic capabilities in place as well as the enforcement of standards capabilities to make such measures meaningful. There would also be a need to develop standards and codes of practice for the installation and operation of biodigestors. In all of this the Barbados National Standards Institute would have to play a role. There is a significant body of regulatory provisions. However, many of these still need to be updated, integrated, adopted and/or operationalized in order to meet the requirements and standards for greening the building/housing industry as a specific integrated policy objective.

4.1.7 GOVERNMENT PROCUREMENT

Like most countries around the world the public sector is the single largest purchaser of goods and services in Barbados. In 2010, Net Government Expenditure amounted to US\$ 834 million or about 20 per cent of GDP in that year (GOB, 2010d). This expenditure is usually on acquisitions of goods such as office equipment, fixtures and fittings, vehicles, building maintenance, transport, cleaning, catering, and others. Government can therefore act as a catalyst for the production and consumption of greener goods by shifting its purchasing policy.

In 2007, the then Ministry of Environment, Water Resources and Drainage produced a Procurement Brief that outlined the current status of procurement policy in the island, the rationale behind green procurement and a programme schedule for the implementation of a green procurement policy. Purchases of some of goods used by Government Ministries/Departments are secured through the Central Purchasing Department. The Department's budget (around US\$ 1.75 million), however, represents just a small proportion of all the purchases made by Government. Most of the items purchased are cleaning products, office stationery and hardware (brooms, batteries, and others).

The Government has taken steps recently to modernise the Department and enhance the procurement process. Financed with a loan from the IDB, the government is in the process of

selecting a consultant to carry out the project entitled "The Modernisation of the Barbados National Procurement System". It is expected that this consultancy, in alignment with the Marrakech Task Force proposed approach, investigate the legal framework with the goal of integrating green procurement as well as assess the overall readiness of the market with respect to green procurement. It is also envisioned that the consultant would work closely with a national steering committee that would address issues in relation to:

- product/service groups;
- baseline inventory;
- target setting;
- development of an action plan;
- implementation of an action plan; and,
- monitoring and reporting procedures.

The Public Sector Energy Conservation Programme was started in 2006 to reduce the cost of energy in the public sector. Key provisions of the programmes include mandates to increase fuel efficiency in government vehicles, install energy efficiency lighting and appliances, and to do energy audits on government buildings. The programme also envisages establishing conservation obligations for various public entities and departments, and enforcing penalties for non-compliance.

One of the potential hurdles towards the implementation of a green procurement policy in Barbados is the relatively high cost of these goods as well as their unavailability (Table 57).

It is important that green policies for procurement also incorporate life cycle concepts as well. Such an approach would incorporate the impact at the purchasing stage (delivery, installation, commissioning and insurance), use (energy losses, maintenance, repair and replacement), end-of-life (removal, recycling, refurbishment and disposal) as well as longevity and warranty time frames.

4.1.8 GOVERNANCE AND INSTITUTIONS

Central to an integrated approach to Government's green economy endeavours is the role of governance and the effectiveness of the supporting institutional framework. The GESS has highlighted several policies and mechanisms already in place that can assist in enabling Barbados' green economy transition. However "experts" highlighted several

TABLE 57. SUMMARY OF EXISTING ENABLING MECHANISMS AND EXPERTS' ANALYSES OF STRENGTHS, CHALLENGES, OPPORTUNITIES AND RELATIVE EFFECTIVENESS – GOVERNMENT PROCUREMENT

Existing policy implementation mechanisms		Key findings from stakeholder meetings and experts' workshops
Local/National	Regional/International	
<ul style="list-style-type: none"> Central Purchasing Department and the Financial Administration and Audit Act Public Investment Programme GOB/IDB Procurement Project Public Sector Energy Conservation Programme Greening Government Initiative 	<ul style="list-style-type: none"> 2010 Ministers of Environment of LAC Decision on Sustainable Consumption and Production re Sustainable Procurement UNEP Marrakech Task Force on Sustainable Procurement 	<p>Strengths</p> <ul style="list-style-type: none"> Green procurement has already been discussed at the highest levels <p>Challenges</p> <ul style="list-style-type: none"> The government procures on the basis of 'least cost', which can lead to harmful effects on the environment and human health Procurement is often seen as an administrative function, when actually it is a technical function <p>Opportunities</p> <ul style="list-style-type: none"> Development of a Procurement Policy that feeds into a green building strategy Establishment of standards Demonstration projects in housing, agriculture and tourism <p>Responses/Effectiveness</p> <ul style="list-style-type: none"> Policies have to be compliant with international trade commitments and standards

Source: Stakeholder discussions and authors' analysis.

governance challenges that might affect its realisation. Those issues include:

- stakeholder buy-in;
- whole-of-government approach and singularity of vision;
- responsiveness of government institutions;
- institutional cohesion and collaboration,
- policy prioritisation;
- policy impact analysis capability;
- harmonisation of government reporting systems (economic reporting is separate to financial reporting);
- timely reporting and feedback systems;
- public information and accountability; and
- public sector-private sector trust and cooperation.

Table 58 highlights some of the strength, as well as opportunities for addressing the above challenges.

The Social Partnership was considered by the Experts' Meeting as having a major role in overseeing the implementation of Barbados' green economy agenda. Of particular note is the Social Partnership's May 2011 declaration with respect to pursuing sustainable development in Protocol Six. Environmental protection and green economy were specifically integrated in current Protocol by strengthening those clauses already subscribed to

in Protocol Five and fully supporting initiatives that seek to reduce the country's carbon footprint and health and safety matters. The specific clauses are:

“7.40 The Social Partners acknowledge and reaffirm Barbados' commitment to the full implementation of the Programme of Action for Sustainable Development of Small Island Developing States agreed to by the global community at the 1994 United Nations Global Conference on Sustainable Development of Small Island Developing States, held in Barbados.

7.41 The Social Partners fully subscribe to the concept of a low carbon resource-efficient Green economy and the goal of Barbados becoming the most environmentally advanced green country in Latin America and the Caribbean and therefore support the principles of the United Nations Environmental Programme and therefore fully support the promotion of all aspects of a green economy in Barbados.

7.44 The Social Partners therefore fully support those policies which acknowledge agreed criteria for sustainability and which seek to implement those principles and practices specifically designed to ensure that economic growth and development do not occur to the detriment of ecological capital.”

TABLE 58. SUMMARY OF EXISTING ENABLING MECHANISMS AND EXPERTS' ANALYSES OF STRENGTHS, CHALLENGES, OPPORTUNITIES AND RELATIVE EFFECTIVENESS – GOVERNANCE AND INSTITUTIONS

Existing policy implementation mechanisms		Key findings from stakeholder meetings and experts' workshops
Local/National	Regional/International	
<ul style="list-style-type: none"> • Social Partnership and Social Protocols • Ministry of Environment and Drainage • Ministry of Finance and Economic Affairs • MEA Committees • Constituency Empowerment Councils • Green economy Technical Steering Committee • Cabinet (and its various committees including Infrastructure, Governance, and Economic) • Parliament • Tourism Advisory Council • Fisheries Advisory Committee • Town Planning Act • Fair Trading Commission • Professional associations and legislative provisions (Architects Registration Act, etc.) • Environmental Education Committee 	<ul style="list-style-type: none"> • CARICOM • Ministers of Environment Forum for LAC • UNEP Governing Council • UWI • UNGA-SIDS Decisions 	<p>Strengths</p> <ul style="list-style-type: none"> • Existence of the Social partnership • High-ranking in Transparency International Corruption Perception Index (Ranked 1st in LAC and 16th world wide of 183 countries surveyed in 2011) <p>Challenges</p> <ul style="list-style-type: none"> • Publication of annual reports by government-owned entities • Weak feedback mechanisms <p>Opportunities</p> <ul style="list-style-type: none"> • The Social Partnership is a potential strength, as it brings together workers, as well as the employers in the private and public sector • Resource efficiency pursuit should be integrated into the island's competitiveness strategy • Partnering with development partners such as (DEFRA UK, Taskforce on Sustainable Lifestyles, etc.) and UWI in assessing "environmental behaviour" as the basis for environmental education programming • Reforming the public sector enhances the management of the country's natural resources base - focus on resource management agencies as a priority <p>Responses/Effectiveness</p> <ul style="list-style-type: none"> • Standards set/imposed by various external economic and environmental organizations, processes and multilateral frameworks

Source: Stakeholder discussions and authors' analysis.

With respect to the latter mentioned clause (7.44), the principles of sustainable development articulated in the National Sustainable Development Policy, should be built on to establish the required criteria for sustainability. These principles include improvements in the quality of life, conservation of resources, economic efficiency, economic instruments, science and technology, equity, participation and respect.

A Sustainability Policy Impact Assessment Framework (SIAF) should be developed. That SIAF should be developed and administered by the Social Partnership for the purpose of evaluating the strategic effect of newly articulated sector-specific policies. The SIAF would provide a consultative-based, structured means to identifying gaps and articulating interventions for aligning policies towards the "Operational Principles". To buttress the Social Partnership in operationalizing the SIAF, a 10-member Sustainability Strategic Advisory Group chosen from institutions involved in Cabinet-appointed GETSC and in the wider

GESS Stakeholder Consultation process should be established. The purpose of that body should be to provide support to the Social Partners in relation to mainstreaming green economy initiatives.

4.1.9 DATA, INFORMATION AND COMMUNICATION

Closely related and intertwined with the role of "Governance and Institutions" is that of "Data, Information and Communication. The European Commission (2008) estimates that using ICT in a smart way could help reduce energy consumption in buildings (by 17 per cent), transport and logistics (by 27 per cent), and save 15 per cent in total carbon emissions by 2020. ICT can improve energy efficiency in several ways:

- Monitoring and controlling energy used in, and produced by, buildings;



Communication tower at the Caribbean Institute of Meteorology and Hydrology. Photo: Anne Gonzalez

- Optimising energy and reducing carbon footprint in the logistics industries, in particular transportation and storage requirements;
- Improving production efficiency control, energy distribution, and consumption through smart metering and smart grids. With smart meters in homes, for example, consumers could reduce their energy consumption by as much as 10 per cent;
- Helping consumers to understand better how much energy they consume, how much it costs, and how it varies during the day, for example through a website such as www.welectricity.com, which was set up by the St Vincent and the Grenadines-based Herbert Samuel;
- The rollout of broadband networks facilitating the increased use of online public services and applications could save at least 1–2 per cent of total energy use worldwide by 2020. For an island such as Barbados where online public services are limited, further savings would be expected.

An evidence-based approach to policy development and evaluation will require an effective green economic, or sustainable development indicators built on sound . According to (Singh and Sealy, 2007) several initiatives have been undertaken to date with respect to establishing a system of sustainable indicators, including:

- Establishment of the National Indicators Programme 1997, including participation in

the UN Testing Programme for Sustainable Development Indicators for Sustainable Development;

- Convening of a National Workshop in 2000 on Indicators for Sustainable Development with aim of developing the “Indicators for Sustainable Development for Barbados”;
- Establishment of Steering Committee on Indicators of Sustainable Development;
- Participation in the OAS Project: Capacity Building in Creating Information Management Systems to Improve Decision-Making on Sustainable Development- Issues and Challenges for Caribbean SIDS,
- Production of a State of Environment Report;
- Consultation on developing Indicators for the 2006-2025 National Strategic Plan, including indicators for Goal 4, Building a green economy- Strengthening the Physical Infrastructure and Preserving the Environment.

The government is also engaged in:

- the Working Group on Environmental Indicators called for by the Forum of Ministers of Environment of Latin America and the Caribbean; and
- various initiatives by CARICOM Secretariat on environmental statistics.

Singh and Sealy (2007) outlined several challenges to institutionalising environmental indicators and specifically to data collection, including:

- Lack of dedicated personnel;
- Fragmentation of institutions involved in data collection;
- Variation in media-type used to collect data;
- Sensitivity of some data-types collected; and
- Lack of coherent data-request structures among regional and international institutions.

As previously mentioned, Government is currently implementing the GOB-IDB Funded Modernisation of the Barbados Statistical Service Project (MBSS).⁷² The US\$ 6.25m project, currently underway, presents a significant opportunity for mainstreaming environment in core social and economic data and statistical systems. The MBSS can assist in addressing the above constraints. The Ministry of Environment and Drainage is also collaborating with UNEP (ROLAC) and the University of the West Indies Cave Hill Campus in the production of a national sustainable development indicators report under the Latin America and the Caribbean Initiative for Sustainable

Development (Singh, A., pers. comm.). The latter effort should be developed with a view to inform the MBSS.

The Government has also made several attempts at integrating Geographical Information Systems (GIS) in environmental, social and economic planning systems. The most successful effort to date has been the Environmental Management and Land Use Project (EMLUP). The application of cartographic information systems can improve the efficiency and effectiveness of Green Economic evidence-based policy processes in Barbados. However, the constraints highlighted above will transcend to the application of GISS. Even the crosscutting nature of data and information systems to the three Rio Conventions and green economy, the NCSA project should be utilised strategically to assess and build

the Barbados GIS capabilities. Data processing department of government should be strengthened to support a central policy and government-wide ICT and GISS processes.

Table 59 highlights the outputs of the Experts Workshop Sub-group on Data, Information and Communication.

UNEP therefore recommends that, in the short to medium term, governments focus on those goods and services that promise lower overall costs, consider long-term lease arrangements and consider transforming tenders for individual products into tenders for integrated services (2011a; UNEP, 2011b) (see Table 57).

TABLE 59. SUMMARY OF EXISTING ENABLING MECHANISMS AND EXPERTS' ANALYSES OF STRENGTHS, CHALLENGES, OPPORTUNITIES AND RELATIVE EFFECTIVENESS – DATA, INFORMATION AND COMMUNICATION

Existing policy implementation mechanisms		Key findings from stakeholder meetings and experts' workshops
Local/National	Regional/International	
<ul style="list-style-type: none"> Barbados Statistical Service and supporting legislation Data processing Department and Barbados Government Information Services and Portal (BGIS Portal) Government Information Service Annual Social and Economic Report EMLUP and the development of Geographic Information System (GIS) capabilities in Government 	<ul style="list-style-type: none"> ILAC under UNEP ROLAC GEO UN CSD Reporting Structures- National reporting UN Stats CARICOM Statistics 	<p>Strengths</p> <ul style="list-style-type: none"> Systematic approach to collecting social, economic and basic environmental data Structures exist for the sharing of information- reporting systems, Government Information Service <p>Challenges</p> <ul style="list-style-type: none"> Government is still largely paper-based Limited human resources- lack of dedicated personnel for management of information in line departments Policy impact analysis capability is limited Information not being shared in a timely manner Current legislative system limits public access to information Keeping websites updated Sensitivity of information <p>Opportunities</p> <ul style="list-style-type: none"> Application of ICTs and data sharing protocol for greater public access- Data Processing Department should have lead responsibility for executing a government wide-policy GOB-IDB Modernisation of the Barbados Statistical Service Partnership with UWI in preparing Sustainable Development Indicators under the ILAC NCSA and a focus on assessing and building GISS Capability Training in Policy Impact Analysis Policy on the sale of data should be established ICTs should be seen as Resource –Efficient and GE strategy <p>Responses/Effectiveness</p> <ul style="list-style-type: none"> Fiscal constraints and effect of not increasing staff complement- opportunity to upgrade and transfer within existing resources Need for constantly updating security protocol and systems regarding public access- requires dedicated highly skilled resources Need for high-level buy-in and direction

Source: Stakeholder discussions and authors' analysis.

ENABLING CONDITIONS FOR IDENTIFIED SECTORAL OPPORTUNITIES

Chapter 3 of this study identified a number of potential sectoral opportunities, and bringing these ideas to fruition will require support in relation to some of the enabling conditions identified above. As a preliminary assessment of these opportunities, Table 60 presents an overview of the key supporting elements that might be necessary and suggests recommendations in relation to finance, taxation, incentives and fiscal reform and education, training and capacity enhancement.



Government headquarters – Providing the policy environment for a green transition. Photo: Steve Devonish

4.3 CONCLUSIONS

Although the sector reports suggest that there is some benefit from greening agriculture, fisheries, transport, building and tourism, enabling conditions are still an integral part of the process. In this section, the study identified nine key policymaking areas that are needed for greening the economy:

1. finance and investment;
2. development, access, and transfer of clean technology;
3. tariffs and trade policy;
4. taxation, incentives and fiscal reform;
5. education, training and capacity enhancement;
6. standards and regulation;
7. government procurement;
8. governance and institutions; and
9. data, information and communication.

One of the most important components of the emerging green economy will be finance. In this regard, stakeholders identified a number of existing policy implementation mechanisms including the government's Consolidated Fund, the Enterprise Growth Fund, the Energy Smart Fund, the IDB Country Strategy, the Central Bank Credit Guarantee Scheme and the Industrial Credit Fund. With all of these existing mechanisms, financing a green economy transition should be feasible once it is effectively packaged. Such financing mechanisms are also sustained by a broad array of fiscal incentives that can support greening in virtually all spheres of economic activity.

This chapter also discussed the importance of education, training and capacity enhancement to enable workers to not only take advantage of new job opportunities offered by green economy but also to enhance the productivity of current occupations. There are already a number of mechanisms that can be utilised, including the National Development Scholarship, the Samuel Jackman Prescod Polytechnic, the Barbados Community College's Industry Services Unit and the Barbados Vocational Training Board to name a few. At the regional and international level, the University of the West Indies, the CARIBSAVE Scholarship Programme and the City and Guild Green Skills Programme are just some of the schemes available.



Financing is key element in a green economy transition.
Photo: Travis Sinckler

These enabling conditions, while supporting the transition to a green economy, are also closely aligned with the United Nations Convention on Biological Diversity, the United Nations Framework Convention on Climate Change and the United Nations Convention to Combat Desertification. The mechanisms available under these three MEAs can also address any investment gap that may exist in terms of supporting the transition to a greener economy. Local policymakers should therefore now attempt prioritise at both the country and industry level the strategies that are aligned with existing commitments.

TABLE 60. SYNOPTIC TABLE OF AN ASSESSMENT OF OPPORTUNITIES IDENTIFIED AT THE SECTORAL LEVEL WITH RESPECT TO REQUIRED AND AVAILABLE POLICY SUPPORT MECHANISMS

	Finance		Development, access and transfer of clean technology		Trade, tariffs and investment		Taxation, incentives and fiscal reform		
	REQ	AVA	REQ	AVA	REQ	AVA	REQ	AVA	
Agriculture									
Cooperatives	PR	PA	—	—	—	PA	PR	—	
Fish offal as organic fertilizer	PR	PA	PR	PA	—	—	PR	—	
Use of household waste as fertilizer	PR	PA	PR	—	—	—	PR	—	
Fisheries									
Process fish offal into higher value-added products	PR	PA	PR	—	—	—	PR	—	
El Dorado skin into fish leather	PR	PA	PR	—	—	—	PR	—	
Clean technologies	PR	PA	PR	—	PR	PA	PR	PA	
Building/Housing									
Convert derelict sugar factories into waste-to-energy plants	PR	—	—	—	—	—	PR	—	
Provisions and subventions	PR	PA	—	—	—	—	PR	—	
Recycling communities	PR	—	—	—	—	—	PR	—	
Transport									
Integrated approach to public transport	PR	—	—	—	—	—	PR	—	
Standards for fuel mixes	PR	—	PR	PA	—	—	PR	—	
Green vehicles	PR	—	PR	PA	PR	PA	PR	—	
Tourism									
Marketing Barbados as a green destination	PR	PA	—	—	PR	—	PR	PA	
Develop heritage tourism sites	PR	PA	—	—	PR	—	PR	PA	
Creation of marine protected areas	PR	PA	—	—	—	—	PR	—	

	Education, training and capacity enhancement		Standards and regulation		Government procurement		Governance and institutions		Information, data analysis and communication		
	REQ	AVA	REQ	AVA	REQ	AVA	REQ	AVA	REQ	AVA	
	Agriculture										
	PR	—	SR	—	PR	PA	PR	—	SR	—	Cooperatives
	PR	—	SR	—	SR	—	—	—	—	—	Fish offal as organic fertilizer
	PR	—	PR	—	SR	—	—	—	—	—	Use of household waste as fertilizer
	Fisheries										
	—	—	SR	—	—	—	—	—	SR	—	Process fish offal into higher value-added products
	—	—	SR	—	—	—	—	—	SR	—	El Dorado skin into fish leather
	PR	—	SR	PA	—	—	—	—	SR	—	Clean technologies
	Building/Housing										
	PR	—	SR	—	—	—	—	PA	—	—	Convert derelict sugar factories into waste-to-energy plants
	PR	—	PR	—	SR	—	PR	PA	—	—	Provisions and subventions
	PR	—	SR	—	—	—	PR	PA	—	—	Recycling communities
	Transport										
	PR	—	PR	—	SR	—	PR	PA	SR	—	Integrated approach to public transport
	PR	—	PR	PA*	SR	—	PR	PA	SR	—	Standards for fuel mixes
	PR	—	PR	PA*	SR	PA	PR	—	SR	—	Green vehicles
	Tourism										
	PR	PA	SR	PA*	—	—	PR	—	SR	PA	Marketing Barbados as a green destination
	PR	—	SR	—	—	—	PR	PA	SR	PA	Develop heritage tourism sites
	PR	—	PR	PA	—	—	PR	PA	SR	—	Creation of marine protected areas

- 5.1 OPERATIONAL PRINCIPLES OF SUSTAINABILITY FOR BUILDING A RESOURCE EFFICIENT GREEN ECONOMY
- 5.2 POLICY COHESION, GOVERNANCE AND INSTITUTIONS
- 5.3 PUBLIC SECTOR LEADERSHIP AND PUBLIC PROCUREMENT
- 5.4 PRIVATE SECTOR COMMITMENT
- 5.5 PUBLIC EDUCATION
- 5.6 PARTNERSHIPS AND SYNERGIES
- 5.7 PERIODIC MONITORING
- 5.8 PROMOTE SIDS-SIDS KNOWLEDGE TRANSFER OF GREEN ECONOMIC POLICIES AND PRACTICES
- 5.9 CAPACITY BUILDING
- 5.10 BUILDING A SCIENCE POLICY RESEARCH PLATFORM



CONSIDERATIONS FOR A GREEN ECONOMY POLICY ROADMAP



CHILDREN AT DAYCARE – A SIDS GREEN ECONOMY MUST ENABLE DEVELOPMENT OPPORTUNITIES FOR THE NEXT GENERATION. PHOTO: TRAVIS SINCKLER



Scaling up efforts to integrate renewable technologies in public infrastructure – The new Sharon Primary School. Photo: Natural Heritage Department

INTRODUCTION

The study has highlighted the progress Barbados has made in relation to greening its production system. The study, however, identified a number of sectoral investment gaps that, if implemented, would support the green transition:

- Institutional strengthening in agriculture and fisheries;
- Standards and regulations for fisheries;
- Develop training programmes to provide a cadre of persons to support green building/housing;
- A policy framework that addresses issues in relation to public attitudes in support of greening transportation;
- Mainstream adaptation to climate change in tourism; and
- Consult with stakeholders to address the problem of low occupancy rates in the tourism industry.

The study also identified a number of critical enabling conditions, such as:

- Public sector demonstration projects in the area of social housing;
- Resource-use fees can be employed, when linked with various heritage, community and marine/

nature-based tourism initiatives, to finance a green economy transition;

- Implement standards to support clean technology transitions;
- Reduce tariffs on resource efficient products; ;
- Include green objectives when regulating utilities;
- Set-up a revolving fund to support re-use and refurbishment of existing buildings (especially those of historic, cultural or aesthetic value) ;
- Consider the use of green taxes to elicit behavioural change;
- Support vocational training, trade schools, university and on-the-job training initiatives that address green training and capacity needs;
- Integrate green building standards into the Barbados building code;
- Develop standards for the operation of wastewater treatment plants;
- Include the environmental and human health effects in government procurement decisions; and
- Consider institutionalising the Green Economy Steering Committee to steer the national green objectives.

5.1

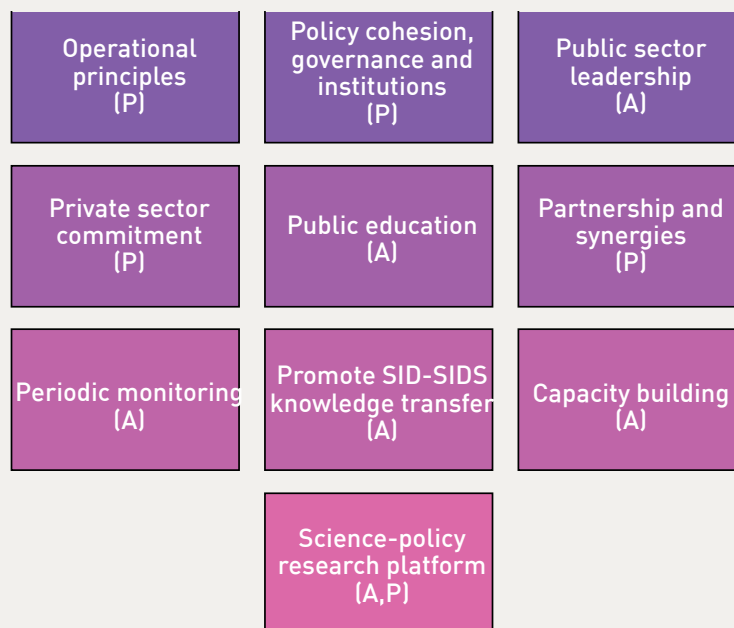
OPERATIONAL PRINCIPLES OF SUSTAINABILITY TO BUILDING A RESOURCE EFFICIENT GREEN ECONOMY

While Barbados' definition of a green economy also recognizes ecological limits as the basis for deploying the country's factors of production, it is important to note that at the core of this is the requirement of an integrated approach to development.. Building a green economy, as articulated in the 2006-2025 National Strategic Plan, remains a key development goal for Barbados.

At the launch of the GESS on the 9th March 2012, the Prime Minister noted that the roadmap for Barbados should encapsulate the following foci for the short- to medium-term: principles of sustainability, policy cohesion and appropriate governance mechanisms, public sector leadership

in conservation and sustainable procurement, private sector commitment through financing, investment and innovation, public investment, public education and engagement, a horizontally and vertically integrated partnership platform, profits invested towards social upliftment and cultural heritage development, periodic monitoring and assessment, and global promotion of the country's green achievements. Through our consultations over the study period and the findings presented herein, the following considerations are offered towards the development of a strategic roadmap for achieving the goal of Barbados in becoming an environmentally advanced green country (see Figure 18).

FIGURE 18. STRATEGIC ROADMAP FOR BARBADOS



Note: "P" indicates policy and "A" indicates activities.

POLICY COHESION, GOVERNANCE AND INSTITUTIONS

The national principles of sustainable development expounded in the 2004 Barbados Sustainable Development Policy provides a philosophical underpinning for a green economy. Those principles are:

- Quality of Life;
- Conservation of Resources;
- Economic Efficiency;
- Equity; and
- Participation

In developing a roadmap, it is further recommended that a set of operational principles be established as the basis for policy development, education, monitoring and evaluation. Such principles should be easily translated into measurable criteria.

The following six operational principles are recommended:

1. Advancing the well-being of society, particularly vulnerable groups;
2. Achieving protection and/or restoration of ecosystem health;
3. Enabling efficiency in resource use and management;
4. Promoting participatory governance ;
5. Enabling responsive institutions; and
6. Promoting research, development and innovation.

Barbados' world-renowned Social Partnership, a tripartite mechanism established in the early 1990s to formulate a united response to the country's economic and social challenges, was represented effectively throughout the GESS process. It was identified during stakeholder workshops as the most appropriate mechanism to oversee Barbados' green endeavour. The Social Partnership, given its configuration – business, labour and government – and strategic role in national development, as well as its new emphasis on green economy and the implementation of the Barbados Plan of Action (BPOA) as articulated in Protocol VI, should have

umbrella responsibility for monitoring, reviewing and reporting on Barbados' green economy roadmap. Moreover, a sustainability policy impact assessment framework (SIAF) should be developed from the operational principles stated above. SIAF should be formulated and administered by the Social Partnership for the purpose of evaluating the strategic effect of newly articulated sector-specific policies. SIAF would also provide a structured consultative mechanism for identifying gaps and articulating interventions that would result in an alignment of policies with the operational principles. To buttress the Social Partnership in activating the SIAF, a 10-member Sustainability Strategic Advisory Group should be established. These persons would be chosen from among those serving in the Cabinet-appointed GETSC and participants in the wider GESS stakeholder consultation process. The purpose of that body would be to provide support to the Social Partnership in relation to mainstreaming green economy initiatives.

Moreover, it is essential that the Social Partnership be afforded a research secretariat to support the above-mentioned functions. The Social Partnership could develop a co-funding strategy for this secretariat. Furthermore, the Social Partnership should be commissioned to publish a biannual report regarding Barbados' progress in implementing the green economy roadmap. Other institutional interventions recommended are the following:

- Establishment of an overarching programme for strengthening agricultural cooperatives in Barbados. The Commonwealth Secretariat's Commonwealth Fund for Technical Cooperation should be considered in this regard.
- During stakeholder consultations, it was noted that there was a need for training and retraining of technical personnel in agriculture. Consideration, therefore, should be given to conducting an institutional strengthening programme for agricultural extension services. Additionally, establishment of an agricultural college and field school should be considered. A partnership framework with existing institutions with a core competence in this area should also be established, such as UWI-St. Augustine, the

Barbados Community College and the Barbados-based Bellairs Research Institute of McGill University.

- Execution of an institutional strengthening programme for the Fisheries Division and harmonisation of the supporting legislative framework.
- Creation and implementation of a sustainable business and financial model to support the development and management of marine protected areas. The recommendations of the Marine Management Authority should be reviewed and acted on in the near-term.
- Creation of fiscal incentives and innovative financial mechanisms to promote the use of fish waste in agriculture. Alternatively, the Global Environment Facility (GEF) Small Grant Programme could be utilized if pursued as a cooperative undertaking. A potential research partnership could be established with the Barbados Manufacturers Association, the Barbados Agriculture Society and Barbados National Union of Fisherfolk Organizations (BARNUFO), with technical support from the Ministry of Agriculture.
- Expediting the establishment of the National Agricultural Food and Health Safety Authority and the laboratory infrastructure upgrade project to support the development and export of seafood value-added products.
- Undertaking the feasibility of creating a sustainable agriculture and fisheries micro-credit scheme. Such a scheme should focus on accessing clean and more efficient technologies. A strengthened extension service should be considered in the design of such a scheme.
- Development of an integrated public transportation policy and investment programme consistent with the Physical Development Plan (Amended 2003) and the Barbados Sustainable Development Policy.
- Establishment of a vehicle emission testing facility.
- Preparation of Barbados' Second National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) with a view to identify technological interventions and climate financing opportunities for mitigation

projects in the transportation and building sectors.

- Given the ecosystems service value, exploration by Government of the options within the current policy and legislative frameworks to expedite the establishment of the Barbados National Park and System of Protected Areas because of its potential for tourism marketing gains and local economic development.
- Review and upgrade of Barbados' Integrated Solid Waste Management Programme. This should include a rationalisation of the role of the Solid Waste Project Unit relative to the Sanitation Service Authority.
- Expediting the implementation of the Water and Sanitation Upgrade Project.

Although various legal instruments exist, the following are recommendations that incorporate the findings of the sectoral analysis and are offered to further buttress the legislative base of a green economy:

- Finalisation of environmental management legislation and operationalization of the Environmental and Natural Resources Management Plan;
- Establishment of water reuse regulations;
- Development of groundwater provisions legislation;
- Development of solid waste management legislation;
- Finalisation of legislation dealing with greening the building/housing sector and operationalization of the Barbados Building Code, and
- Strengthening of the policy guidelines framework as outlined in the Physical Development Plan (Amended 2003).

PUBLIC SECTOR LEADERSHIP AND PUBLIC PROCUREMENT

The GESS highlights several examples of public sector innovation and initiative in operationalizing various aspects of green economy. It is critical that such efforts be intensified in the following areas:

- Implementation of the Public Sector Energy Conservation Programme under the coordination of the Cabinet Secretary. The Renewable Energy and Energy Efficiency Unit should be the technical secretariat for this initiative.
- Establishment of sustainable design criteria for public sector social housing initiatives based on the stated operational principles. Government should undertake demonstration projects for the development of sustainable communities over the short term. Such communities would serve to demonstrate key elements of the vision articulated by housing and building stakeholders. Data and information should be gathered and reported throughout the life cycle of these projects. In this regard, the Eckstein Village housing project, identified during Client meetings by the National Housing Corporation, and the Urban Development Commission should be given priority.
- A public sector social and environment reporting pilot project should be established that focuses on statutory corporations. The National Conservation Commission within the Ministry of the Environment and Drainage should pilot this undertaking given its 'greening' focus.
- Additionally, the Urban Development's 'Go Green' Programme should be applied to housing estates and expanded to include wider use of sustainable technologies such as rainwater harvesting and technologies to prevent erosion (reinforced cellular in situ—cast on site—concrete in which natural grass can be grown).
- A Government-wide adoption of technologies to control erosion should be undertaken. All new government-financed projects should integrate this technology where applicable to enable ground water recharge. The Ministry of Transport and Works should coordinate this initiative. As a climate change adaptation measure, external financing should be sought for this undertaking.
- Warrens Suburban Centre should be enabled and promoted as a 'Green Urban Centre'. Efforts to achieve this by the Ministry of Transport and Works (MTW), with support from the Beautify Barbados Programme that has as its core competence landscape design and planning, should be intensified. Other elements for consideration should include:
 - Solar street lighting;
 - Small scale photovoltaic applications on existing infrastructure;
 - Wastewater treatment systems;
 - Infiltration technologies;
 - Secure sidewalks/pedestrian routes; and
 - Solar-lit bus stations (in progress).
- Consistent with its strategic plans, the BIDC should spearhead a Warrens Industrial Park Eco-Innovation Initiative with a focus on improving resource efficiency.
- The Public Investment Unit, as the coordinating agency for capital expenditure, should, in consultation with technical agencies (such as the TCDPO, EPD and MTW) and professional associations (such as the Barbados Institute of Architects, the Town Planning Association and Barbados Association of Professional Engineers), should integrate sustainability principles throughout the procurement process. The feasibility of establishing "A Sustainability Design Brief" as a standard requirement for all tenders should be undertaken. The brief should be based on the operational principles stated earlier.
- The Public Investment Unit, as the lead agency for capital infrastructure programming, should be strengthened. A multiplicity of skill sets should be acquired to support the agenda of the Unit.

5.4 PRIVATE SECTOR COMMITMENT

The GESS highlights several examples of private sector innovation and initiative in operationalizing various aspects of green economy. It is critical that such efforts be intensified in the following areas:

- A comprehensive policy impact analysis of the existing fiscal instruments to support Environmental Management should be undertaken by the Director of Finance and Economic Affairs with the purpose of reforming and strengthening such measures.
- The Green Business Programme (see appended Best Practices) administered by the Future Centre Trust should be evaluated for establishment as a national certification scheme and development agencies approached in that regard. In addition, the environmental and social risk analysis training undertaken by the Barbados Banking Association, UNEP-Finance Initiative and the Ministry of the Environment of the Government of Barbados should be expanded to include all other financial institutions in Barbados and the Eastern Caribbean. The University of the West Indies – Cave Hill could be approached as an academic partner in this regard.
- A feasibility study for the establishment of the Resource Efficiency and Technology Innovation Centre (RETIC), following the call by the Prime Minister, is currently being undertaken. With support from the British High Commission, the study is expected to be completed by mid-2012. The involvement of the Barbados Chamber of Commerce and Industry will be critical to the success of this endeavour. Given the potential role of RETIC in assisting businesses in meeting environmental obligations, while reducing their cost of doing business through resource efficiency measures, it is proposed that the IDB's Competitiveness Programme be accessed for implementation support through its Cluster Facility. It should be noted, though, that the budget for the feasibility study is of the order of BBD 100,000, with contributions in kind of technical assistance valued at approximately BBD 200,000, and this in just one area. This might therefore suggest that actual support required could be at least BBD 1 million, with up to twice that from in-kind contributions.
- With respect to marine protected areas, partnerships with the local tourism fraternity, possibly through the BHTA and marine based non-governmental organizations such as the newly formed Friends of Folkestone, should be encouraged. The GEF Small Grants Facility should be approached for seed financing to facilitate such conservation and education efforts. The recommendations of the Folkestone Redevelopment Programme should be reviewed and implemented.
- The Barbados Chamber of Commerce and Industry's (BCCI) effort to green its facilities should be promoted across the private sector.
- In addition, there is a need for a Prime Minister's Corporate Social and Environmental Annual Award Scheme. The Sustainability Strategic Advisory Group (referred to above in the Policy Cohesion section of this study) and the BCCI's Green Committee should constitute the evaluation committee for the Award Scheme.
- The BIDC's Business Catalyst should continue to showcase green business initiatives and trends.
- BIDC should also consider the market feasibility for establishing an Eco-Innovation Industrial Park at a greenfield site with emphasis on attracting investment in the production of environmental goods and services.
- Incentives should be developed to encourage research and development by local enterprises into cost-effective, alternative renewable energy options under a joint private-public sector arrangement.

5.5 PUBLIC EDUCATION

The GESS highlights several examples of innovation and initiative in public education to operationalize various aspects of green economy. It is critical that such efforts be intensified in the following areas:

- A national public education and information strategy to promote green economy was echoed throughout the stakeholder process. The Social Partnership and the Ministry of the Environment and Drainage through its Environmental Education Committee should drive that strategy jointly. Professional marketing companies should also be engaged.
- The Government Information Service (GIS) should undertake to produce an annual television series on Barbados' Best Practices identified in the GESS.
- Given the success of the Green Economy Solution Panel Series conducted in the GESS process, the Ministry of the Environment through the Policy Research, Planning and Information Unit should convene a similar forum on a bi-annual basis. Regional and international participants should be invited to participate.
- The Ministry of the Environment and Drainage should continue promoting its 'Living Sustainably' motif as an umbrella theme during its month of raising awareness about the environment.
- The focus of the Ministry of the Environment's grant fund to non-profit organizations should be redirected towards green economy initiatives at the local community level. That fund currently manages BD\$ 100,000 but this sum should be doubled in the next two years. The current procedures for utilising the government's Environmental Education Committee as well as showcasing the impact of the grants via the Government Information Service are key information dissemination and accountability measures that should be maintained.
- Government's Constituency Empowerment Councils should create and implement constituency-wide environmental enhancement initiatives. An annual day to celebrate successes in this regard should also be established. The umbrella ministry, the Ministry of Social Care and Constituency Empowerment, should drive this process through existing budgetary allocations. Moreover, additional support to such undertakings should be provided by the pertinent government agencies.



Children at play – The environmental education programme of the Environment Division reaches out to primary, secondary and tertiary education institutions. Photo: Steve Devonish

5.6 PARTNERSHIPS AND SYNERGIES

Achieving a transition to a green economy is not something that a government can hope to achieve by itself, nor should it attempt to do so. One of the implicit approaches of sustainable development, within which a green economy is situated, is the involvement of stakeholders. In this respect, the involvement of stakeholders must go beyond that of consultation, as there has to be recognition that they have an active rather than a passive role to play. What is required is a partnership approach where the respective skills of parties can be harnessed to best effect.

Governments have the important role of setting goals, expectations and the conditions, which implies defining the environment and ensuring that there are systems of incentives that reward compliance. Civil society and the private sector have their roles to play especially with regard to implementation. Given the pioneering nature of transitioning to a green economy and the paucity of prior knowledge as to what this entails, it is imperative that the process draws on examples and experience of best and emerging practices that support a green economy. For this, it will be necessary not just to draw on national players, but to look beyond national borders and partner with actors in the international community.

In the areas of capacity building and knowledge transfer, partnerships with international bodies will be advantageous to Barbados. These could include partnering with UNEP in its Cleaner Production Centres Programme and, through this Programme, with national centres across the globe to help develop local approaches to green technologies. The UNEP Sustainable Production and Consumption Programme is also a likely candidate for cooperation, information sharing and technical support.

Other partnerships that should be explored for the purpose of capacity building are the European Union—for assistance with developing green accounts coming out of The Economics of Ecosystems and Biodiversity (TEEB) Project, as well as other countries that have embarked upon similar exercises. This would include partnerships with the Barbados National Standards Institute and the Statistical Service Division to assist them in preparing such accounts as well as assistance with developing appropriate national green standards. To support this, specific assistance might be available through the GEF.

The development of certification programmes and accreditation, in particular, will require partnerships with certifying bodies. A programme identifying what certification schemes Barbados should seek to adopt or emulate and who the potential partners in this might be should be put in train. As part of this, there is a need to identify particular projects that would support transitioning sectors of Barbados' economy.

At the local level, the Social Partnership will be critical to securing a national consensus. For this reason, consideration should be given to the following:

- Barbados' GEF Small Grant Country Programme Strategy should be aligned to support green economy priorities in the spirit of enabling country ownership.
- At a national project level, specific actions could include piloting of green building projects by private and public sector agencies; the NHC is keen to participate in such a process. These green building projects must include community building designs and arrangements (such as at the Coverley Development) that seek to integrate the socioeconomic needs of community members into the concepts.
- The development of the agricultural sector is hampered, among other things, by the small size of most farms that curtails any benefits to be derived from economies of scale. One solution to this is to encourage the formation of farmer's cooperatives and the adoption of a more commercially orientated approach to farming as a business. In order to advance this process, partnerships involving farmers, Government, the FAO, agricultural suppliers, service suppliers and the banking sector would have to be formed. This should be actively investigated and pursued especially given the potential it holds to advance Barbados' food security.
- The proposals of the Coalition for the Revitalization of the Economy (CORE), which brings together small and medium sized manufacturers and interested parties from the agro-industry sector with the intention of developing an export orientated manufacturing and agro-industry subsector, should be given

serious consideration. Whilst this involves collaboration between local businesses and farmers, it will also necessitate other forms of institutional support as mentioned above along with assistance from, inter alia, the FAO and international transportation and trading bodies.

- The Energy Smart Fund is an important and very useful concept, but it is also important that Government continues to work with partners in private finance to support the growth and implementation of green technologies.
- The Sustainable Finance Initiative highlighted the relatively small role that the banking sector is playing in support of the greening of the economy as well as the potential it has to expand its contribution. More needs to be done to bring this sector into the green economy initiative, and the ways in which this could be done should be explored in a follow-up to this Scoping Study, through the GETSC.
- The stakeholder consultations uncovered evidence that there are pockets of good practice and a willingness to participate in transitioning the economy by actors in all the sectors that were researched. At the same time, the majority of sectoral players have very little understanding of the green economy concept or even how current sectoral practices are undermining the overall sustainability of Barbados economically, environmentally and socially. The prevailing perception is that greening the economy is too difficult, too costly and unprofitable, an opinion that needs to be challenged. Furthermore, there is a lack of understanding of how different sectors relate to, depend on and influence each other and, therefore, what the available synergies might be. This is a systemic problem that will take time to address and requires a concerted effort to create the conditions for intercommunication and cooperative learning. It is recommended that a study be launched to ascertain how this problem might be overcome through developing local information sharing, dissemination and cross-sectoral exchanges. In this regard, involvement by the Chamber of Commerce and Industry, the Hotel and Tourism Association and other professional and trade associations needs to be pursued.
- In some key sectors, institutional frameworks are not working effectively and require reform,

as already discussed. One of the features of the dysfunctional nature of these institutional frameworks is the lack of opportunities for stakeholder involvement and the absence of a clear role for the private sector. Whilst much has been done to address this in the waste management sector, the transportation and water management sectors, in particular, require urgent action. Clearly defined roles and responsibilities, risk sharing and an understanding of who pays for what are a prerequisite to fostering sound economic partnerships, and more especially so in relation to an important emerging objective such as a green economy.

- The continued development of small-scale, locally owned tourism businesses that are well linked to the community can result in greater focus on finding local solutions and therefore increase the resource efficiency of the industry.
- Additionally, the GOB's partnership with UNEP for building a resource-efficient green economy can be further realised through a number of existing UNEP-supported partnership initiatives.

As technology transfer mechanisms, Barbados should avail itself for membership in the areas described in Table 61.

The regional context for pursuing a resource efficient and green economy is also important to advancing implementation of the Programme of Action for the Sustainable Development of Small Island Developing States and the Follow-up Mauritius Strategy for the Further Implementation of the Programme of Action. Barbados is located within a fragile ecologic island chain, one that is extremely vulnerable to the impacts of climate change and other natural phenomena. These issues were highlighted in the Outcome Statement from the Caribbean Regional Review Meeting of the Five Year Review of the Mauritius Strategy for the Further Implementation (MSI) of the Barbados Programme of Action that was held in St. Georges, Grenada, on March 18th 2010 (CSD 18/2010/BP8). It will therefore be critical to develop a SIDS-specific approach to green economy in the context of the BPOA and MSI, which is consistent with the regional pursuit of a CARICOM Single Market and Economy, for which Barbados has lead responsibility. The meeting specifically noted that:

TABLE 61. RECOMMENDED NATIONAL FOCAL POINTS FOR EXISTING PARTNERSHIPS

Sector/Policy Focus	Partnership Platform	Recommended Focal Point Ministry and Associations
Agriculture	FAO/UNEP Agri-food Task Force on Sustainable Consumption and Production (SCP)	Ministry of Agriculture
Transport	Partnership for Clean Fuels and Vehicles	<ul style="list-style-type: none"> Ministry of Transport and Works Environmental Protection Department
Tourism	UNEP- Global Partnership for Sustainable Tourism	<ul style="list-style-type: none"> Barbados Hotel and Tourism Association Ministry of Tourism
Building/Housing	UNEP The Sustainable Building and Climate Initiative	<ul style="list-style-type: none"> Ministry of Transport and Works Barbados Institute of Architects
	Green Building Council	<ul style="list-style-type: none"> Barbados Institute of Architects Public Investment Unit
Public Procurement	Marrakech Task Force on Sustainable Public Procurement	Central Purchasing Department
Education	The Partnership for Education and Research about Responsible Living	<ul style="list-style-type: none"> Ministry of Environment/Ministry of Education UWI Erdiston Teacher Training College

Greening of the economies is considered a priority for Caribbean SIDS. It is therefore necessary to expand the current initiatives in transforming existing economies into more environmentally-friendly ones by for example, building capacity for trade and export in environmental goods and services, especially through providing incentives for small and medium enterprises; promoting sustainable consumption and production patterns, building capacity in valuation and costing of ecosystems resources and ecosystem services.

Since that time, ministers at the Special Meeting of CARICOM's Council for Trade and Economic Development (COTED) on the Environment and Sustainable Development endorsed the undertaking of a harmonised regional approach to tackling challenges related to the environment and sustainable development, including climate change (as recent as September 2011). Thus, a partnership for building a CARICOM-inclusive green economy seems to be under consideration. To date, UNEP has formulated proposals to support CARICOM countries. The Green Economy Forum held on 26-28 March 2012 in Barbados suggested that there was a need for deeper consultations and research on green economy in the Caribbean.

5.7 PERIODIC MONITORING

The establishment of targeted indicators for purposes of monitoring and evaluating the impact and trends associated with sector-specific green economic policies and the broader sustainable development policy is urgently required.

- As a follow-on to the GESS, it is therefore recommended that the UWI, with the support of the ILAC (Initiative for Latin America and the Caribbean) led by UNEP's Regional Office for Latin America and the Caribbean (ROLAC), produce sustainable development core indicators.
- To support this process, a technical advisory group drawn from the Green Economy Technical

Steering Committee should be established.

- It is also recommended that Barbados update its State of the Environment Report following development of the indicators.
- In collaboration with the Barbados Statistical Service and the Ministry of the Environment and Drainage, the University of the West Indies should undertake a Green Accounting Project in Barbados (please see the appendix on Green Accounting).



UWI consultation on establishing a Resource Efficiency and Technology Innovation Centre. Photo: Steve Devonish

5.8

PROMOTE SIDS-SIDS KNOWLEDGE TRANSFER OF GREEN ECONOMY POLICIES AND PRACTICES

The study highlighted on-going initiatives led by various institutions consistent with green economy. Examples include:

- The Barbados Sustainable Finance Group is reflective of the societal stakeholder approached pursued by the island. The group is a partnership between Government, the UNEP Finance Initiative and the banking community. The partnership seeks to raise the level of awareness and education among stakeholders in the local financial sector in relation to the constraints and potential opportunities associated with the adoption of a sustainable finance agenda. The main results of the partnership to date include stakeholder training, preliminary research and dialogue fora.
- The Renewable Energy Rider is a pilot programme to customers of the BL&P that allows customers to feed electricity back into the national grid from approved renewable energy sources. All kWh supplied to the grid at 1.8 times the fuel clause adjustment or 31.5 cents/kWh, whichever is greater. Billing is done on net basis, with rolling credit and buyback approach used. At the end of each calendar year, if the customer has accumulated a renewable energy credit they can rollover into the subsequent year or receive a refund.

- The Folkestone Park and Marine Reserve was established in 1981 by the Designation of Restricted Areas Order (1981) and the Marine Areas Regulation (1981). The Park and Reserve are located on the West Coast of the island and stretches a total distance of 2.2 km and extends a distance offshore of 950m at its widest point and 660m at its narrowest. The Reserve is in the middle of the tourist belt and has been modified significantly from its natural state due to human use. The Reserve has four zones: a scientific zone, Northern and Southern water sports zone, and recreational zone. The area has an extensive area of intertidal sandy beach habitat with associated interstitial fauna.

A repository of several case studies is appended to this report. Beyond their catalytic value at the local level, they are apt to other Small Island Developing States. It is therefore recommended that the best practices be submitted to the Rio+20 website.

Additionally, the Prime Minister, in his statement of 9 March 2012, suggested the establishment of a Green Economic Policy Institute for Small Island Developing States. The Principal of UWI-CH has since commenced discussion with GOB and UNEP in this regard. Upon its establishment, it is recommended that the Institute host a SIDS-SIDS Knowledge Transfer Platform of Green Economy Policies and Practices.

5.9 CAPACITY BUILDING

A critical component of the green economy initiative is having the right mix of skills and knowledge to support the transition. In numerous stakeholder consultations, it was noted that government departments that interface with businesses or the public and implement policy are often short-staffed. Many private sector actors also mentioned the need for government to build capacity. This would enable them to play their part in the country's transition to a green economy and engage in new economic opportunities, as noted in the previous section. It is evident that having the human capital for this purpose is a critical enabling condition, which will have to be met.

Moreover, it is clear that there are new areas of need, i.e. certification, which will require support. All of these will require capacity building at different levels and by different types of institutions in the form of vocational and technical training, graduate and postgraduate training, and continuing professional development. There is an exigency, therefore, for a better understanding of the capacity-building needs to support a green economy as well as the identification of who should provide what sort of capacity building.

The following further recommendations are advanced:

- Facilitate greater private sector research and development – this could be achieved by offering a wider range of tax and investment measures that would encourage businesses to invest in research and development.
- The staff of departments/agencies such as the Town and Country Development Planning Office, the Building Authority, The Environmental Protection Department, the Sanitation Services Authority, the Electrical Engineering Department, departments servicing agriculture and fisheries and the Barbados Water Authority need to be trained or retooled in the areas of green design, green standards, and monitoring and evaluation of the process.
- Incentives for retraining and retooling should be developed for use both within the private and public sector. As an aid to this, professional associations are to be encouraged to incorporate requirements for continuing professional development as part of their accreditation

schemes. Incentives could range from the application of lower tax rates for a limited period of time; say 5 years, to profits from the provision of accredited training programmes.

- Based on the above, a human resource capacity-building programme directed towards the goal of greening the economy should be developed via the Social Partnership.
- Given the importance of data collection, the need for green economy indicators and the proposed development of green national accounts, capacity to undertake these activities needs to receive special attention. For this reason, it is important that the Statistical Service Modernisation Programme be completed so that it can make a significant contribution to this goal.
- The opportunities for emerging green economy related-jobs should be catalogued and widely publicised. A regional outlook relative to the realisation of the CARICOM Single Market and Economy should be integrated in this exercise.
- A strategy and policy for on-going education, outreach and information of targeted publics must be put in place to facilitate change in behaviours within the public and private sectors.
- The Environmental and Social Risk Analysis Training undertaken by the Barbados Banking Association, UNEP-Finance Initiative and the Ministry of the Environment of the Government of Barbados should be expanded with a view to systematically including all other financial institutions in Barbados and the Eastern Caribbean. The University of the West Indies' Cave Hill School of Business could be approached as an academic partner in this regard.
- A short course in a resource efficiency programme for property and operations managers should be developed in the short to medium term. The tourism sector should be targeted for recruits in the first instance. The Barbados Community College Industry Services Unit should be approached as well.
- Some consideration should be given to integrate a resource efficiency stream in UWI-CERMES' postgraduate offering with an emphasis on water, waste and energy.
- The National Development Scholarship should include five of the following areas in its annual postgraduate offerings:



Nature hikes are important tools for raising public awareness Photo: Anne Gonzalez

- Sustainable/Organic Agriculture
 - Biotechnology
 - Food Processing Technology
 - Urban Planning
 - Environmental Planning
 - Transport Planning
 - Tourism Planning - emphasis on Nature, Heritage or Community Tourism
 - Marine Spatial Planning
 - Protected Areas Management
 - Environmental Design
 - Industrial Ecology/Resource Efficiency
 - Sustainable Building Technologies
 - Electrical Engineering
 - Public Health Engineering/Environmental Engineering
 - Development Economics
 - Sustainable Supply Chain/Logistics Management
 - Trade and Climate Change
 - Cartographic Information Technology/Systems Design
- In addition to the above, specific areas requiring capacity building include:
 - Customer service in the public transport service,
 - Government's Electrical Engineering Department in the sphere of installation of renewable energy technologies,
 - The Environmental Protection Department in fields related to air quality and emission standards and wastewater treatment, and
 - Environmental awareness of the public and tourist. The CZMU's Sun-Down Walks and the National Heritage Department's (NHD's) "de heart uh Barbados" 10K and 5K Nature Events should be viewed as part of this endeavour and receive full support from the BHTA and BTA.
 - Given the synergies among the multilateral environmental agreements, the GOB should proceed to redirect the focus of its GEF National Capacity Self-Assessment Project towards strengthening pertinent capacities within government, the private sector and civil society institutions in the context of green economy priorities.

5.10 BUILDING A SCIENCE-POLICY RESEARCH PLATFORM



The University of the West Indies is the technical partner in advancing Sustainable Development and the green economy priorities in Barbados and the CARICOM region. The GESS is testimony. Given its core competencies, several areas for further studies have been identified (see Table 62).

Every effort should be made to encourage partnerships with development agencies and governments facilitate create a Science-Policy Platform for enabling green economy and sustainability targeted postgraduate research.

Collecting samples in the Scotland District. Photo: Anne Gonzalez

TABLE 62. FURTHER AREAS OF RESEARCH PROPOSED BY STAKEHOLDERS

Sector	Proposed Green Economy Research
Agriculture	<ul style="list-style-type: none"> Undertake the Feasibility of establishing a Payment for Ecosystem Services in the Agricultural Sector Undertake the Feasibility for Establishing an Agri-Insurance Scheme for Small Scale Producers (Fisheries and Farmers) Research into waste to energy options utilising the current derelict sugar cane factories.
Fisheries	<ul style="list-style-type: none"> Undertake a Systematic technical and Economic Feasibility of Utilizing Fish Skin as Leather for Niche Products Undertake the feasibility of establishing a regional eco-label scheme for sustainably harvested fish in Barbados and the Caribbean
Building/Housing	<ul style="list-style-type: none"> Analysis of trends in land converted from agriculture to meet the needs of residential and other building development needs over the last 10 years. Research on the social, cultural and economic impacts of high-rise communities so as to document the pitfalls and successes of these types of developments. Development of best practice guidelines for harvested rainwater, wastewater treatment systems or on site solid waste management facilities. Analysis of investment data for public and private sector for energy efficiency in both residential and commercial buildings. Evaluate the economics of alternatives to local sand resources in the building and construction industry Explore opportunities to extend community level recycling programmes by building on the experiences of the Future Centre Trust and the Solid Waste Project Unit of the Ministry of the Environment and Drainage. Conduct socio-environmental cost-benefit analysis on green low cost housing options to meet demand for social housing.
Transport	<ul style="list-style-type: none"> Assess the cost of retrofitting existing bus fleet(s) to make them compatible with the new green technology. Health benefits of switching existing fleet of public service vehicles to run on cleaner fuels Design and implement a mode-switching programme (shifting travel from the private vehicle to other sustainable modes, such as public transit, park and ride systems, carpooling, cycling and walking), within a specified zone. Develop a master plan/planning strategy that guides the use and integration of a non-motorized mode of transport over a medium-term period. Conduct a cost – benefit analysis of alternative fuel options for the transport industry. This assessment could help to significantly reduce the foreign exchange spent on fossil fuels. Develop government incentives to encourage the private sector to get involved in research and development in the green transport industry. Develop and implement climate change adaptation plans for the air and seaports. Feasibility study of switching to electric vehicles in the public sector
Tourism	Development of a system of tradable permits as a market-based solution to environmental management for the tourism sector.
Policy support mechanisms	<ul style="list-style-type: none"> A study on the impact of integrating sustainable criteria in the Central Purchasing Department's procurement process on SMEs should be undertaken. The Barbados Chamber of Commerce and Industry should be consulted in this regard; Dialogue on carrying capacity and limits to growth; The role of the Fair Trading Commission in regulating Economic Performance and Consumer Service in the Delivery of Transport, Water and Solid Waste Services; An assessment of the status of trade in Environmental Goods and Services in Barbados with a view to developing an Environmental Goods and Services Index; In-depth sector specific study of fiscal policy options for supporting green industries and technologies, taking into consideration the impact of international trade and WTO rules, regulatory impacts and other factors; Analysis of national energy costs of production and importation of main raw materials (concrete, aluminium, wood, steel) used in the construction industry with the purpose of developing a sustainable energy plan and best practice guidelines. Assess need for curricular changes in tertiary facilities to support a green building industry. This would represent an extension of public education and training efforts that currently include the activities at the Barbados Training Board where vocational opportunities are available for local skill enhancement such as instructional training for prospective Solar Water Heater Technicians. Refinement of the term green jobs and further analysis based on specific industry targets and indicators Develop a system of effluent charges as a payment for environmental services.



6

CONCLUSIONS



As a small island developing state, Barbados faces special challenges in relation to its small size, remoteness from large markets, and high vulnerability to economic and natural shocks. Barbados also has a high dependence on imported fossil fuels and relatively fragile ecosystems. The green economy concept offers the possibility of reducing these vulnerabilities, enhancing resource efficiency and improving livelihoods. It is, however, important to ensure that green efforts do not displace ecological and environmental impacts in space or time (i.e. shifting impacts from one country to another or from one generation to another). The Barbados approach to conceptualising green economy has been to actively seek out the opinions of stakeholders (business, labour, NGOs and policymakers). They were of the opinion that a green economy transition could not be divorced from fundamental issues in relation to energy, water, waste and land all set against the context of an island that is by and large highly susceptible to external shocks.

The study highlighted numerous opportunities in relation to agriculture, fisheries, building, transportation and tourism. A green economy transition can therefore be seen not only as a way to encourage environmental sustainability, but also as an opportunity to diversify the economy, generate new business opportunities, jobs and support poverty alleviation. In many sectors, this transition has already begun with positive results. Since the 1970s, solar water heaters largely supported by tax incentives for consumers have dominated Barbados' water heating industry. In the tourism sector, many hotels have sought to achieve green certification as a means of enhancing demand and increasing profitability. It is expected that these and other initiatives will penetrate the economy in a way that will benefit the island.

In order to exploit these potential opportunities, Barbados will have to address various sector specific challenges, such as lack of research and development in agriculture, standards legislation in fisheries, lack of training programmes and regional experts in building/housing, limited public awareness of green initiatives in transportation and the heavy dependence on imports as well as low occupancy rates in tourism. It will also be necessary to develop the supporting enabling conditions to facilitate the transition in the areas of financing, development access and transfer of clean technology, trade tariffs and investment, taxation, incentives and fiscal reform, education, training and capacity enhancement, standards and regulation,



Statue of Right Excellent Errol Walton Barrow, Barbados' Father of Independence. Photo: Wikimedia

and government procurement. To this end, an investment plan should be seen as a key input into the islands future green policy plans. This would help to coordinate investment and reduce overlap.

Given the importance of the above-mentioned sectors, and the already existing legislation that supports behavioural change by consumers, it is likely that there would be a spill over effect to other industries. In the 1950s and 1960s, Barbados embarked on a plan to diversify its economy away from sugar towards tourism. This vision resulted in the transformation of the island and provided its citizens a relatively comfortable standard of living. A green economy portends a similar moment in history, whereby the country can enable the next great economic transformation that benefits both current and future generations.

Table 63 provides a summary of the main recommendations from the study. The recommendations are classified as immediate (0-2 years), medium (2-5 years) or long-term targets (over 5 years) that would allow Barbados to continue on the path towards a greener economy.

If the methodological approach identified in this study is to be used in future studies, the constraints faced by the authors of this study and suggested solutions should also be discussed. One of the most important factors in building consensus on the issue of greening a firm, industry or economy is stakeholder buy-in. The GETSC, the body that provided technical oversight for this project was an important part of this process. The membership of the Steering Committee was quite broad-based, with members pulled from Government, industry, academia and civil society.

As a gauge of the study's significance and gravity, stakeholder consultations were held for each industry and cross-cutting issue as well as on their corresponding enabling conditions to foster a green economy transition. Holding the consultations and ensuring that the views of participants were fully reflected in the current study signified that the document would have a life after publication. The time needed to achieve adequate stakeholder consultation should not be underestimated. The administrative team for the GESS spent numerous hours planning and ensuring that key individuals were present at stakeholder meetings. While this process somewhat held up the completion of the project within the deadline, the legacy benefits more than outweighed the potential costs.

While quite useful for data scarce countries, the methodological approach utilised in this study also requires coordination and planning. Ideally, the strengths, opportunities, challenges, responses and effectiveness analysis should be undertaken in a symbiotic way by the technical team in consultation with the stakeholders. The stakeholder consultation process provides verification of the technical analysis and ensures that all views are fully captured in the report.

The GESS was also constrained by data shortcomings, particularly in relation to environmental statistics. Ideally, the methodological approach employed in this study could have been supplemented with econometric modelling to quantify some of the potential impacts identified in the study. The importance of providing, dollar values of the benefits of a green economy transition is a key element of generating buy in at all levels and is an area that should not be under-estimated.

TABLE 63. PRIORITISATION OF RECOMMENDATIONS

Category	Specific target	Immediate target	Medium-term target	Long-term target
Governance and institutions	Establishment of a sustainability strategic advisory group	x		
Taxation, incentives and fiscal reform	Fiscal incentives to promote the use of fish waste and fish leather in agriculture	x		
Policy cohesion, governance and institutions	Review and upgrade of Barbados' Integrated Solid Waste Management Programme	x		
Idem	Expediting the implementation of the Water and Sanitation Upgrade Project	x		
Idem	Finalisation and operationalization of environmental management legislation	x		
Idem	Development of solid waste management legislation	x		
Idem	Strengthen policy guidelines in the PDP	x		
Government procurement	Public Sector Energy Conservation Programme	x		
Promote SIDS-SIDS Knowledge Transfer	Resource Efficiency and Technology Innovation Centre	x		
Public education	Public education campaign promoting green economy	x		
Capacity building	Include resource efficiency areas in National Development Scholarship	x		
Building a Science-Policy Research Platform	Development of science policy platform	x		
Capacity building	Facility training in environmental risk assessment	x		
Partnerships and synergies	Undertake the GEF NCSA in the context of green economy	x		
Periodic monitoring	Completion of the ILAC Indicators Report	x		
Partnership and synergies	GEF Country Programme Strategy	x		
Idem	Enhance cooperation with the United Nations, in particular with the United Nations Environment Programme (UNEP) on green economy	x		
Promote SIDS-SIDS Knowledge Transfer	Support implementation of Caribbean-wide Green Economy Initiative	x		
Public education	Green Economy Solutions Panel Series	x		
Policy cohesion, governance and institutions	Implement the Folkestone Redevelopment Programme	x		
Idem	Institute the Barbados National Park and System of Protected Areas	x		
Idem	Integrate the principles of sustainability into macroeconomic policy programming	x		
Partnerships and synergies	Market Barbados as a green destination	x		
Idem	Develop agri-tourism products	x		
Public sector leadership and Public Procurement	Greater recycling materials in road construction	x		
Partnerships and synergies	Recycling materials from scrap shops	x		
Private sector commitment	Green communities	x		



TABLE 63. PRIORITISATION OF RECOMMENDATIONS (CONTINUED)

Category	Specific target	Immediate target	Medium-term target	Long-term target
Taxation, incentives and fiscal reform	Provisions and subventions to support greening the housing and building sector	x		
Policy cohesion, governance and institutions	Social Partnership given umbrella responsibility for monitoring the Green Economy Roadmap		x	
Periodic monitoring	Report on green economy progress		x	
Policy cohesion, governance and institutions	Strengthen agriculture cooperatives		x	
Capacity building	Training of technical personnel in Ministries		x	
Policy cohesion, governance and institutions	Sustainable financial model for marine protected areas and		x	
Public sector leadership and public procurement	Establishment of the National Food and Health Safety Authority		x	
Partnerships and synergies	Sustainable agriculture and fisheries micro-credit scheme		x	
Policy cohesion, governance and institutions	Establishment of water use regulations		x	
Idem	Development of groundwater provisions legislation		x	
Idem	Operationalization of Barbados Building Code		x	
Public sector leadership and public procurement	Government-wide infiltration technology project		x	
Public sector leadership and public procurement	Warrens Industrial Park Eco-Innovation Initiative		x	
Public education	Corporate Social and Environmental Annual Award Scheme		x	
Periodic monitoring	Development of green indicators		x	
Policy cohesion, governance and institutions	Update of the Barbados State of the Environment Report		x	
Public sector leadership and public procurement	Increase the Ministry of the Environment's grants to NGOs in support of green economy initiatives		x	
Idem	Heritage tourism sites		x	
Public sector leadership and public procurement	Standards of fuel mixes		x	
Private sector commitment	Integrate clean technologies into the fisheries sub-sector		x	
Partnerships and synergies	Household waste in agriculture		x	
Private sector commitment	Biodigesters at the farm level		x	
Policy cohesion, governance and institutions	Integrated public transportation policy			x
Idem	Establishment of a vehicle emission testing facility			x
Idem	Sustainable design criteria for public sector housing initiatives			x
Private sector commitment	Promotion of Warrens as a green urban centre			x
Public sector leadership and public procurement	Integration of sustainability principles in public procurement process			x
Partnerships and synergies	Convert derelict sugar factories into waste to energy plants			x

¹ In this scoping study, it will not be possible to assess the effectiveness of the current approach in its entirety, although aspects of it will frequently be encountered in the sectoral analyses and in the treatment of crosscutting issues. Given the limits of time and resources, it is necessary for this study to make the assumption that, in pursuing a green economy, the country is fully cognisant of the key role of ecosystem services and that these will be treated as foundational.

² The GOB decided not to levy the commensurate charge on domestic producers necessary to ensure WTO compatibility due to concerns over eroding the fiscal base.

³ Sea Water Air Conditioning.

⁴ <http://www.pnuma.org/documento/DISCURSO%20PRIMER%20MINISTRO%20BARBADOS.pdf>.

⁵ Accessed 19 March 19 2012.

⁶ The analysis of the MEAs was subsumed in the report and Addendum 4 presents the analysis with respect to the enabling conditions.

⁷ Embodied energy refers to the energy that is used in the production process. It includes such things as the manufacturing process, transportation, and all other aspects that are required to get the good to the consumer.

⁸ <http://www.caricom-fisheries.com/LinkClick.aspx?fileticket=eeRVRXUBWGA%3D&tabid=37>

⁹ http://www.unep.org/pdf/GreenEconomy_SuccessStories.pdf

¹⁰ <http://www.pnuma.org/documento/DISCURSO%20PRIMER%20MINISTRO%20BARBADOS.pdf>

¹¹ www.ifoam.org

¹² Biogas comprises primarily methane (CH₄) and carbon dioxide (CO₂), and may have small amounts of hydrogen sulphide (H₂S), moisture and siloxanes.

¹³ To transform and reposition the Agricultural Sector in Barbados through the promotion of an agri-business approach to farming, with particular attention being paid to the effective use of resources, as well as the adoption of appropriate technology and sound management practices in order to achieve internationally competitive production, processing and marketing enterprises, which contribute significantly to social and economic development and food security, as well as to the sustainable management of the natural resource base of the country.

¹⁴ Transmigration refers to the movement of labour from one sub-sector or sector to another sub-sector or sector in the economy.

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¹⁶ Stakeholder vision statement reflects views captured in the development of the Fisheries Management Plan.

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¹⁸ In general, EAF is taken as requiring: (1) definition

and scientific description of the ecosystem in terms of scale, extent, structure, functioning; (2) assessment of its state in terms of health or integrity as defined by what is acceptable to society; (3) assessment of threats; and (4) maintenance, protection, mitigation, rehabilitation, etc., using (5) adaptive management strategies. Fisheries and Aquaculture Department. Terminology and Paradigms. FAO Corporate Document Repository. 2003.

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ANNEX 1 TERMS OF REFERENCE FOR THE GREEN ECONOMY SCOPING STUDY

The “Green Economy Scoping Study” is a broad assessment of opportunities and challenges to promote a green economy at the macroeconomic level. It should take stock of existing natural capital stocks, the status of investment in green economic sectors, with a view to identify priority areas for promoting a green economy, existing constraints and policy enabling conditions, and finally pointers towards key policy reforms where applicable.

The GESS will also include a stocktaking and review of green economy-related policies and initiatives already existing in the country. Such an exercise should enable the development of synergies with on-going processes, avoid duplication and provide an opportunity to build partnerships to fill existing gaps.

The total length of the GESS report should be approximately 50 pages in A4 following Editorial Guidelines in Annex 5. The duration for producing the report is expected to be 6 months from the date of contracting authors.

1. Background and context

This section outlines the background and context for undertaking a Green Economy Scoping Study (GESS). It should place the GESS exercise in the context of a partnership between UNEP and the Government of Barbados.

The background section would ideally frame the GESS assessment within the context of national greening initiatives and overall sustainable development strategy, so as to be in line with, and complement key strategies, policies and programmes being implemented or considered for implementation in Barbados.

The development of the GESS is expected to complement and reinforce the past and on-going activities within the area of Sustainable Consumption and Production (SCP).

2. Study objective

The overall objective of this study is to support and complement national initiatives on green economy, through macroeconomic economic assessments and policy analysis with a view to better understand how government policies and public and private investment can help achieve the fundamental

macroeconomic objectives of income growth, economic development/diversification, and job creation, following a path that also contributes to social equity and environmental improvement.

The specific objectives are to:

- Analyze opportunities and challenges of a green economy focusing on four priority sectors: tourism, agriculture, transport, and housing/buildings;
- In addition, due to their transversal nature, analyse the cross-sectoral issues of water resources, energy, and waste.
- Analyse trends and patterns and gaps in green investments, covering public spending and private investment in terms of gross domestic product focusing on the four priority sectors and three cross-sectoral issues indicated above;
- Analyse and quantify the direct and indirect benefits of such green investments, with reference to economic growth, employment creation, and environmental improvement and other spill over effects;
- Identify opportunities and challenges (barriers) to green investments, including an estimation of required additional investment required to achieved existing or desirable policy targets;
- Identify and develop recommendations on key enabling conditions and related policy reforms in order to support and facilitate green investments (e.g., taxation, subsidies, laws, standards, tariffs, procurement policies, etc.)

3. Expected outcomes

- A macroeconomic assessment of the potential benefits and challenges of investment in priority economic sectors that offer the largest potential to promote a transition to a green economy;
- A set of policy recommendations to address policy and capacity gaps and needs, through specific policy reforms, programmes and projects;
- A contribution to the formulation of a national strategy on green economy.

4. Structure and content of the report

The GESS could be based on the structure and content outlined below.

Summary for policymakers

The summary should focus on the main recommendations of the GESS written in a policy language and avoiding as far as possible technical terms. The summary should include a green economy vision for Barbados in the sectors studied, main priorities and challenges, policy recommendations with a focus on macroeconomic policies and suggestions for further work, programmes and projects that are needed.

Introduction and background

The report will start with a brief introduction of the concept of green economy, its relevance to Barbados in the context of its economic, social and environmental situation. It will present a description of the scope of the study, the main audience targeted and the process of undertaking the study.

Macroeconomic and country profile

This section should give a short but comprehensive overview of the macroeconomic profile of the partner country including:

- Basic macroeconomic figures (GDP and income, including if possible income inequality measures; employment; CPI; investment statistics), their evolution over the last 5 years and (if available) forecasts for the coming years.
- A brief description of the most important economic sectors in terms of GDP, employment, investments, resource use and GHG emissions.
- A brief description of main economic development vision, policies, and plans, as well as programmes of international institutions and international donors.
- Stock-taking of green economy-related initiatives, programmes, and projects (e.g., GEF supported programmes and projects, Marrakech process on Sustainable Consumption and Production, Resource Efficiency projects, sustainable finance best-practices.)
- Resource status. Reference to the availability and use of main natural resources and their importance for the economy.
- Policies for resource use and management. Specific emphasis should be given to current fiscal and legislative framework affecting resources under regulated management status or for resources for which an oligopoly, or other type of imperfect market (e.g., bilateral monopoly, duopoly, etc.) exists.
- Impact of economic development to the resource status including as far as possible data on GHG emissions, indexes of atmospheric quality, indicators of land and water quality and information on waste production.
- Resource intensity. Basic indexes on the intensity

of use of main resources and their evolution over the last 10-20 years. References to cases where substantial gains or losses on resource efficiency have been observed. Forecasts for the resource use and status over the next 20 years.

- Ecosystem services, their effect on GDP and their importance for the poor.

Sectoral analysis

This part of the study provides an assessment of the status of investment, gaps and needs for increased investment in the identified priority sectors. The Government of Barbados indicated to UNEP its willingness to focus the sectoral analysis on four key sectors: agriculture, building/housing, transport, and tourism. The analysis of the sectors will have to be undertaken taking into account three cross-sectoral aspects, which are water, waste and energy management.

The assessment will focus on potential returns in terms of economic growth, development, and poverty reduction and improved livelihoods; the potential for green jobs creation; and the potential for environmental improvement, including resource and material efficiency, mitigation of and adaptation to climate change, better valuation of resources; sustainable use and conservation. The sectoral analysis will cover the following issues:

- a. How policies and public and private investment will help achieve the fundamental macroeconomic objectives of income growth, economic development/diversification, and job creation, following a path that also contributes to social equity and environmental improvement.
- a. Make a case for reshaping and refocusing policies, investments and public spending to reconfigure businesses and infrastructure that can yield improved flows of income – higher and sustainable – from produced capital, natural capital and intangible capital.
- a. This income stream derived from the asset base – representing returns on a new portfolio of investments and policies considered at the macroeconomic scale – could be measured in terms of the following macroeconomic indicators:
 - i. Growth of national income (GDI/GDP)
 - ii. Creation of employment/livelihoods
 - iii. Poverty reduction
 - iv. Stock of natural capital.

The analysis will in particular show that progress in terms of (b), (c) and (d) need not be at the expense of (a) and vice-versa. Given the focus on reorienting investments and spending between both private and public sectors, the reforms analyzed and proposed should also take account of the implications for

fiscal and monetary targets such as price stability and public debt levels.

Enabling conditions

This section will identify and analyse the key factors and conditions that are required at the local and national levels to facilitate a transition to a green economy in the sectors identified, in addition to increased investment. The enabling factor of emphasis is capacity enhancement, with a focus on strengthening capacities for natural resources management, resource pricing and ecosystem valuation. Other factors to be considered relate to the development, access and transfer of clean technology; reforms of taxation, incentives and fiscal policies; the mobilisation of domestic and foreign public and private financing; standards and regulations; and tariffs and trade policies. This section will review and discuss policies and reforms already being undertaken in Barbados and focus on how such reforms could be furthered, with a specific focus on delivering green economy objectives.

Policy recommendations

This last section will include a set of recommendations that could form the basis of a green economy strategy in the selected sectors for Barbados, including the following elements:

- Policy recommendations. A brief but concrete set of policies that are required to achieve a transition towards a green economy. These recommendations should respond to the findings of the economic assessment and focus on the macro level.
- Capacity strengthening. A draft proposal identifying the capacity building needs together with a preliminary set of proposed capacity strengthening activities, building on local knowledge and capacity.
- Partnerships. A list of main partners and types of partnerships needed.
- Further work. A brief list of follow up activities, including programmes, projects, studies with an approximate time planning and potential institutions responsible for each activity.

5. Methodology

The study will rely on quantitative and qualitative economic analysis. The overall purpose is to focus on a macroeconomic assessment in order to generate policy advice and recommendations. The authors are encouraged to make use of quantitative economic tools such as regression analysis, input-output tables, and cost-benefit analysis to the extent possible. These can be complemented by a SWOT analysis. The SWOT analysis should not be

limited to a descriptive presentation, but should also include an explanatory part on the basis of proposed SWOT strategies (S/O, S/T, W/O, W/T). It should be highlighted that this should be a SWOT analysis of the potential for greening the national economy and not a SWOT analysis of the country's economic development potential.

6. Process

For the production of the GESS, UWI and the team of experts involved will be guided by a GESS Technical Steering Committee (GTSC) to be chaired by the Permanent Secretary of the Ministry of the Environment, Water Resources and Drainage. The UWI-based GESS Study team will report via the Team leader, to the Steering Committee throughout the study.

ANNEX 2 METHODOLOGY SHEET FOR STAKEHOLDER DISCUSSIONS

HOW DO WE ARRIVE AT OUR VISION?

CURRENT SITUATION	
Challenges	Strengths and Opportunities

VEHICLES FOR MOVING FORWARD	
Financial and fiscal measures – consider taxation, governance, investment (capital infrastructure), financing, standards and regulations, export and import policy	Capacity building – training, education, job creation

OTHER CRITICAL CONSIDERATIONS		
Resource efficiency strategies	Climate change resilience	Who benefits and who loses when we “go green”

ANNEX 3 GREEN ACCOUNTING

A measure of a country's development is often given in terms of its Gross Domestic Product (GDP), which is said to reflect the value of all goods and services produced, as measured by the System of National Accounts (SNA). Since the SNA was introduced in the 1940's it was recognized that it does not reflect the impact of environmental pollution and natural resource depletion that results from the production of goods and services. Thus, it is argued the true value is not reflected and that these accounts ignore scarcities of natural resources, which threaten to undermine the sustainability of economic performance and growth, and treat environmental degradation as an 'external' (social) cost of economic activity. This has led to increasing interest in and calls for the adoption of green accounting through which the full cost associated with development is reflected.

Green accounting incorporates the value of environmental assets (Natural Capital, Costanza et al 1997) into national accounts. In recognition of this Agenda 21, which came out of the Rio Summit in 1992 included a commitment to establish a system for integrated environmental and economic accounting thus expanding the national accounts. In 1993, the UN published *The Handbook of National Accounting: Integrated Environmental and Economic Accounting* or SEEA that set out a methodology for treating the environment within economic accounts. The handbook was revised in 2003 and jointly published by the UN, IMF, OECD and the World Bank with the intention that this would become an international standard. It represents one approach to addressing the problem of recognizing and incorporating environmental assets, goods and services within a national accounting framework.

The actual mechanics of producing a system of accounts that reflect environmental values is a complex one. Mäler et al. (2008) in reviewing green accounting identified two challenges to the inclusion of natural capital; how can the production

functions of ecosystems be characterized and, who estimates the accounting prices of ecosystem services. While monetary values of the services can be readily assessed when they support revenue generating activities, assessment of non-market services is more challenging (Boyd 2007), and the discount rates that should be applied in assessing their future value are largely a matter of societal choice. Nonetheless, as the non-market value of these services may often exceed their market value, this is an area that requires focused policy attention. Green accounting is an area that should be given priority attention in moving towards a green economy.

For explicit consideration of the value of ecosystem services to become a part of the national development strategy will require a policy change towards inclusion of full ecosystem value in assessing development options. This in turn will require considerably more information about the value of these services and consideration for the weight that they are given in national accounting – green accounting. The idea of ecosystem services and the importance of recognizing their value were introduced in section 2.3.1. Examples of the valuation of these services in Barbados appear in the sectoral analyses; but are few.

Complementary to national green accounting is social and environmental accounting (SEA) which considers the effects of organizations' economic activities and holds that these effects should be accounted for as part of standard accounting practices. Whilst there are few examples of SEA being a formal requirement on companies and organizations its adoption would assist in gauging the extent to which actors in the national economy are contributing to the greening of the economy. Thus any discussion of national green accounting should also include consideration of green accounting at the sub-national level.

ANNEX 4 SYNERGIES BETWEEN ENABLING CONDITIONS FOR A GREEN ECONOMY AND MULTILATERAL ENVIRONMENTAL AGREEMENTS IMPLEMENTATION

As mentioned in Chapter 1, Barbados is a signatory to several Multilateral Environmental Agreements (MEAs). These include the United Nations Convention on Biological Diversity (UNCBD), the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD). Each of these conventions have implementation/action plans (developed in most instances through a participatory approach, similar to the one use for the Barbados GESS, that involves government ministries/departments, scientific institutions and local community groups). These implementation plans are very closely aligned to the goal of greening the economy and should be leveraged. An assessment of the synergies between the UNCBD, UNFCCC and UNCCD is provided in Table 67.

ANNEX 4 (CONTINUED)

TABLE 64. MULTILATERAL ENVIRONMENTAL AGREEMENTS AND GREEN ECONOMY

	UNCBD	UNFCCC	UNCCD
FINANCE AND INVESTMENT	1. Access financial resources provided via the financial mechanism of the convention and/or other donors	1. Clean Development Mechanism (CDM)	N/A
DEVELOPMENT, ACCESS AND TRANSFER OF CLEAN TECHNOLOGY	1. Develop and introduce measures regulating the access to genetic resources and to provide access for and transfer to other parties of technologies that are relevant to the conservation and sustainable use of biodiversity	1. Development and transfer of technology	1. Transfer, adaptation, acquisition and development of environmentally sound, economically viable and socially acceptable technology 2. Research and development 3. Joint research programmes (also involving public and private sector) for the development of improved, affordable and accessible technologies for sustainable development
TARIFFS AND TRADE POLICY	1. Take legislation, administrative or policy measures, as appropriate, with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilisation of genetic resources	N/A	N/A
TAXATION, INCENTIVES AND FISCAL REFORM	1. Develop and introduce economically and socially sound measures that act as incentives for the conservation and sustainable use of components of bio-diversity	1. Enhancement and/or creation of an enabling environment	N/A
EDUCATION, TRAINING AND CAPACITY ENHANCEMENT	1. Establish and maintain programmes for scientific and technical education and training	1. Institutional capacity building, including the strengthening or establishment of national climate change secretariats or focal points 2. Capacity building for implementation of adaptation measures 1. Education and public awareness	1. Education, training and public awareness 2. Training and technology regarding the use of alternative energy, renewable energy sources (aimed particularly at reducing dependence on wood or fuel) 3. Promotion of alternative livelihoods, including training in new skills 4. Training of decision-makers, managers and personnel responsible for collection and analysis of data for dissemination and using early warning information on drought conditions, water resources and for food production 5. Technological and scientific co-operation in the fields of combating desertification and mitigating the effects of drought through appropriate national, sub-regional and international institutions
STANDARDS AND REGULATION	1. Develop and introduce appropriate measures to ensure safety regulations in handling living modified organisms resulting from biotechnology	N/A	N/A
GOVERNMENT PROCUREMENT	N/A	N/A	N/A
GOVERNANCE AND INSTITUTIONS	1. Effective national biodiversity planning	1. National climate change programmes 2. Improved decision-making, including assistance for participation in international negotiations	1. Training of decision-makers, managers and personnel responsible for collection and analysis of data for dissemination and using early warning information on drought conditions, water resources and for food production 2. Effective early warning and advance planning for periods of adverse climatic variation (provided in appropriate forms)
DATA, INFORMATION AND COMMUNICATION	1. Identification and monitoring of components of bio-diversity important for its conservation and sustainable use	1. National communications 2. Greenhouse gas inventories, emission database management, and systems for collecting, managing and utilising activity data and emission factors 3. Research and systematic observation, including meteorological, hydrological and climatologically services 4. Information and networking, including the establishment of databases	1. Training of decision-makers, managers and personnel responsible for collection and analysis of data for dissemination and using early warning information on drought conditions, water resources and for food production 2. Information collection, analysis and exchange (relevant short- and long-term data and information; particularly to ensure systematic observation of land degradation in affected areas and to better understand and access the processes and effects of drought and desertification)

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