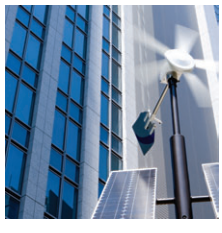
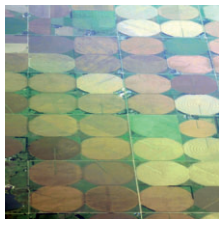
Review of the Implementation of the OECD Environmental Strategy for the First Decade of the 21st Century


MAKING
GREEN GROWTH
DELIVER

Meeting of the Environment Policy Committee (EPOC) at Ministerial Level
29-30 March 2012



OECD

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GENERAL NOTES

Country Aggregates

OECD Europe: This zone includes all European member countries of the OECD, *i.e.* Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

OECD: This zone includes all member countries of the OECD, *i.e.* the countries of OECD Europe plus Australia, Canada, Chile, Israel[*], Japan, the Republic of Korea, Mexico, New Zealand and the United States.

Country aggregates may include Secretariat estimates.

Cut-off Date

This report is based on information and data available up to the end of December 2011.

[*] The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

MESSAGE TO THE COUNCIL ON THE IMPLEMENTATION OF THE ENVIRONMENTAL STRATEGY FOR THE FIRST DECADE OF THE 21ST CENTURY

OECD Environment Ministers adopted the *OECD Environmental Strategy for the First Decade of the 21st Century* on 16 May 2001. The following day, the OECD Meeting of Council at Ministerial level endorsed the *Strategy*.

At our meeting on 29-30 March 2012, we took stock of the progress that we have made over the intervening decade. This followed on from two interim reviews along the way. We submit this report to the OECD Council at Ministerial level on the lessons that can be learned to help guide future action.

The *Strategy* was intended to provide directions for environmentally sustainable policies in OECD Member countries, and to guide the future work of the OECD in the field of environment. Given the multiple and cross-sectoral pressures on the environment, many of the policy actions identified in the *Strategy* fell outside the responsibility of Environment Ministries. Their implementation depended on a whole-of-government response.

The fundamental objective of the *Strategy* was to maintain ecosystem integrity, particularly climate, biodiversity and water. Four other objectives were also established: decoupling environmental pressures from economic growth (particularly in the energy, transport and agriculture sectors); improving information for decision-making; enhancing the interface of social and environmental policies; and improving global environmental governance and cooperation.

Ten years on we must conclude that the objectives of the *Strategy* have not been fully achieved. Despite significant improvements on some environmental fronts, it is clear that much work remains. Environmental pressures have not been reduced to the extent needed to maintain ecosystem integrity and to ensure environmentally sustainable development. Although uncertainties remain about environmental thresholds, crossing them would entail real reductions in well-being and welfare. There is an urgent need for more ambitious policies to tackle environmental pressures. But such policies will only be acceptable and effective if they demonstrate that they take full account of economic and social considerations. For this reason, the active engagement of other Ministers will be essential, including those responsible for Finance, Economy and Trade, as well as the private sector, trade unions and NGOs.

The *OECD Environmental Strategy* is a living document that will continue to provide a reference for the Environment Policy Committee's Strategic Vision and guide its priorities. The OECD's *Green Growth Strategy* must now guide us and relevant OECD committees in integrating environmental and economic policies and pursuing green growth objectives.

Areas of progress

Some of the main areas where progress has been achieved by OECD countries in implementing the *OECD Environmental Strategy* over the last decade, include:

- advances in the scientific and economic understanding of climate change, biodiversity, and other key elements of global change science;

- the more active participation of a better informed citizenry in environmental policy development and implementation;

- the development and use of more cost-effective policy instruments, individually and in combination, in many environmentally related areas;

- initiatives by cities and other sub-national levels of government;

- the beginnings of an international carbon market;

- an increase in the share of official development assistance allocated to the environment, particularly to support implementation of the Rio Conventions; and

- strengthened environmental governance in areas such as the marine environment and chemicals.

These efforts have helped to reduce some important environmental pressures and to improve environmental conditions:

- overall emissions of some key air pollutants such as SO_2, NOx have decreased, thereby reducing their related environmental impacts;

- water-borne disease in large urban areas is generally a thing of the past for OECD countries, life has returned to many rivers that had been considered dead, and water bodies are increasingly managed on the basis of hydrological rather than administrative boundaries;

- there are many local examples where populations of endangered species, and the extent of protected areas, have increased;

- some OECD countries have reduced their emissions of greenhouse gases in absolute terms; in others, the increase has been less than the rate of growth of GDP;

- some of the key environmental pressures from the agricultural sector, including the use of freshwater for irrigation, GHG emissions and inputs of nitrogenous fertilizers, have been reduced;

- total annual water abstractions have remained unchanged in the OECD area, and some countries have reduced the volume of water abstracted;

- donors have helped some developing countries to improve their environmental conditions and to strengthen their capacities for environmental management; and

- damage to the ozone layer has been arrested and is beginning to be reversed.

Key challenges

Despite the progress that has been achieved over the last decade, the overall result falls short of what is needed to ensure the integrity of ecosystems. In particular, we note that:

- we are not on track to limit the rise in the average temperature of the global atmosphere to 2°C above the pre-industrial period; overall GHG emissions from OECD countries increased in the last decade;

- the overall energy mix in OECD countries has not changed appreciably and is still more than 80% reliant on fossil fuels;

- the environmental gains associated with more fuel-efficient, less-polluting motor vehicles have been overwhelmed by the increased scale of their use, which is related to the continued dominance of motor vehicles in the modal split, urban sprawl, and the expansion of motorways;

- air quality, particularly in many urban centres, poses an increasing risk of premature death and disease, particularly to vulnerable populations such as children and the elderly;

- there are increasing risks of non-linear, irreversible changes in ecosystems on which economic and social development depends; one indicator is the increasing number of endangered animal and plant species;

- major changes in agricultural policies and practices are needed if a growing world population is to be fed without over-exploiting scarce natural resources or further damaging the environment;

- diffuse sources of pollution, the declining quantity and quality of groundwater, as well as the increasing frequency and severity of droughts and floods, in some countries partly due to climate change, is making the sustainable management of aquatic and related ecosystems more challenging; and

- increased collaboration is needed to better understand the risks as well as the benefits associated with chemicals, including nanomaterials and the products of modern biotechnology.

Key obstacles

There are a variety of factors holding back progress. A key factor is that prices still do not sufficiently internalise environmental costs; and some subsidies create perverse incentives for environmentally harmful activities. Natural assets are consistently undervalued in conventional economic analysis and decision making. As a result, there is a gap between private returns from economic activity and the overall benefits that accrue to society.

Policy ambition and implementation is another key factor. There are wide variations in environmental performance among, and sometimes within, OECD countries. Some of these are inevitable. Countries have different resource endowments, different economic and social structures, and different legacies. Nevertheless, if all OECD countries converged with the performance of the "top-runners", the overall performance of OECD countries would be substantially improved. However, even this would not be enough to decouple environmental pressures from economic growth in absolute terms. Even more demanding policies will be needed if critical environmental boundaries are to be respected. The size of the challenge underlines the need for countries to adopt the cost-effective policies.

The scale of many environmental pressures has continued to outstrip the gains that current policies have achieved in terms of more efficient resource use and reduced pollution generation. Current economic structures, and the associated patterns of production and consumption, are reinforcing the dominance of existing technologies, infrastructure and related institutions. These are formidable barriers to the transition to a low-carbon, more resource-efficient economy. Overcoming this inertia will require substantial innovation, not just in technologies but also in the social and institutional relations in which they are embedded.

At the global level, the main engines of economic growth and the associated environmental pressures are increasingly occurring beyond the OECD's membership. Thus the ability of OECD countries to influence global environmental conditions is decreasing. The growing importance of the major emerging economies is posing both new opportunities and challenges for global economic and environmental governance. In both spheres, there appears to be a shift away from multilateral to more bottom-up approaches. The challenge is to find ways to make these approaches complementary and consistent, while staying within critical environmental limits. Increasing economic interdependence calls for further efforts to harness trade, investment, capital and aid flows to support the achievement of environmental objectives.

Achieving environmentally sustainable growth requires a better understanding of the political economy of reform; what it takes to make reform happen. At the heart of this is the challenge of managing the distribution of the costs and benefits of more ambitious policies, within and among countries, and across generations. This requires a continuing effort by governments to integrate environmental considerations into policies that generate environmental pressures, and to co-ordinate action at different levels of government. Successful reform requires not only effective enforcement but also winning from stakeholders an acceptance of the need for compliance, and developing effective partnerships. This should be based on effective communication, and on public participation, strengthened access to information, robust data and indicators, and evidence-based analysis. It also requires effective leadership, well-designed institutions, good sequencing of reforms, and strategies for mitigating the impacts of policy change on those most adversely affected.

Towards Green Growth

The economic and financial context is much less favourable now than when the *OECD Environmental Strategy* was adopted. However, this is no excuse for inaction. While governments are facing severe pressures to reduce budget deficits, there are nevertheless opportunities for environment-related policies to contribute to fiscal consolidation (by removing environmentally harmful subsidies and shifting the tax burden from capital and labour to environment), and to improving productivity and competiveness (by driving innovation, more efficient technologies, and related employment opportunities). Moreover, the messages from the *OECD Environmental Outlook to 2050* are clear: if we do not take policy action to address the key environmental challenges, the costs of inaction to the economy and human well-being of over-use of natural resources, pollution and waste will be significant. With cost-effective policies, the costs of action now are likely to be much lower than the costs of delayed action or inaction in a number of areas.

In addressing future environmental challenges, the main objectives and recommendations in the *OECD Environmental Strategy* remain valid. In addition to the issues identified in the *Strategy*, more attention should be given to other issues, including sustainable resource management, related issues of waste management, and the linkages of environmental policy to spatial planning. Moreover, we need country-targeted advice, for example through the improved and streamlined environmental performance reviews to address the political economy challenges of implementing environmental policies. We ask the OECD to continue to support us in these efforts through its work on green growth and the environment.

INTRODUCTION

Background

The OECD Environmental Strategy for the First Decade of the 21st Century was adopted by OECD Environment Ministers on 16 May 2001, and endorsed by the OECD Council the following day. Ministers of Finance, Economics and Environment participated in this meeting. The Strategy was intended to provide clear directions for environmentally sustainable policies in OECD Member countries, and to guide the future work of the OECD in the field of environment.

Ministers agreed that: "the Strategy should be implemented before 2010. The OECD Environmental Performance Reviews and the environmental indicators programme will be used for the monitoring of progress. Future meetings of the OECD Environment Policy Committee (EPOC) at ministerial level will review the progress achieved in implementing the Strategy." Reviews of the implementation of the OECD Environment Strategy were prepared for OECD Environment Ministers meetings in 2004[1] and 2008.[2]

At its meeting in February 2011, EPOC agreed that a further report on implementation of the Strategy should be prepared for the next meeting of OECD Environment Ministers scheduled for March 2012. EPOC agreed that this review should be organised around the five main objectives of the OECD Environmental Strategy, and corresponding indicators of progress identified in the Strategy. The indicators would be complemented by OECD analysis of country experience, particularly in Environmental Performance Reviews.

Box 0.1. OECD Environmental Performance Reviews

The OECD Environmental Performance Reviews provide independent assessments of countries' progress in achieving domestic and international environmental policy commitments. They aim:

- to promote peer learning by identifying and sharing good practices;
- to enhance countries' accountability to each other and to the public;
- to improve governments' environmental performance - individually and collectively.

As far as possible, the analyses are based on economic and environmental data. Targeted recommendations are designed to reinforce national environmental policy initiatives.

Since work began in 1992, over 60 Environmental Performance Reviews have been prepared. Most OECD Members have been reviewed at least twice. Russia and China, as well as some non-members have been reviewed within this programme, and reviews of South Africa and Colombia are planned.

This report has been prepared in light of the guidance provided by EPOC. It does not aim to be comprehensive. It focuses as far as possible on indicators that track country progress and aims to enrich the knowledge-base by drawing extensively on good practice examples drawn from Member country experience. These examples illustrate in a concrete way the new and effective policy approaches that Member countries have developed over the last decade. If all Member countries were to emulate the performance of the "top-runners" in each policy field, the overall progress in achieving the Strategy's objectives would be significantly enhanced.

1. OECD (2004), *OECD Environment Strategy: 2004 Review of Progress*, OECD, Paris.

2. "Implementation of the OECD Environment Strategy for the First Decade of the 21st Century: 2008 Review of Progress for Ministers", ENV/EPOC(2008)9/FINAL.

To some extent the review of the *Strategy* complements the *OECD Environmental Outlook to 2050* that is being prepared for the 2012 meeting of OECD Environment Ministers. The review of the *Strategy* will examine progress achieved by Member countries in the last decade, while the Outlook will examine global environmental trends and the policy interventions that would be needed to make them environmentally sustainable.

EPOC discussed whether the *Strategy* should be updated to provide a framework to guide future OECD work on the environment for the 2nd decade of the 21st Century. However, EPOC considered that the OECD Green Growth Strategy, which was under preparation when it last met, should provide the strategic framework for its future work.[3] The theme selected for the 2012 meeting of OECD Environment Ministers was intended to facilitate this by focusing on how Environment Ministers should play their part in operationalising the OECD Green Growth Strategy.

The OECD Environment Strategy for the 1st Decade of the 21st Century

The OECD Environment Strategy was elaborated in conjunction with the first OECD Environmental Outlook.[4] The Outlook analysed the main environmental pressures confronting OECD countries, and classified them using a red-yellow-green traffic light model according to their urgency. On this basis, the OECD Environment Strategy identified "five inter-linked objectives for enhancing cost-effective and operational environmental policies in the context of sustainable development."

Box 0.2. Objectives of the OECD Environment Strategy for the First Decade of the 21st Century

1. Maintaining the integrity of ecosystems through the efficient management of natural resources:

- climate;
- freshwater;
- biodiversity.

2. Decoupling Environmental Pressures from Economic Growth:

- agriculture;
- transport;
- energy.

3. Improving Information for Decision Making: Measuring Progress through Indicators.

4. The Social and Environmental Interface: Enhancing the Quality of Life.

5. Global Environmental Interdependence.

The OECD Environment Strategy specified 71 national actions that countries could take to meet these objectives, 32 indicators that could be used to measure progress, and work that OECD could undertake to support its Member countries in these actions.

3. See: OECD (2011), *Towards Green Growth*, and OECD (2011), *Towards Green Growth: Monitoring Progress*, OECD, Paris.

4. OECD (2001), *OECD Environmental Outlook to 2050*, OECD, Paris.

The 2001 *OECD Environmental Outlook* concluded that despite some progress in controlling pollution and improving efficiency in resource use, substantial further efforts were needed, in particular for the "red light" issues examined – climate change, biodiversity, water and environmental health. Advances made had been outweighed by the "volume effects" of increased levels of production and consumption. As a result, decoupling environmental degradation from continued economic growth was a necessary but not sufficient condition for ensuring that pressures on the environment were at a level compatible with environmentally sustainable development. Achieving the latter goal required a focus on the health of ecosystems and their carrying capacity so that that the biosphere is able to provide society with sufficient ecosystem services of adequate quality in the long run. To this end, the OECD Environment Strategy defined four criteria for environmental sustainability.

Box 0.3. Four Criteria of Environmental Sustainability Specified in the OECD Environment Strategy for the First Decade of the 21st Century

1. *Regeneration:* Renewable resources shall be used efficiently and their use shall not be permitted to exceed their long-term rates of natural regeneration.

2. *Substitutability:* Non-renewable resources shall be used efficiently and their use limited to levels which can be offset by substitution by renewable resources or other forms of capital.

3. *Assimilation:* Releases of hazardous or polluting substances to the environment shall not exceed its assimilative capacity; concentrations shall be kept below established critical levels necessary for the protection of human health and the environment. When assimilative capacity is effectively zero (*e.g.* for hazardous substances that are persistent and/or bio-accumulative), effectively a zero release of such substances is required to avoid their accumulation in the environment.

4. *Avoiding Irreversibility:* Irreversible adverse effects of human activities on ecosystems and on biogeochemical and hydrological cycles shall be avoided. The natural processes capable of maintaining or restoring the integrity of ecosystems should be safeguarded from adverse impacts of human activities. The differing levels of resilience and carrying capacity of ecosystems must be considered in order to conserve their populations of threatened, endangered and critical species.

EPOC agree that the report should aim to describe key trends and progress in achieving the Strategy's objectives. The key drivers underlying these trends, and the main obstacles to achieving the objectives, should also be analysed. Good practice policy approaches would be identified. The report would also identify some of the main reports that OECD has produced in the areas covered by the five objectives of the Environment Strategy.

OBJECTIVE 1

MAINTAINING THE INTEGRITY OF ECOSYSTEMS THROUGH THE EFFICIENT MANAGEMENT OF NATURAL RESOURCES

Assessment

Over the last decade, scientific understanding of "ecosystem integrity" – the ability of the environment to provide the crucial services upon which human well-being relies – has been strengthened. The target of limiting greenhouse gas (GHG) emissions so that the global average temperature of the atmosphere does not increase by more than 2°C from pre-industrial times provides an important benchmark for policy. There is better understanding of how disruptions of ecosystems beyond certain thresholds can result in irreversible changes in biodiversity and the provision of ecosystem services. OECD and other work (including *e.g.* the Stern and the Economics of Ecosytems and Biodiversity (TEEB) reports) have provided better insights into the huge economic costs of inadequate management of climate, biodiversity and water, as well as the most cost-effective approaches for addressing them. Better science and economics have supported innovation in policy instruments. However, the political economy of reform has proved difficult, and concerns about the distribution of costs and benefits within and between countries, and across generations have been major obstacles. As a result, we are not on track "to maintain ecosystem integrity."

In the field of *climate policy*, many OECD countries have developed comprehensive packages of policy measures; in some, market-based instruments play a central role. As a result 11 OECD countries have absolutely decoupled *production-based* GHG emissions per unit of GDP, and the others decoupled relatively. 12 of the OECD countries that have GHG emission reduction commitments under the Kyoto Protocol are on track to meet their targets using domestic measures. A number of other countries would need to rely on the Kyoto flexibility mechanisms to purchase additional credits in order to achieve their Kyoto targets.

Nevertheless, overall GHG emissions for OECD countries have continued to rise, although more slowly than GDP. In 9 OECD countries, *consumption-based* emissions of CO_2 increased faster than OECD net disposable income, the opposite of decoupling. Amongst other things, this is due to imports of products with a high carbon footprint from emerging economies such as China. GHG emissions from these countries continued to grow at a faster rate than in OECD countries. In 2008, the BRIICS (Brazil, Russia, India, Indonesia, China and South Africa) emitted 10.5 gigatonnes of CO_2, compared with 12.6 Gt CO_2 in OECD countries. This underlines how mitigating climate change is increasingly dependent on actions in countries outside OECD membership, as well as the actions by OECD members themselves.

Responding to the growing evidence of climate change impacts, many OECD countries have developed adaptation strategies. However, despite considerable efforts invested to develop tools and methodologies, a reliable information base for priority-setting and strategy development is generally lacking. Developing appropriate institutional frameworks is also a challenge.

The development of new policies and institutions to manage *water resources* in a more integrated way is providing a better basis for enhancing the ecological status of water bodies. Despite increasing demand for water, total water abstraction has remained virtually unchanged in the OECD area since the 1980s. This is largely due to more efficient use, which in turn is linked to better pricing policies. Nevertheless, 8 OECD countries are subject to medium-high water stress (whereby they are withdrawing more than 20% of resources available), and a further 9 where water availability is becoming a constraint (withdrawal of 10-20% of available resources). Many countries face seasonal and local water quantity problems. Over the last decade, depletion of ground water has become a cause for concern.

Good progress has been made in improving the quality of surface water, and reducing pollution from large point sources. About 80% of the population in OECD countries is connected to a municipal wastewater treatment plant. However, standards for water treatment are increasing in response to risks from a range of more diffuse sources of pollution, including agricultural and other chemicals. Many OECD countries are also facing significant costs to renew ageing water infrastructure. Water prices will have to be maintained or increased to cover these costs.

Despite some local successes, global trends in *biodiversity* are on the decline. Though advances in the science and economics of biodiversity has helped to underpin the strengthening of national biodiversity policies, further efforts will be needed to maintain the integrity of ecosystems and their related biodiversity. A number of countries are implementing or developing new, innovative approaches and instruments for biodiversity conservation and its sustainable use (such as payments for ecosystem services and biodiversity offsets). However, biodiversity policies will need to be more ambitious. It is now widely recognised that the targets agreed in 2002 by Parties to the Convention on Biological Diversity (CBD) to "significantly reduce the rate of biodiversity loss" by 2010 have not been met. At the most recent Conference of the Parties to the CBD (CBD COP-10) in October, 2010, Parties renewed their commitments to biodiversity, agreeing on *inter alia*, a new Strategic Plan and Biodiversity Targets for 2020.

Within OECD countries as a whole, protected areas have increased to just over 14% of the total land area. However, they are not always representative of national biodiversity, nor sufficiently connected. Lack of finance and effective management also limit their role in protecting biodiversity. Contrary to the global trend, forest coverage in OECD countries has grown significantly over the last decade, though the share of biodiversity-rich natural forest is less clear. The number of animal and plant species in OECD countries that are endangered is increasing.

The data and indicators required to effectively manage biodiversity need to be further strengthened. Biodiversity needs to be more effectively integrated into sectoral policies, and subsidies that harm biodiversity removed or reformed. Policy instruments and mechanisms that capture the economic value of ecosystem services, particularly those involving the private sector, should be further developed and more widely applied.

Introduction

The *Strategy* considered that unsustainable patterns of production and consumption were increasingly threatening the health of ecosystems at all levels. Since ecosystems are finite and vulnerable, and their capacity as sinks and sources is limited, the *Strategy* called for further efforts to manage them in a sustainable manner. The *Strategy* focused on three areas in particular:

- climate;
- freshwater;
- biodiversity.

1.1. Climate

The global climate is changing, in part due to the release of greenhouse gases (GHGs) from human activity. While there is significant uncertainty about the costs of inaction, it is generally agreed that failing to tackle climate change will have significant implications for the world economy, especially in developing countries, where reduced agricultural yields, sea level rise, extreme weather events and the greater prevalence of some infectious diseases are likely to be particularly disruptive (OECD, 2009). Furthermore, there are significant risks of unpredictable, potentially large and irreversible, damage worldwide. Cost estimates vary widely depending on the scale and categories of costs included in the models and the discount rate used. The economic and welfare costs of policy inaction could equate to as much as a permanent 14% loss in average world consumption per capita over the next two centuries, when both market and non-market impacts are included (Stern, 2006). The high level of risks and uncertainties suggests that strong early action against climate change may be partly justified as an insurance policy against large unforeseen adverse climate developments (OECD, 2009).

In reviewing actions taken by OECD Member countries to mitigate the potential impacts of climate change, it will not be possible to do justice to the huge volume of work that has been carried out within OECD and elsewhere. Rather, this section will focus on those aspects of the *OECD Environment Strategy* that were identified as major challenges:

1. Significantly reduce global GHG emissions, with developed countries taking the lead, and to protect and enhance greenhouse gas sinks and reservoirs to stabilise concentrations in the atmosphere over the long term at a level that would prevent dangerous anthropogenic interferences with the climate system.

2. Meet all obligations under the UNFCCC and work through international processes to take forward its objectives; for a large majority of OECD countries this means seeking entry into force of the Kyoto Protocol by 2002, with timely ratification processes, and with the broadest possible support of the international community.

3. Further develop new technologies, market approaches and other innovative solutions to address climate change, in particular with a view to combining actions for energy savings, and efficient and low GHG-emitting technologies.

1.1.1. Reducing greenhouse gas emissions

Taking OECD countries together, emissions of CO_2 and other GHGs have risen over the last decade, but at a lower rate than GDP (relative decoupling). However, individual OECD countries' emissions vary significantly, regardless of whether they are considered in absolute numbers, per capita amounts, or through carbon productivity (Figure 1.1). 11 OECD countries achieved absolute decoupling of production-based CO_2 emissions per unit of GDP in the period 2000-08 (Belgium, Czech Republic, Denmark, France, Hungary, Japan, Poland, Slovakia, Sweden, UK and US). In other OECD countries, the decoupling was relative (Figure 1.2).

A slightly different picture emerges when emissions are considered from the perspective of consumption or final demand. Only three OECD countries achieved absolute decoupling of consumption-based emissions of CO_2 in the period 2000-05 (Czech Republic, Slovakia and Sweden). 20 countries achieved relative decoupling. In nine countries, consumption based CO_2 emissions increased faster than the average increase of OECD net disposable income (Figure 1.2). This is at least partly due to the fact that consumption-based estimates include emissions from imports of goods with a relatively high carbon footprint. The carbon emissions of some products consumed in OECD countries are "displaced"; that is,

they are not produced in the countries consuming the products but in the producing/exporting countries, notably China.

Box 1.1. Sweden's global greenhouse gas emissions: Production and consumption perspectives

A recent study calculated Sweden's net contribution to global GHG emissions in 2003. Emissions produced in Sweden, including international transport, amounted to 76 Mt CO_2 eq. Of these, 24 Mt CO_2 eq were linked to exports leaving a balance from a production perspective of 52 Mt CO_2 eq. GHG emissions related to imports were calculated at 43 Mt CO_2 eq. Emissions from a consumption perspective were then calculated by adding the net emissions from production with those from imports to give 95 Mt CO_2 eq. Given the data and methodological difficulties in making this calculation, the study suggested that the emissions from a consumption perspective were probably in the range 85-105 Mt CO_2 eq. This is 25-35% more than if emissions related to production in Sweden were calculated.

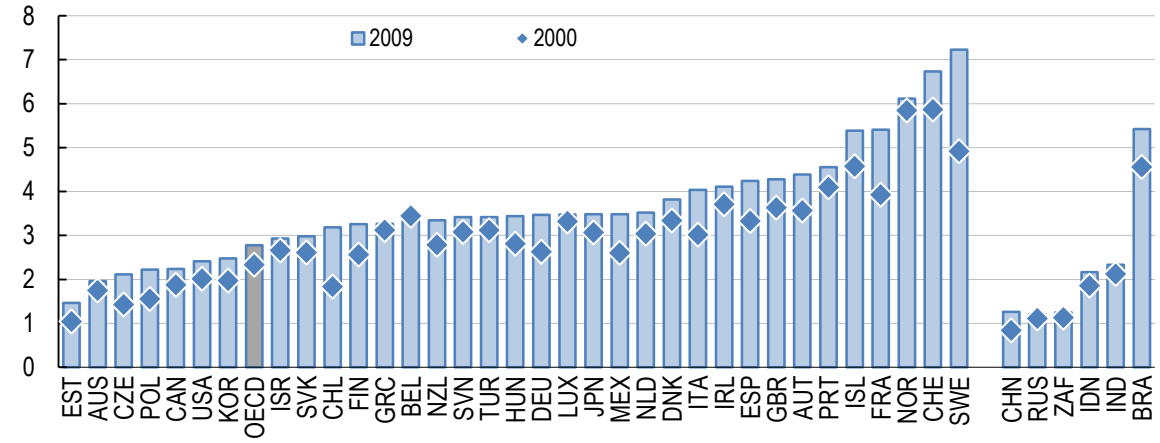
Source: Swedish Environmental Protection and Chemical Agencies (2011).

Globally, CO_2 emissions from energy use have grown more slowly in OECD countries as a group than they have world-wide and in developing countries (Figure 1.3). This trend was reinforced in recent years by the rapid economic growth of emerging economies (Figure 1.4). Whereas total emissions generated to satisfy domestic demand (final consumption plus investment) in OECD countries rose quicker than emissions related to production, the converse holds for large emerging economies. This reflects a host of factors, including trends in the international specialisation in production and relative comparative advantages of different countries. It should be emphasised here that the estimates are not "leakage" estimates obtained from a model (based on assumptions about how actors may react to a price change); rather they are estimates based on observed trends in production, consumption and trade patterns.

Figure 1.1. Production-based CO_2 productivity and intensity

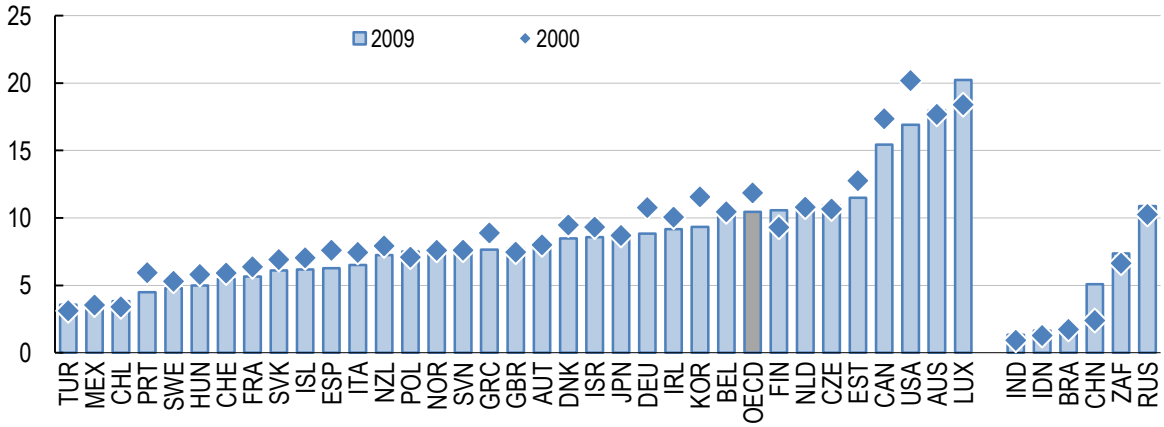
Energy related CO_2 emission productivity, GDP per unit of CO_2 emitted (production-based), in USD/Mtonnes of CO_2

OECD countries, 2000, 2008



Energy related CO_2 emission intensities per capita (production-based), tonnes of CO_2/capita

OECD countries, 2000, 2008



Source: OECD-IEA (2011), CO_2 emissions from Fuel Combustion.

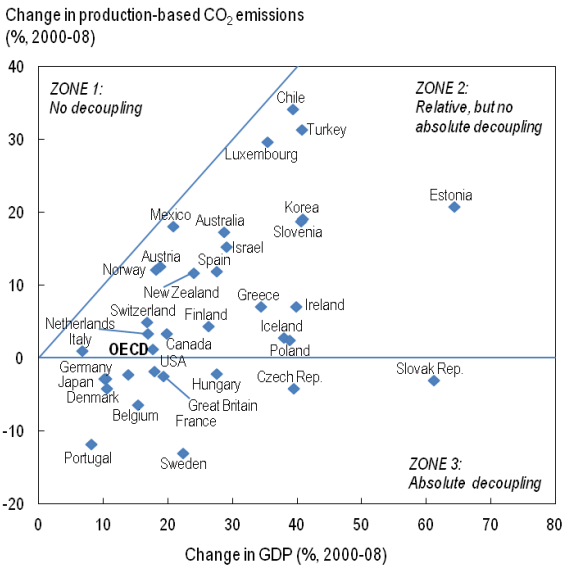
Within the OECD membership, CO_2 emissions from energy use continued to grow (Figure 1.4), particularly in the OECD Asia-Pacific region and North America. This can be partly attributed to energy production and consumption patterns, often combined with relatively low energy prices. In OECD Europe, CO_2 emissions from energy use remained more or less stable due to changes in economic structures and the energy supply mix, energy savings, implementation of policies and, in some countries, decreases in economic activity, particularly toward the end of the decade.

Disaggregating emission estimates shows substantial variations within individual sectors. Between 1990 and 2008, the combined share of electricity and heat generation and transport has continued to grow and now represents more than two-thirds of the total (67%) (Figure 1.5). Some of these issues are considered further in the section of the report dealing with decoupling in the energy and transport sectors.

Figure 1.2. Decoupling CO_2 in OECD countries: Production- and demand-based emissions

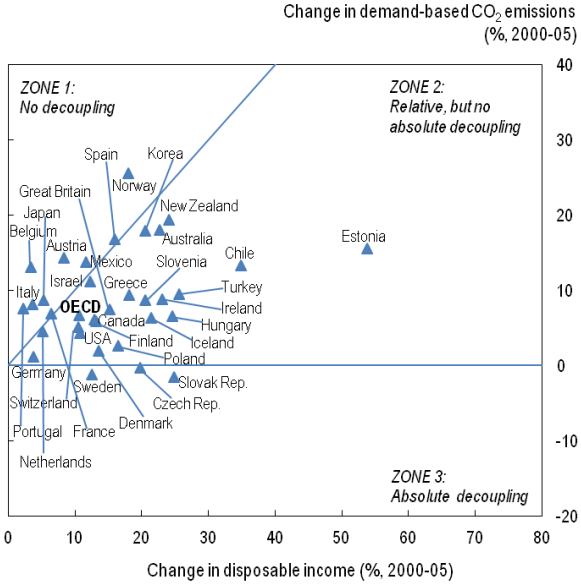
Change in production-based CO_2 emissions versus change in GDP

2000-08



Change in demand-based CO_2 emissions versus change in disposable income

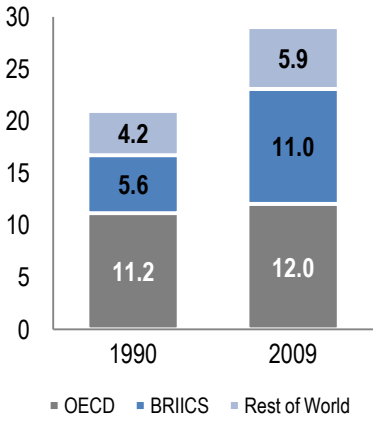
2000-05



Source: OECD (2011), *Towards Green Growth*, OECD, Paris.

Figure 1.3. Global CO_2 emissions

Gigatonnes of CO_2

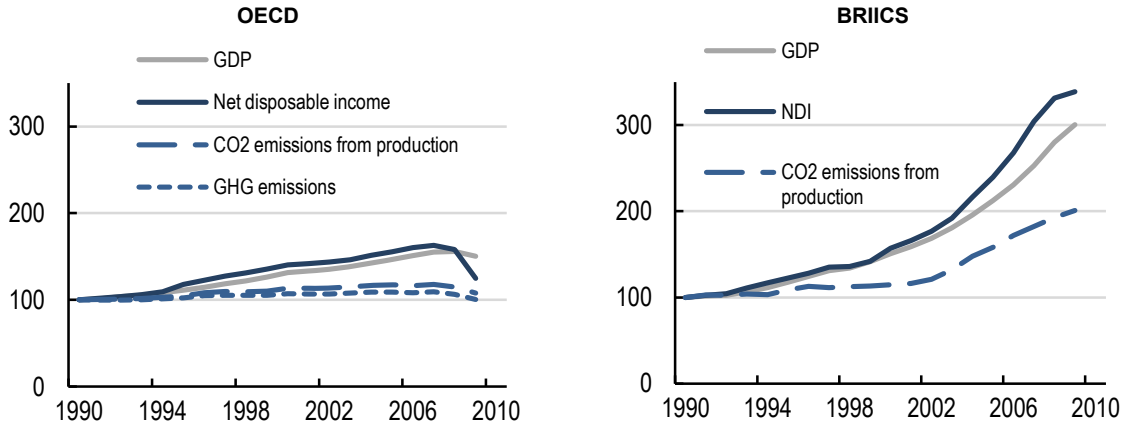


Source: OECD-IEA (2011), CO_2 emissions from Fuel Combustion.

Figure 1.4. Decoupling trends for OECD and BRIICS

Production-based CO_2* and GHG emissions versus GDP and real income

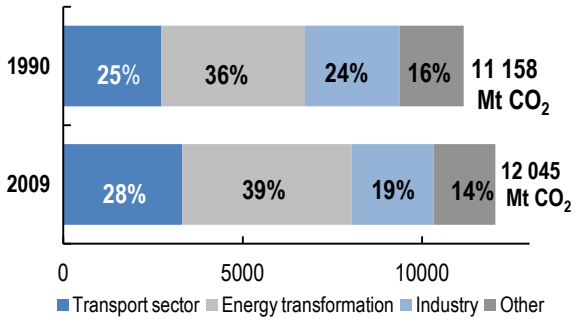
1990-2008, Index 1990=100



* Data refer to CO_2 emissions from energy use.

Source: OECD (2011), National Accounts of OECD Countries, OECD-IEA (2011), CO_2 emissions from Fuel Combustion, UUNFCC & World Bank (2011), World Development Indicators.

Figure 1.5. OECD CO_2 emission structure, 1990, 2008



Source: OECD-IEA (2011), CO_2 emissions from Fuel Combustion.

1.1.2. Meeting obligations under the UNFCCC

The United Nations Framework Convention on Climate Change (UNFCCC), which entered into force in 1994, set an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. It recognised that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other GHGs. Under the Convention, governments agreed to:

- gather and share information on GHG emissions, national policies and best practices;
- launch national strategies for addressing GHG emissions and adapting to expected impacts, including the provision of financial and technological support to developing countries;
- co-operate in preparing for adaptation to the impacts of climate change.

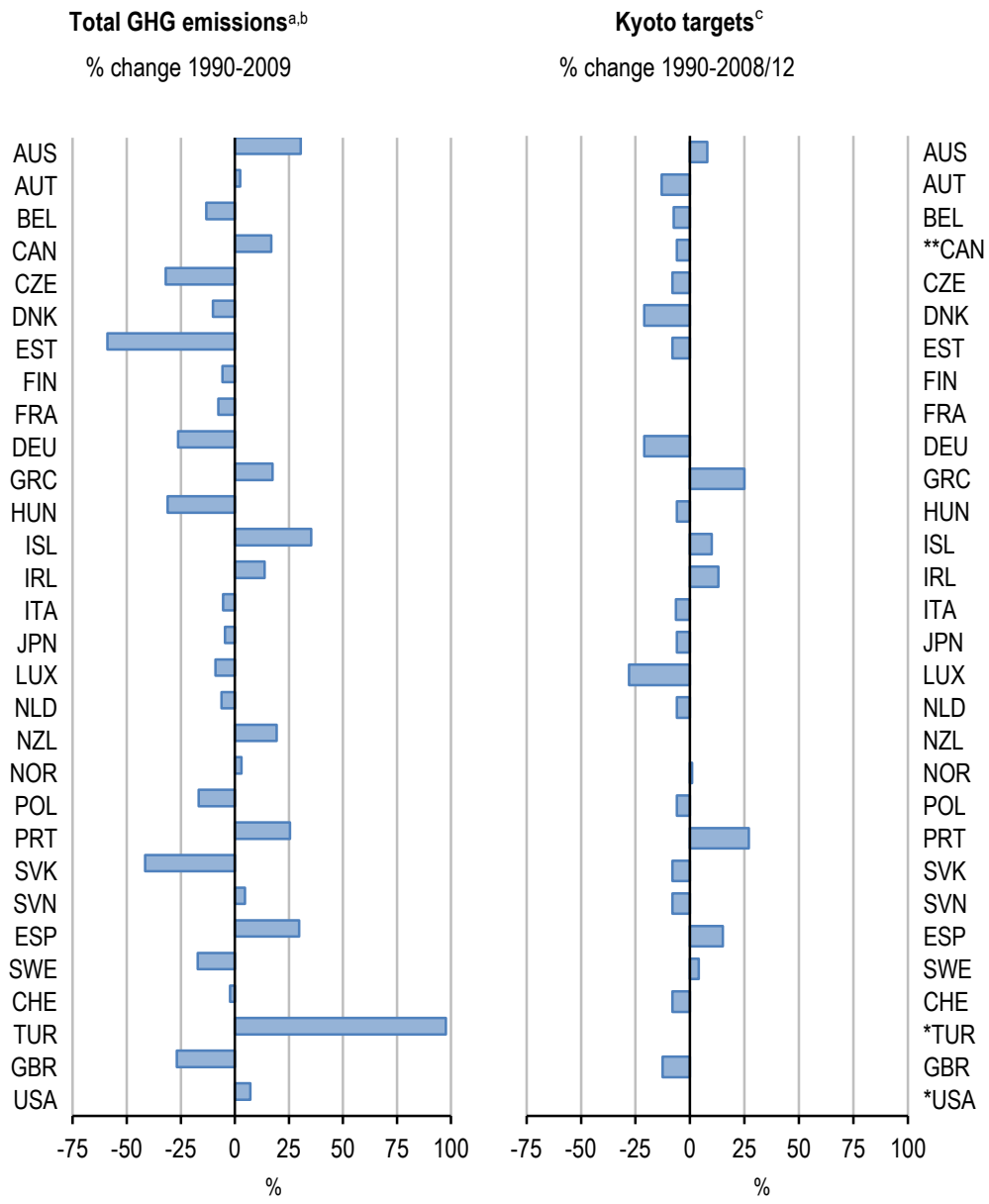
Throughout the decade, the Conference of the Parties to the UNFCCC have met annually to share information and to discuss further progress. These discussions have been supported by the analysis of the underlying science of climate change by the work of the Intergovernmental Panel on Climate Change. Throughout the decade, OECD has provided substantial analytical support to these discussions, focused primarily on the economics of climate change (OECD, 2010a).

The Kyoto Protocol to the UNFCCC, which entered into force in 2005, established binding targets for 37 industrialised countries and the European Community for reducing GHG emissions. The overall target of the Kyoto Protocol was to reduce GHG emissions by five per cent against 1990 levels over the period 2008-12. The major distinction between the Protocol and the Convention is that while the Convention *encouraged* industrialised countries to stabilise GHG emissions, the Protocol *commits* the Parties to do so. All OECD countries have GHG emission reduction commitments under the Kyoto Protocol except Chile, Israel, Korea, Mexico, Turkey and the US.[5]

The Figure 1.6 summarises changes in country GHG emissions between 1990 and 2008, and compares them, as appropriate, with their Kyoto commitment. By 2008, 12 of the current OECD Member countries were on track to achieve their Kyoto targets: Belgium, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Poland, Slovakia, Sweden, and UK. Achieving Kyoto targets would require a number of countries currently not on track to rely on the Kyoto flexible mechanisms to purchase additional credits.

5. In December 2011, the Canadian government announced the intention of withdrawing from the Kyoto Protocol.

Figure 1.6. Changes in GHG emissions and progress in achieving Kyoto targets



Notes: * Non-participating Annex 1 Countries. ** In December 2011, the Canadian government announced the intention of withdrawing from the Kyoto Protocol.

a) Data refer to the sum of the six main greenhouse gases expressed in CO2 equivalent; they refer to domestic emissions and exclude CO2 emissions and removal from land-use change and forestry.

b) Excluding non-Annex 1 Countries (Chile, Israel, Korea and Mexico).

c) Targets for the commitment period 2008/12 for the Annex 1 countries that are parties to the Kyoto Protocol. Targets can be achieved by i) domestic policies and measures and/or ii) the use of international transactions and flexible mechanisms of the Kyoto Protocol that affect emissions outside the national territory. Kyoto targets for EU member states refer to the EU burden sharing agreement, not to original targets in the protocol. Depending on the country commitment, the base year reference may differ; *e.g.* base year is 1985-1987 for Hungary, 1988 for Poland and 1986 for Slovenia.

Source: UNFCCC; OECD, Environment Directorate.

One important advance that has been achieved through the intergovernmental process is the consensus that has emerged to limit the increase in the global average temperature to no more than 2°C above pre-industrial levels. Above this level, the impacts of climate change are thought to be large, irreversible and costly. Agreement on this objective provides a valuable yardstick against which future policy proposals can be assessed.

Many developed and developing countries voluntary pledged to reduce emissions by 2020, first in the Copenhagen Accord in 2009 and later in the 2010 Cancun Agreements. The agreements also provide a framework for national plans to be prepared in a mutually accountable way; a comprehensive package of finance, technology and capacity building to support developing countries address urgent needs related to mitigation and adaptation; a schedule to review progress in keeping the average global temperature rise below 2°C; and an agreement to review whether this objective needs to be strengthened in future, on the basis of the best scientific knowledge available (UNFCCC, 2011).

However, significant challenges remain in the international climate negotiations regarding the future of the Kyoto Protocol, and its instruments, beyond 2012. Aggregating all the pledges and commitments of Copenhagen/Cancun indicates that they are unlikely to be sufficient to stay within the 2°C target without significant further action after 2020 (OECD 2011a; UNEP 2010).

1.1.3. Policies to mitigate greenhouse gas emissions

The design of instruments to mitigate GHG emissions has generated much debate and innovation. Some of the instruments applied are dealt with in other parts of this review (see the chapters on decoupling and global environmental governance). A number of lessons have been learned from OECD analysis concerning the technical design of policy instruments to mitigate GHG emissions, and these can be summarised as follows (de Serres *et al.*, 2011):

- given the high costs involved in mitigating GHG emissions, identifying cost effective approaches is crucial;
- establishing a clear carbon price is generally the most cost effective way to reduce GHG emissions;
- a mix of policy instruments that address the various market and policy obstacles will be needed to reduce GHG emissions efficiently and effectively;
- care should be taken to co-ordinate, and to avoid overlap, among policy instruments in order to ensure cost-effectiveness and environmental integrity;
- instruments should be applied as widely as possible regarding countries, sectors, sources, gases, etc;
- reforming policies that create perverse incentives to generate GHGs should be a priority;
- taxing the "bads" is generally more efficient than subsidising measures to reduce GHG emissions;
- to the extent possible, environmental policy instruments should be designed to foster innovation and be supported by appropriate R&D and innovation policies;
- the choice of instruments should take account of the need for effective enforcement, low administrative costs, and maintain sufficient flexibility for future improvement.

Box 1.2. EU Emissions Trading System

Launched in 2005, the EU Emissions Trading System (EU ETS) represents the world's largest GHG emission trading system. The system now operates in 30 countries (the 27 EU Member States plus Iceland, Liechtenstein and Norway). It covers CO_2 emissions from installations such as power stations, combustion plants, oil refineries and iron and steel works, as well as factories making cement, glass, lime, bricks, ceramics, pulp, paper and board. Together with nitrous oxide emissions from certain processes the currently covered installations account for almost half of the EU's CO_2 emissions and 40% of its total GHG emissions.

The EU ETS works as a "cap and trade" system. For a given period, a cap is defined for the total amount of GHGs that can be emitted by companies participating in the system. At the end of each year each company must submit enough allowances to cover all its emissions, or incur a fine. Companies can buy or sell emission allowances from one another as needed. This ensures that emissions are cut where it costs least to do so. The limited number of allowances available ensures that they have a value.

Experience to date has shown that the price signal transmitted through the ETS has been effective in triggering the search for less-emitting ways of production. Even in the first years of the system, when there were many start-up difficulties, the price signal induced companies to reduce their emissions cost-effectively despite robust economic growth and other factors that could have caused emissions to increase. Overall abatement during the trial period has been modest, probably between 120 and 300 million tonnes of CO_2. However, this is in line with the level of ambition of the pilot phase. In addition, it takes time for the CO_2 price to take full effect and for investments to bear fruit.

From 2013, a number of important changes to the way the EU ETS works will take effect, when the third trading period begins. Notably the cap and the allowance allocation will be determined at EU-level and no longer through national allocation plans. The number of allowances will be reduced so that in 2020 emissions will be 21% lower than in 2005. Auctioning of allowances will be gradually introduced, further enhancing the cost-effectiveness of the system. Airlines will join the system in 2012, and the EU ETS will be further expanded to the petrochemicals, ammonia and aluminum industries, and to additional gases, from 2013.

Following the introduction of the EU ETS, the price of carbon is now an economic reality in the European Union, and is taken into account in operating choices and investment decisions in the industry and electricity sectors.

Source: Hood (2010).

A new development in the last decade has been the greater involvement of sub-national levels of government in efforts to reduce GHG emissions. Given the concentration of economic activities and population in urban areas and that some cities generate more GHG emissions than some of the smaller OECD countries; these efforts can provide valuable support to national and global effort. However, aligning incentives and effective co-ordination among different levels of government will help to avoid duplicative or costly policy measures. Successful co-ordination can be driven from the top by national or regional authorities, emerge from policy innovations at local level, or feature a hybrid of both approaches. National governments play a key role in enhancing cities' capacity to act on climate change. Key roles include providing funding and technical assistance to cities and regions, such as in Finland and Sweden. Climate mandates in national urban and regional policies in Australia, Austria, Canada, the Czech Republic, France, Germany, Japan, Mexico and the United Kingdom, and in the Korean "Green New Deal", can advance local climate action (OECD, 2011b).

Box 1.3. CO_2 emission reduction in Tokyo

Tokyo is one of the biggest cities in the world, with a population of 13 million and a GDP close to USD 1 000 billion. It generates CO_2 emissions comparable to some OECD countries (*e.g.* Denmark, Finland, New Zealand). The Tokyo Metropolitan Government (TMG) is committed to reducing GHG emissions in the Tokyo area by 25% from 2000 levels by 2020, with large cuts targeting different sectors (-40% in transport, -20% in the residential sector, -10% in the business sector).

One of the measures taken by the TMG involves a planning and reporting system for public sector activities. Another innovative approach involves a cap and trade system for large facilities emitting above 3 000t-CO_2 eq per year in the area. Most of the covered entities are buildings and commercial activities. Emissions from these activities are growing and are already higher than those of the transport and household sectors. The system applies to some 1 400 buildings and commercial activities, and aims to reduce their emissions by 6-8% in 2010-14, and by 17% in 2015-19. The trading system includes the possibility of offsets from large sources outside the metropolitan area. The TMG is sharing its experience internationally, for example through its membership of the International Carbon Action Partnership.

Source: OECD (2010b).

The design and implementation of policy instruments is not just a technical exercise: it also needs to take account of political economy considerations; that is, how to address the uneven distribution of costs and benefits associated with different instruments. Failure to do so reinforces opposition to the proposed policy and instruments. A variety of approaches have been devised to meet this challenge, such as recycling carbon taxes or allocating allowances in emissions trading systems for free. However, such measures have not always been sufficient to gain popular or political support. A recent OECD Working Paper (de Serres *et al.*, 2011) identified the following main issues that policymakers need to address in order to implement a successful, low-cost mitigation strategy:

- *The intergenerational issue*: As with most structural reforms, the cost of climate policy tends to be borne up-front, while the likely benefits are realised only in the distant future. It is thus not easy to convince current voters to incur a cost to benefit a future generation, especially given that the latter is likely to be richer.

- *The carbon leakage issue*: There is always a risk of production shifting to another region with a less stringent emission policy. The evidence, so far at least, is that this risk may have been overstated, although such effects could build up over time.

- *The competitiveness concerns*: Competitiveness concerns arise mainly from differences in carbon prices across countries, which can be alleviated only through integrated carbon markets or harmonised taxes across jurisdictions, at least at the industry level. Short of that, possible measures to address competitiveness concerns include free allocation of permits or border tax adjustments, but all have significant drawbacks.

- *The distributional concern*: Aside from the natural resistance from those who stand to lose most from policy action, there is evidence that electorates attach importance to the distributional consequences of mitigation policies. Hence, assessing these consequences and providing effective targeted compensation measures to address specific distributional concerns without distorting the price signals, and hence the overall thrust of policy, is fundamental. Arguably, this is one of the most difficult political-economy challenges.

- *The "counterfactual" issue*: Policy should not be assessed *vis-à-vis* the status quo, insofar as the latter may not be regarded as a viable option. The costs and benefits of a proposed policy should

rather be examined *vis-à-vis* what is judged would happen in the absence of policy. In the same vein, the relative cost of policy alternatives should be established in a way that is as directly comparable as possible (*e.g.* per tonne of CO_2 eq. abated) so as to inform the public better about the economic consequences of policy instruments whose costs are less directly visible.

- *The international solidarity issue*: Climate change is proving to be a difficult area for international co-operation. Earlier analyses suggest that, for most countries/regions, the domestic benefits from joining a broad coalition of countries in climate change mitigation would exceed the domestic costs. However, in all cases, the benefits from "free-riding" would likely be even higher. This adds to other complications, such as the comparability of efforts and historical responsibilities, and makes achieving a broad agreement difficult in a world that has become increasingly multi-polar. International solidarity is under strain in other areas, including trade policy and regulation of the financial services industry.

1.1.4. Policies to adapt to climate change

During the 2000s, signatories to the UNFCCC began to respond more actively to the UNFCCC call for action on adaptation to climate change. Some OECD countries have developed climate adaptation strategies, and are providing information about their work on adaptation in their National Communications to the UNFCCC. In 2010, Parties to the UNFCCC adopted the Cancun Adaptation Framework (CAF) as part of the Cancun Agreements, thereby affirming that adaptation must be addressed with the same level of priority as mitigation. In 2011, the initial guidelines for the formulation of national adaptation plans by least developed country Parties were adopted.

Box 1.4. Developing a national climate adaptation strategy: France and Switzerland

In 2011, France launched its first national climate change adaptation plan (PNACC) for the period 2011-15. The Plan sets forth 84 actions and 230 concrete measures to help the country adapt to the changing climate. The PNACC is based on the results of a broad consultation process conducted in 2010. It takes into account different climate change scenarios and is based on the following principles: improving the knowledge on the effects of climate change, with a view to informing public decisions on adaptation; integrating adaptation into existing public policies, to ensure policy coherence and to reflect the crosscutting nature of adaptation; providing information to the public; considering interactions among activities and sectors; and co-ordinating implementation and financing responsibilities. Twenty fields of actions were selected: health, water, biodiversity, natural risks, agriculture, forestry, fishery, energy and industry, transport infrastructure, urban planning and buildings, tourism, information, education, research, finance, coastal zones, mountain zones, international and European actions, governance, and cross-sectoral actions. Due to the many uncertainties about the magnitude of climate change impacts, priority will be given to measures that: are beneficial even in the absence of climate change (*e.g.* the promotion of water efficiency); are reversible (*e.g.* the inclusion of climate change considerations in public procurement); can extend the "safety margins" (*e.g.* the mapping of areas prone to forest fire); and-can be adjusted periodically as new knowledge arises. Implementation of most measures is planned to start in 2011-12.

In August 2009, the Swiss Federal Council called for the preparation of strategy for adaptation to climate change. An interdepartmental group is co-ordinating the work, led by the Federal Office of the Environment. The Strategy will aim to take advantage of the opportunities provided by climate change (such as better conditions for crop cultivation), minimise risks (such as floods and landslides), and increase the adaptive capacity of resources (such as the resilience of water management systems). Work is supported by the development of scenarios for different regions by the meteorological office which provide a basis for analysing risks and opportunities. The most affected sectors will be identified and sectoral strategies prepared. Sectors under examination include: water, natural hazards prevention, agriculture, forest management, energy, spatial development, health, biodiversity. The interface among the sectoral strategies will be examined to support the preparation of an overall Strategy.

Sources: www.developpement-durable.gouv.fr/-L-adaptation-au-changement-.html and *www.bafu.admin.ch/klima/.*

A 2006 review found that climate change impacts and adaptation received only limited attention within National Communications of Annex 1 Parties to the UNFCCC relative to the discussion of GHG emissions and mitigation policies, and that this was often limited to the identification of generic options rather than the elaboration of specific action plans or policies (Gagnon-Lebrun and Agrawala, 2006). More recent reviews showed more progress, with adaptation and information on climate risks being mainstreamed in the national policies of the OECD countries reviewed (OECD, 2011a).

National governments have invested considerable efforts in recent years to develop methodologies and tools to screen the risks posed by climate change. Some progress has been made in using environmental impact assessment and strategic environmental assessment to incorporate climate change impacts and adaptation in design and evaluation of projects and programmes, as in Australia, Canada, the Netherlands and Spain (OECD, 2011a). However, the information needed to set clear priorities and to support strategy development is lacking. Establishing an appropriate institutional framework is also a challenge, particularly involving sub-national levels of government.

1.2. Freshwater

The *Strategy* identified two key challenges related to freshwater: to maintain an adequate supply of water for human use and to support aquatic and other ecosystems; and to ensure good water quality. This section will examine these issues by focusing on:

- balancing supply and demand for water;
- maintaining water quality;
- managing water in an integrated way;
- water pricing.

Some issues related to the agricultural uses of water are considered under Objective 2, decoupling in the agricultural sector.

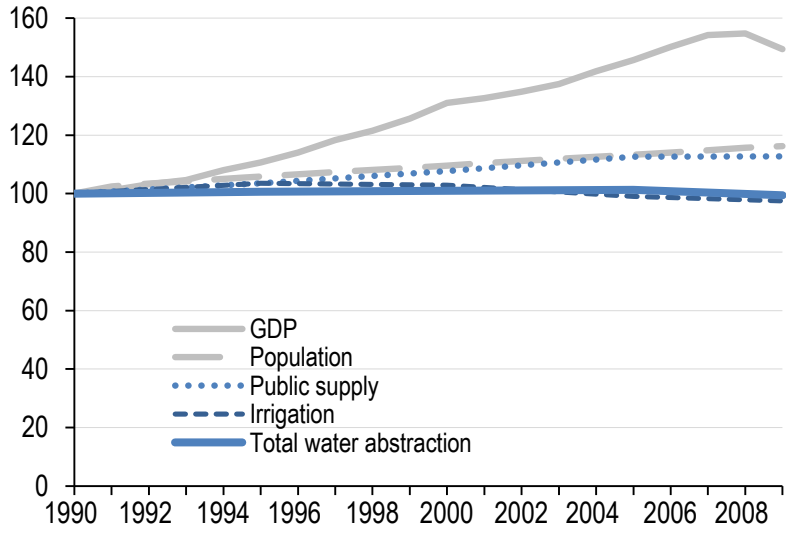
1.2.1. Balancing supply and demand

Water resources are subject to a growing number of demands. While populations are generally not growing in OECD countries, lifestyle changes and rising living standards are nevertheless intensifying pressures on water resources. Urbanisation increases demand, as does the development of key sectors such as agriculture, energy and industry. Agriculture is the largest single source of demand, and accounts for about 70% of global water demand, though probably less in most OECD countries. Energy, industry and households are among the other main users of water. Pricing is a key mechanism for allocating water among these competing uses. However, it is increasingly complemented by a range of other approaches, including tradable water rights, smart metering, water reuse and innovation.

Despite increasing demand for water, total water abstraction has remained virtually unchanged in the OECD area since the 1980s (Figure 1.7). This is despite increases in abstractions for public water supply and, to a lesser extent, irrigation. Stabilisation is the result of more efficient irrigation techniques, the decline of water intensive industries (*e.g.* mining, steel), increased use of cleaner production technologies, increased use of alternative water resources (water reuse, desalination), and reduced losses in pipe networks. Although at the national level most OECD countries show sustainable use of water resources, most still face at least seasonal or local water quantity problems, and several have extensive arid or semi-arid regions where water is a constraint to sustainable development and to the sustainability of

agriculture. In France for example, agriculture can account for between 48 to 79% of water consumption depending on the season (Conseil d'État, 2010).

Figure 1.7. OECD freshwater abstraction, by major use verses GDP



Source: OECD Environmental data.

Indicators of water use intensity show great variations among OECD countries. Water resources in eight member countries are already subject to high or medium-high stress (they withdraw more than 20% of the resources available to them),[6] in a further nine (where withdrawals account for between 10 and 20% of available resources), water availability is becoming a constraint on development and significant investments are needed to marshal adequate supplies (Figure 1.8). Some other member countries, though relatively water rich on a national scale, have extensive arid or semi-arid regions. A few countries have low population density and abundant water resources.

Box 1.5. Innovation in Israeli water technology

Israel's limited water resources are under severe pressure due to its geo-climatic location, rapidly expanding population, growing economy, and water pollution loads. The intensity of freshwater use is much higher than the OECD average. Water prices have been increased sharply and tariffs now cover the full cost of supplying water services, though not yet in the agricultural sector. High prices, government support and export markets have provided incentives for Israel to develop a range of innovative technologies to use water more efficiently.

Reuse of treated domestic wastewater (effluent): Effluent is discharged to sand infiltration fields, where it is treated by physical, biological and chemical processes before reaching the aquifer. The long retention time which is part of these processes produces a high quality effluent suitable for all agricultural crops, with no restrictions and no risk to public health. About 25% of total wastewater treated at plant in Tel Aviv is used in this way.

Large-scale desalination of seawater: Three large-scale desalination facilities currently provide 320 million m^3 of potable water to all sectors, the equivalent of approximately 42% of current domestic water requirements. By 2015, 2025 and 2050, respectively, new desalination facilities are expected to cover 62.5%, 70% and 100% of domestic water demand. Any supplementary desalinated water available in these years will be used to narrow the gap between replenishment of Israel's natural water systems and increasing water demand. Israel's desalination plants are among the most energy- and cost efficient in the world.

6. Israel, Germany, Hungary, Belgium, Korea, the Netherlands, Spain, Portugal.

Drip irrigation: First developed in the 1960s, drip irrigation technology was refined in the 1980s to include innovations such as computerisation, fertigation (direct application of fertilisers to plant roots), and pressurised drippers which enable even water distribution. Over half of Israel's irrigated area is now under drip irrigation, significantly improving water use efficiency. Drip irrigation technology also makes up a significant part of the country's water technology exports, which totalled USD 1.4 billion in 2008 (double the amount in 2005).

Large-scale filtration of water from Lake Kinneret: In 2007, a state-of-the-art Central Filtration Plant became operational to improve water quality and reduce the turbidity of water from Lake Kinneret transported through the National Water Carrier. With an annual filtering capacity of more than 500 million m^3, the filtration plant is one of the largest of this type of facility in the world. The decision to go ahead with the project was taken following a cost-benefit analysis, which estimated that savings in the form of avoided damage to health would be much higher than the USD 134 million spent to build the filtration plant.

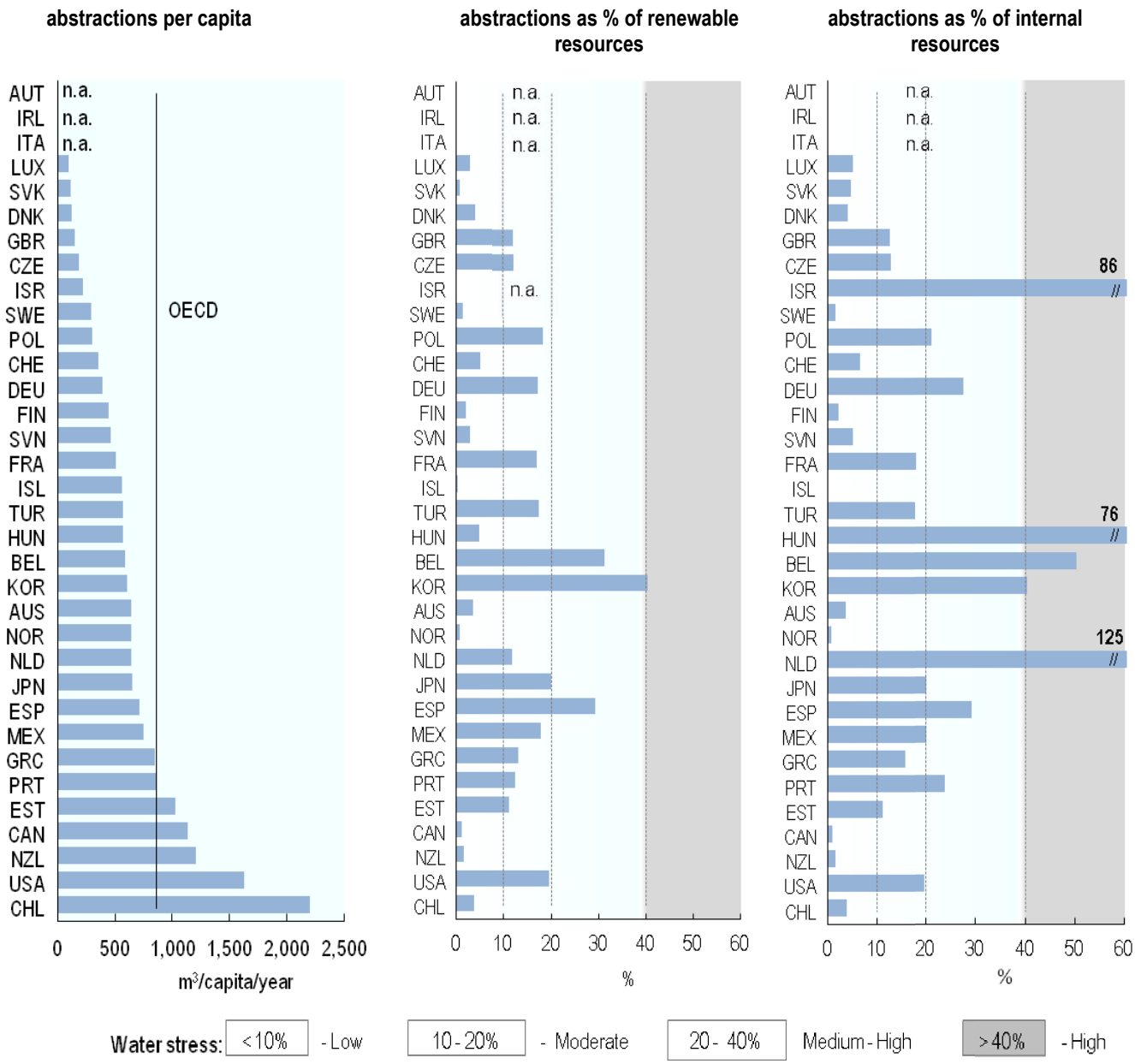
Source: OECD (2011c).

Over the last decade, groundwater has become a particular point of concern. The balance between demand and supply is becoming unstable in some countries. Some current water management policies, such as subsidies and lowering costs for extraction, have aggravated the problem. Groundwater depletion may be the single largest threat to irrigated agriculture, exceeding even the build-up of salts in soils.

There is some evidence that climate change may be affecting water availability as well as the incidence of floods because of changed precipitation patterns. In the future, changes in water quantity and quality due to climate change will affect annual average river runoff and water availability, including floods and droughts.

Figure 1.8. Water stress in OECD countries, 2009 or latest available year

Gross freshwater abstractions



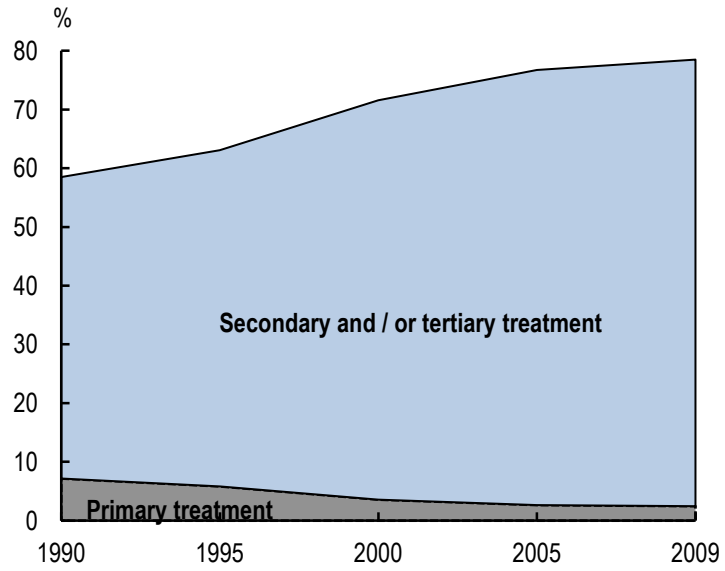
Notes: Excluding data prior to 2000 and considering England and Wales only.

Source: OECD Environmental data.

1.2.2. Improving water quality

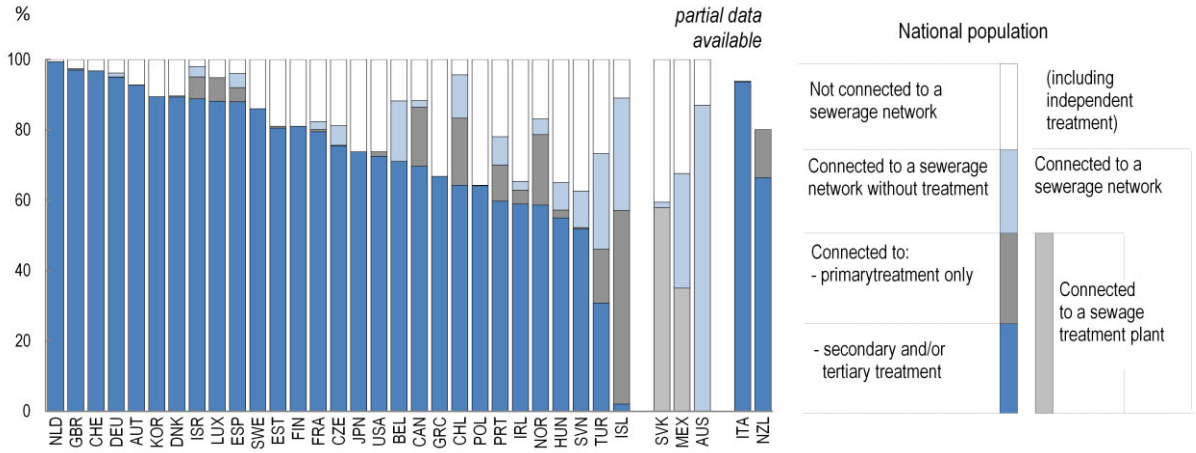
During recent decades, OECD countries have made large efforts to develop water supply, sewerage and waste water treatment infrastructure. OECD countries with relatively low GDP per capita are still in the intense phase of infrastructure development which can command investment of the order of 1% of GDP. A few richer OECD countries have yet to connect a part of their population to water supplies and sanitation, especially in rural areas. Nevertheless, good progress has been made in combating the most pressing surface water pollution problems, and about 80% of the population in the OECD area is now connected to a municipal waste water treatment plant (Figure 1.9). While the construction of secondary and tertiary treatment has progressed in many countries, primary treatment remains dominant in some. These efforts have resulted in substantial improvements in many countries such as the UK (see Box 1.7) and France (Comité de bassin Seine-Normandie, 2009).

Figure 1.9. Population connected to wastewater treatment, OECD region



Source: OECD Environmental data.

Figure 1.10. Population connected to wastewater treatment



Source: OECD Environmental data.

Box 1.6. Water reform in Chile

During the recent decade, Chile has implemented a major water reform that has resulted in a dramatic improvement in the delivery of water supply and sanitation services. The reform, which involved the regionalisation and privatisation of water companies, could provide valuable lessons for other countries at a similar level of development. More than two-thirds of the population is now connected to wastewater treatment. Full cost recovery pricing applies to public water supply and sewage treatment. Prices are regulated at the regional level, and subsidies are targeted on the poorest 18-20% of the population. Water prices increase in summer to reflect water scarcity. There is high level of compliance with WHO drinking water quality standards. Minimum river flow is included in the legislation and is broadly taken into account in the allocation of surface water rights. A pioneering nationwide system of tradable water rights was introduced for surface water and groundwater, though active trading remains mainly confined to some irrigated areas. Effluent discharge standards were introduced for industry, covering both direct discharges and discharges to sewers.

Source: OECD (2005a).

A number of OECD countries established their water infrastructure decades ago and now face the challenge of upgrading ageing networks. For example, an OECD study assessed that the UK and France would have to increase their water spending as a share of GDP by about 20% to maintain water services at current levels; Japan and Korea may have to increase their water spending by more than 40% (OECD, 2006). At the same time, new demands for more, and higher, standards for drinking water purification and sanitation are arising because of micropollutants. The need to remove nitrates and pesticides from water supplies is becoming more frequent as a result of agricultural run-off. The presence of endocrine disruptors in a number of water bodies raises a new source of concern and requires preventive measures. Concern about the poor quality of some drinking water supplies and the greater vulnerability of children or the elderly to infections by viruses and parasites is also creating demand for more advanced purification. Addressing these challenges will be costly. As a result, water prices in most countries are unlikely to decrease, and may increase.

Box 1.7. Improved water quality in England and Wales

The Environment Agency of England reported on the improved water quality in some of the main rivers in England and Wales. The transformation of these rivers has been achieved thanks to thousands of habitat improvement projects, tighter regulation of polluting industries and work with farmers, businesses and water companies to reduce pollution and improve water quality. River habitats have also benefited from reductions in the volume of water taken by water companies, farmers and industry. The Environment Agency has reviewed thousands of abstraction licences and is amending those that were causing environmental damage. Britain's rivers are the healthiest for over 20 years and otters, salmon and other wildlife are returning for the first time since the industrial revolution. However, more remains to be done and plans have been made to transform a further 9 500 miles of rivers by 2015 to meet challenging EU targets on the water quality and ecology of its rivers and lakes.

The River Wandle in London suffered extreme pollution and was officially declared a sewer in the 1960s. But over the last 20 years it has become a vibrant rich habitat due to better environmental regulation, a fish stocking programme and huge local enthusiasm for the river which has resulted in a vast improvement of water quality.

The River Thames was classified as biologically dead in the 1950's. Today' it is a thriving waterway; teeming with fish, and with returning salmon, otter and sea trout populations. Since April 2005 over 500 habitat enhancement projects have been completed and nearly 90 km of river has been restored or enhanced. Tighter regulation of polluting industries and the Environment Agency's work with farmers, businesses and water companies to reduce pollution and improve water quality, have all helped to make the Thames a living river once again.

On the River Wear, work with farmers and industry to reduce polluting discharges to the water, as well as huge investment in improving the sewerage infrastructure, has lead to a dramatic improvement in river water quality. Apart from the large numbers of game fish – such as salmon and trout – that are now being caught in the river, other wildlife has benefited, and now water voles, otters, and a vast array of invertebrates, plants and flowers have returned to the river.

Source: www.environment-agency.gov.uk/news/132754.aspx.

1.2.3. Integrated water resources management

Over the last decade, a number of OECD countries have taken important steps to manage water's different uses in a more co-ordinated way. Some countries have developed Integrated Water Resources Management; that is comprehensive, participatory approaches for managing and developing water resources in a way that balances social and economic needs, and that ensures the protection of ecosystems. Increasingly this is done at the level of the river basin or catchment. This has been accompanied by the emergence of institutional arrangements for water resources management based on hydrological rather than administrative boundaries. The EU Water Framework Directive adopted in 2000 is one example of such a comprehensive approach. The Australian National Water Initiative is another. Initiatives such as these, and the corresponding institutions, are pioneering new approaches to water management, though they are still at a relatively early stage and are very much work in progress.

The trend toward more integrated water resources management has supported an increased emphasis on preserving aquatic ecosystems. Some of the measures adopted for this purpose include setting minimum flows and/or levels in rivers and lakes; protecting wild and scenic rivers for conservation purposes; and increased attention to river sediments and their interaction with underground water, and to the role of upstream ecosystems and forests, wetlands and marshes. Increases in fish populations were observed in a number of previously polluted rivers. Other measures are being taken to aid channel maintenance, to control bank erosion, to reintroduce near-natural morphology, and to render watercourses as habitats suitable for fish and other aquatic biota. This is a move away from canalisation of rivers and provides more space in which water bodies can expand, while restoring ecological buffer zones and enhancing recreational uses.

Integrated water resources management also provides a better basis for managing floods and droughts. Using one classification of severe weather events, floods accounted for 41% of such events over the period 1980-2009, storms 44% and droughts 15%. The number of victims ranged between about 100-200 million per year, with peaks of 300 million or more. Economic losses are estimated at USD 50-100 billion per year between 1980 and 2009. The Katrina disaster in the US in 2005 caused a peak of USD 220 billion. Storms represent 53% of these costs; floods 33%, and droughts the remaining 14%.

With the recent rise in flood incidence, insurers are requesting increased government spending on flood defence, along with tighter planning guidelines to discourage building on flood plains. If flood insurance were to be made optional, people living in flood-prone areas would face a drastic rise in premiums, or might be unable to get insurance at all. While awareness of the benefits associated with flood prevention has increased in OECD countries, OECD governments spend relatively little on flood defence, even though flooding may cause material damage equivalent to a few percent of GDP.

Droughts are felt most strongly in regions where water stress is already relatively high. If weather patterns become more extreme with climate change, many member countries will have to modify their water use practices. The Murray Darling River Basin Authority played a central role in co-ordinating the response that affected southern Australia, illustrating the role that such institutions can play in combating drought.

River basin organisations are also well-placed to co-ordinate plans for adapting to climate change in the water sector. In particular, they can identify and provide the means to enhance the resilience and flexibility in water infrastructure to respond to the effects of climate change. This includes infrastructure for hydropower, structural flood defences, storage, drainage and irrigation systems, and wastewater treatment.

Box 1.8. Integrated water resource management in Canada

A variety of approaches to Integrated Water Resource management (IWRM) have been implemented in Canada at different levels of government. The federal government is engaged in some of these initiatives, while others are led by one or more provinces, and still others are led by non-governmental organisations. Examples include:

Inter-jurisdictional (US-Canada) level:

- Canada-U.S. Great Lakes Water Quality Agreement (*www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=88A2F0E3-1*).

Interprovincial level:

- Lake Winnipeg Basin Initiative (*www.ec.gc.ca/doc/eau-water/winnipeg_e.html*).
- Saint Lawrence Plan (*www.planstlaurent.qc.ca/index_e.html*).
- Prairie Provinces Water Board: Created by the Provinces of Alberta, Saskatchewan, and Manitoba and the Government of Canada in 1948 (*www.ppwb.ca/*) to apportion or share water equitably between the Prairie Provinces and to protect interprovincial surface water quality and groundwater aquifers.
- Great Lakes – St. Lawrence River Basin Sustainable Water Resources Agreement – An agreement between the Great Lakes Governors and Premiers which details how the Great Lakes States, Ontario and Québec will manage and protect the Basin and provide a framework for each State and Province to enact laws for its protection, see *www.glslregionalbody.org/GLSLRBAgreements.aspx.*

Provincial:

- Some provinces have implemented policies and/or legislation to support IWRM. The Conservation Authorities in Ontario and the River Basin Councils in Quebec are examples of watershed management organisations that are particular to those provinces.

Local:

- Fraser Basin Council: A not-for-profit organisation focused on advancing sustainability throughout the entire Fraser River Basin.

Water rights increasingly attract attention as instruments to manage water resources in an integrated way and to allocate water among competing uses. OECD countries (Australia, Chile, the US, to name a few) are gaining experience with the reform of water rights. Such reforms raise policy issues which deserve attention. One is the risk of speculation. To prevent the purchase of water rights for speculative purposes, several states in Australia prohibit or cap the ownership of water rights by persons not owning or occupying land, or restrict the proportion of entitlements in a given catchment that could be held by non-farm users. As a result, water markets are often inaccessible to urban users. Another issue is the potential tension between water rights and pricing policies: in practice, right holders may consider high water prices as depriving them from their entitlement.

1.2.4. Water pricing

Pricing water and water-related services serves several objectives, including: to reduce demand and promote efficient use of water; to allocate water among competing uses; to explore low cost options (*e.g.* eco-system services instead of man-made infrastructures); and to generate finance to invest in water-related infrastructure and services. However, the pricing of water may be at a level that poses

problems of continued access for poorer consumers. This issue is addressed under Objective 4, the social-environment interface. Since the middle of the 2000s, OECD has developed a comprehensive, cross-sectoral analysis of water pricing and financing.[7]

A recent OECD survey revealed that OECD countries are covering more of the costs associated with the provision of water services (OECD, 2010a). This is reflected in the level of prices (which have increased, at times substantially, over the last decade), in the structure of tariffs (which better reflect consumption and treatment costs), and in the increasing use of abstraction, pollution charges, and other economic instruments including tradable water permits.

Box 1.9. EU Water Framework Directive

The Water Framework Directive (2000/60/EC), adopted in 2000, establishes a legal framework to protect and restore clean water across Europe and ensure its long-term and sustainable use. It introduces two key economic principles. First, it requires water users – industries, farmers and households – to pay for the full costs of the water services they receive. Second, the directive calls on Member States to use economic analysis in the management of their water resources and to assess both the cost-effectiveness and overall costs of alternatives when making key decisions.

Under the directive the recovery of costs refers to several elements. The prices users pay for water should cover the operational and maintenance costs of its supply and treatment and the costs invested in infrastructure. In addition, the directive requires that prices paid by users also cover environmental and resource costs. This is a key step towards implementing the economic principle that polluters and users should pay for the natural resources they use and the damage they create. Environmental costs include damage to ecosystems such as pollution that harms fish and wildlife in rivers. Extracting water for human causes may harm ecosystems by reducing water levels in rivers and lakes. The directive also recognises the need to take into account social, environmental and economic considerations when determining cost recovery.

Reports prepared by EU Members States in 2005 revealed that many did not provide complete economic information, especially in the areas of industrial and agricultural users or on the resource and environmental costs of water services. The reports indicated that most Member States would have significant work to do to introduce water pricing policies by the target date of 2010.

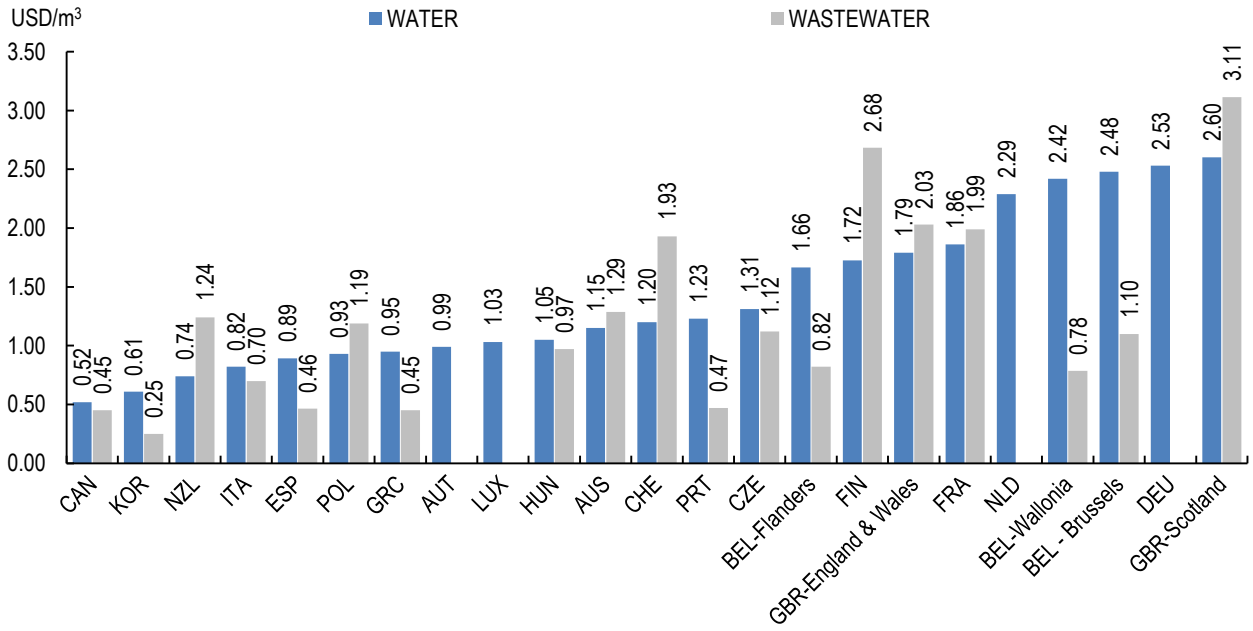
Source: European Commission, DG Environment, Water Note 5. Economics in Water Policy, The value of Europe's waters.

Tariff levels charged to households for water supply and sanitation services vary greatly among OECD countries (Figure 1.11), reflecting variations in the level and types of costs recovered. Data collected in the first part of the last decade shows that in half of the countries, wastewater services are more expensive than drinking water supply. Prices have risen over the last decade due to increased wastewater charges linked to higher investment costs (*e.g.* tertiary treatment), and the application of value-added and other taxes.

7. See: *www.oecd.org/document/47/0,3746,en_2649_34285_36146415_1_1_1_1,00.html*.

Figure 1.11. Unit price of water and wastewater services to household, 2008

including taxes



Source: OECD (2010a).

Tariff structures for water supply vary within and across OECD countries. The diversity of tariff structures in a country reflects the degree of decentralisation of the tariff-setting process, as well as the different costs associated with providing water services in different locations, especially in rural areas. The main difference with previous surveys is the smaller number of countries where flat fees and decreasing block tariff structures are used. An emerging trend in some OECD countries is the increasing use of fixed charges alongside volumetric components, or the progressive increase in the weight of fixed charges in the overall bill.

The greater use of economic instruments in water management is helping to achieve more economically efficient and environmentally sustainable water abstraction and allocation among competing uses. Abstraction charges are often designed with the objective of providing funding for water resources management or for watershed protection activities. Despite this, they tend to be relatively low. Abstraction taxes imposed on groundwater tend to be higher than on surface water. In most cases, charges are collected and retained locally.

In most cases, pollution charges are collected at the local rather than river basin level, and are earmarked to finance environmental activities. In some countries revenues collected from downstream beneficiaries are used to compensate upstream residents for restrictions put on their land use, an important step towards truly integrated water and land management at the river basin level.

Box 1.10. New York City's watershed management

US cities are required to filter water supplied to citizens from surface water sources unless they can establish that an equivalent system of quality control has been established. About 90% of New York City's water comes from the Catskill-Delaware region. The City demonstrated that the water from this region satisfied water quality standards. However, it need to demonstrate that it could maintain the quality of the water supply through ownership or agreements with landowners in order to use this water source without investing in expensive filtration equipment. A co-operation programme was established through a multi-stakeholder process. Overall expenditure, primarily financed by the city came to USD 1.6 billion, compared to avoided filtration costs of USD 6 billion.

Source: OECD (2005b).

The level of prices for water supplied to farms has risen in OECD countries. Frequently, however, farmers are only paying the operation and maintenance costs for water supplied, with little or no recovery of capital costs for irrigation water infrastructure. Where countries have raised water charges to farmers, available evidence indicates that it has not necessarily led to reduced agricultural output, and that a mix of policy instruments and approaches is required for this purpose (OECD, 2010c). However, water prices rarely reflect scarcity and/or environmental costs.

1.3. Biodiversity[8]

The *Strategy* called for the restoration and enhancement of biodiversity, as well as a significant reduction in threats to ecosystems and their species. In 2002, the year after the *Strategy* was adopted, the Parties to the UN Convention on Biological Diversity (CBD) agreed to "significantly reduce the rate of biodiversity loss" by 2010.

This section examines these issues by focussing on:

- the state of biodiversity;
- policy responses.

1.3.1. State of biodiversity

At the most recent meeting of the Conference to the Parties to the CBD in Nagoya, Japan, in 2010 – CBD COP-10 - there was wide recognition that the target of significantly reducing the rate of biodiversity loss had not been met. While there have been some local successes, the overall trends in biodiversity protection have been negative (OECD, 2011b):

- globally, Mean Species Abundance (which refers to the population size of species) has declined by nearly 11% from 1970 to 2010;
- all four sets of species covered by the IUCN Red List Index – corals, birds, mammals and amphibians – have declined in recent decades;
- between 1990 and 2010, global forest area decreased, though the rate of deforestation also declined;

8. This section draws heavily on OECD (2011).Unless otherwise indicated, the data and examples in this section are drawn from this source.

- over 30% of fish stocks currently are over-exploited or depleted, around 50% of stocks are fully exploited, and less than 20% have the potential for further development.

Many of the most biodiversity-rich or "megadiverse" countries are developing countries, where the additional costs of conservation and sustainable use may be difficult to bear. Mexico has played an important role in promoting co-operation among these countries, including promoting the equitable sharing of benefits from the use of genetic resources (see Box 1.11).

Box 1.11. Indigenous communities, biodiversity and intellectual property rights in Mexico

The Mexican population includes about 10% indigenous people. Indigenous communities are often socially and economically marginalised, with little access to basic environmental, health or educational services. They are frequently located in areas with high environmental and biodiversity value.

Changes in the Mexican Constitution recognise the rights of indigenous people to make decisions concerning their own economic, social and cultural development, including their cultural and historical identity (*e.g.* beliefs, institutions, spiritual well being and the land they occupy or use). This is consistent with Agenda 21 and with international agreements such as Convention 169 of the International Labour Organisation and the Convention on Biological Diversity (Article 8J).

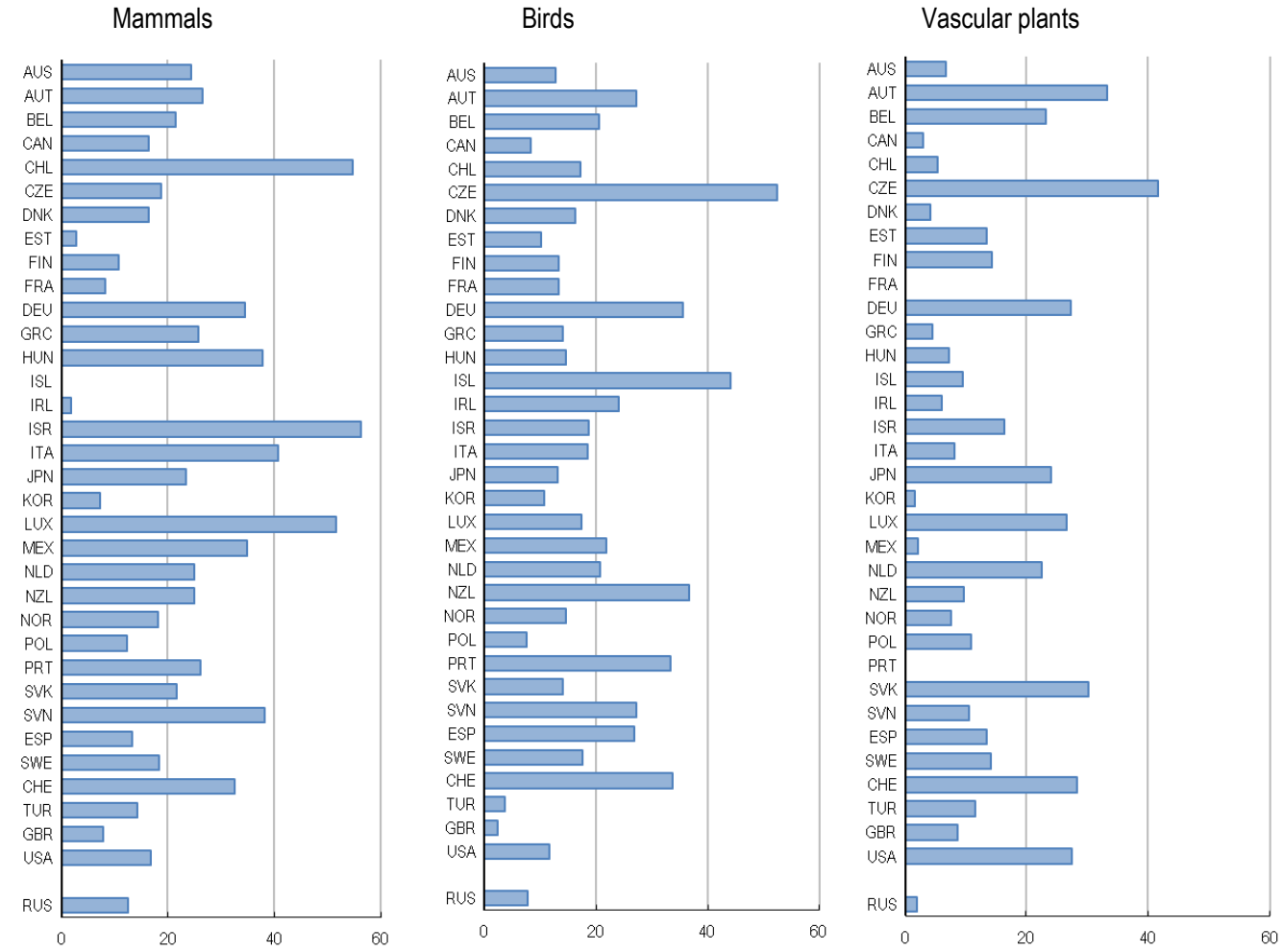
A Special Programme for Indigenous Settlements of the Mexican ministry in charge of biodiversity promotes sustainable use of natural resources and conservation of biodiversity in areas where indigenous people live, values their traditional knowledge and protects their intellectual property rights. Public authorities, NGOs and the indigenous communities have entered into partnerships concerning land use planning, designation of natural protected areas or national parks, and eco tourism. They have also promoted innovative models of indigenous production and community mobilisation that combine traditional values and modern technology and marketing. Successful examples include organic agriculture, coffee co operatives, community forestry enterprises, and nature/cultural tourism.

Through the creation of a Group of Like-minded Megadiverse Countries (Group of Cancun), Mexico has taken the lead internationally in ensuring that traditional knowledge is properly recognised in the evaluation and granting of intellectual property rights.

Source: OECD (2003).

In keeping with global trends, in most OECD countries, the share of animals and plants species identified as endangered is increasing. Many species are threatened by habitat alteration or loss, both within and outside protected areas. These shares vary significantly among OECD countries (Figure 1.12). Only a few endangered or threatened species have begun to recover and/or their habitats have been extended as a result of reintroduction or recovery programmes, or reduced pollution pressure.

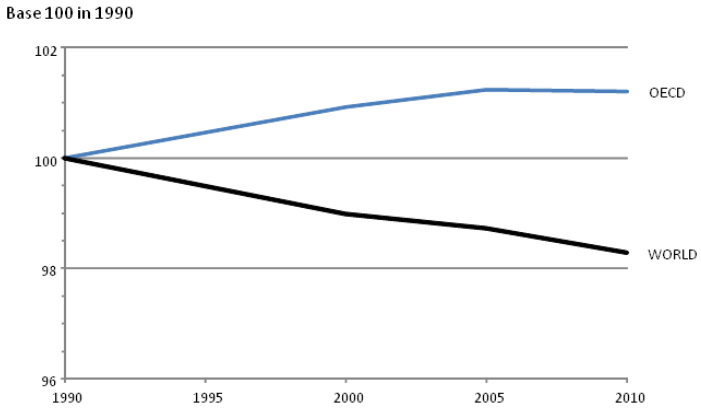
Figure 1.12. Threatened species, OECD countries, mid-2000s
as % of species known



Source: OECD Environmental data.

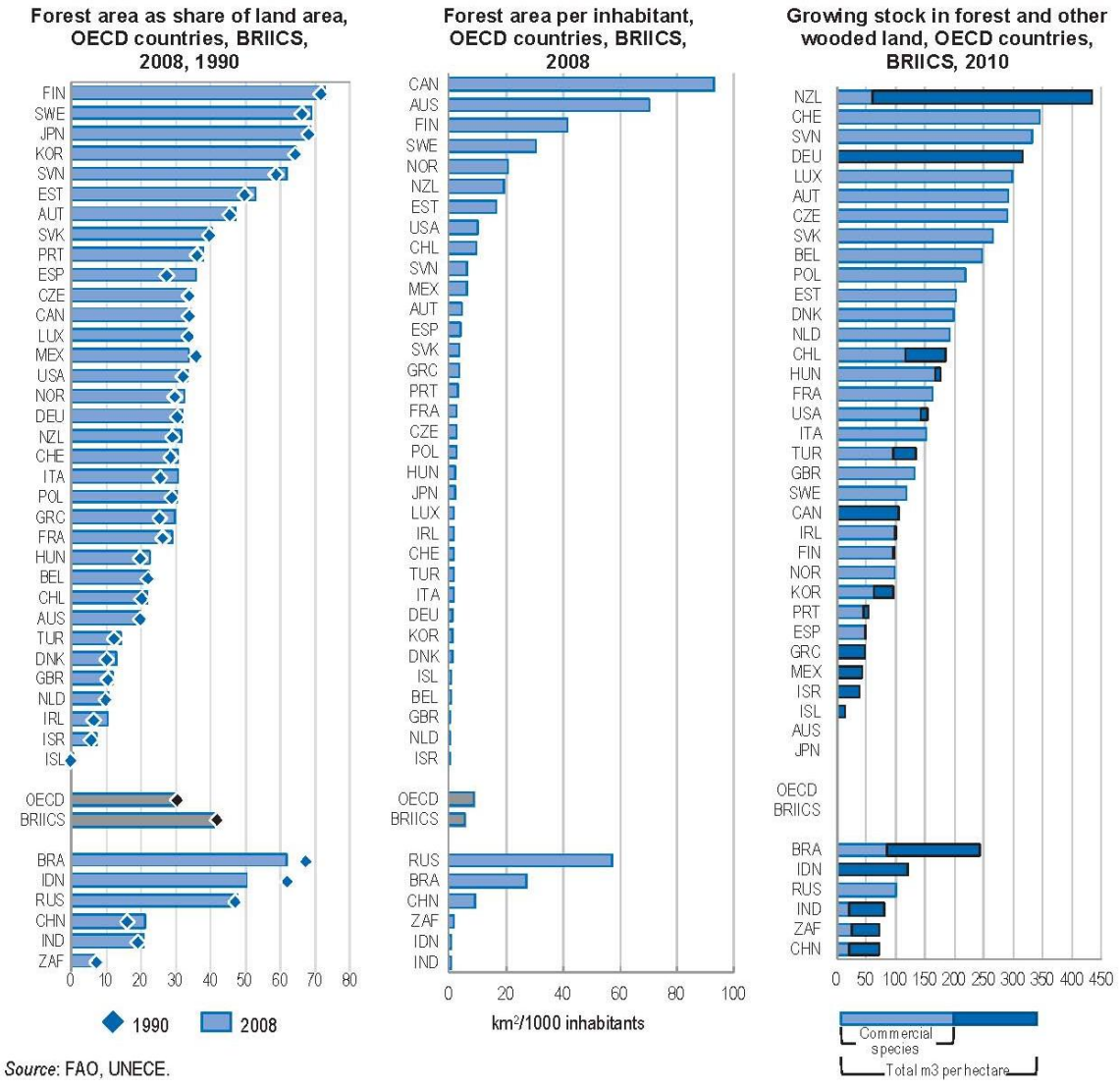
Forests tend to be highly diverse and to provide multiple ecosystem services, including habitat provision. Contrary to worldwide trends, the forest area of OECD countries has continued to grow significantly in the recent past (Figure 1.13). However, this does not necessarily result in an improvement in biodiversity. If the increased forest coverage is due to monoculture plantations rather than natural forests, this may result in continued biodiversity loss. Despite the overall increase in forest coverage for OECD countries as a whole, there are wide variations among countries, with high deforestation in Mexico and high afforestation in Turkey.

Figure 1.13. Global and OECD trends in forest land



Source: FAO Global Forest Resources Assessment.

Figure 1.14. Changes in forest area and growing stock



Source: FAO, UNECE.

1.3.2. Policy responses

1.3.2.1. Strengthening the science and economics base for decision making

Insufficient information and understanding have been impediments to the development of more efficient and effective biodiversity policies. An important step in addressing this problem was taken by the Millennium Ecosystem Assessment (MEA). This initiative was conducted under the auspices of the UN and involved 1 360 experts from 95 countries. It was designed to assess the consequences of ecosystem change for human well-being and to establish the scientific basis for actions needed to enhance the conservation and sustainable use of ecosystems and their contribution to human well-being. An important outcome of this work was the increased realisation that disruption of ecosystems beyond a certain threshold could lead to irreversible changes with negative social, environmental and economic consequences.

Box 1.12. Four Main Findings of the Millennium Ecosystem Assessment

Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, freshwater, timber, fibre and fuel. This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth.

The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people. These problems, unless addressed, will substantially diminish the benefits that future generations obtain from ecosystems.

The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals.

The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met under some scenarios that the MA has considered but these involve significant changes in policies, institutions and practices, that are not currently under way. Many options exist to conserve or enhance specific ecosystem services in ways that reduce negative tradeoffs or that provide positive synergies with other ecosystem services.

Source: Millennium Ecosystem Assessment (2005).

Recognising the need strengthen the scientific understanding of biodiversity for decision making, the CBD COP-10 approved the establishment of an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). The IPBES is intended to provide an interface between the scientific community and policy makers. Governments have agreed that the four main functions of the IPBES will be to: 1) identify and prioritise key scientific information needed for policy makers and to catalyse efforts to generate new knowledge; 2) perform regular and timely assessments of knowledge on biodiversity and ecosystem services and their interlinkages; 3) support policy formulation and implementation by identifying policy-relevant tools and methodologies; and 4) prioritise key capacity-building needs to improve the science-policy interface, as well as to provide and call for financial and other support for the highest-priority needs related directly to its activities (quoted in OECD, 2011).

Further progress is required on biodiversity metrics and indicators at local, national and international levels (see also the section on environmental information for decision making) to aid more informed and cost-effective policy interventions and to assess progress over time.

In parallel with the strengthening of the science base for better sustainable management of ecosystems and biodiversity, OECD promoted the strengthening of economic analysis to support decision making on

biodiversity. In 2004, the OECD Council adopted a Recommendation on the Use of Economic Instruments in Promoting the Conservation and Sustainable Use of Biodiversity [C(2004)81]. In 2008, progress with the implementation of the Recommendations was reviewed and a report prepared. Since then, OECD has carried out work on a range of issues related to market-based approaches to biodiversity protection (see OECD, 2011c).

In the second half of the decade, UNEP launched an initiative with several partners to examine The Economics of Ecosystems and Biodiversity (TEEB, 2010).The report documented the enormous economic value of ecosystems and biodiversity, as well as the economic and social costs of their loss. For example, TEEB indicated that the aggregate loss of biodiversity and ecosystem service benefits associated with the global loss of forests is between USD 2 and 5 trillion per year.

Box 1.13. TEEB's recommendations to policy makers to better reflect the value of nature

- create better measurement and monitoring systems – from biodiversity and ecosystem services indicators to natural capital accounts and more comprehensive national income accounts;
- develop a culture of assessment – taking wider ecosystem values over longer time periods into account, as well as the range of costs and benefits across affected parties;
- adjust incentives – rewarding benefits through price payments, premiums, and markets, reforming environmentally harmful subsidies and applying the 'polluter pays principle' to addressing losses;
- green markets and supply chains – developing and regulating markets, setting standards, supporting labelling and promoting green public procurement;
- use regulation and good governance to raise national legislative standards and move towards policy coherence that integrates the values of nature;
- improve the implementation and enforcement of legal frameworks;
- invest in ecological infrastructure – improving protected areas, restoring natural assets, increasing connectivity and supporting climate change adaptation and other policy objectives cost-effectively;
- increase understanding and awareness, *e.g.* through new information tools, to demonstrate the value of nature for policymakers, business, communities and citizens.

Source: TEEB (2009).

At CBD COP-10, 89% of the Parties reported that they had prepared national action plans. Not only has the number increased, but the content of these plans has also evolved. A number of OECD countries have adopted strategies based on an ecosystem approach. This new generation of biodiversity strategies recognises that economic development is compatible with sustainable use of biodiversity; shifts the focus from protecting as much biodiversity as possible to the sustainable use of biodiversity; and aims to protect ecosystems, not just individual species or sites. As scientific and economic analysis improves, national biodiversity strategies should establish clearer priorities, and deploy a more coherent and cost-effective set of policy instruments. They will also need to address political economy challenges which, in some though not all cases, are similar to those facing climate policies (see above), particularly concerning distributional impacts of policies, both nationally and internationally.

Box 1.14. Protecting biodiversity in Norway

The 2009 Nature Diversity Act consolidated a new and innovative framework for biodiversity management in Norway that goes beyond the requirements in equivalent EU Directives. In particular it introduces two new concepts – priority species and selected habitat types – that are intended to shape the future of Norway's biodiversity policy. Nature and biodiversity management objectives are also included in sector strategies – notably for agriculture, aquaculture, fisheries and forestry – as well as in land and sea management plans. The area of land under protection has increased significantly. More broadly, policies for biodiversity have been reinforced by a significant increase in budget, and by a substantial investment in expanding the knowledge base, including the establishment of the Biodiversity Information Centre. Nevertheless, Norway still faces major challenges in the conservation and sustainable use of biological diversity, including: strengthening protection within protected areas, and for some nature types, notably forests; increasing risk of disease and genetic effects on wild populations of fish from aquaculture; maintaining viable populations of the four large carnivore species (brown bear, lynx, wolf, wolverine); strengthening spatial planning so as to prevent the loss of large "wilderness" areas, as well as building in coastal zones and along rivers; and long-term protection of marine areas.

Source: OECD (2011c).

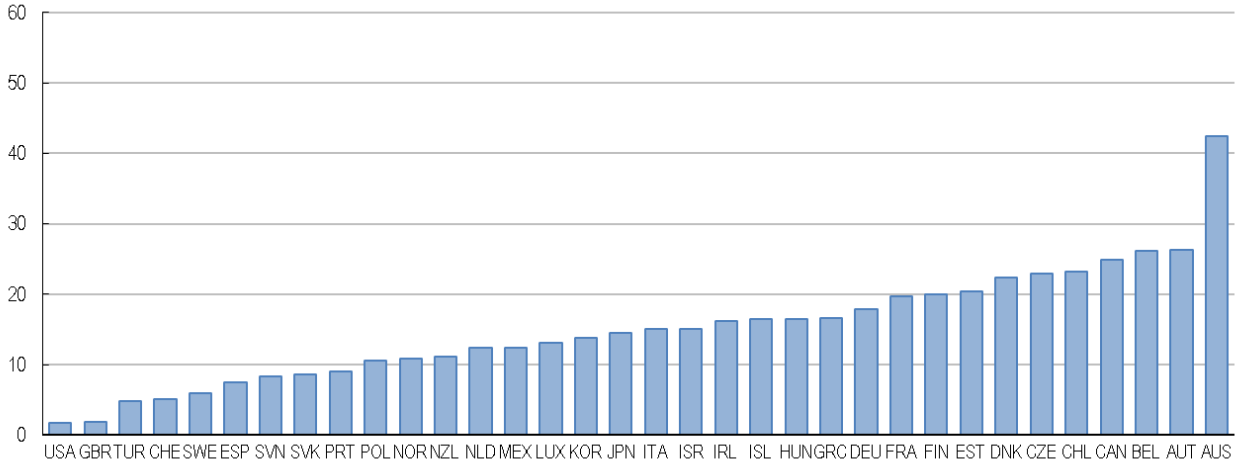
Improvements in scientific and economic analysis have also supported progress at the international level. CBD COP-10 resulted in two important political achievements: (i) agreement on package of measures, including a new Strategic Plan and Biodiversity Targets for 2011-20; a Strategy for Resource Mobilisation, as well as the adoption of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation;[9] and (ii) the approval of an Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services described above.

1.3.2.2. Protected areas

Historically, protected areas have been the main component of national biodiversity programmes. Within OECD countries as a whole, the area covered by protected areas increased to about 14.3% of the total land area, though with significant variations among countries. In the EU, Natura 2000 sites cover 18% of the EU territory, and 130 000 km² of it seas. These achievements can now be set against the target agreed at the recent CBD COP 10 to expand the global protected area network to at least 17% of terrestrial areas by 2020. Part of this challenge includes protecting areas that are important for biodiversity and ecosystem services, and that are representative of national ecosystems. One challenge facing most countries in this regard is increasing marine protected areas which currently are significantly under-represented. There is also growing awareness that protected areas should not be treated as "biodiversity islands", and that greater emphasis should be given to creating ecological 'networks' with connecting corridors between protected areas.

9. The Nagoya Protocol is a commitment to attain prior-informed consent from the country of origin before accessing genetic resources and to share both monetary and non-monetary benefits derived from genetic resource use, based on mutually agreed terms.

Figure 1.15. Terrestrial protected areas, % of total land area, OECD countries, 2010



Note: Nationally designated terrestrial protected areas. Includes different level of protection ranging from IUCN categories I to VI.

Source: UN Millennium Development Goals Indicators, 2011.

Protected areas need to be developed with effective management plans and receive adequate resources to fulfil their functions; if not they become open access areas. For example, Canada has established the goal of maintaining or improving ecological integrity in all national parks by 2013, and has invested in management and restoration to address a prioritised set of ecological issues using a corresponding set of indicators.[10] The costs involved in implementing effective management plans for protected areas could be substantial, but need to be compared with the cost of inaction which are probably larger. One estimate suggests that an additional USD 18-27.5 billion per year is required to establish a comprehensive Protected Area (PA) network covering 10-15% of global terrestrial area.

In most Member countries, management of protected areas is complicated by the distribution of responsibilities for nature conservation among different administrations at national or regional levels. The definition of property rights (*e.g.* land rights, rights for wetlands conservation, transferable fishing quotas) can also have an important bearing on nature conservation. In some countries non-governmental nature conservation associations have played an active role in acquiring and managing sensitive areas and protecting species, and in developing innovative partnerships with stakeholders (*e.g.* forest companies (Box 1.15).

Box 1.15. Protecting the national heritage in the UK

Voluntary organisations play a key role in heritage and nature conservation activities in the United Kingdom. The National Trust is a non-profit organisation, established by an Act of Parliament, which has been granted special privileges exempting land in its care from the normal processes of development. The Trust's aim is to protect and preserve for the nation lands and buildings of beauty or historical interest; it acquires scenic areas for preservation in their natural state, protecting indigenous plants and animals.

In 2010, the Trust had 3.7 million members and owned about 1.5% of the land of England, Wales and Northern Ireland, where it operates, in the form of more than 26 National Nature Reserves and 466 Sites of Special Scientific Interest. In the same year, 61 000 volunteers contributed a total of 3.5 million hours of maintenance work. The combination of special legal status with private money and effort has made the National Trust a very effective instrument for nature conservation. Its model has inspired the establishment of similar organisations in other countries.

Source: OECD (2002), *Environmental Performance of the United Kingdom*, OECD, Paris.

10. See : *www.ec.gc.ca/indicateurs-indicators.*

1.3.2.3. Integrating biodiversity into sectoral policies

Some of the main pressures on biodiversity result from the implementation of policies in other sectors. Historically, land-use change related to deforestation, agricultural expansion, and forestry has been a key driver of biodiversity loss, and this is likely to continue. Similarly, infrastructure development related to urbanisation, transport, tourism and other sectors reduces and fragments the areas covered by ecosystems. Thus, modern biodiversity strategies must address how biodiversity and economic development can be reconciled.

Box 1.16. Controlling invasive alien species

Another important driver of biodiversity loss is invasive alien (exotic) species. The introduction of alien species may also contribute to the loss of natural resources, reductions in food production, poor human health and increased costs for agriculture, forestry, fisheries and water management. The number of alien species in Europe has increased by 76% since 1970, and similar trends are likely in the rest of the world. Continued increase of invasive alien species is likely over the next few decades posing further risk to biodiversity. For example, trade, travel and transport are expected to grow strongly in the future, and have been the predominant agents for moving species outside their natural ranges. An important step in controlling invasive alien species was achieved with the adoption of the 2004 Convention for the Control and Management of Ships' Ballast Water and Sediments, though it has yet to enter into force.

Source: OECD (2011b).

Integrating biodiversity considerations at the planning stage of projects or programmes provides one approach. This can be done at the level of environmental (project-based) or strategic (planning and programming-based) impact assessment. The CBD has developed a set of guidelines for this purpose in 2005 (CBD, 2005).

Biodiversity offsets have been used in conjunction with planning processes. These are defined as "measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken" (quoted in OECD, 2011). Developers can arrange biodiversity offset themselves or pay someone else to do it for them. This can be done as an ad-hoc arrangement or through biodiversity banking. Biobanks serve as a repository of biodiversity credits representing beneficial biodiversity outcomes beyond business-as-usual. The credits can be stored over time and eventually purchased by developers to offset biodiversity loss at development sites. Examples of biobanks include US Conservation Banking and the New South Wales BioBanking programme in Australia. Biodiversity offsets may operate in a regulatory framework, or they may be undertaken voluntarily. Several industry leaders have already incorporated offset policies into their corporate strategy, including inter alia Rio Tinto, BHP Billiton, Anglo Platinum, and Shell, while a number of countries have developed national or regional guidelines or incorporated biodiversity offsets into their legal framework.

A key driver of biodiversity loss in sectoral policies are subsidies that promote the intensification or geographic expansion of economic sectors. One of the targets agreed at CBD COP-10 is to phase out or reform subsidies that are harmful to biodiversity by 2020 in order to minimise or avoid negative impacts. Subsidies to increase production in the agricultural sector are a particular source of concern. Although the level of agricultural support is still high, it is decreasing, and many countries have reformed agricultural payments to support biodiversity protection; for example, by paying landowners to restore degraded forest ecosystems (*e.g.* Korea); to remove land from production (*e.g.* Austria); to not use fertilisers in areas of conservation importance (*e.g.* Czech Republic); and to cultivate/raise endangered species, to avoid retiring farmland, and to reduce inputs (*e.g.* France).

Payments for Ecosystem Services[11] (PES) can also be used to reduce the loss or enhance the provision of ecosystem services. The first schemes were introduced in the 1970/80s. Today there are more than 300 PES programmes implemented across developed and developing countries, predominantly for carbon, biodiversity, watershed services and landscape beauty. Five of these national schemes are transferring more than USD 6.5 billion per year. Examples include the Victorian Bush Tender Programme in Australia, which aims to improve the management of native vegetation on private land; and Vittell's (Nestle Water) PES scheme initiated in 1989, which pays farmers in France to change farming practices that have a negative impact on water quality. A number of PES schemes are also mobilising private sector finance (OECD, 2010).

A variety of other instruments have also been deployed to reduce pressures on biodiversity from other sectors, including regulations (such as environmental standards for soil), economic instrument (such as tradable permits), and information-based instruments (such as eco labels on timber and fish products).[12] The challenge is to deploy them in a co-ordinated, cost-effective manner.

1.3.2.4. Integrating biodiversity protection with other environment-related policies

Biodiversity loss and ecosystem degradation have impacts on a number of other environment-related areas including climate change, water management, and human health. A number of countries are paying increased attention to understanding these inter-linkages and interactions in order to identify potential policy synergies and trade-offs, and thus enable more co-ordinated and strategic decision-making. Some of the main issues under examination are:

Climate Change: Biodiversity plays an important role in both climate change mitigation and adaptation. Terrestrial and marine ecosystems are estimated to store, and provide a net yearly sink, for substantial quantities of greenhouse gases. However, deforestation and other land-use changes account for up to 20% of global anthropogenic GHG emissions. Maintaining and restoring ecosystems (*e.g.* reforestation) can therefore help mitigate GHG emissions and increase carbon sequestration. It is estimated that the contribution of marine biodiversity alone to climate regulation may be as much as USD 12.9 billion annually. Biodiversity and ecosystems can also play an integral role in climate change adaptation. Examples of so called "ecosystem-based adaptation" include maintaining and restoring "natural infrastructure" such as mangroves, coral reefs and watershed vegetation as a cost-effective means for reducing vulnerability to storm surge, rising sea levels and changing precipitation patterns.

At the same time, climate change is a driver of biodiversity loss and degradation, and this pressure is projected to increase. Climate change will alter ecosystem composition, structure and functioning. However, climate change adaptation and mitigation policies may also have adverse impacts on biodiversity. For example, agricultural adaptation approaches such as draining wetlands during times of flooding, increased irrigation and the use of dykes may lead to habitat loss, soil erosion and eutrophication; and renewable energy sources such as biofuel, hydro-electric dams and wind turbines have been observed to have a negative impacts on biodiversity.

Water: The hydrological services provided by ecosystems include water purification, flow regulation, erosion and sedimentation control. Forest soils and wetlands generally have a good capacity to absorb water, releasing water gradually and reducing peak flows. Conversely, water quality and quantity impacts biodiversity. For instance, eutrophication, habitat loss through land drainage, river flow regulation and

11. PES are "a voluntary, conditional agreement between at least one seller and one buyer over a well defined environmental service – or land use presumed to produce that service".

12. See: OECD (2011b).

sediment load from soil erosion can cause declines in freshwater and marine biodiversity and changes in ecosystem structure and functioning.

Human health: Biodiversity and ecosystems provide services which are critical to human health. These include provisioning services covering basic human needs; prevention of disease through biological control; provision of medical and genetic resources; and the provision of opportunities for recreational, creative and therapeutic activities for improved mental health (Zaghi *et al*., 2010) (see also chapter on health).

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OBJECTIVE 2

DECOUPLING ENVIRONMENTAL PRESSURES FROM ECONOMIC GROWTH

Assessment

Between 2000 and 2008, GDP in OECD countries grew by 18%. Following the global economic and financial crisis, GDP and output in the main sectors of the economy fell by several percentage points. This created an "environmental dividend" in that environmental pressures were less than they would have been if previous growth patterns had continued. However, the reduction in environmental pressures is not an excuse to delay action.

In the last decade, there was some decoupling of environmental pressures from economic trends in the sectors examined: energy, transport and agriculture. However, most was relative rather than absolute decoupling. As a result, many environmental pressures increased. Further efforts are particularly needed to better internalise environmental costs in prices, including by removing environmentally harmful subsidies, and to promote innovation. In some cases, achieving absolute decoupling requires innovation not just in technologies but also in the social and institutional relations in which they are embedded.

In the *energy sector*, emissions of SO_x and NO_x have been absolutely decoupled from energy supply, and in most countries they are significantly lower than at the beginning of the decade. In addition to structural changes and fuel switching, environmental policy measures contributed to this trend, including by stimulating the adoption of abatement technologies. This progress has contributed positively to reducing health impacts from local air pollution, and the environmental impacts of acid precipitation. Greenhouse gas (GHG) emissions followed a similar trend as energy supply and were relatively decoupled from GDP in the period 2000-07. A more evident decoupling can be observed at the end of the decade, partly due to the effects of the global economic crisis.

Energy intensity for OECD countries decreased over the decade, both per unit of GDP and on a per capita basis. This was linked to a sharp rise in global energy prices, and latterly, the economic downturn, when overall energy consumption also fell, mainly driven by a strong decline in the industrial sector. The energy mix for OECD countries was little changed over the decade, with the combined share of fossil fuels continuing at about 80% of total primary energy supply. The share of renewable sources increased from 6% to nearly 8% of energy supply. However, renewables represented less than 20% of overall electricity production, with hydro accounting for the largest share.

In the *transport* sector, the key trends from an environmental point of view have been the increasing use of motor vehicles and their continued dominance in the modal split. This has been supported by an increase in motorway density, particularly in Europe. Since 1990, growth in private cars has followed growth in GDP, but at a slightly lower rate. A variety of means have been used to reduce the environmental impacts of motor vehicles: standards for fuel quality and consumption; taxes on car registration and annual usage; taxes on fuels linked to emissions; toll and congestion charges. While these policies have helped to improve fuel consumption and to reduce some emissions of individual cars, the gains have been swamped by the increasing scale of car use. Incentives to purchase diesel- rather than petrol-driven vehicles have also contributed to the generation of more hazardous emissions. Approaches for limiting the environmental impacts of international air and sea transport are the subject of discussion.

Between 2000 and 2008, the combined contribution of electricity, heat generation and transport to GHG emissions continued to grow and now represents more than two-thirds of the OECD total. While there are significant variations among OECD countries, many OECD economies appear to be locked-in to high carbon production and consumption patterns that are difficult to break. The development and commercialisation of alternatives to fossil fuels face a formidable range of technical, financial and political obstacles. For instance, fossil fuel subsidies in 20 OECD countries have increased over the second half of the last decade. Revenues from environmental related taxes (which are mostly levied on motor fuels) only account for about 7% of overall OECD tax receipts and have fallen in recent years, though this is also linked to rising energy prices. Even countries with the most active energy efficiency policies have realised only about 60% of recommended potential energy savings.

In the period 2000 to 2008, *agricultural production* in OECD countries was more or less stable while GDP grew. Against this backdrop, GHG emissions from agriculture, the use of irrigated water, and nitrogenous fertiliser use declined relative to agricultural production in OECD countries. However, these overall trends mask significant variations within and among countries.

A key factor in the reduced environmental pressures from agriculture has been a reduction in the overall level of agricultural support, as well as decline in the share of that support that is most environmentally damaging. Implementation of cross-compliance schemes, whereby farmers' receipt of support is linked with compliance with environmental requirements, has helped to further reduce environmental pressures from agricultural support. The absolute level of agri-environment measures has also increased substantially over the decade. Farmer must generally go beyond environmental requirements in order to receive this form of support. However, the overall volume of agri-environment measures is still very small compared to the level of farm support.

Introduction

Decoupling refers to the link between "environmental bads" and "economic goods" (OECD, 2002). It is measured by comparing the relative growth rates of a direct pressure on the environment, such as GHG emissions, and an economic variable to which it is linked, such as GDP or energy supply. Decoupling occurs when the growth rate of the environmental pressure is less than that of its economic driver. Decoupling is *absolute* when the environmental bad is stable or decreasing while the economic variable is growing. Decoupling is *relative* when the environmental pressure continues to grow, but at a lower rate than the economic variable.

Interpreting decoupling trends generally requires careful analysis. Decoupling has no automatic link to the environment's capacity to sustain, absorb or resist pressures of various kinds: an environmental pressure may be absolutely or relatively decoupled from economic trends but still exceed a critical environmental threshold. Most economic drivers have multiple environmental effects, and most environmental pressures are generated by multiple economic drivers. Policy measures influence both environmental pressures and economic drivers, and their relationship. Thus, trends in decoupling should be decomposed into their contributing factors such as: changes in the scale of the economy, consumption patterns, and economic structure, the adoption of cleaner technology, changes in inputs, and environmental policy measures.

Achieving decoupling in the context of maintaining the integrity of ecosystems - Objective 1 of the *Strategy* – calls for significant changes in government policies, corporate behaviour and in people's consumption patterns. A wide mix of policy instruments will be required, including regulatory approaches, economic instruments, and information-based instruments. Key factors that have been highlighted in earlier reviews of the *Strategy* are "getting the prices right", by removing environmentally harmful

subsidies and making greater use of environmentally related taxes, and promoting the development and diffusion of cleaner technologies.

The *Strategy* identified three sectors where action was urgently needed:

- energy;
- transport;
- agriculture.

(Given data limitations, this section focuses on decoupling in these sectors from a production, and not a consumption, perspective.)

Between 2000 and 2008, GDP in OECD countries grew by 18%. Following the global economic and financial crisis, GDP fell by several percentage points. Output from the energy and transport sectors dramatically dropped, whereas output from agriculture was more stable. The fall in output created an "environmental dividend" in that environmental pressures were lower at the end of the decade than they would have been if the growth trends prior to the economic and financial crisis had continued. This needs to be taken into account when assessing progress with decoupling over the decade.

2.1. Energy sector

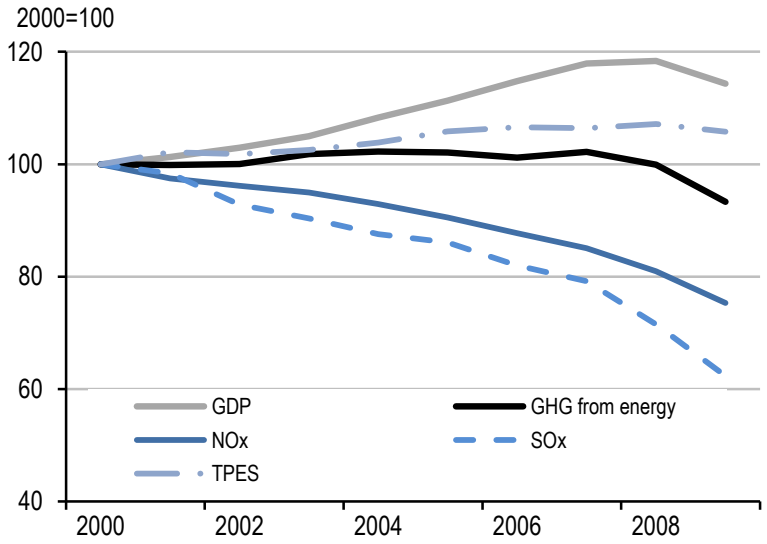
2.1.1. Environmental decoupling in the energy sector

For much of the last decade (2000-07), GHG emissions from the energy sector were constant or slightly increasing in OECD countries, while GDP and energy supply increased. Hence, in this period, GHG emissions from the energy sector were relatively decoupled from GDP and energy supply. At the end of the decade, following the economic and financial crisis, GHG emissions fell at a higher rate than GDP and energy supply (Figure 2.1).

GHG emissions followed a similar trend as Total Primary Energy Supply (TPES), increasing at a slightly lower rate and then falling (Figure 2.1). GHG emissions from electricity and heat generation and transport have continued to grow in OECD countries. These sectors now account for the majority of emitted GHGs.

Emissions of SO_x and NO_x, the two main local and regional air pollutants from energy production and use, were both absolutely decoupled from GDP and TPES (Figure 2.1). In addition to structural changes and a shift from coal to other sources of energy, policy measures played an important role in this decoupling. Many OECD countries employed strict regulatory measures, some in combination with economic instruments. For instance, in the U.S., cap-and-trade systems were implemented for SO_2 and NO_2. It was estimated that the shift from standard-based regulation to permit trading in the late 1990s yielded compliance cost savings of USD 153-358 million. The combination of regulatory and market-based measures also stimulated technological innovation which helped achieve compliance with SO_x and NO_x targets at a lower cost.

Figure 2.1. Decoupling GHG, SO_x and NO_x emissions from GDP



Box 2.1. Decoupling SO_x and NO_x from energy production in the EU

Within Europe, SO_x, NO_x and a range of other air pollutants are controlled under the UN Economic Commission for Europe's Convention on Long-range Transboundary Air Pollution, and its Gothenburg Protocol. For EU member states, these emissions are also controlled under the National Emission Ceilings Directive. A recent report by the European Environment Agency (EEA) showed that SO_x emissions for the EU-27 in 2009 were 80% less than in 1990. NO_x emissions were reduced by 44% in the same period. Energy production and distribution were by far the largest source of SO_x emissions, and a major source of NO_x emissions.

For SO_x, the emissions reductions were achieved as a result of a combination of measures: fuel switching to lower-sulphur containing fuels like natural gas, desulphurisation technology, limits on the sulphur content of some fuels, and the economic recession which had a particularly large impact in the eastern members of the EU at the beginning and end of the period 1990-2009.

For NO_x, in addition to measures taken in the transport sector, there were significant reductions in the electricity/energy generation sectors. Measures included the introduction of combustion modification technologies (such as the use of low-NO_x burners), implementation of flue-gas abatement techniques (such as NO_x scrubbers and selective and non-selective catalytic reduction techniques), and fuel switching from coal to gas. Both regulatory and market-based instruments were applied; these included taxes on NO_x emissions implemented in a number of EU countries (*e.g.* Denmark and Sweden).

Source: EEA (2011).

2.1.2. Energy mix

Concerns about the environmental impacts of fossil fuels, as well as energy security considerations, have led many OECD Member countries to consider how to diversify their sources of energy, and to pursue a low-carbon pattern of economic development. However, Figure 2.2 shows that, by and large, the composition of energy sources for OECD countries as a whole has not changed much since 2000. The combined share of fossil fuels remained at around 82%, a bit less than the historical highpoint of 90% in the 1970s.

Oil has remained the major energy source, and accounted for 36% of TPES in 2010. This was largely driven by demand from the transport sector. Not much change occurred in the use of solid fuels, with the share of coal and peat remaining stable at 20% over 2000-10. The share of natural gas increased from 22% to 25% of TPES in this period. The shares of nuclear and hydro energy remained stable, accounting for respective 11% and 2% of TPES. Renewable sources have gained in importance, increasing their share from 6% to nearly 8% between 2000 and 2010. Biomass and hydro were the main renewable sources (Figures 2.3 and 2.4). The share of renewable energy in electricity production has slightly increased, reaching 18% in 2010, of which hydro accounted for about 70% and solar and wind together for about 16% (IEA, 2011a).

Within these overall trends, there are significant differences among countries. A few OECD countries have considerably reduced their reliance on fossil fuels, such as Sweden, where they now account for about one third of energy supply. However, in countries such as, Australia, Greece and Poland, fossil fuels account for about 95% of total energy supply.

Figure 2.2. Total primary energy supply by source, OECD, 2000-10

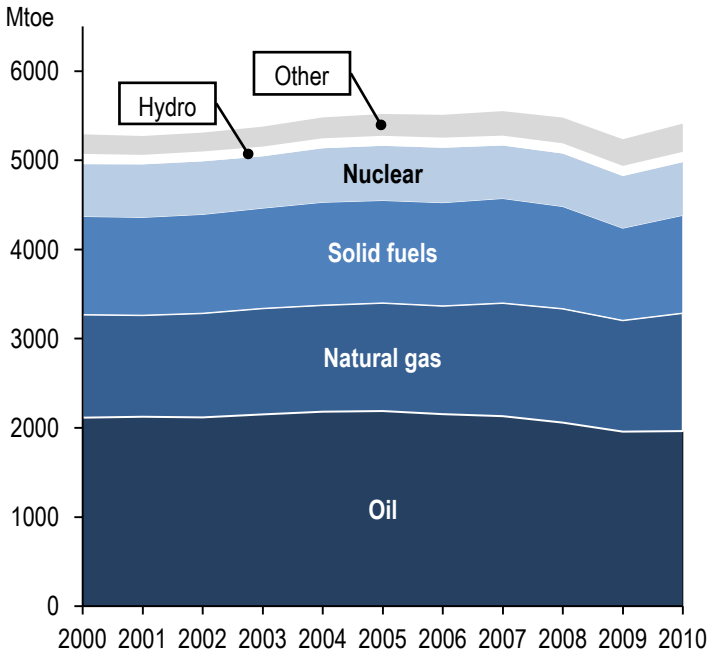
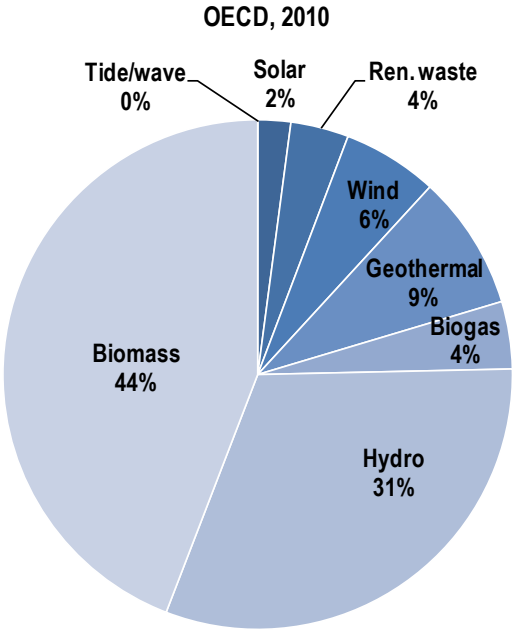
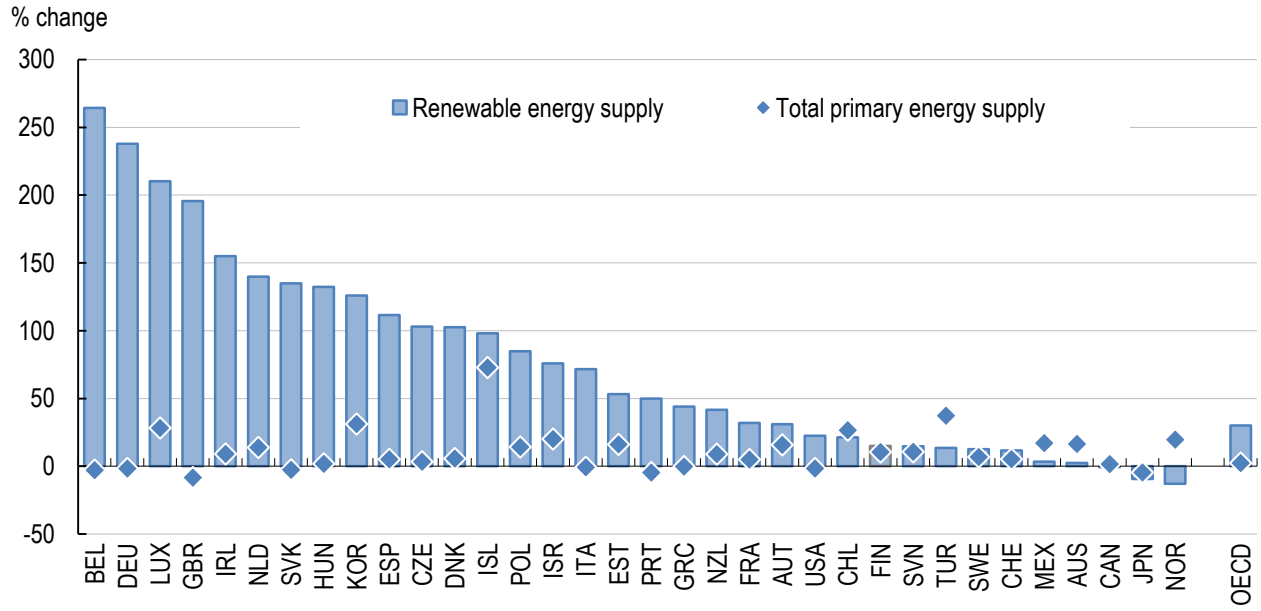


Figure 2.3. Renewable energy supply by source, OECD, 2010



Source: OECD-IEA.

Figure 2.4. Change in renewable and total energy supply, 2000-10



Source: OECD-IEA.

The IEA has argued that a number of factors are impeding the transition to a cleaner energy economy (IEA, 2011b): strong vested interests in the *status quo* and in the sunk capital of existing technologies that may be "stranded" by change, and the distributional effects of change. As a result, many national energy systems are 'locked-in' to high-carbon production and consumption patterns that are difficult to break. At

the same time, it argues that the energy sector is on the verge of major new capital investments that create opportunities to move toward greener energy systems. It suggests a set of policy measures to facilitate this transition, including:

- sound market and regulatory frameworks that remove barriers to green investments and facilitate the move away from existing systems and patterns of fossil fuel energy use;
- eliminate fossil fuel production and consumption subsidies while adequately addressing the needs of the vulnerable through effectively targeted poverty alleviation policies;
- set a price signal to value externalities and provide robust signals for longer-term structural changes;
- reform energy markets to avoid inefficiencies and artificial influences, paving the way for the effective implementation of green growth strategies;
- design effective policy packages, to address specific market failures and national circumstances most effectively, including well-designed energy efficiency measures.

Box 2.2. Investment in the energy sector: Exploiting opportunities and avoiding lock-in

The energy sector is on the verge of major new capital investment to replace aging plants and meet growing demand for electricity. Global total installed power generation capacity in 2008 was about 4 722 gigawatts (GW). Estimated gross capacity additions of 5 900 GW are needed to meet forecasted electricity demand in the period to 2035, with more than 40% installed by 2020. China is projected to install the largest amount of new capacity, accounting for more than one-quarter of global additions to 2035.

Worldwide, more than 400 GW of installed fossil fuel-fired capacity are more than 40 years old – the end of their average technical lives. With a further 585 GW between 30 and 40 years old, about one-third of the 2008 installed fossil-fuel capacity will be approaching the end of its technical lifetime in the next 10 to 15 years. Plants in non-OECD countries are relatively young, as most have been built to meet growing demand in the last two decades. Whereas plants in OECD countries are reaching the end of their average technical lifetimes, particularly coal-fired plants that have served as base-load generating capacity. The coming investment cycle of the electricity sector in OECD countries is unique in its magnitude. Replacement with clean energy technologies would work to facilitate the transition to green growth, while replacement with unmitigated thermal capacity could lock-in air pollution and greenhouse-gas emissions for another 40 years.

Cumulative global investment in the power sector is estimated at USD 16.6 trillion (at 2009 prices) in the period 2010-35. Two-thirds of the total investment is expected in China, OECD Europe, the United States and India. About USD 9.6 trillion of total power sector investment, almost 60%, is expected to be invested in new generating plants and plant refurbishments. Improvements and expansion of electricity networks account for the remainder of total power sector investment, with cumulative investment in transmission and distribution expected to total USD 2.2 trillion and USD 4.8 trillion, respectively.

Source: IEA (2010).

2.1.3. Energy supply and final consumption

Energy supply and fossil fuel supply were relatively decoupled from growth in GDP over the last decade. As a result, energy supply per unit of GDP - energy intensity - was reduced by 13% between 2000 and 2010. However, variations in energy intensity among OECD countries are wide and depend on national economic structures, geography, climate, energy endowments, pricing and other policies. Energy intensity fell during the last decade due to a pronounced rise in energy prices and slowdown of economic activity at the end of the period. Energy supply per capita has been reduced by 7% between 2000 and 2009, less than that per unit of GDP, reflecting the overall increase in energy supply and increasing energy demand for transport (Figures 2.5 and 2.6).

Figure 2.5. Energy sector trends, OECD

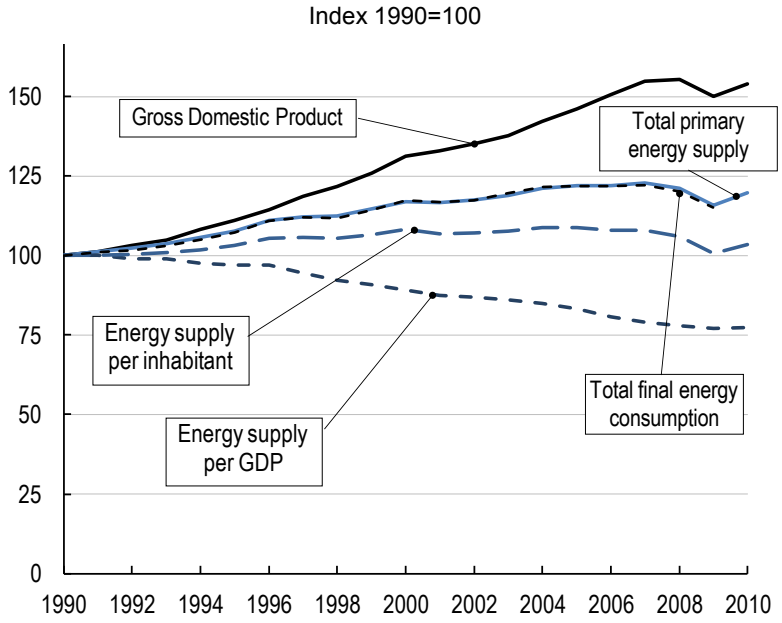
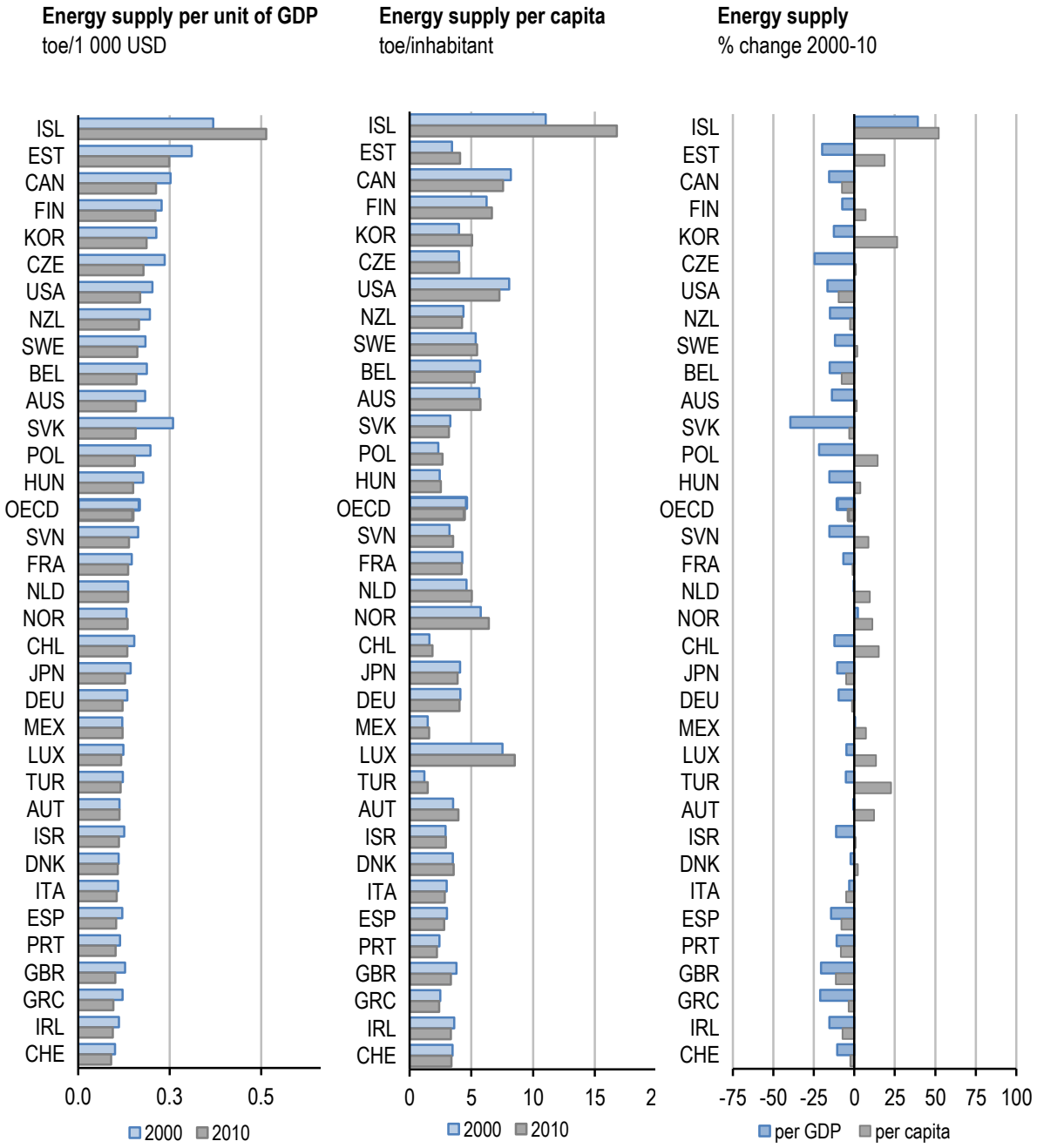


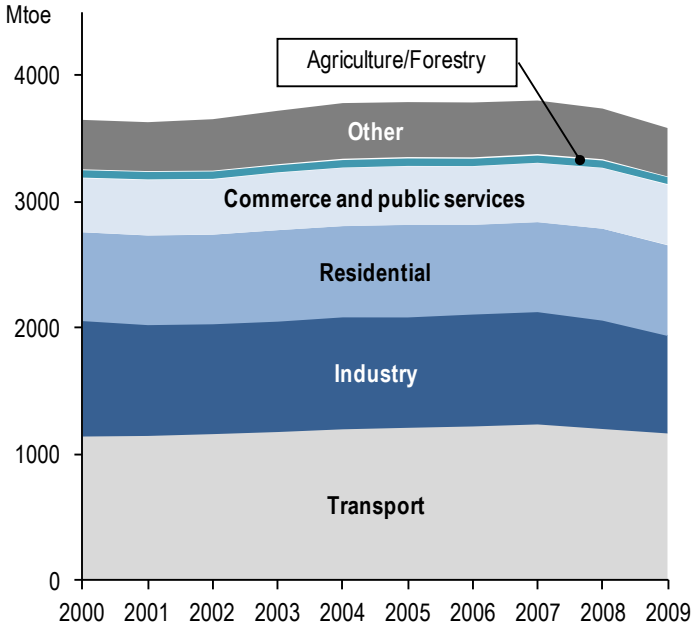
Figure 2.6. Energy intensities by country



Source: OECD-IEA.

Total final consumption (TFC) of energy in OECD countries was also relatively decoupled from GDP. TFC increased by more than 4% between 2000 and 2007; it amounted to 3 582 Mtoe in 2009, 5.8% lower than the peak before the crisis in 2007, and 1.8% lower than in 2000. In 2009, TFC represented more than two-thirds of TPES. The overall decline in energy consumption was mainly driven by a strong decline in energy consumption of the industrial sector. Between 2000 and 2009, the share of industry in TFC decreased by 3.5% points, while the share of the transport sector increased by 1.2% points, the residential sector by 0.7%, and commerce and public services by 1.6%. Energy consumption in the industrial and transport sectors decreased by 13.0% and 5.7% respectively between 2007 and 2009, due to the global economic and financial crisis (Figure 2.7).

Figure 2.7. Total final consumption of energy by sector, OECD, 2000-09



Source: OECD-IEA, Energy Balances 2011.

2.1.4. Energy efficiency

Promoting energy efficiency can be one of the most cost-effective means of addressing energy security, environmental and economic challenges. It can also yield important co-benefits in terms of reduced impacts from energy on human health.

To support governments with their implementation of energy efficiency, the IEA recommended the adoption of specific energy efficiency policy measures to the G8 summits in 2006, 2007 and 2008. The consolidated set of recommendations to these summits covers 25 fields of action across seven priority areas: cross-sectoral activity, buildings, appliances, lighting, transport, industry and power utilities. The IEA estimates that if implemented globally without delay, the proposed actions could save around 8.2 Gt CO2/year by 2030 – equivalent to twice the European Union's current yearly emissions (IEA, 2009).

The IEA reviewed implementation of its recommendations. It found many positive examples of energy efficiency policy implementation in IEA member countries. Governments are investing in a wide array of well-known energy efficiency policies from national strategies to minimum energy performance

standards for appliances and equipment. There are also signs of energy efficiency policy innovations. These include the widespread development of energy efficiency strategies and action plans, innovative financial instruments, active policies promoting energy efficiency in buildings, the extensive adoption of standby power policies and policies to phase out inefficient lighting, measures to promote proper inflation of tyres and innovative policies to create incentives for utilities to promote energy efficiency.

However, the IEA also found that there is a need to increase the rate of energy efficiency improvement significantly and urgently across all countries. Even the countries with the most active energy efficiency policies had achieved only about 40% of the potential energy savings from the IEA recommendations. On a sectoral basis, policies for transport stand out as having the least substantial implementation. The main barriers holding back further progress include lack of access to capital for energy efficiency investments, insufficient information, principal-agent problems and externality costs that are not reflected in energy prices.

Box 2.3. Energy efficiency in Japan

Japan has traditionally attached high priority to promoting energy efficiency, aiming to both improve the security of energy supply and curb greenhouse gas emissions. It was judged by IEA to be one of the country's that has made the greatest efforts to improve energy efficiency. The energy intensity of its economy has steadily, albeit slightly, declined since 2000 and remains below the OECD average. However, some consumption trends are still a cause for concern, in particular electricity consumption in the service and residential sectors. Electricity consumption per capita is slightly below the OECD average, but remains higher than in a number of countries, namely all large European OECD economies.

Energy consumption from industry – the largest end consumer of energy - remained largely stable in the last decade, before Japan's deep economic recession in 2008-09. Indeed, energy consumption per unit of industrial production decreased by 7.5% in that period, mainly due to heavy investments in improving energy efficiency. Some Japanese manufacturing sectors are now amongst the most energy efficient in the world. These results were achieved by a number of means, including: extending energy management requirements from factories to companies, mandatory energy reporting; a requirement on firms to reduce energy intensity by 1% per year; sectoral benchmarking in energy-intensive sectors; "naming and shaming" companies that do not meet energy targets.

Unlike many OECD countries, Japan has made progress in improving the energy and environmental performance of its transport sector, where GHG emissions decreased by 12% between 2000-08. The core of Japan's energy efficiency policy, including in the transport sector, is the Top Runner programme. It sets energy efficiency targets for energy intensive products such as home appliances and motor vehicles, providing incentives for manufacturers to emulate the most energy efficient products in specific categories. Japan is the only country that has imposed fuel efficiency targets for heavy-duty vehicles. Technological advancement and tax breaks for "cleaner" vehicles have helped to improve the average fuel efficiency of the road vehicle fleet considerably, and the rise in global oil prices has helped to moderate private car use.

Between 2000 and 2007, electricity consumption from households grew by 13% and from commercial and service activities by 19%. This reflects, in part an expansion of office floor space, and an increase in the number of households relative to total population growth. Japan has adopted various measures to improve energy efficiency in the residential and commercial sector including requirements to report on the energy performance of buildings, and tax breaks for households and small businesses to invest in energy efficient equipment. As in the case of motor vehicles, the Top Runner programme has helped to improve the energy performance of several home appliances. However, despite the improvements generated by the Top Runner and other initiatives, the scale of use has outweighed the efficiency gains. The OECD Environmental Performance Review of Japan considered that Japan's energy efficiency strategy is largely based on promoting technological progress, and that further progress could be achieved by greater reliance on demand-side (pricing) management.

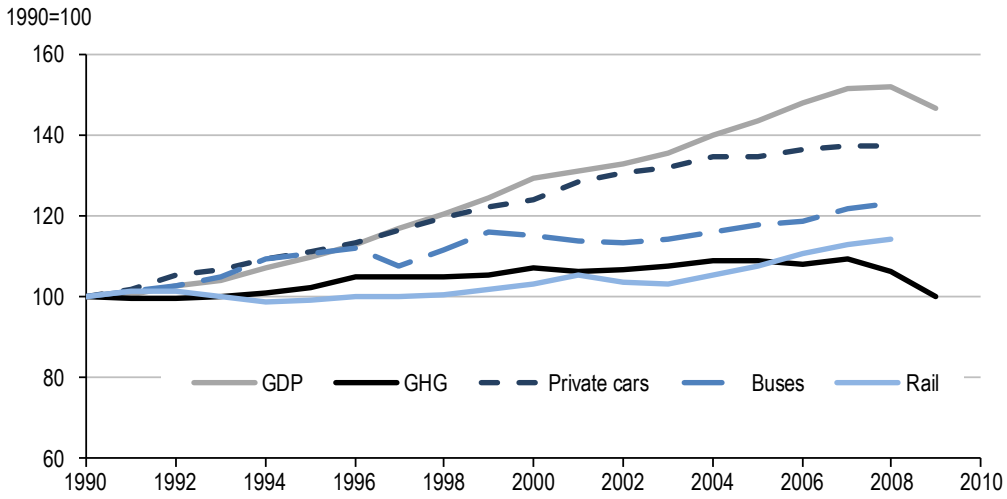
Source: OECD (2010a).

2.2. Transport sector

2.2.1. Decoupling transport and economic growth

Increased openness to trade and internationalisation of supply chains have contributed to increased transport activity. While the maritime and air transport account for the major part of long-distance trade, road and rail transport dominated the intra-continental transport in OECD countries. Since 1990, growth in private car use followed the same trend as GDP, but it increased at a slightly lower rate. Distances travelled by car, bus and train increased by 11% overall between 2000 and 2008 (Figure 2.8). Freight transport grew faster than GDP since 2000. Hence, overall transport activities remained coupled to GDP growth.

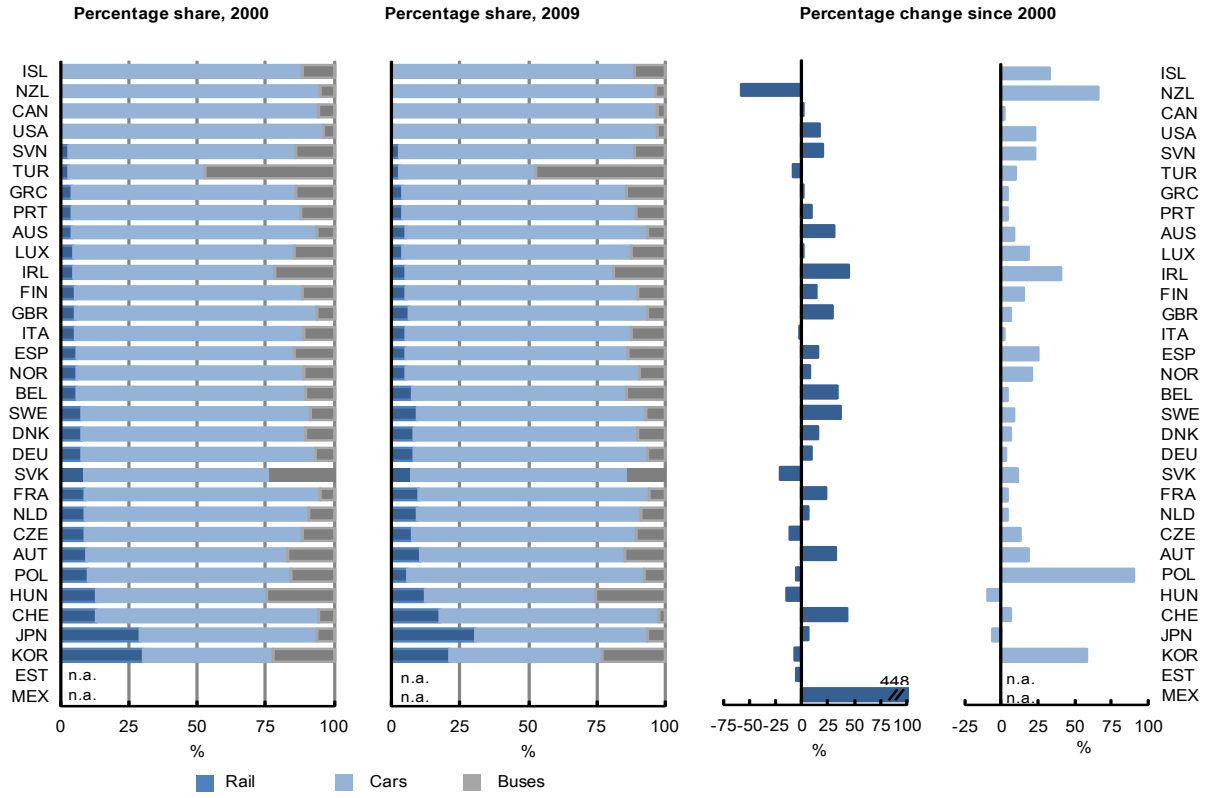
Figure 2.8. Trends in passenger transport volumes, OECD



Source: International Transport Forum, OECD Environmental Data.

In all OECD countries, private cars dominate the passenger transport mode, although there are notable differences in the modal shares (Figure 2.9). While most countries have increased the share of private cars in passenger transport, only a few, such as Japan, showed a declining trend in car traffic. Rail transport showed a 2% increase in passenger transport over the period 2000-09. In 2009, the share of rail transport ranged from 31% in Japan to virtually nil in Iceland and New Zealand, with car traffic exceeding 80% in 22 OECD countries (20 OECD countries in 2000).

Figure 2.9. Passenger transport, by mode



Notes: Share with respect to the following modalities: rail, private cars and buses and coaches. Indicators are based on data expressed in passenger-km. Depending on data availability, the reference year may correspond to the closest available year. Provisional data currently under revision

Source: International Transport Forum (ITF), OECD Environmental Data.

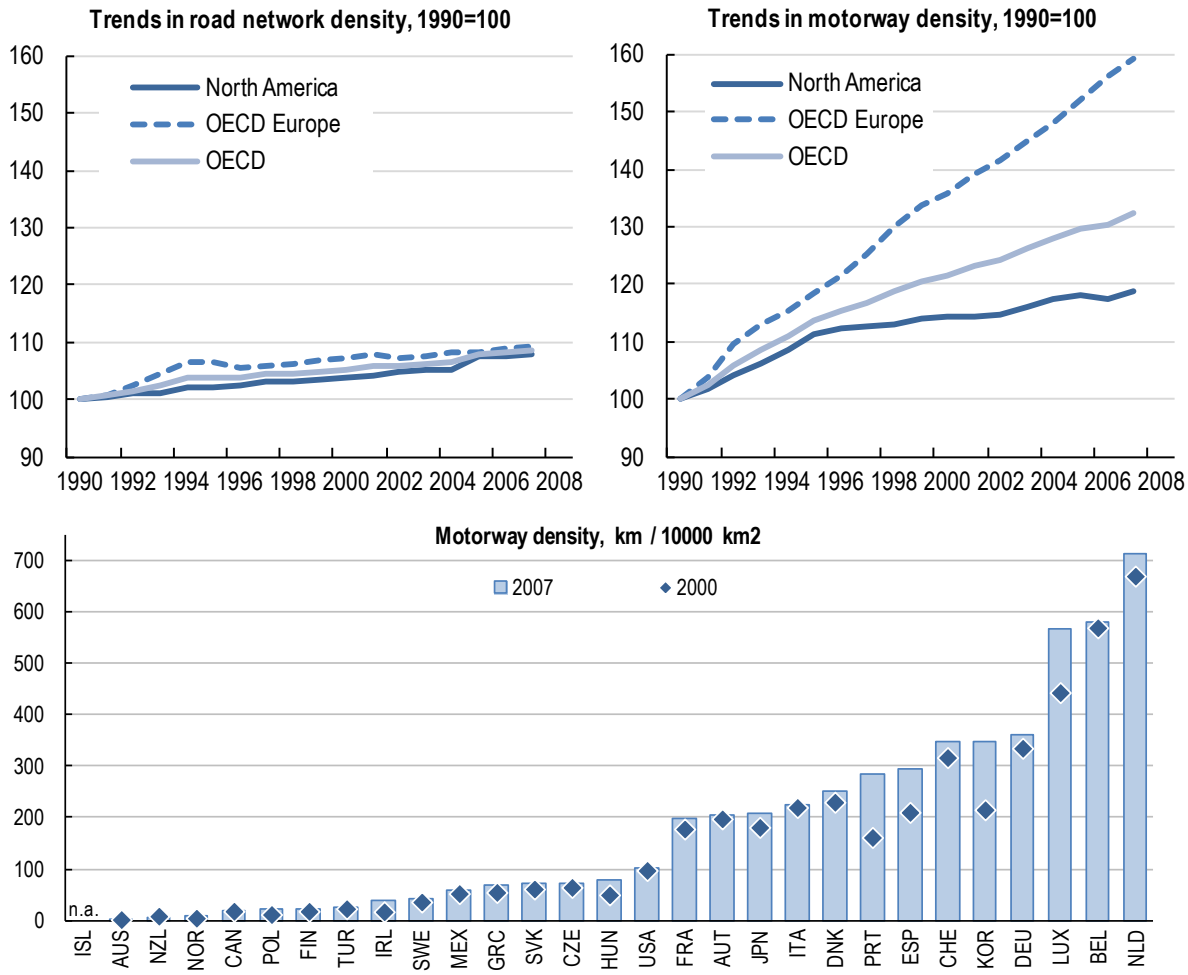
Differences across OECD countries are more pronounced when analysing freight transport modes. Road freight has largely dominated transport of goods in most OECD countries, with some exceptions such as the Netherlands where the bulk of goods are shipped on waterways. Between 2000 and 2009, the share of rail freight decreased from 29% to 24%, mostly due to increased road freight. Rail's share of freight ranged from 65% in Canada to 1% in Ireland in 2009.

Energy consumption in transport has increased in conjunction with transport growth. However, the overall energy intensity of transport has remained close to the 1990 level, partly due to the introduction of more fuel-efficient vehicles which has compensated for emissions due to increased usage. Differences across countries in energy intensity are more pronounced in the freight sector than in passenger transport. Road transport almost entirely relies on oil.

The length of the road network is an indicator of infrastructure development. It has implications for environmental pressures, not only in terms of transport supply but also in terms of space and physical transformation of the natural environment. The variation in density of overall road infrastructure is much less pronounced than variation in the density of motorways across OECD countries. While road density has progressed at a significantly slower pace than economic activity in most OECD countries, the motorway density has rapidly increased, particularly in the last decade. While road density trends are similar for OECD Americas and OECD Europe, the motorway density increased at much higher rate in Europe, perhaps related to the enlargement of the EU. Between 2000 and 2008, the length of motorways increased

by 17% in OECD Europe, significantly above the OECD average of 9% and 4% in OECD Americas. The Netherlands, Belgium and Luxembourg stand out as OECD countries with the highest motorway density. Australia, New Zealand and Norway are at the lower end (Figure 2.10).

Figure 2.10. Transport network density, OECD



Notes: Roads refer to motorways, main or national highways, secondary or regional roads, and others. Motorways refer to a class of roads differing from main or national, secondary, or regional, and other roads. Data include estimates and provisional data.

Source: International Transport Forum (ITF), OECD Environmental Data.

The increasing use of private vehicles has increased the concentration of pollutants in urban areas and increased related health risks (see Objective 4). Gradual tightening of emission standards for new car models has helped to reduce some emissions from motor vehicles. US, EU and Japanese standards have converged significantly, notably since about the middle of the last decade. To make sure vehicles maintain performance standards, many countries require emission tests in their inspection regimes for in-use vehicles.

2.2.2. Decoupling environmental pressures from transport

From an environmental point of view, the increased scale of car use, and its continued dominance in the transport modal split, is the key factor. A variety of efforts have been made to reduce emissions of

GHG and other air pollutants from the use of private vehicles. However, the efficiency gains have generally been offset by the increased scale of car usage.

GHG emissions from the transport sector increased until the economic recession. After falling from 2007, they were at about the same level in 2009 as in 2000. Car emissions include air pollutants of local and regional significance, such as particulates and NO_x. However, given their local and regional nature, it is more difficult to provide overall trends. The health impacts of local air pollution are considered under Objective 4.

OECD countries have deployed a mix of instruments to address the growing environmental pressures from car usage. Standards have been set for fuel economy and vehicle emissions, which have led to improvements in the amount of fuel required per unit of distance travelled, the quality of the fuel, and the resultant emissions. Market-based instruments have also been applied such as taxes imposed on vehicles at the time of purchase and annually. This has reinforced the shift to more fuel efficient vehicles. While vehicle taxes that are based on vehicle performance usually target either emissions of CO_2 or that of local air pollutants, Israel has developed an approach that covers both dimensions (OECD, 2011a). Motor fuels have also been taxed (see below) and represent the largest component of environment related taxes.

Box 2.4. The French "Grenelle de l'Environnement" and its transport component

The "Grenelle de l'environnement" is a multi-stakeholder, comprehensive, action-oriented, process that aims to lay the foundation for environmentally sustainable development in France up to 2020. Partners organised in five colleges (national state, local governments, enterprises, NGOs, unions) met in intensive negotiations over the summer 2007, covering a comprehensive agenda (*e.g.* transport, building, energy, consumption, biodiversity, agriculture, health, waste). They adopted an agreement comprising 268 commitments. It provides an ambitious reference for partners with often quite different initial positions, outside the normal law-making processes. The agreement enjoyed large public opinion support, as well as commitments from the President and government to support its implementation. Two main implementation laws were prepared, Grenelle 1 (3 August 2009) and Grenelle 2 (12 July 2010) and a few other legislative texts (*e.g.* budgetary texts). It has been estimated that full implementation would require EUR 400 billion, and create about 500 000 jobs by 2020. The financial and economic crisis 2008-10 contributed to accelerate some of its implementation. By the end of 2010, an audit assessed the degree of implementation of its 268 commitments: 18% were completed and 59% underway.

Transport is a major sector of the French economy and a major source of exports (of cars, planes, rail equipment, subways, etc.). However, transport is also estimated to impose costs of some 7% of GDP, including environmental costs. The agreement includes 35 commitments aiming at a "drastic change of transport strategy", focusing on the reduction of the environmental impacts of the sector, the development of transport modes alternative to road and air, and a shift of governance towards sustainable mobility. The goal of reducing transport-related CO_2 emissions by 20% by 2020 (back to the 1990 level) was established.

Concerning vehicles, the agreement established a "bonus/malus" incentive for car purchases which aimed to accelerated the reduction of emissions from new cars, from 149 g CO_2/km in 2007 to 130 in 2010. It was also intended to provide an impulse for research, development and production of electric cars. On average, the emission levels of the new vehicles registered in France decreased by 9.2 g CO_2/km between 2007 and 2008, and by 6.3 g CO_2/km between 2008 and 2009, compared to an average annual decrease by 1 to 2 g CO_2/km in previous years. It is estimated that about half of this decrease is attributable to the bonus/malus system (Commissariat général au développement durable, 2010a and 2010b).

Concerning a modal shift for passenger and freight transport, heavy rail investments have been accelerated or launched, involving the construction of an additional 2 000 km of high-speed railways by 2020. Road construction has been stopped (except for security, congestion or local reasons). 1 500 km of light rail and reserved bus lanes are being constructed or programmed in urban areas. Numerous measures have been adopted to develop non-road freight (inland water transport, "motorways of the sea", rail). An environmental charge for trucks will contribute to the financing of the modal shift. A proposal to introduce a carbon tax that would have applied to the transport sector, although approved by Parliament, was rejected on constitutional grounds.

A transport observatory was created to support an explicit environmental evaluation and the provision of information on all transport services. It will also support the strengthening of the price signal to better internalise the environmental and social costs of transport. Several other institutional changes were introduced.

Source: www.legrenelle-environnement.fr.

Many countries apply higher taxes for petrol than for diesel. Diesel-driven motors are more fuel efficient than petrol-driven motors, and emit less CO_2 per km driven. However, this is not an argument for a preferential tax treatment of diesel. Drivers benefit from this fuel efficiency advantage without a tax incentive. In addition, one litre of diesel causes more CO_2 emissions than one litre petrol. Diesel-driven vehicles also cause more harmful emissions of NO_x, particle matter (PM_{10}, $PM_{2.5}$) and noise than petrol-driven ones. Thus, from an environmental perspective, tax rates per litre of diesel should be higher, rather than lower, than tax rates per litre of petrol.

A number of countries have sought to improve the environmental performance of cars by promoting the use of biofuels. However, this has proved controversial, and in many countries increased use of biofuels has led to a net increase in GHG emissions as a result of land conversion and soil disturbance. The preponderance of evidence suggests that support for the current generation of biofuels in most OECD countries is not justified environmentally or economically (OECD, 2008a).

A number of countries are also targeting car usage, either charging tolls on inter-city motorways, or applying congestion charges in urban centres. Sometimes inter-city tolls may have a congestion component. In addition to reducing air pollution from vehicles, such charges may have other objectives, particularly raising revenues. Depending on the objectives and design of such schemes, they may be more or less effective from an environmental point of view (ITF, 2010). Public opposition is also an important consideration.

Box 2.5. Urban road pricing in Italy: The case of Milan

Due to adverse climatic conditions and the widespread use of cars for passenger transport, Milan suffers from serious air pollution problems. The social costs of congestion and transport-related air pollution, including health impacts, damage to buildings, accidents and climate change, were estimated to exceed EUR 5 billion per year. To deal with these problems, private and commercial vehicles have been charged a fee since 2008 to enter an 8 km^2 area in the centre of the city.

From 2008 to 2011, the charge (Ecopass) was differentiated according to vehicle emission standards: vehicles with particulate emissions below a certain threshold (recent Euro standard, electric and hybrid, LPG and CNG fuelled) paid no fee, while other vehicles were charged according to their level of emissions (in the range of EUR 2-10 per day, with a reduced fee for residents). The introduction of the fee was accompanied by a major strengthening of public transport. The Ecopass was designed as a pollution, rather than a congestion charge as it regulated access only on the basis of vehicle emissions. Nonetheless, in the first period of its introduction, a 14.4% reduction in traffic was registered in the centre, and a 3.4% reduction in the urban outskirts. PM_{10} and NO_x emissions decreased by between 11% and 19%. In the first half of 2011, a 15.7% reduction in traffic was registered in the centre, and a 9.4% reduction in the urban outskirts. In the same period, PM_{10} and NO_x emissions decreased by 37% and 33%, respectively. The effect of the measure on road safety was not clear, as the same decrease in road accidents (about 20%) was recorded inside and outside the Ecopass area.

In January 2012, the Ecopass was converted into the so-called Area C programme, moving from a pollution, to a congestion charge. This change was prompted by the favourable results of a local referendum held in June 2011. All vehicles have to pay a fee of EUR 5 per day (with a reduced fee for residents and other special categories) to enter the city centre during working hours on week days. In addition, vehicles with emission levels above certain thresholds (based on the Euro classification) cannot enter the area. In the first month of implementation, traffic decreased by more than 30%. As a result, emissions of black carbon were nearly halved in the charged area. PM_{10} concentrations have also showed a decreasing trend, although they remain above the related air quality standards.

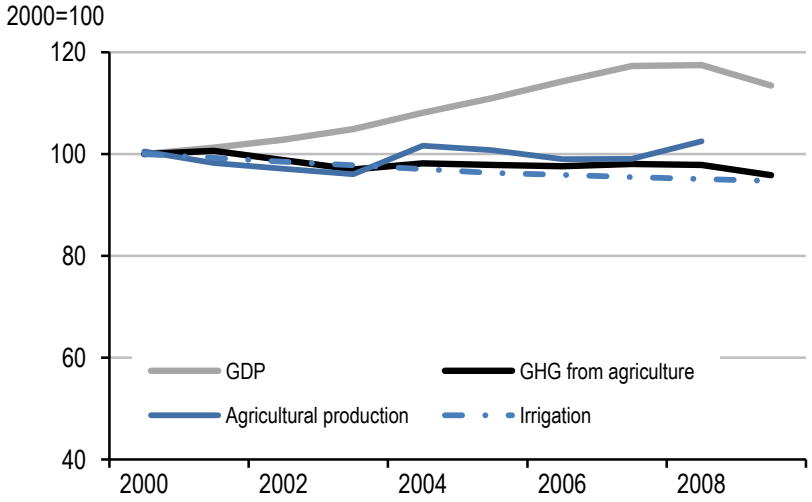
Source: OECD (2011b); OECD (2013, forthcoming).

2.3. Agriculture

2.3.1. Decoupling trends in the agricultural sector

Between 2000 and 2008, agricultural production in OECD countries fluctuated around its 2000 level; Comparing the beginning of the decade (1999-2001) with the latest period for which data is available (2006-08), the level of agricultural production was about the same, and borderline between absolute and relative decoupling from GDP.

Figure 2.11. Decoupling trends in the agricultural sector, OECD countries



Source: OECD Environmental data, *OECD Economic Outlook No.88*, UNFCCC, FAO.

GHG emissions fluctuated around the trend for agricultural production. By 2008, GHG emissions for OECD countries were slightly decoupled from agricultural production.

GHG emissions from the agricultural sector accounted for about 10-12% of global anthropogenic emissions of GHGs, mostly due to emissions of methane and nitrous oxide. In 2007-09, they accounted for 7.5% of OECD GHG emissions, excluding LULUCF. Agricultural land can also act as sink for GHGs.

Box 2.6. Reducing GHG emissions from agriculture in New Zealand

In New Zealand, agriculture accounts for nearly 50% of GHG emissions, a significantly higher share than in other OECD countries. Some of the GHGs are related to fossil fuels used in farming and farming-related transport. Fossil fuels are also used to produce inputs to farming such as fertilisers and pesticides. However, a significant share of GHG emissions in New Zealand is related to methane and nitrous oxide.

Methane is generated following digestion in ruminant animals (such as cattle and sheep). Efforts to reduce methane emissions from these sources is challenging and focused on developing low methane-emitting strains of animals, and changing dietary inputs. Nitrous oxide is generated by the breakdown of nitrogenous fertilisers following their application to crops. Efforts to reduce nitrous oxide emissions involve improving farming practices so as to minimise the use of nitrogenous fertilisers.

The New Zealand government has decided to include the agricultural sector into its Emissions Trading Scheme (ETS) from 2015. This is part of an ambitious aim by New Zealand to include all sectors and gases in its ETS, the first such attempt. To prepare for this, the government developed a Plan of Action through an extensive consultative process. Part of the Plan of Action will prepare the supporting groundwork for the introduction of the agricultural and forestry sectors into the ETS. NZD 45 million has been allocated for research over five years. Priorities include

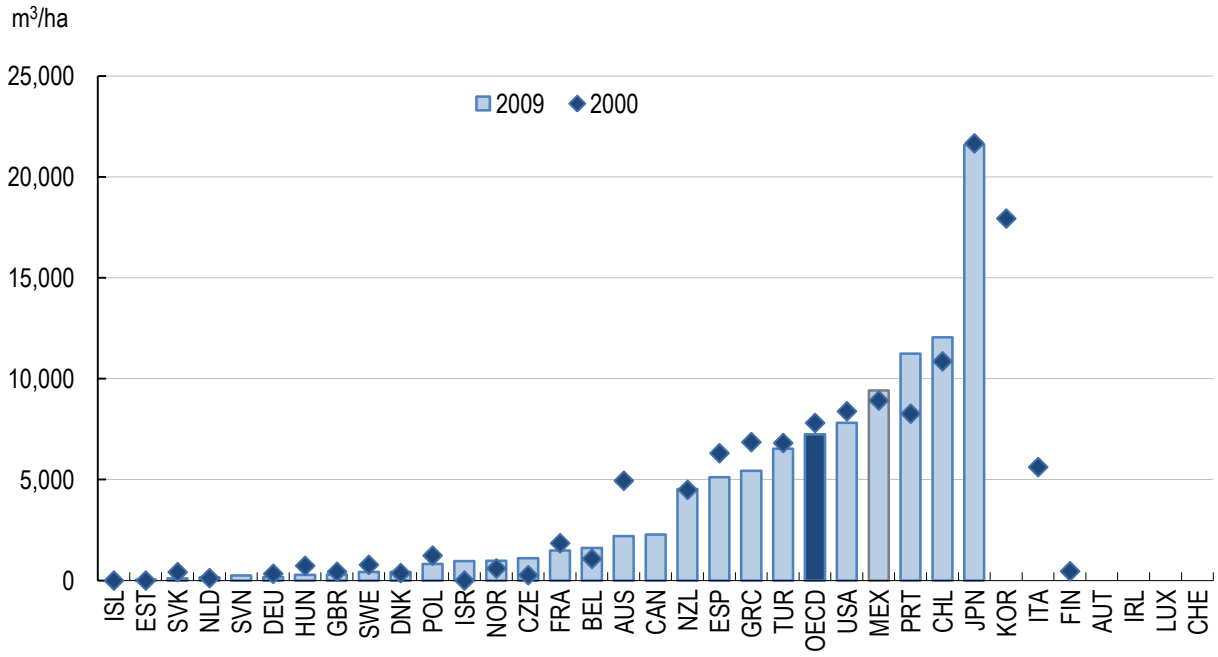
research into technologies and practices that will improve the measurement and reduce GHG emissions, including methane from livestock. The Plan of Action also includes the development of a technology transfer implementation programme to encourage and accelerate the uptake of new mitigation technologies and practices by farmers, as they become available. It expected that developments in these areas will generate business opportunities for New Zealand companies.

Source: www.maf.govt.nz/news-resources/faqs/faqs-climate-change-plan-of-action.

2.3.2. Agricultural use of water

In many OECD countries, agricultural uses of water continue to account for the largest share of water usage. Between 2000 and 2008, the use of irrigated water in OECD countries slightly declined compared to agricultural production, and was decoupled absolutely compared to GDP. However, this masks wide variations among OECD countries. Agricultural water use increased in about half of the OECD countries, driven mainly by an expansion in the irrigated area. Government support for irrigation is widespread, encouraged by energy subsidies for groundwater pumping in some countries. Overall, there is a low uptake of water-efficient irrigation technologies (*e.g.* drip irrigation) and poor maintenance of irrigation infrastructure (*e.g.* canals). These trends are reflected in the mixed picture that emerges from comparing irrigation water abstracted with the area equipped for irrigation. In most cases, this ratio has remained largely unchanged between 2000 and 2009, and in some cases there has been a deterioration. Australia, Spain and Greece are notable exceptions to the general trend with the relative amount of water abstracted for agricultural practices decreasing in 2009 compared to 2000.

Figure 2.12. Irrigation water abstraction per area equipped for irrigation, 2000 and 2009 or latest available year



Agriculture affects not only water quantity but also water quality. Water pollutants from agriculture include run-off and leaching from using and disposing of nutrients (inorganic fertilisers and livestock manure) and pesticides, soil sediments, and other contaminants (*e.g.* veterinary products). In the second half of the last decade, the agricultural impact on water quality was either stable or deteriorating, with few cases involving significant improvements. This marks a change from the trend between 1990 and the

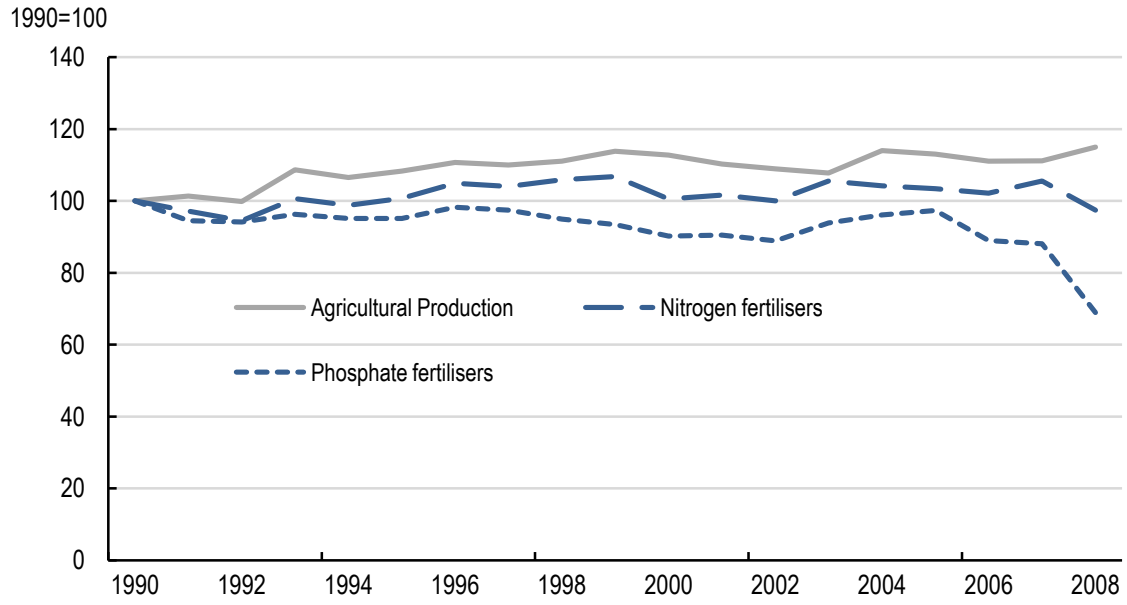
mid-2000s, when the OECD study concluded that there had been a slight reduction in agricultural pressure on water systems (OECD, 2011c). Achieving further reductions in pollution from agriculture is a challenge since most originates from diffuse sources. However, point source agriculture pollution is increasing in some locations, largely from intensive livestock farms.

Although there has been an uptake of farm management practices and systems beneficial to water quality, it has only resulted in a modest improvement in water quality. This is due to the time lag between adoption of farm management changes being able to detect improvements in the quality of a specific water system. In addition, recent rises in agricultural commodity prices have created incentives for farmers to intensify production and/or extend production onto marginal land, increasing the risks of water pollution.

2.3.3. Decoupling nutrient usage from agricultural production

Nutrient balances are indicators of the level of potential environmental pressures from nutrients on natural assets, in particular soil, water and air. Soil fertility can decline in the case of nutrient deficit. A nutrient surplus may result in pollution of soil, air and water (eutrophication). Polluting nutrients from the agriculture sector (nitrogen and phosphorous) result from commercial use of fertilisers and intensive livestock farming.

Figure 2.13. Trends in fertiliser use and agricultural production, OECD



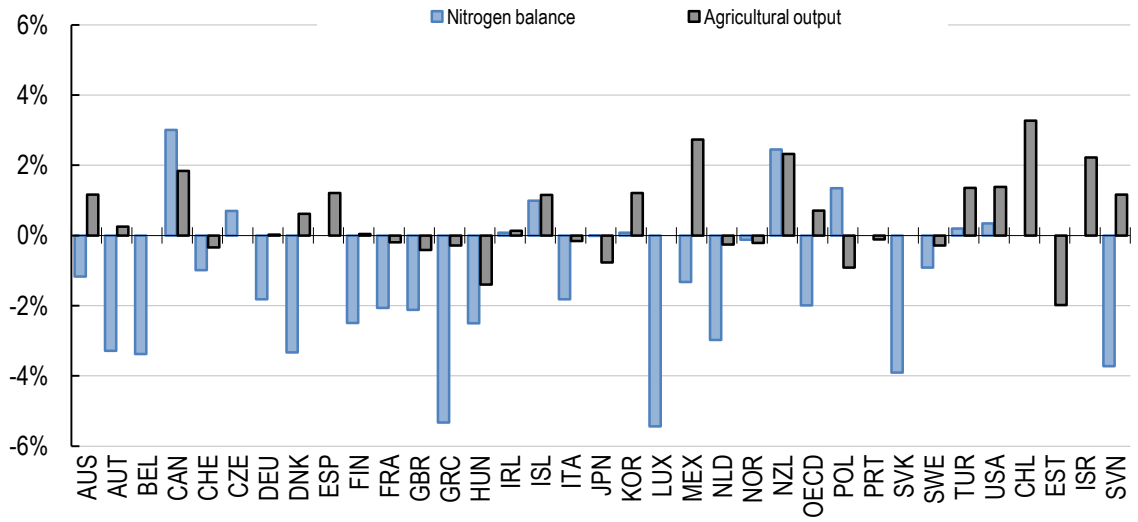
Notes: Trends of the individual years have to be interpreted with caution due to potential variability in agricultural output and due to wide differences in nitrogen and phosphorus balances across OECD countries. A relatively lower initial level in the phosphorus balances than in the nitrogen balances should also be taken into account when interpreting these trends. Relative trends should be interpreted against the absolute values in the nitrogen and phosphorus balances.

Source: FAO.

The use of nitrogen fertilisers were only absolutely decoupled from overall OECD agricultural production toward the end of the decade. Nevertheless, for many OECD countries, nutrient surpluses were decoupled from agricultural production (Figure 2.13). This reflects both improvements in nutrient use efficiency and a reduction in agricultural output. There are, however, sizable variations among and within countries in terms of the intensity and trends of nutrient surpluses. These variations are explained by the

spatial distribution of intensive livestock farming and cropping systems that require high nutrient inputs, such as maize and rice relative to wheat and oilseeds.

Figure 2.14. Changes in nitrogen surplus and agricultural output, OECD countries, 1990-2008



Source: OECD Agri-environmental indicators, Eurostat.

Box 2.7. Reducing nitrate leaching from agriculture in Denmark

A key environmental challenge facing Denmark is the reduction of nitrate leaching from its agricultural sector. The sector provides significant export revenues but accounts for the major share of the nitrogen loadings of its lakes and coastal waters as well as rivers and groundwater. While emissions of nitrates from industry and urban wastewater treatment plants were controlled at a relatively high cost by de-nitrification in the 1990s, effective reduction of nitrate leaching required better control of leaching from commercial fertiliser use and intensive livestock production.

A target of reducing nitrogen leaching by half from 1985 levels was met in 2003 (rather than 1993, the initial deadline). Denmark now complies with requirements of the EU Nitrates Directive. The third Action Plan for the Aquatic Environment (2005-15) aims to further reduce nitrogen leaching by 13%. In the last decade, the use of farm nitrogen inputs was further decoupled from agricultural production, largely through a big reduction in the use of commercial fertilisers. However, nitrogen surpluses and livestock density remain high by OECD Europe standards.

This good progress in reducing the use of fertilisers is largely due to regulatory approaches, in combination with some economic incentives and voluntary measures. Since 2005 farmers have had to comply with regulatory measures in order to benefit from EU Common Agricultural Policy support (cross compliance). In practice, some 55 000 farms produce fertiliser accounts based on a relatively complex methodology. If farmers buy fertiliser, or produce manure, which in total exceeds a defined threshold, they must either store, sell, or give away the surplus to another registered business. A non-compliance fine is applied to the use of nitrogen above the defined threshold. More recently, Denmark has begun work to evaluate the possibilities of introducing tradable “leaching quotas”, an approach that has been tried in a number of OECD countries.

Agri-environmental measures are an integral part of the Action Plan for the Aquatic Environment. Their main thrust is to reward farmers who go beyond environmental regulatory requirements on farming practices. Since 2005, the Plan’s coverage has been more “holistic”; it is no longer limited to reducing nitrate discharges, but also covers reducing phosphorus discharges and enhancing nature protection. The cost-effectiveness of current regulatory measures (equivalent to setting a farm-level nitrogen quota) might usefully be compared to a tax on nitrogen surplus for the whole agricultural sector. Nevertheless, these measures have proved effective, and have forced farmers to better plan and actually reduce the use of nutrients with associated financial gains.

Source: OECD (2007).

2.4. Key approaches for decoupling in the energy, transport and agriculture sectors

2.4.1. Subsidy reform

Removing fossil fuel subsidies

In general, subsidies to fossil fuels provide incentives for their production and use, as well as the associated environmental pressures. Removing such subsidies is therefore a potentially cost-effective option, which can also help to strengthen government budgets, an important consideration for governments in the current global economic and financial context. However, identifying environmentally harmful subsidies is not an easy task. Once identified, removing them is difficult due to the vested interests of those affected.

Box 2.8. Environmentally harmful subsidies in Norway

The report of the Norwegian Green Tax Commission in 1996 was one of the first analyses of the environmental impacts of government expenditures, including subsidies. The study indicated that subsidies to agriculture and forestry were among the most deleterious to the environment. Since then, this issue has been examined regularly by the Norwegian authorities. A report by the Ministry of Finance estimated that in 2008, environmentally harmful subsidies amounted to NOK 13 609 million. The different sectors involved were: trade and industry – NOK 1 750 million; fisheries and coastal affairs – NOK 76 million; agriculture and food – NOK 9 300 million; transport and communications – NOK 2 349 million; environment (compensation for loss of livestock by predators) – NOK 104 million; and petroleum and energy – NOK 30 million.

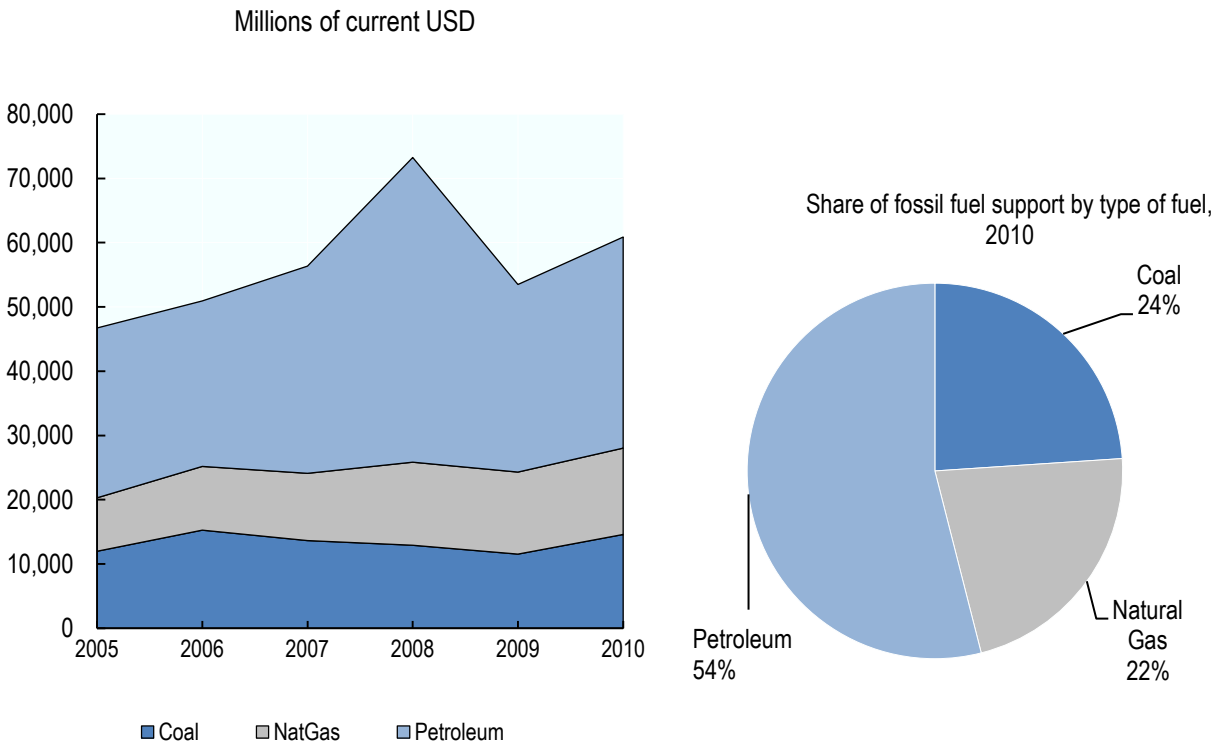
The 2011 Environmental Performance Review of Norway shows how, despite the analysis conducted of environmentally harmful subsidies, their removal faces significant obstacles, even though removing environmentally harmful subsidies and exemptions in environmentally related taxes would contribute to achieving both fiscal and environmental policy goals.

Source: OECD (2011e).

OECD has attempted to estimate budget support and tax expenditures related to fossil fuels in selected OECD countries. This is a first attempt at the international level. Making these calculations involves difficulties at the level of methodology and data. Moreover, in the absence of a common benchmark, tax expenditure estimates are not readily comparable across countries. Nevertheless, the study has identified broad trends for the OECD countries examined (OECD, 2011f). These suggest that, in the period 2005-10, support for fossil fuels increased. It was in the range of USD 45-75 billion per year in the same period. In absolute terms, petroleum products (*i.e.* crude oil and its derivative products) have generally been the prime beneficiaries of the fossil-fuel support measures, followed by coal and gas. This may reflect the larger share of oil than other fossil fuels in total primary energy supply (Figure 2.15). In terms of recipients of the fossil-fuel support in OECD countries, consumers have attracted a larger share of support than producers (Figure 2.16).[13]

13. However, these estimates do not take into account ultimate incidence nor the behavioural responses of economic agents to the measures considered.

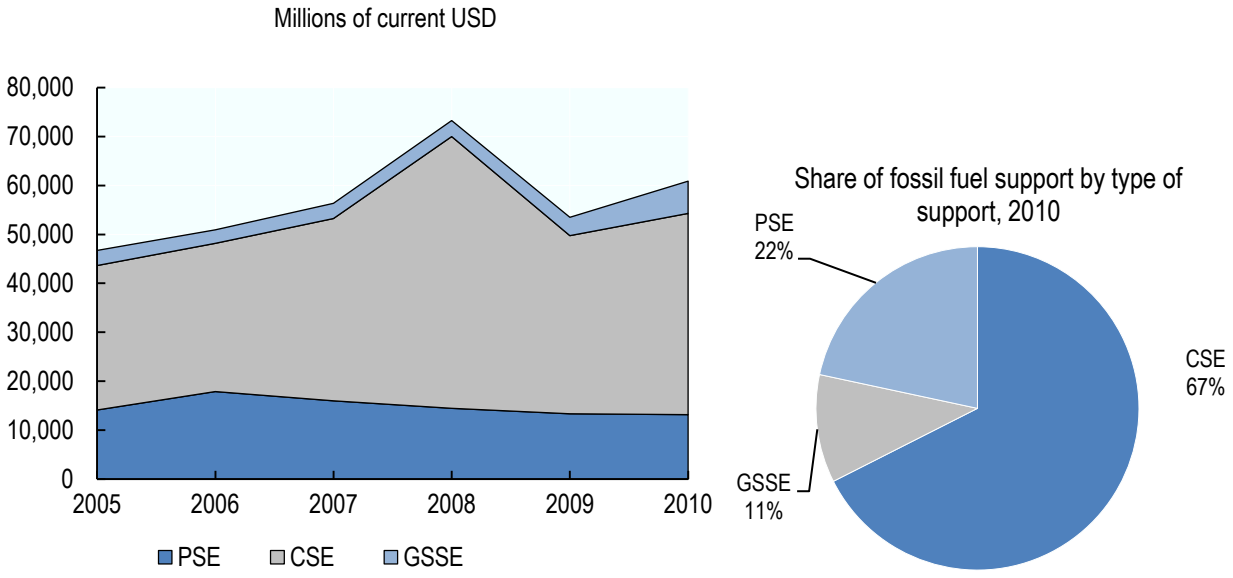
Figure 2.15. Support to fossil fuels in OECD countries by type of fuel



Note: The above charts are based on an arithmetic sum of the individual support measures identified for a sample of 21 OECD countries, *i.e.* the 24 OECD countries included in the inventory net of those countries for which estimates have not been collected yet (Chile, Iceland and Luxembourg). It includes the value of tax relief measured under each jurisdiction's benchmark tax treatment. The estimates do not take into account interactions that may occur if multiple measures were to be removed at the same time.

Source: OECD (2011f).

Figure 2.16. Support to fossil fuels in OECD countries by type of support



Notes:

- PSE = Producer Support Estimate; CSE = Consumer Support Estimate; GSSE = General Services Support Estimate. See OECD Secretariat (May 2010) for more information.

Note: The above charts are based on an arithmetic sum of the individual support measures identified for a sample of 21 OECD countries, *i.e.* the 24 OECD countries included in the inventory net of those countries for which estimates have not been collected yet (Chile, Iceland and Luxembourg). It includes the value of tax relief measured under each jurisdiction's benchmark tax treatment. The estimates do not take into account interactions that may occur if multiple measures were to be removed at the same time.

Source: OECD (2011f).

Decoupling public support from agricultural production

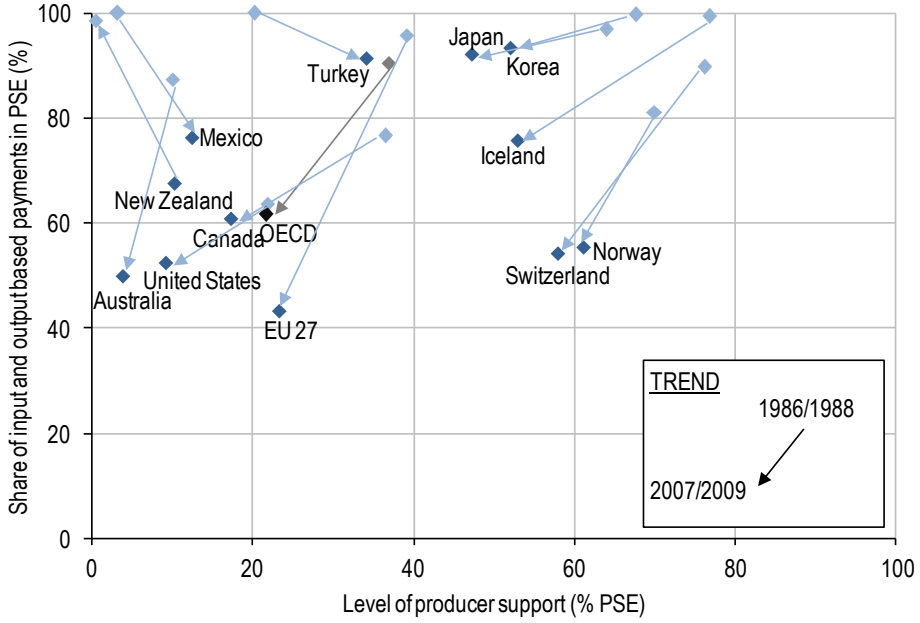
Over the last 20 years, OECD countries have reduced both the level of agricultural support, and the share of support that is more directly linked to agricultural production. For OECD countries, the level of support as measured by the percentage producer support estimate (PSE)[14] fell from 37% in 1986-88 to 22% in 2007-09.

The composition of PSE has changed in two respects which affect the environment: i) the potentially damaging share of PSE to the environment has decreased as measured by the share of payments based on input use and support based on commodity output; for the OECD, it has declined from 90% to 62% over 1986/88-2007/09; ii) A more narrowly defined group of payments based on non-commodity criteria, including environmental requirements, is in principle environmentally more favourable than the agricultural support based on fixed input use and commodity output. Only a few OECD countries have increased the share of non-commodity based payments over time. Their share in PSE remains relatively small, estimated at about 2% for OECD in 2007/09.

14. The Producer Support Estimate (PSE) estimates the annual monetary transfers from consumers and taxpayers to farmers, measured at the farm gate level, arising from policy measures that support agriculture, regardless of their nature, objectives or impacts on farm production or income. The %PSE is the PSE expressed as a share of gross farm receipts.

The principle of requiring farmers who are recipients of agricultural support to comply with environmental requirements – cross compliance – was first elaborated in the US to address soil erosion. Since 2005, all farmers receiving direct payments within the EU are subject to compulsory cross-compliance. This involves requirements to meet legislative standards in the field of the environment, food safety, animal and plant health and animal welfare. Recipients are also under an obligation to keep land in good agricultural and environmental condition. This covers a range of standards related to soil protection, maintenance of soil organic matter and structure, avoiding the deterioration of habitats, and water management. Satisfying legal obligations such as these are a condition for receiving agri-environment payments (see below).

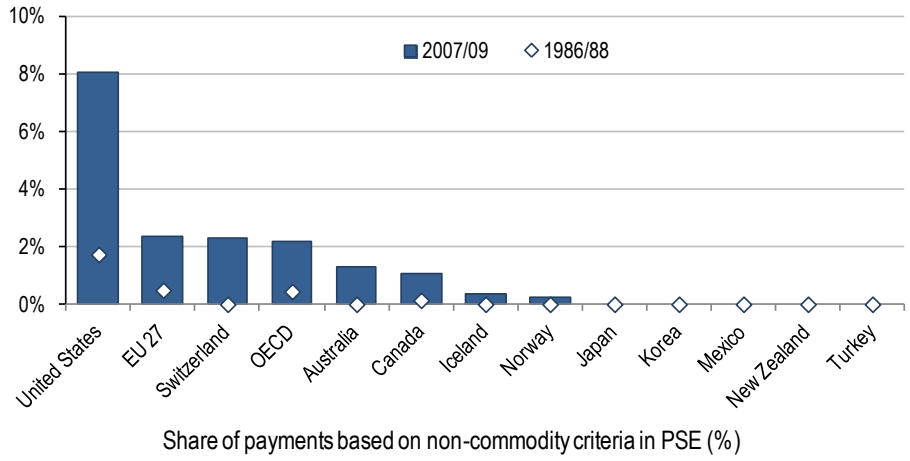
Figure 2.17. Changes in the level and composition of producer support[a]



Notes: a) The level of producer support is measured by the Producer Support Estimate expressed in % (%PSE). The composition of support is measured by the share of market price support and payments requiring production in gross farm receipts. The level of producer support (% PSE) is shown on the X-axis and the composition of support on the Y-axis. In principle, lower values are better for the environment on both axes.

Source: OECD, PSE database.

Figure 2.18. Share of payments based on non-commodity criteria within the PSE



Note: Including environmental requirements.

Source: OECD, PSE database.

Environmentally related subsidies

Subsidies are a commonly used tool for shaping incentives. They can be an effective policy option when pricing instruments such as taxes are too difficult or costly to enforce. Used in a targeted manner, these subsidies can provide incentives towards more environmentally sound products and practices, and can promote new technologies. However, subsidies often involve complications around targeting, administrative and transaction costs, and inefficiencies. They can also have far-reaching and unintended consequences (OECD, 2011f).

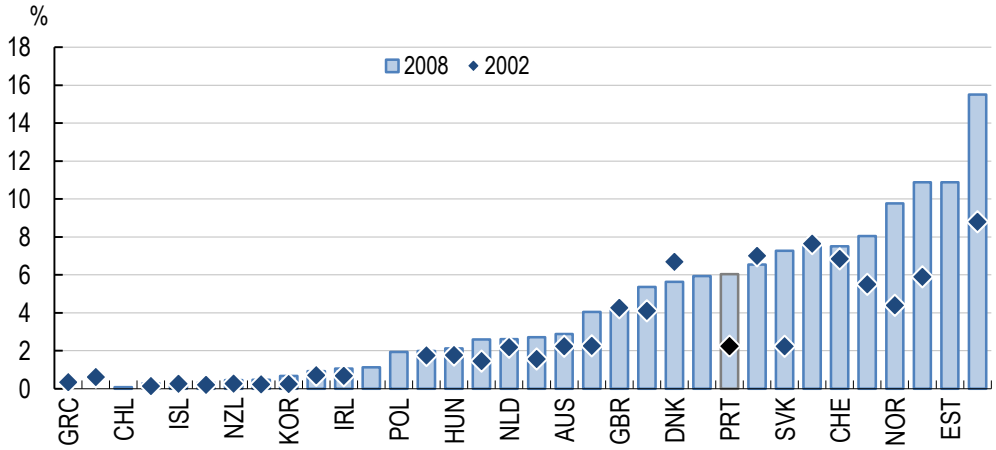
Subsidies of this kind have been used to promote energy efficiency (see below) and environmentally beneficial practices in the primary sector. Agriculture can generate a range of environmental effects which can be more or less positive and which are not captured by the market. Most OECD countries provide monetary payments to farmers and other landholders to compensate them for the provision of environmental amenities, or for addressing environmental problems such as reducing pollution. In practice, many agri-environmental payments tend to be linked to land or other factors of production, and often function by lowering the intensity of agricultural production (OECD, 2011h).

The amounts of agri-environmental payments (AEPs) in the EU and the United States, for example, have risen significantly since the early 1990s. However, AEPs are still relatively small compared to the total support for agricultural production. For the EU27, total AEP expenditure was in 2007-09 about EUR 6 billion annually, or about 7% of the total PSE. The equivalent figures for other countries are; United States, USD 5 billion (16% of PSE); Norway, NOK 950 million (5%); Switzerland CHF 240 million (4%) and Australian payments under the Natural Heritage Trust have been around AUD 460 million annually (18%).[15] For most other OECD countries, AEPs have either only just been introduced on a limited scale to date or are not used as a policy instrument.

AEPs include payments across all environmental domains in agriculture, such as payments for biodiversity conservation, air pollution control, and soil conservation. Organic farming has been supported in some OECD countries, not only as a way of reducing agrochemical inputs and their negative impacts, but also as a way of contributing to landscape conservation and biodiversity enhancement. High shares of

agricultural lands under organic farming are found for instance in Austria, Sweden, Norway and the Czech Republic, with large increases in the recent decade. Nevertheless, certified organic farming still accounts for less than 2% of the OECD agricultural land area.

Figure 2.19. Share of agricultural land under certified organic farm management



Box 2.9. Promoting environmentally friendly agriculture in Switzerland

Landscape maintenance and decentralised settlement patterns are two of Switzerland's agricultural policy objectives. However, developing appropriate indictors is a challenge. Over the past few decades, both usable farmland and Alpine areas had been shrinking at a rate of 3% per year, while built-up areas and woodland have expanded by 13.3% and 1.4% per year, respectively. Ecological payments contribute to the maintenance of the Swiss landscape, such as summer pastures and ecological compensation areas. Summer grazing payments have been an integral part of Swiss agricultural policy for many years. Agri-environment payments have also contributed to the planting of 3 million fruit trees in Switzerland. Not only are they a fundamental part of the landscape, but they are also important wild bird habitat.

A number of other areas benefit from ecological payments: extensive cereal and rapeseed crops; extensive grassland on set-aside land; organic farming; animal welfare-friendly livestock housing (see below); water protection payments; and "ordinance on ecological quality" areas. However, the environmental benefits of these payments in the context of the whole range of support measures.

Switzerland has identified species that are endangered by agriculture and developed measures to enhance their protection. The share of wild species using agricultural land as habitats is 75% for mammals, 55% for butterflies and 22% for wild birds. To protect these species, semi-natural habitats have increased by some 20 000 hectares to 624 000 hectares (almost 40% of all agricultural land), while the total amount of land devoted to agriculture remained stable. Most of these habitats are extensive Alpine pasture (86%), extensive grassland (7%) and low-intensity grassland (7%). Arthropods (spiders, beetles, flies, wasps and bees) with semi-natural habitats are far more numerous there than in more intensively farmed land (intensive grassland, fields of cereals).

Crop diversity has declined sharply, with food supply provided mainly by 12 crop varieties and 5 species of domesticated animals. To protect genetic resources, Switzerland has made a complete inventory of crops and of the pressures threatening them, covering 2 800 varieties or lines of fruit and almost 2 000 varieties or lines of cereal. This is helping to speed up their conservation *ex situ* (*in vitro, in gene* and seed banks, and in field collections of fruits and vines).

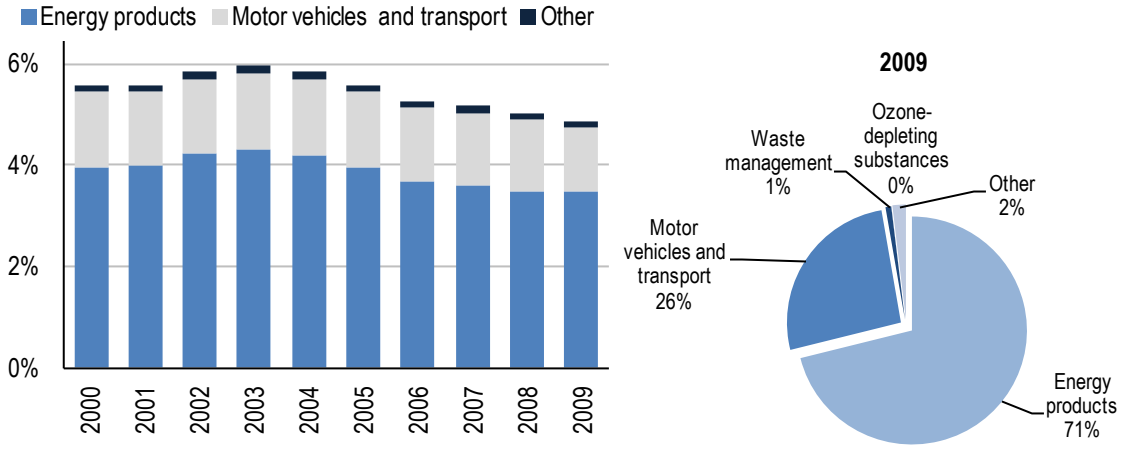
Swiss agricultural policy gives high priority to animal welfare. Two programmes have been put in place: regular access to fresh air (SRPA), and improved animal housing (SST). Participation in these programmes has grown rapidly, with 40 000 and 20 000 farms, respectively, joining them. No fewer than as a result, 68% of farm animals (and 80% of cattle) are reared with regular access to fresh air, and 37% (80% of poultry) benefit from better housing conditions. Although animal welfare measures are not primarily ecological in nature, they have beneficial environmental effects since more extensive and more natural animal rearing methods tend to be promoted.

Source: OECD (2004a).

2.4.2. Environmentally related taxes

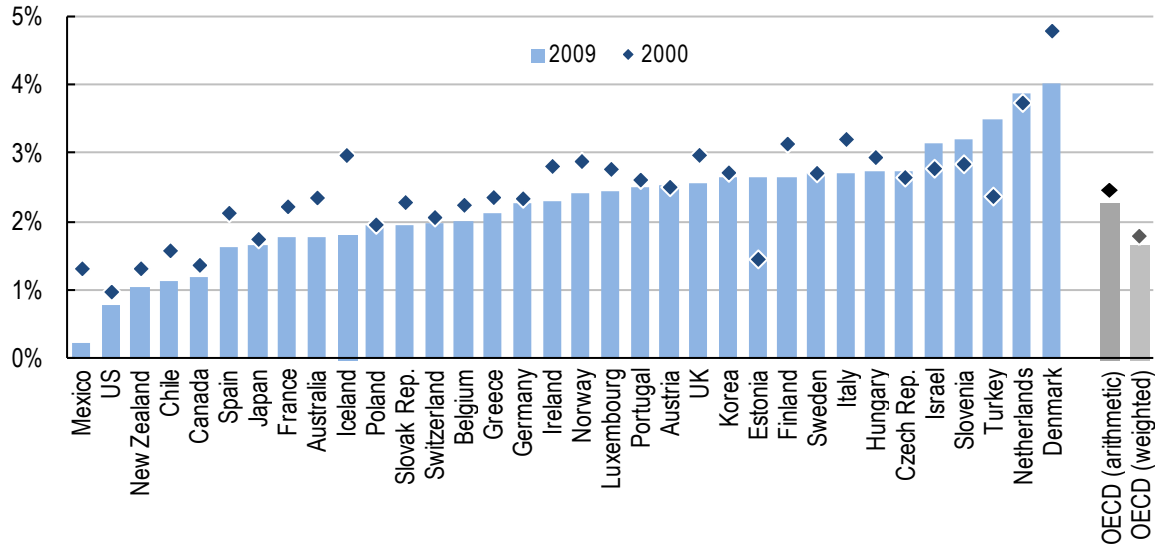
Environmentally related taxes are among the most cost-effective instruments for decoupling environmental pressures from energy production and use. However, in practice their effectiveness is sometimes compromised by exemptions. The vast majority of environmentally related tax revenues are derived from taxes on energy – of which taxes on motor fuels constitute nearly all of those proceeds. The revenues from energy taxes account for about two-thirds of the total environmentally related tax revenues (Figure 2.20).

Figure 2.20. Composition of environmentally related tax revenues, as % of total tax base, OECD



Source: OECD/EEA database on instruments used for environmental policy and natural resource management.

Figure 2.21. Revenues from environmentally related taxes, as % of GDP, OECD countries



Source: OECD/EEA (2011), Database on instruments used for environmental policy and natural resource management.

Only a few countries levy taxes on potentially environmentally harmful agricultural inputs, such as pesticides and fertilisers. The revenues derived from these taxes vary significantly across countries, from USD 80 million in Denmark in 2007 for pesticides to USD 11.5 million in Norway. These countries have adopted different approaches. Sweden, for example, imposes the same per unit tax on the active ingredient pesticides for all varieties, thereby levying the same rate on rather benign products as those which are more

toxic. A percentage tax is used by others, which is dependent on the price of the good. In Norway, tax rates depend on the negative human health and environmental effects of the pesticides, which encourages more conservative use of pesticides and provides incentives to substitute for less damaging products (OECD, 2010b).

In 2009, the weighted average of tax revenues came to about 1.7% of GDP for OECD countries, with a range of 0.2-4% of GDP. Overall, revenues from environmentally related taxes per unit of GDP declined in OECD countries over the last decade (Figure 2.21). This is related to a decline in the use of petrol per unit of GDP in OECD countries in this period. There is an inverse relationship between pre-tax petrol price and revenues from environmentally related taxes. When pre-tax petrol prices are high, revenues are low, and *vice versa*.

Depending on how far revenues from environmentally related taxes are in effect used to compensate losers, there is the potential to shift (part of) the burden away from more distortive corporate and personal income taxes and social contributions. Such a shift in the composition of taxes can promote economic growth, particularly if cuts are made in the elements of income taxes that are most distortive to investment, productivity growth and labour supply. Environmentally-related taxes are likely to be passed on into higher prices to some degree, so they may involve a reduction in real wages, in effect attenuating the scale of the reduction in the tax burden that may be attainable in practice. However, most tax systems have room to improve incentives in income taxes and in ways that do not make the distribution of income less equal (OECD, 2011f).

OECD analysis of environmentally related taxes suggests that the "price mechanisms work" – both in the short and in the longer term (*e.g.* OECD, 2006, 2008b, 2009a, 2010b). As the tax on motor fuels increases, the level of transport fuel use per unit of GDP tends to decrease. In most countries, increased taxes and/or higher pre-tax fuel prices have contributed to significant improvements in the transport fuel efficiency. In countries with little or no tax preference for diesel over petrol, the share of diesel in total transport sector fuel use is lower than in other countries.

Box 2.10. Environmental taxes in Sweden

The CO_2 tax

Sweden is on-track to meet its commitment under the Kyoto Protocol. While Sweden's commitment is to limit growth in national GHG emissions to 4% between 1990 and 2008, it has actually decreased its emissions further and established more ambitious targets on a unilateral basis. Sweden's CO_2 emissions per unit of GDP are today the lowest in OECD countries.

Market-based policy instruments have been a highly effective part of Swedish environment policies. The CO_2 tax and a 25% VAT on energy use, both introduced in 1991, have helped limit GHG emissions by encouraging energy conservation and fuel switching. The subsequent environmental tax reform involved a reallocation of taxes from labour to environmentally harmful activities, notably energy production and use. This further enhanced the climate protection effect of environmentally related taxes while creating better incentives for employment. The general CO_2 tax progressively increased in the last decade from 40 to 110 EUR/tonne. While energy intensive industry is covered under the EU emission trading system (EU ETS) – where the carbon price has been about 10 EUR/tonne in 2011 – sectors outside the EU ETS are subject to a domestic CO_2 tax of 20 EUR/tonne, which is planned to be gradually increased.

The CO_2 tax has contributed significantly to reduced fossil fuel consumption in Sweden. This is in particular the case for the household and service sectors and district heating production, where the full CO_2 tax rate is applicable. The differential treatment of biomass related fuels in CO_2 taxation, accentuated over time by an increasing general CO_2 tax, has contributed to fuel switching towards biomass renewable energy. Overall, CO_2 emissions in Sweden would have been 20% higher in 2010, if taxes had remained at the 1990 level. Thus energy and CO_2 taxation has been successfully used as part of Sweden's climate policy, closely co-ordinated with the EU ETS.

The NO_x tax

In 1992, Sweden introduced a tax on emissions of NO_x from stationary combustion sources. The decision was part of a strategy to reduce overall NO_x emissions by 30% between 1980 and 1995. Quantitative emission limits had already been introduced in 1988 on an individual basis for stationary combustion plants. However, it soon became apparent that these measures alone would not be enough to attain the desired reductions. The NO_x tax was introduced as a complementary instrument.

The tax was gradually extended from about 200 to all stationary combustion plants with an energy output larger than a certain limit. Plants pay a fixed amount per kg of NO_x emitted. The revenues are refunded, minus the costs of administration, to the paying plants in relation to their respective fraction of total useful energy produced. The scheme is designed so that firms having an emission intensity at the average of all other firms pay no net tax; relatively cleaner plants receive a net refund; and dirtier plants pay a net tax.

The introduction of the tax resulted in the share of firms using existing abatement technologies jumping from 7% to 62% in the first year alone. In addition to stimulating adoption of existing technologies, the tax provided incentives for innovation. Introduction of the tax resulted in a significant increase in patent activity, the continuous reduction in emission intensities at large firms beyond what could be attributed to the phase-in of the tax, and falling marginal abatement costs in some of the main sectors covered by the tax.

Source: OECD (2010b), OECD (2004b), OECD/EEA data base on economic instruments.

2.4.3. Technology and innovation

Technology and innovation are key instruments in decoupling strategies. Environmental policies can affect the rate and direction of innovation in environmental technologies by changing relative input prices. In doing so, they encourage research on technologies which save on the use of the more expensive inputs. A recent OECD study concluded that both market-based and regulatory instruments can promote technological innovation (OECD, 2011i). It is not so much the type of instrument chosen, but the incentives they provide for innovation which is important in this regard.[16]

Good design of policy instruments is a necessary but not sufficient condition for achieving policy objectives, including through the development of new technology. As other sections of this report demonstrate, in OECD countries an implementation gap exists between policy objectives and performance. Insufficient compliance with environmental requirements is an important part of this implementation gap.

A recent OECD study examined how some OECD Member countries were trying to close this implementation gap (OECD, 2009b). The study identified some key trends, innovative approaches, and good practices. Improving the efficiency of compliance assurance is at the core of most of these trends. Enforcement agencies are responding to the challenge of achieving better environmental results with less financial resources by streamlining activities, adopting new, and improving existing, instruments, and targeting their activities on higher-risk segments of the regulated community.

16. From this perspective, OECD (2011g) proposes the following key characteristics of environmental policies intended to promote innovation: stringency (how ambitious is the environmental policy objective relative to business-as-usual?); predictability (what effect does the policy measure have on investor uncertainty; is the signal consistent, foreseeable, and credible?); flexibility (does it let the innovator identify the best way to meet the objective?); depth (are there incentives to further improve one's performance regardless of the level of performance already achieved); and incidence (does the policy target directly the externality, or is the point of incidence a "proxy" for the pollutant?).

Box 2.11. The Netherlands "Table of Eleven": Key factors of compliance

Understanding the factors that determine compliance can help governments design more effective regulations and compliance assurance programmes. In the Netherlands, the parameters of the regulated community's response to regulation were summarised in the so-called "Table of Eleven" which was developed to assist the work of environmental inspectors. It is based on a combination of social and criminal theories of compliance behaviour and on practical experience in the maintenance of law and order.

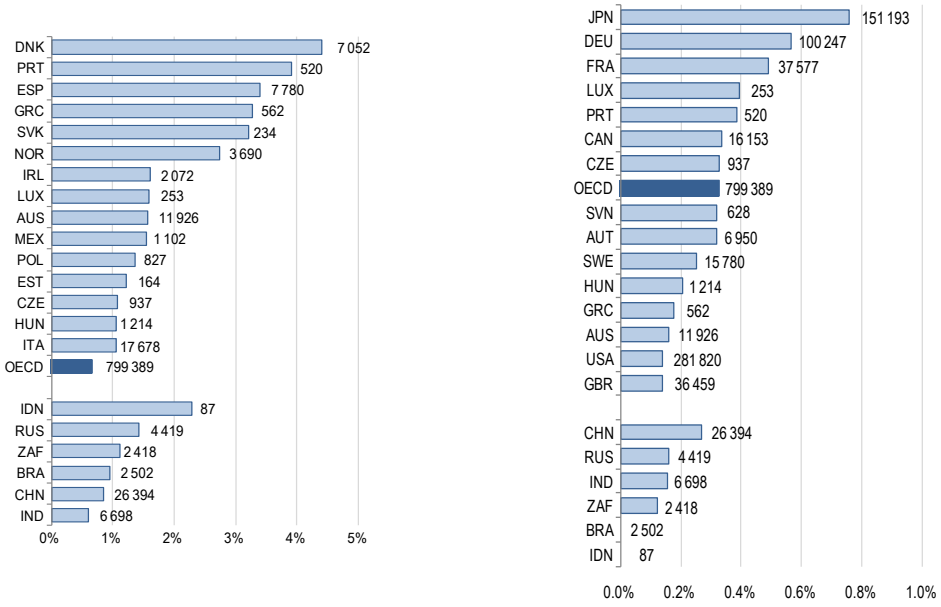
Spontaneous compliance dimensions – factors of voluntary compliance and the influence of compliance promotion:

1. Knowledge of rules – familiarity of the regulated community with the regulation and the clarity of requirements.
2. Cost-benefit considerations – advantages and disadvantages of compliance in terms of time, money, and effort.
3. Level of acceptance – the extent to which policy and regulations are (generally) accepted by regulated entities.
4. Loyalty and obedience – innate willingness of regulated entities to comply with laws and regulations.
5. Informal monitoring – possibility of detection and disapproval of non-compliance by non-government actors.
6. Monitoring dimensions – the influence of compliance monitoring.
7. Informal report probability – possibility that an offence is reported by non-government actors (whistle blowing).
8. Monitoring probability – likelihood of being subject to inspection by competent authorities.
9. Detection probability – possibility of detection of an offence by competent authorities.
10. Selectivity – chance of inspection as a result of risk-based targeting of firms, persons, or areas.
11. Sanctions dimensions – the influence of enforcement.
    - Sanction probability – possibility of a sanction being imposed if an offence has been detected.
    - Sanction severity – stringency and type of a sanction and adverse effects associated with it.

Source: OECD (2009b).

In addition to appropriate environmental policy design, governments also provide support for research and innovation to counteract a variety of market and policy failures. While the share of GDP dedicated to public environment- and energy-related R&D expenditure has slightly decreased since 1990, the amount dedicated to renewable energy and energy efficiency, including in the transport sector, has gained in importance in recent years. This is reflected in the increased share of renewable energy and "cleaner" vehicle patents in total patents in some countries (Figure 2.22).

Figure 2.22. Patents in renewable energy (left panel) and electric and hybrid vehicles (right panel), % of total patents, 2003-08



Notes: The numbers beside the bars are the total number of patent applications filed under the Patent Co-operation Treaty (PCT) in 2003-08, rounded to the nearest integer. The OECD total includes 34 OECD countries. The 5-year averages are considered to avoid the potential bias arising from volatility of patent applications over time.

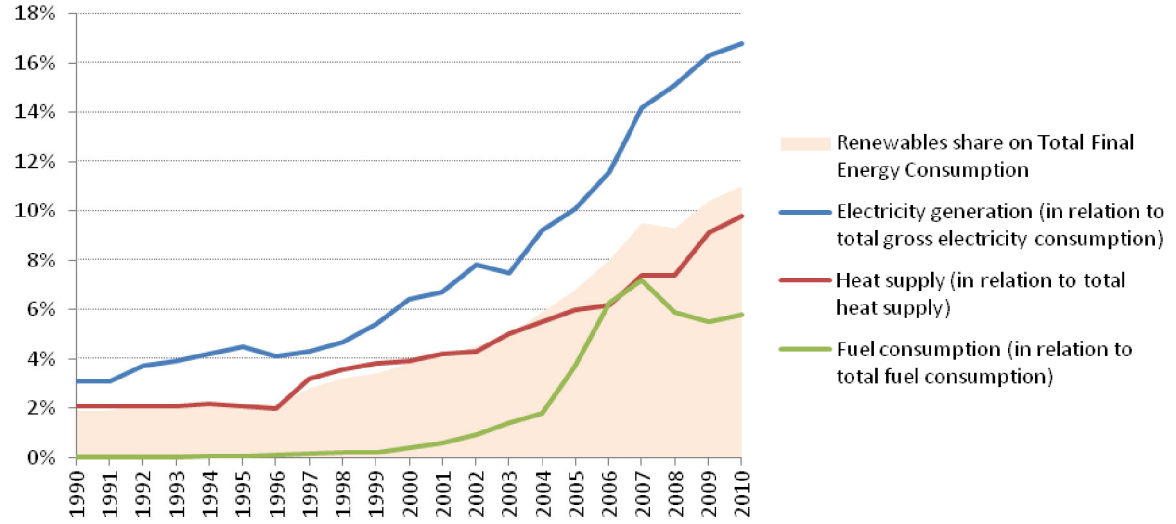
Source: OECD Patent Database.

It is not the development of new technologies that influences decoupling; rather, it is their diffusion and application which are critical. The commercialisation of new technologies must overcome various barriers. Renewable energy, for example, includes a variety of technologies at different stages of maturity. Supporting technology development and diffusion requires different types of financial instruments adapted to the different stages of development, demonstration and commercialisation. The challenge facing governments is to develop effective and efficient approaches that are likely to provide a good return on investment. This is fraught with difficulty for public sector institutions where there are many expensive examples of failed attempts to support potential commercial winners. There is no one-size-fits all approach: the choice of mechanism depends on local political and economic conditions.

Box 2.12. The penetration of renewable energy in German energy markets

Since the early 2000s, the German government has promoted the penetration of renewable energy in both electricity and heat generation. Among the applied measures, the renewable energy feed in tariff (FIT) scheme was key. Germany introduced the initial version of the scheme in 1991, and modified it in 2000 and 2010.

Renewable energy sources as a share of total final energy consumption in Germany 1998-2009



The key features of the scheme are:

- guaranteed price premium for renewable energy producers (the feed-in tariff paid at a defined, declining rate during 20 years);

- guaranteed market for producers (grid operators are required to provide grid access to generators of renewable electricity and to purchase all electricity fed into the grid (except in emergency situations);

- independence of the scheme from the general budget (the aggregate FIT costs are apportioned to the electricity price paid by end-use consumers).

The combination of these features provided a predictable and credible long-term price signal to potential investors. They have been important factors in the effectiveness of the German system. Guaranteed grid access has reduced investment uncertainty and thus helped raise the necessary financing. The independence from public budgets increased the credibility of the scheme in the eyes of potential investors, and reduced the risks associated with the R&D process. This is in contrast to FIT systems implemented in other countries where rising public deficits led to dramatic downscaling of FIT rates and stop&go policies.

Source: OECD (2012, forthcoming).

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OBJECTIVE 3

IMPROVING INFORMATION FOR DECISION MAKING: MEASURING PROGRESS THROUGH INDICATORS

Assessment

OECD countries have made good progress in establishing robust information systems to support environmental decision making. Many countries have strengthened the legal and institutional frameworks to guarantee the independence and quality of data. There have been important improvements in environmental data quality in some areas, notably the energy-climate-air pollution nexus, as well as advances in statistical methods and classifications, monitoring techniques, and communication tools.

Environmental information has become more responsive to policy needs. Indicators have gained in importance and are often related to policy objectives or targets. Reporting has focused more on environmental performance and future challenges. Many countries have improved the communication of environmental information, using small sets of indicators, brochures and briefing notes to deliver messages to different audiences: policy-makers, the media and the general public.

The internet has profoundly changed activities along the environmental information chain, from its collection, to treatment and communication. Linked to this, there have been advances in geographical information systems that combine monitoring data with information from earth observation systems. Increasingly data are made available in the form of interactive maps where users can find location-specific information. Map-based systems have also been important for disseminating the results of Pollutant Release and Transfer Registers which most OECD countries have now developed.

More attention has been given to integrated and cross-cutting approaches such as life-cycle assessments, and ecosystem-based approaches. Greater efforts have been made at national and international level to analyse resource efficiency, and to measure natural resource stocks and material flows. Similarly, further investments are being made to strengthen environmental-economic accounting, including the revision of the System of Environmental-Economic Accounting (SEEA).

Despite this progress, further efforts are needed to strengthen the information base that decision makers need to address the future environmental agenda. Major differences exist among OECD countries in terms of the quality and coverage of reporting activities, and the effectiveness of reporting processes. From an international perspective, the quality and comparability of data, among countries and over time, remains an issue. The timeliness of providing information has not improved. There are continuous pressures to cut budgets for environmental information systems, especially following the economic and financial crisis. While there are often opportunities for efficiency gains, and some countries have not sufficiently prioritised information needed for decision-making purposes, there are also limits of "doing more with less". In some cases, legal reporting requirements are improving data in the areas covered, but also reducing capacity to respond to new demands.

Additional, policy-relevant information is needed in areas such as biodiversity, environmental risks and environmental health, integrated waste and materials management, and sectoral breakdown of environmental data. Not enough coherent information is available on the stocks and flows of key natural

resources, including non-energy mineral resources, and land and soil resources. Economic information on environmental policies has improved, but most environmental information still concerns physical parameters that cannot easily be related to economic data; this represents an obstacle for the more effective integration of economic and environmental policies. There are new demands to measure the impacts that environmental conditions have on the quality of people's lives. More accurate reporting is needed on the territorial dimensions of environmental management, and on the social aspects of environmental policies such as distributional issues and inequalities. Data and indicators on policy measures should be strengthened to support policy evaluation and country performance reviews. It would be timely for OECD members to consider their collective priorities on the emerging environmental information agenda, and how to monitor progress in greening growth. This should involve closer co-operation between environment and other ministries, as well as statistical agencies.

Introduction

Measuring progress through indicators

Objective 3 of the *Strategy* called for improved environmental decision making through better use of information. It called on OECD countries to base environmental policies on environmental data and indicators related to the pressures on, and the state of, the environment. This requires the establishment of a solid framework for collecting environmental data; the identification of policy relevant, analytically sound, and measurable parameters and indicators; and appropriate data quality mechanisms.

The *Strategy* did not identify specific indicators to monitor progress in achieving this Objective. The document which EPOC discussed on preparing for the review of the *Strategy* indicated that this section would draw on an analysis of countries' responses to the OECD State of the Environment questionnaire. This would include an assessment of the data sets for which reporting has improved, deteriorated or remained the same. Information would also be drawn from the annual Roundtables on environmental information organised in the framework of the Working Party on Environmental Information (formerly the Working Group on Environmental Information and Outlooks), and from Environmental Performance Reviews. Successful approaches for improving environmental information for decision-making would be identified.

The section on environmental democracy, under objective 4, complements this chapter by examining access to environmental information, public participation, and access to justice in environmental decision making.

3.1. The information base for environmental decision making

3.1.1. Framework for environmental information and indicators

More than 30 years ago, the OECD elaborated the Pressure-State-Response framework to guide work on environmental reporting. The framework has since been used to structure the core set of OECD environmental data and the associated state of the environment questionnaire. These data were intended to complement and support other environmental data collected at the national level. The questionnaire is managed jointly by OECD and Eurostat, and involves co-operation with UNSD and UNEP. Thus, it is a key element in international efforts to harmonise the collection of environmental data and to provide a factual basis for international work on environmental policies. The questionnaire has also been used as a reference framework for the establishment of environmental information systems in individual countries.

The collected data, together with other environmental data from other international sources, are used in the OECD's policy work and provide a basis for calculating environmental indicators. They are

published in the OECD Compendium of Environmental Data, which was the first international publication of its kind. The Compendium is now updated on a rolling base, with new information posted on the OECD website.

The pressure-state-response framework has also been used to structure work on country environmental performance reviews and to elaborate various sets of indicators. The selection of indicators for any set depends on its purpose; there is no unique set. Moreover, in analysing an issue, indicators are only one tool among others and must be interpreted in context. Indicators are selected based on their relevance, analytical soundness and measurability. The OECD approach to environmental indicators has influenced similar activities by a number of countries and international organisations, and has thus contributed to the harmonisation of Member countries' initiatives. The main sets of indicators elaborated by the OECD are:

- *Core Set:* an agreed set of indicators for international use to monitor environmental progress and performance, including in Environmental Performance Reviews.

- *Key Set:* a sub-set of the Core Set, agreed by OECD Environment Ministers, for communication purposes for the public and policy makers.

- *Sectoral Indicators:* to help integrate environmental considerations into sectoral policies.

- *Decoupling Indicators:* to assess the extent to which environmental pressures are evolving in relation to economic trends.

The provision of high quality environmental information requires continued efforts. In 2001, after the adoption of the environmental strategy, the OECD and its members took the initiative to elaborate a common strategy and action plan for improving environmental data quality. The initiative focusses on the data's relevance for the purpose of international reporting on environmental performance and international indicator development. Particular attention is given to data that are most needed to support OECD policy work, *i.e.* data underlying the OECD Core and Key Environmental Indicators and data needed to monitor countries' environmental performance and the implementation of the OECD Environmental Strategy. The action plan identifies the quality criteria that work in the OECD should promote and that OECD countries agreed to improve in a collaborative manner, and a list of issues on which data quality efforts in the OECD should focus as a matter of priority. It is structured around four major quality goals:

- Consolidate and improve the quality of existing environmental data (comparability, timeliness, coherence over time, transparency, interpretability).

- Develop and innovate to fill gaps.

- Support countries in their efforts to improve the quality of environmental data and information systems.

- Increase cost-effectiveness of tools and processes that underlie data quality efforts.

3.1.2. Trends in the compilation of environmental information and indicators

Table 3.1 assesses OECD Member country progress in compiling information on priority environmental topics included in the OECD state of the environment questionnaire and sets of indicators. The analysis builds on previous discussions, including a special discussion on data quality in the OECD Working Group on Environmental Information and Outlooks in 2002, and the treatment of data from

Member countries, and their use in Environmental Performance Reviews. It also takes into account developments in related international work.

Table 3.1. Environmental data quality: Progress since 2000

Priority topics [a]	Assessment of progress at OECD level [b]
Pressures	
4. Air emissions (SO_x, NO_x, VOCs, Particulates, etc.) and GHG emissions	☺ ♦ country coverage ♦ pollutants covered under international agreements (*i.e.* UNFCCC; CLRTAP) ♦ timeliness; consistency of time series from 1990 😐 ♦ GHG emissions for non Annex I countries ☹ ♦ emissions of toxics; of PM2.5 ♦ consistency and completeness of time series over longer periods (*e.g.* since 1980) ♦ GHG sinks ♦ breakdown by economic activity sector
5. Use of freshwater resources (abstractions)	😐 no change ☹ ♦ abstractions for uses other than public supply ♦ abstractions for irrigation and other agricultural uses ♦ timeliness; length and consistency of time series ♦ coherence with information on water supply ♦ spatial and seasonal distribution
6. Discharges of pollutants into water	☺ progress in Europe: countries covered, pollutants covered 😐 Limited progress at OECD level ☹ ♦ country coverage and comparability ♦ pollutants and sources covered; actual discharges ♦ time series ♦ breakdown by economic activity sector
7. Conversions in land use and changes in land cover	😐 no major progress yet; but promising developments using information from satellite images ☹ ♦ country coverage and comparability ♦ coverage of certain land use/cover categories, *e.g.* built-up/sealed land; ♦ consistency of time series ♦ conversions and multiple uses
8. Use of forest resources (stocks, growth, fellings, natural losses)	😐 limited progress; change in variables covered by FRA (UN-ECE/FAO) ☹ ♦ country coverage and comparability ♦ length and consistency of time series
9. Waste generation	☺ progress for waste by sector and materials at EU level, base year 2004 (link to EU regulation) 😐 Limited progress at OECD level ☹ ♦ Industrial and hazardous waste ♦ breakdown by economic activity sector ♦ consistency of time series ♦ timeliness ♦ comparability among countries ♦ coherence with information on waste treatment
10. Use of fish resources	😐 No change; dependent on other international work

Priority topics [a]	Assessment of progress at OECD level [b]
Responses	
11. Environmental expenditure (water, air, waste, nature, other)	☺ continued progress especially at EU level ☹ ♦ timeliness; length and consistency of time series ♦ country coverage and comparability ♦ expenditure by the business sector, by specialised producers ♦ expenditure on natural resource supply and management ♦ expenditure on environmental risks (natural, industrial)
12. Environmentally related economic instruments	☺ ♦ continued progress (link to OECD/EEA data base) ♦ country coverage ♦ fossil fuel subsidies ☹ ♦ fees and charges, tradable permits ♦ environmentally related subsidies
13. Water pricing and cost recovery	😐 dependent on non-OECD data sources; prices for households in selected cities (public supply) ☹ ♦ pricing for industry, for agriculture ♦ link to costs; cost recovery ratios ♦ comparability among countries
14. Waste water treatment connection rates	😐 no major progress at OECD level ☹ ♦ comparability among countries ♦ breakdown by treatment level
15. Waste recovery, treatment and disposal	😐 limited progress at OECD level ☹ ♦ recycling in general and by material in particular ♦ coherence with information on waste generation and collection ♦ treatment and disposal costs ♦ exports and imports of non-hazardous waste ♦ industrial waste ♦ length and consistency of time series; timeliness; comparability among countries

Topics deserving special attention	Assessment of progress at OECD level
Biodiversity and ecosystems	☺ ♦ continued progress at international level with the selection and definition of indicators (*i.e.* CBD/BIP) ♦ increased knowledge of economic aspects of biodiversity (cf international work on the valuation of ecosystem services and on ecosystem accounting (EEA, TEEB, WB) ☹ ♦ major gaps in basic data ♦ comparability among countries ♦ no trends or lack of historical consistency; timeliness
Material use and resource productivity	☺ ♦ continued progress at international level ♦ improved economy-wide material flow data (by major material groups) especially in Europe and in Japan ☹ ♦ major gaps in physical trade data ♦ breakdown by economic activity sector ♦ flows of secondary materials and of waste ♦ indirect flows (demand-based)
Environmental health and risks ♦ toxic contamination, population exposure, links to social aspects, including distributional aspects, sub-national disparities ♦ Population exposure to natural and technological risks	☺ ♦ Some progress with international data on population weighted air pollution levels (EEA, WB) ♦ Interest in developing measures on environmentally related health problems (link to work on human capital and on well-being; Stiglitz commission) ☹ ♦ Gaps in basic data, including on toxic contamination ♦ Little comparable data about population exposure and impacts on human health ♦ Little comparable data on exposure to risks

Priority topics [a]	Assessment of progress at OECD level [b]
Linkages between environmental, economic and social trends, with a focus on economic aspects and with a link to decoupling and environmental performance assessment.	☺ ♦ increased knowledge of economic aspects of environmental change ♦ Environmentally related taxes ♦ NAMEAs (mainly in Europe) ☹ ♦ breakdown of environmental data by economic activity sector ♦ link with disparities and inequalities (social dimension) ♦ coherence at international level

Notes:
(a) Topics, which in 2001 were considered to have a potential for progress over the following six to eight years.
(b) ☺ progress made; 😐 no change or limited progress; ☹ remaining deficiencies & gaps ➔ further action needed.

Evidence from the OECD Environmental Performance Review programme suggests that OECD countries generally have made good progress in establishing robust information systems to support the development and implementation of environmental decision making.[17] Environmental information systems involve many actors and are based on an increasingly broad range of sources: amongst others, monitoring networks, reporting by industry, sampling, satellite images, and public opinion surveys. Countries that developed their systems more recently have been able to adopt best practices directly. A common challenge is to design environmental information systems so as to respond to the needs of decision makers, and to avoid a supply- or technology-driven approach.

Environmental indicators are commonly used to track environmental progress, including progress in achieving objectives (*e.g.* environmental quality or resource efficiency) or targets (*e.g.* emission reduction targets). Strategic, planning and programming documents increasingly include environmental components and are evidence-based and performance-oriented. More integrated approaches based on environmentally related information have been developed, including life-cycle assessments, ecosystem-based monitoring systems, and material flow analyses. Modelling and quantitative scenario development shed light on possible environmental futures. The experience of the Netherlands is among the most advanced in this regard.[18]

There are a wide a variety of institutional arrangements in place in OECD countries regarding the collection, analysis and dissemination of environmentally related information. Annex 1 describes these arrangements at the country level. Generally there has been a trend to insulate environmental information from political pressure by allocating responsibility to institutions that have autonomy in this regard. This has been done by allocating responsibility to National Statistical Offices, to independent Environment Agencies, or to National Statistical Offices and Environment institutions in combination.

17. See for example recent Environmental Performance Reviews of Ireland, Luxembourg, Japan, Portugal, Norway, and the Slovak Republic.

18. Nationale Milieuverkenning 6, 2006-2040.

Table 3.2. Summary of institutional responsibilities for environmental information and reporting

	Environmental institutions	National statistical offices	Joint	Other
Environmental data	13	3	14	-
Environmental indicators	23	1	6	-
Sustainable development indicators	13	6	3	3
Environmental reporting and assessment	24	1	5	-
Environmental accounting	4	20	4	-

Table 3.5 summarises how responsibilities for environmental data is allocated among national institutions in OECD countries. For the reporting countries, environmental institutions are primarily responsible for environmental indicators, and overall they also have more responsibility for sustainable development indicators than other institutions. Sustainable development indicators is the only area for which institutions other than those responsible for environment or statistics play a role (Ministry of Finance, President's Office and Sustainable Development Council). Environment Ministries are also predominantly responsible for environmental reporting and assessment. National Statistical Offices have the major responsibility for environmental accounting.

The main emphasis in environmental information systems has continued to be on the physical dimensions. New developments in scientific understanding have contributed to the further evolution of environmental information systems such as satellite imagery, though generally more could be done to better link science and policy in this area. Similarly, important progress has been made in strengthening the economic analysis of environmental issues, both on the economic impacts of environmental policies and the environmental impacts of economic and sectoral policies. The use of cost-benefit analysis and assessments of the cost effectiveness of policy options has become better institutionalised in many OECD countries. The Stern report on climate change[19] and the TEEB report on biodiversity[20] have also had an important influence on the analysis of the economic aspects of these policy areas. Nevertheless, the absence of environmental indicators expressed in economic terms, continues to impede the integration of environmental considerations into economic and sectoral decision making.

Despite the strengthening of environmental information systems in many countries, data quality did not improve significantly over the last decade. More attention was paid to "upstream" development of methodologies, classifications, electronic information infrastructure and to "downstream" interpretations of environmental information and indicators. Further efforts are needed to ensure the quality of core environmental data, and to maintain a shared base of environmental information among countries that can facilitate cross-country comparison and benchmarking of performance. The analysis and recommendations of the 2001 OECD initiative concerning a common strategy to improve environmental data quality remain largely valid today.

19. *http://webarchive.nationalarchives.gov.uk/+www.hm-treasury.gov.uk/sternreview_index.htm.*

20. Kumar (2010).

Nevertheless, there have been improvements of data quality in some areas. An important motor for improved environmental quality has been the international harmonisation of data sets covered by multilateral environmental agreements. This has been particularly the case for greenhouse gas and air pollutant emissions where major progress was made in the 1990s. Progress has also been made in several other areas such as natural resources, waste and materials management, environmental protection expenditure, and economic instruments, though further efforts are still needed to improve data quality in all these areas.

In Europe, reporting requirements backed by regulatory authority, and efforts to establish common databases and a shared environmental information system (SEIS)[21] for EU member states and countries participating in the work of the EEA, are showing first results (Box 3.1). In areas covered by mandatory reporting and by the SEIS, European countries are generally progressing faster than other OECD countries (*e.g.* urban air quality, water quality in rivers and lakes, waste and material flows, biodiversity, environmental expenditure and transfers), though these developments also sometimes introduce differences in definitions between EU and other OECD Member countries.

Generally the comparability of data, consistency of time series, and the timeliness in the provision of environmental data need to be improved. Different definitions and methodologies, as well as different sources of data, frequently limit cross-country comparison. Changes in methodologies or data collection limit the comparability of data within a time series. It is not unusual for environmental data to become available two years or more after the event. These limitations are a continued obstacle to the effective and efficient development and implementation of environmental policies. More systematic use of "now-casting" methods, provisional data, and ex-post revisions of selected data series could help to address some of these deficiencies.

Some countries have invested substantially in expanding their systems of environmental information; for example Norway has made substantial investments to strengthen information on biodiversity to underpin policy developments in this area.[22] However, most countries have sought to enhance the efficiency of data collection. This has included greater reliance on self-monitoring by industry, more recourse to sampling rather than monitoring, more use of internet-based communication, and the development of shared environmental information systems.

Concerns also remain as to the capacity of many national environmental information systems to cope with expanding demands and to effectively support policy making at international level. Responding to new demands requires more and better environmental information. However, in many cases there are pressures to reduce environmental information systems. While there are often opportunities for efficiency gains, particularly through better use of existing environmental information, there are also limits of "doing more with less". Lack of financial resources has been a constant obstacle to the improvement of the quality and coverage of environmental data. Where legal reporting requirements exist, funding tends to concentrate on the areas covered by these requirements. This ultimately results in improved data availability and quality in these areas. But when budget constraints apply, this helps on the one hand to secure funding, but on the other hand it may also divert funding from other activities, hence a loss of flexibility to respond to new and emerging demands.

21. European Commission, Shared Environmental Information System, *http://ec.europa.eu/environment/seis/.*

22. OECD (2011a).

Box 3.1. European Shared Environmental Information System

In February 2008, the European Commission (EC) proposed to develop a Shared Environmental Information System (SEIS). This has now become a collaborative initiative of the EC together with the EEA and its member and co-operating countries.

SEIS aims to create a decentralised but integrated and web-enabled, Europe-wide environmental information system. It will be based on a network of public information providers that share environmental data and information. To make SEIS possible requires a shift from 'controlling' information to "sharing it", as freely as possible. It is expected that this will reduce administrative costs for public administrations. Implementing an SEIS involves simplifying, streamlining, and modernising existing information systems and processes, thereby improving quality, availability, accessibility and understanding.

SEIS is based on the following principles:

1. Manage information as close to its source as possible.
2. Collect information once, and share and use often.
3. Help public authorities with their legal environment reporting obligations.
4. Help public authorities to assess the state of environment (SoE), and environmental policy effectiveness, and to design new environmental policy if needed.
5. Help make geographical comparisons of the environment.
6. Help citizens to participate in the development and implementation of environmental policy, while making information fully available to them.
7. Base SEIS on open standards.

A key goal is to maximise and expand use – information is often created to serve one purpose. There is often potential for other uses of information, and applying SEIS principles is intended to make it easier. For example, information about floods, while needed to mitigate potential flood impacts, is also valuable for insurance companies and homebuyers, to assess risks for buildings.

Source: www.eea.europa.eu/about-us/what/shared-environmental-information-system.

3.1.3. Other initiatives related to environmental information and indicators

Toward the end of the 2000s, a number of initiatives reinforced the demand not only for better quality environmental information and indicators, but also for new sets of data and indicators to be developed to help address the evolving policy agenda. Some of these initiatives are summarised below. Prominent themes include the need to better integrate environmental and economic decision making, and the importance of relating environmental measures more directly to people's lives. Drawing on the review of these initiatives, and of environmental data provided to OECD, some of the main elements for the future environmental measurement agenda are identified.

1) UNECE/OECD/Eurostat Working Group on Sustainable Development

In 2005, the UNECE, OECD and Eurostat established a Joint Working Group on Statistics for Sustainable Development (WGSSD) to propose a small set of sustainable development indicators that could be used for the purposes of international comparison. The Working Group was comprised of representatives from National Statistical Offices and environmental administrations.

The Working Group considered that the establishment of sustainable development indicators was an opportunity for many countries to move environmental issues higher up the policy agenda, and to link more closely with economic and social priorities. It adopted the "capital approach", defining sustainable development as "non-declining per capita wealth over time." This involves at least maintaining five types

of capital stock, including by substitution among them.[23] Within this framework, and building on a review of existing sets of sustainable development indicators, in a report in 2009, the Working Party proposed the following set of sustainable development indicators:[24]

Table 3.3. A proposed small set of sustainable development indicators

Indicator domain	Stock Indicators	Flow Indicators
Foundational well-being	Health-adjusted life expectancy	Index of changes in age-specific mortality and morbidity (place holder)
	Percentage of population with post-secondary education	Enrolment in post-secondary education
	Temperature deviations from normal	Greenhouse gas emissions
	Ground-level ozone and fine particulate concentrations	Smog-forming pollutant emissions
	Quality-adjusted water availability	Nutrient loadings to water bodies
	Fragmentation of natural habitats	Conversion of natural habitats to other uses
Economic well-being	Real *per capita* net foreign financial asset holdings	Real *per capita* investment in foreign financial assets
	Real *per capita* produced capital	Real *per capita* net investment in produced capital
	Real *per capita* human capital	Real *per capita* net investment in human capital
	Real *per capita* natural capital	Real *per capita* net depletion of natural capital
	Reserves of energy resources	Depletion of energy resources
	Reserves of mineral resources	Depletion of mineral resources
	Timber resource stocks	Depletion of timber resources
	Marine resource stocks	Depletion of marine resources

23. The five stocks of capital are: financial capital like stocks, bonds and currency deposits; produced capital like machinery, buildings, telecommunications and other types of infrastructure; natural capital in the form of natural resources, land and ecosystems providing services like waste absorption; human capital in the form of an educated and healthy workforce; and, finally, social capital in the form of functioning social networks and institutions.

24. UNECE (2009).

2) System of Environmental and Economic Accounts

A considerable amount of work has been carried out to develop and refine *frameworks and methodologies* for various environmental accounting tools. There are several international developments in *environmental accounting* that provide opportunities for improving information on variations in natural capital stocks in both monetary and physical terms. A prominent example is the System of Environmental-Economic Accounts (SEEA) developed within the UN framework. This is a statistical framework that provides internationally agreed concepts, definitions, classifications, accounting rules and standard tables for producing harmonised accounts on the environment and its relationship with the economy, and for deriving coherent indicators. The purpose of the SEEA is to integrate information on the economy and the environment by using concepts, definitions and classifications consistent with the System of National Accounts (SNA). The SEEA encompasses: (i) the physical flows of materials and energy within the economy and between the economy and the environment; (ii) the stock of environmental assets that comprise the environment and changes in these stocks; and (iii) economic activity related to the environment.

Subsystems of the SEEA framework elaborate on specific resources or sectors, including: Energy, Water, Land and Ecosystems, and Agriculture.

A multi-year process of revision to the SEEA was initiated in 2005 by the United Nations Statistical Commission. The revised SEEA consists of three volumes: the central framework consisting of agreed concepts, definitions classifications, accounting rules and tables; experimental accounts for ecosystems; and extensions and applications of the SEEA. Work on the central framework of the SEEA is due to be completed by February 2012. *Experimental Ecosystem Accounts* and *Extensions and Applications* will not be considered international standards, but will describe best practices. They are scheduled to be completed by February 2013.

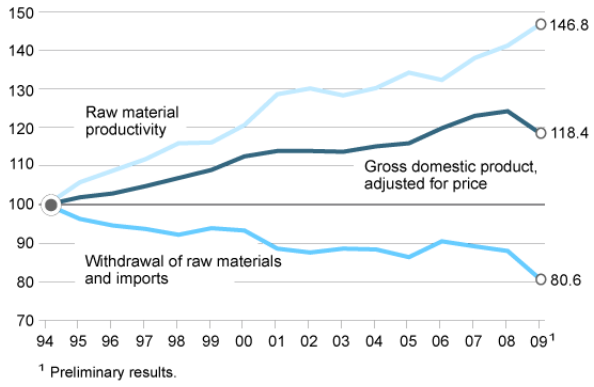
Box 3.2. Monitoring progress with resource productivity – the German experience

Improving resource productivity has long been high on the German policy agenda. It is embedded in the objectives of the National Strategy for Sustainable Development adopted by the Federal Government in 2002. It is also central to policies concerning waste and materials management, technology development, innovation, employment, and to the federal government's raw materials strategy. Implementation is supported with government initiatives that explore opportunities for efficiency gains in the German economy, and develop guidance for public and private action. Germany is also actively engaged in international processes including OECD work on material flows and resource productivity, the UNEP International Resource Panel, the G8 3R (Reduce, Reuse, Recycle) Action Plan, and in related European work. Policy analysis and the monitoring of progress build on a well-established information base and on long-standing research on material flows.

Germany is among the most experienced countries in material flow analysis and resource productivity indicators, and contributed to pioneering work in the 1990s through joint research projects with Japan, the United States, the Netherlands and Austria. The work is carried out by both the government and research institutes, and benefits from a close co-operation among the actors involved. It is part of the country's official statistics and is embedded in its Environmental Economic Accounting (EEA) system that links physical data on materials, waste and emissions to monetary data from economic accounts. The data can thus be used to monitor overall economic productivity as well as the efficiency of use of specific materials (*e.g.* certain metals).

Information on material flows and resource productivity is published regularly and benefits from an active dissemination including through the internet and press releases. The most prominent indicator is raw material productivity that describes the efficiency with which "non-renewable raw materials "are used in the national economy. It is included in the German system of core environmental indicators, and in the set of key sustainable development indicators. It is associated with a quantitative target, and is updated annually (see below). Work is underway to better account for all material requirements induced by domestic demand, including those associated with the production of imported and exported goods.

Raw material productivity and economic growth, 1994=100



Definition: Raw material productivity has similarities with labour and capital productivity. It is defined as the gross domestic product (in euros, adjusted for price) that is obtained per tonne of abiotic primary material used, whether from domestic origin or imported in the form of raw materials, semi-finished and finished products. Biotic materials such as agricultural and forestry products are excluded.

National SD target: A doubling by 2020 of energy- and raw materials productivity in relation to 1990 and 1994 respectively.

Assessment: Raw material productivity increased by 46,8% between 1994 and 2009 due to structural changes in the German economy and a reduction in coal and peat extracted domestically. Though positive, the observed trend is seen as insufficient to achieve the fixed target by 2020.

Sources:

(a) Federal Environment Agency (UBA) (2009), Environmental Data for Germany 2009, *www.umweltdaten.de/publikationen/fpdf-l/3877.pdf.*

(b) German Federal Statistical Office (Destatis) (2010), Sustainable development indicators, *www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/Navigation/Statistics/TimeSeries/Indicators/SubstainableDevelopmentIndicators__nk.psml;jsessionid=28E0EE1662806582CEA605C705AA8902.internet2.*

(c) Wuppertal Institute for Climate, Environment and Energy, *www.wupperinst.org/en/home/index.html.*

There have been a number of recent developments in this area. For example, the EU adopted a legally-binding regulation in this area.[25] Starting in 2011, EU Member states will initially be asked to provide national accounts on air emissions, environmental taxes and material input and output flows. According to the regulation, the European Commission may propose further modules such as environmental protection expenditure, the environmental goods and services sector, and energy, and possibly at a later stage water, waste, forests, and ecosystem services.

The UK which issued a White Paper, in June 2011, "The Natural Choice: securing the value of nature." Amongst other things, the White Paper proposes to integrate natural capital into the UK environmental accounts, and to establish an independent Natural Capital Committee to advise the government on the state of natural capital in England.

The World Bank has worked for some time on the development of a "net savings" approach for measuring national wealth that takes account of environmental damage and the depletion of stocks of natural capital.[26] It has recently launched a project on Wealth Accounting and the Valuation of Ecosystem Services (WAVES) that aims to support the implementation of natural capital accounting and its integration into the national economic accounting framework.

Drawing on the SEEA framework, the European Environment Agency has been working on the development of an experimental framework for "simplified ecosystem capital accounts".[27] This aims to

25. Proposal for a Regulation of the European Parliament and of the Council on European environmental economic accounts (Text with EEA relevance), COM/2010/0132 final.

26. World Bank (2006).

27. EEA (2011).

provide a feasible proxy means to link ecosystem services in physical and monetary terms to economic development and to deliver new indicators to support decision making at different scales, from the local to the global. Work is underway to produce physical accounts considering the ecosystems' potential to provide land, biomass/carbon, and water, as well as regulating and cultural services, and a toolbox to enable these accounts to be analysed against policy priorities using techniques such as multi-criteria analysis, now-casting, short-term forecasting and what-if scenarios. It includes the following elements:

1. First draft terrestrial ecosystem capital accounts in 2010 to support the impact assessment of the post-2010 biodiversity policy options.

2. Second draft terrestrial and marine accounts in 2011 to support discussions under the 2014-20 EU Financial Perspective as well as post-2010 biodiversity reflections and marine strategy objectives.

3. Final draft terrestrial and marine accounts in 2012 to support the above as well as the accounting objective under the Beyond GDP process and the EU and global (Rio+20) reviews of Sustainable Consumption and Production strategies and actions.

Box 3.3. Key messages from the European Environment Agency's work on ecosystem accounts

Some of the key messages that emerge from the European Environment Agency's recent work on ecosystem accounts are:

- ecosystem accounts are open frameworks that bring together different approaches to ecosystem assessment, such as those based on physical, monetary, or other criteria, and link them to efforts to value particular service outputs or the costs of ecosystem capital maintenance;
- since they are consistent with and part of the UN SEEA system and the UN System of National Accounts (SNA), ecosystem accounts potentially provide a robust and systematic framework for policy makers, because of the association to well established indicators such as GDP;
- to be most effective, accounting approaches must be implemented at different scales. Macro accounts can be developed with the support of Earth observation programmes (for example, GEO, GMES), and statistical networks (for example, Eurostat, UNCEEA, UNSD). Micro−scale accounts can be built at the level of individual public or private organisations and used to calculate complete ecosystem costs and benefits in the context of local needs such as infrastructure project assessments. While these tasks are challenging, there are currently insufficient data resources to enable such work to be started;
- the multi-functional character of ecosystems is a major issue for assessments. In many cases, ecosystem degradation results from the preference given to one or a very limited number of services: food, fibre or energy crops in agriculture, timber in forestry, fish in fishery and fish farming, navigation in estuaries or deltas. Such emphasis often means that stakeholders and decision-makers often overlook other services that generate ancillary products and public benefits, such as recreational or environmental regulation (for example, formation of soil, water regulation, or carbon storage and sequestration). Accounts provide an overarching framework in which these multi‑functional issues can be addressed.

Source: EEA (2010), *Ecosystem Accounting and the cost of biodiversity losses: The case of coastal Mediterranean wetlands*.

Practical applications in countries have also progressed, mainly in areas where the demand for accounting tools was clearly identified and linked to specific policy questions such as the management and planning of natural resource and materials use (*e.g.* water, energy, material flows) or pollution control (emission accounts) and the associated indicator development. Many OECD countries have set up environmental expenditure accounts and material flow accounts driven by international initiatives. A

review of experience with SEEA in 99 countries conducted by the UN Statistical Commission[28] showed that no country implements all elements of the SEEA. Most countries compile physical rather than economic accounts. The valuation of depletion and degradation of natural resources, and damage from pollution, is not widely implemented. No developed country compiles the monetary macroeconomic indicators described in SEEA. Only Australia and Canada compile monetary macroeconomic indicators with natural capital in annual balance sheets with total national wealth.

3) New measures of performance and progress

A number of recent initiatives have called for a "new generation of measurements" to bridge the gap between official statistics of economic performance, actual performance, and people's perception of it. These initiatives include:

- The Global project on "Measuring the progress of societies" initiated in 2004.
- The Beyond GDP initiative initiated in 2007.
- The Commission on "Measuring economic performance and social progress" also called the "Stiglitz-Sen-Fitoussi (SSF) Commission", initiated in 2008 by French President Sarkozy.[29]

The Global Project on Measuring the Progress of Societies,[30] initiated by the OECD in 2004, aims to develop a worldwide institutional partnership to improve methods and tools for measuring well-being and societal progress. The project looks at new approaches to measuring how societies are changing and how that affects citizens' quality of life, including environmental quality of life.

The European Commission's work on "GDP and Beyond: measuring progress in a changing world" aims to improve measures of progress, wealth and well-being, and to identify indicators that meet citizens' concerns and make the most of new technical and political developments. The initiative focusses on comprehensive measures of well-being, and on a better coverage of environmental and social aspects.[31]

The SSF Commission's report, released September 2009, highlights the increasingly important role of statistical indicators for designing and assessing policies, and for influencing and assessing economic markets. It points to the distance between statistical measures of a phenomenon and people's perception of the same phenomenon. It suggests that current measurement systems give a distorted view of economic performance, and fail to account for the long-term implications of decisions and "subjective" aspects of quality of life.

The SSF Commission's report's recommendations distinguish between: classical GDP issues focusing on the current material well-being; quality of life issues focusing on current immaterial well-being; and sustainability issues focusing on future (material and immaterial) well-being. Environmental issues are addressed under both the quality of life and sustainability headings.

The Stiglitz Commission report acknowledges the good progress that has been made in recent years in terms of measuring environmental conditions, primarily in physical terms. The report also supported the reluctance of many governments to develop aggregate environmental indicators intended to support

28. UNSD (2007).

29. See: *www.stiglitz-sen-fitoussi.fr*.

30. See: *www.oecd.org/progress.*

31. See: *www.beyond-gdp.eu*.

decision making because of their perceived opacity, methodological shortcomings, and potential for misinterpretation and misuse. However, from the perspective of assessing the contribution of environmental conditions to Quality of Life (QoL), the report suggested that existing indicators remain limited, and suggested a number of indicators to fill this gap.

These developments have stimulated a number of country initiatives. France for example has launched a multi-year programme on the further development of well-being and sustainability measures; the Uk has constructed a set of national well-being indicators.

Box 3.4. Indicators Proposed by the Stiglitz Commission to measure the Environmental Quality of Life

i) the number of premature deaths from exposure to air pollution, in particular from particulate pollution;

ii) the share of the population lacking access to water services, in particular water supply and sanitation;

iii) the share of the population without access to nature, with a focus on daily proximity and appropriate mapping;

iv) the share of the population exposed to daytime noise above 65dBA levels68, in particular noise in dwellings, to be collected through appropriate surveys and mapping;

v) information on the damage (both insured and non-insured) incurred due to environmental disasters, such as floods and droughts;

vi) measures and assessment tools for emerging environmental issues (*e.g.* endocrine disruptors, pesticides, non-ionising electromagnetic radiation) and their longer-term effects on QoL (*e.g.* from hazardous substances, climate change, biodiversity degradation, resource depletion);

vii) methods for valuing people's environmental choices (*e.g.* hedonic prices, valuation of externalities and of the services provided by ecosystems) and for supporting economic decisions related to the environment and QoL (costs of inaction, environment-related jobs; energy and material intensities); and finally

viii) surveys of people's own feelings and evaluations of the environmental conditions of their country and neighbourhood. As many of the effects of environmental conditions on QoL differ across various groups of people, these indicators should (when possible) refer to people grouped according to various classification criteria.

4) OECD Green Growth Strategy

The most recent initiative related to environmental information and decision making is the OECD Green Growth Strategy which was submitted to the annual meeting of the OECD Council at Ministerial level in May 2011. The Strategy defines green growth as "fostering economic growth and development while ensuring that the quality and quantity of natural assets can continue to provide the environmental services on which our well-being relies. It is also about fostering investment, competition and innovation which will underpin sustained growth and give rise to new economic opportunities."[32]

The Green Growth Strategy emphasises the dual nature of natural capital; as a factor of production, and as a source of well-being and welfare. It argues that there are important uncertainties about thresholds, irreversible outcomes and discontinuities – "planetary boundaries" – in the environmental goods and services that make up natural capital. If natural capital is not managed so as to avoid crossing these planetary boundaries, both economic activity and the functioning of critical ecosystems could be undermined. Thus the Green Growth Strategy advocates policies to better value and manage natural capital

32. OECD (2011b).

with a view to avoiding crossing such critical limits, and the elaboration of suitable indicators to track progress in this regard.

A companion report proposed an initial set of indicators to "serve as markers or milestones on a path of greening growth and of seizing new economic opportunities."[33] The indicator groups and topics proposed were:

Table 3.4. OECD Green Growth Strategy: Indicator groups and topics

1 The environmental and resource productivity of the economy	• Carbon and energy productivity • Resource productivity: materials, nutrients, water • Multi-factor productivity
2 The natural asset base	• Renewable stocks: water, forest, fish resources • Non-renewable stocks: mineral resources • Biodiversity and ecosystems
3 The environmental dimension of quality of life	• Environmental health and risks • Environmental services and amenities
4 Economic opportunities and policy responses	• Technology and innovation • Environmental goods & services • International financial flows • Prices and transfers • Skills and training • Regulations and management approaches
Socio-economic context and characteristics of growth	• Economic growth and structure • Productivity and trade • Labour markets, education and income • Socio-demographic patterns

The Green Growth Strategy argued that the multi-dimensional nature of green growth requires a sufficient number of indicators to do justice to the various aspects of the issue at hand. However, a large dashboard also carries the danger of losing a clear message that speaks to policy makers and helps communicate with the media and with citizens. It proposed that a small set of 'headline' indicators be selected that are able to track central elements of the green growth concept and that are representative of a broader set of green growth issues. Headline indicators are not necessarily the same as aggregate indicators which, as indicated above, have been criticised for their opacity, methodological shortcomings, and potential for misuse.

3.2. A new generation of environmental information

Drawing on the previous analysis, it is clear that OECD countries face significant challenges to adapt their environmental information systems to meet the evolving needs of decision makers. There is still much that needs to be done to strengthen environmental information in areas where demand has been evident for some time, *e.g.* biodiversity and the integration of environment into economic and sectoral decision making. There are new areas of concern requiring the development of new information sources, *e.g.* nanotechnology. There are also new demands from decision makers *e.g.* at subnational and city levels, or to support green growth strategies. Meeting these new challenges in the context of budget pressures and the demands on government to do more with less will not be easy. At the same time, there may be opportunities to streamline environmental information systems. This will require closer co-operation between Environment Ministries and Agencies and National Statistical Offices, and with scientists and economists.

33. OECD (2011c).

Drawing on the previous analysis, some of the main elements of the environmental measurement agenda facing the OECD and its members include:

- developing measures and indicators that could be related to the concept of planetary boundaries, and that would help to characterise anthropogenic intervention in the bio-geochemical cycles, in particular the carbon and nitrogen cycles;

- filling gaps in environmental-economic data at the industry level, and in other data needed to populate environmental-economic accounts in line with the SEEA framework;

- developing and improving the physical data for key stocks and flows of natural assets. Prominent examples are information on land and soil resources, non-e*nergy* mineral resources that often constitute critical inputs into production, and marine resources;

- improving waste and material flow data and related analyses;

- improving information on biodiversity**,** including forestry and and land use changes;

- developing monetary values reflecting prices and quantities for (changes in) key stocks and flows of natural assets. Such valuations, even if incomplete and imperfect are required for extended growth accounting models, more comprehensive balance sheets and for adjusted measures of real income and savings;

- developing better measures of environmentally related innovation;

- developing indicators on economic instruments and environmental regulation;

- improving information on the social aspects of environmental policies, such as their distributional and employment impacts;

- improving measures of both the objective and the subjective dimensions of quality of life, in particular measures of environmentally induced health problems and related costs; and public perceptions. This includes improved information on a number of hazardous substances such as heavy metals, nano-materials, pesticides and chemicals from pharmaceuticals or personal care products (*e.g.* endocrine-disrupters) that are still not well monitored.

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OBJECTIVE 4

THE SOCIAL AND ENVIRONMENT INTERFACE: ENHANCING THE QUALITY OF LIFE

Assessment

The social-environment interface covers a range of disparate, yet important, issues. Environmental health and environmental democracy have an important influence on the focus and orientation of environmental policy. Good progress has been made in both areas, though important challenges remain. Some progress has been made in analysing the employment and distributive implications of environmental policies, but managing them in an efficient, effective and equitable manner is often an impediment to policy implementation.

Available evidence suggests that long-range, regional and local air pollution are all important known *environmental health* risk for people in OECD countries, resulting in illness and premature death, and the related economic costs. Significant progress has been made in virtually all OECD countries to reduce air pollution from point sources. The major risks are now linked to the variety of pollution sources in urban areas, particularly motor vehicles.

Provision of water supply, sanitation and wastewater services also generates substantial benefits for public health, the economy and the environment. The benefit to cost ratio from the provision of basic water supply and sanitation services in developing countries may be as high as 7:1. Most OECD members have already reaped a substantial part of such benefits, but further efforts are needed to reduce health risks, including incidents of waterborne diseases in rural areas. Some OECD countries still have significant further capital investments to make to achieve high standards for wastewater treatment, and to renovate ageing infrastructure.

Important progress has been achieved through national and international efforts to manage the health and environmental impacts of chemicals, including the entry into force of the Stockholm and Rotterdam Conventions. Nevertheless, the challenge of managing chemicals remains daunting. Thousands of chemicals are on the market for which adequate information to assess human health effects is lacking, and new products enter the market each year. Products involving nanotechnology and biotechnology pose new challenges for protecting human health and the environment. International co-operation provides a cost-effective way to share the burden and to minimise the costs of investigating potential health and environmental impacts of chemicals which can be significant. Emerging economies are responsible for a growing share of production and trade in chemicals, and should be more actively engaged in co-operative efforts if these efforts are to be efficient and effective.

Some governments have begun to assess their preparedness for health-related consequences of climate change in the context of national adaptation strategies.

Environmental democracy has been strengthened over the last decade in OECD countries. Of the three pillars – access to information, public participation, and access to justice – progress is most advanced for the first two. Many countries have strengthened national legislation to enshrine right-to-know principles in both general and environmental laws, and have improved public consultation practices. The internet has

become the dominant pathway for disseminating environmental information, expanding the ways in which information is presented to the public and subsequently used.

During the 2000s, Strategic Environmental Assessment (SEA) has broadened the scope for public participation beyond projects to plans, programmes and policies at all levels. Within Europe, the UNECE Espoo Convention extended SEA to the transboundary context. OECD's Development Assistance Committee has promoted the integration of SEA into development co-operation.

Many governments have promoted public participation by providing financial support to NGOs because of the public good function they perform by bringing information and perspectives to decision making that would not otherwise be represented. Many governments now include NGO representatives on national delegations to international negotiations. A number of OECD governments, though not all, have begun to provide fuller information about the rationale for their decisions following public consultations. Despite these initiatives, environmental NGOs in some countries have continued to complain that public authorities have followed the letter rather than the spirit of legislation, and that this has impeded effective public participation.

Access to justice remains the most challenging aspect of environmental democracy. The most commonly cited obstacles include: restrictive standing for NGOs, the duration of judicial review, financial barriers, the need for *pro bono* legal services, and difficulties with obtaining injunctive relief.

The net impact of environmental policies on *employment* from an economy-wide perspective has generally been either neutral or slightly positive. However, individual sectors, such as electricity supply, may be positively or negatively affected. Some countries have used environmental taxes to shift the tax burden from labour to the environment. Labour market and skills policies can play an important role by helping workers to move from contracting to expanding sectors, and to assure a fairer sharing of adjustment costs occasioned by environmental related structural change. Environmental policies can also have locally significant effects on employment. In some countries, urban policies have been used to promote green growth and jobs.

Environmental taxes and increases in utility tariffs are often opposed because of their potential negative *distributional effects*. However, all environmental policy instruments have distributional impacts, but they are less visible. During the last decade, distributional impacts were particularly discussed in regard to water pricing. While access to water is considered as a human right by many countries, this does not imply it should be provided free of charge. Maintaining tariffs which provide incentives to reduce over-consumption and finance efficient and effective infrastructure, together with targeted support for poor households, should be the preferred policy.

There is evidence that in many countries the more disadvantaged sectors of the population suffer most from poor environmental conditions and have least access to nature and green space. However, there appears to have been little progress during the 2000s on producing policy-relevant information about this issue, or providing means to address it.

Introduction

Enhancing the quality of life

The focus on the social-environment interface in the Strategy is consistent with the sustainable development perspective which advocates a balance among economic, environmental and social concerns. While the economy-environment and economy-social interfaces have been extensively analysed, in 2001, when the Strategy was adopted, relatively little attention had been devoted to the social-environment interface.

Following the adoption of the Strategy, a social-environment chapter was prepared for all Member countries as part of the second cycle of the Environmental Performance Review programme. These chapters covered a wide range of issues. However, compiling information to conduct the analysis proved difficult, even though the issues examined often had an important bearing on the development and implementation of environmental policy. Thus one general conclusion arising from the review of the social-environment chapters in EPRs is that better information on this interface is needed to support environmental decision making.

Drawing on the second cycle of Environmental Performance Reviews and on work on environmental information, the issues addressed in this chapter are:

- environmental health;
- environmental democracy and education;
- environment and employment;
- distributional effects of environmental policies.

4.1. Environmental health

Historically the aim of reducing the health impact of pollution has been a driving force for the development of environmental legislation. From the end of the 19th Century, laws have been enacted to control the most egregious environmental health impacts involving acute poisoning from pollutants or other substances. More recently, there has been a growing understanding of the longer-term environmental risks to human health which can take the form of increased incidence of allergies and asthma, heart disease, reproductive and development effects, neurological disease and cancer. While acute and many longer-term environmentally related health impacts have been significantly reduced in OECD countries, in developing countries they are more frequent. Much of the global environmental burden of disease falls on low and middle income countries. The World Health Organization (WHO) estimates that exposures to outdoor and indoor air pollution, unsafe water supply and sanitation and climate change are responsible for around 8-9% of global premature deaths and burden of disease, and almost 25% of global premature deaths and burden of disease in children under 5 years of age (Table 4.1) (WHO, 2009a).

Table 4.1. Percentage of deaths attributable to four environmental risks, by region 2004

Risk	% Deaths		
	World	Low & Middle income countries	High income countries
Indoor smoke from solid fuels	3.3	3.9	0.0
Unsafe water, sanitation & hygiene	3.2	3.8	0.1
Urban outdoor air pollution	2.0	1.9	2.5
Global climate change	0.2	0.3	0.0
All 4 risks	8.7	9.9	2.6

Source: WHO (2009).

Whereas some environmental health risks are well known (*e.g.* SO_x NO_x, PM_{10}, $PM_{2.5}$ or heavy metal pollution), others (*e.g.* endocrine disrupters, nanomaterials or ultrafine particulate matter) are not. One of the main challenges in the area of environment and health is establishing the scientific basis to justify policy action. As cases like the health impacts of smoking demonstrate, establishing cause and effect can

be difficult. Yet waiting for causality to be scientifically "proven" may result in much death and disease. This was the underlying reason for the formulation of the Precautionary Principle at the 1992 Rio Conference. In its simplest form, the Precautionary Principle asserts that policy action can be justified when there is a reasonable body of evidence of risk to human health or the environment, even if the evidence falls short of a full scientific consensus. Throughout the last decade, operationalising this principle has proven difficult. Despite national and regional initiatives, there are still significant differences of views on how to apply this principle at the international level.

Environmental health impacts impose economic costs on individuals and societies. However, the benefits of avoiding environmental health impacts are often not recognised and hence underestimated in public policy decision making. For the more well-established environmental health risks, continued progress has been made in improving methodologies, collecting data, and strengthening the information base for decision making. OECD contributed to these efforts through work on the costs of inaction, including for the special case of children's health, and conducting analysis to promote a more consistent approach to the statistical value of life used in policy-related studies.

Over the last decade, and drawing on scientific and economic analysis, there have been a number of initiatives at both international and national level to promote more systematic approaches to environmental health issues. AWHO/Europe initiative that was launched in the 1990s set in motion an environment and health process involving many OECD countries (Box 4.1) from that region. As part of this process, countries developed National Environmental Health Action Plans (NEHAPs) and, from 2004, also Children's Environmental Health Action Plans (CEHAP).

Box 4.1. Examples of environmental health programmes: European Commission, Korea and Mexico

Under its 2003 European Environment and Health Strategy, the European Commission focused on generating the scientific information needed to establish causal links between environmental risk factors and disease, notably respiratory diseases, neuro-developmental disorders, cancer and endocrine disrupting effects. The following year, it adopted the 2004-10 Environment & Health Action Plan and began funding a programme of activities aimed at, inter alia, developing standardised methodologies (*e.g.* a project on human bio-monitoring), and the establishment of an environmental health information system (ENHIS).

The Korean National Environmental Health Action Plan 2006-15 was formulated co-operatively with civic groups and academic experts and aims to make Korea one of the world's ten leading nations in terms of environmental health by protecting the biologically vulnerable (children and the elderly) and the socially disadvantaged (lower income groups). Some of its main objectives are: establish an environmental health surveillance system and institute; develop an integrated environment and health information system; adopt an Environmental Health Act; and develop risk information, communication and the right-to-know.

The Mexican Environmental Health Action Programme 2001-06 set some specific health targets: 30% reduction of respiratory illnesses due to children's exposure to indoor pollution; 15% reduction of average population exposure to atmospheric pollutants; 70% reduction of incidence of high child blood levels; and a guarantee of access to safe drinking water by 70% of the population.

Sources: Ministry of Environment (2009), *Korean National Environmental Health Action Plan toward 10 years - Annual Review 2009*, *www.environment-health.asia/fileupload/KNEHAP.pdf.* and OECD (2003), *OECD Environmental Performance Reviews: Mexico*, OECD, Paris.

Other examples of environmental health-related international actions taken during the past decade include the WHO/UNECE initiative on Transport, Health and Environment, and the Protocol on Water and Health (to the UNECE Helsinki Convention on the Protection and Use of Transboundary Watercourses and International Lakes), which entered into force in 2005.

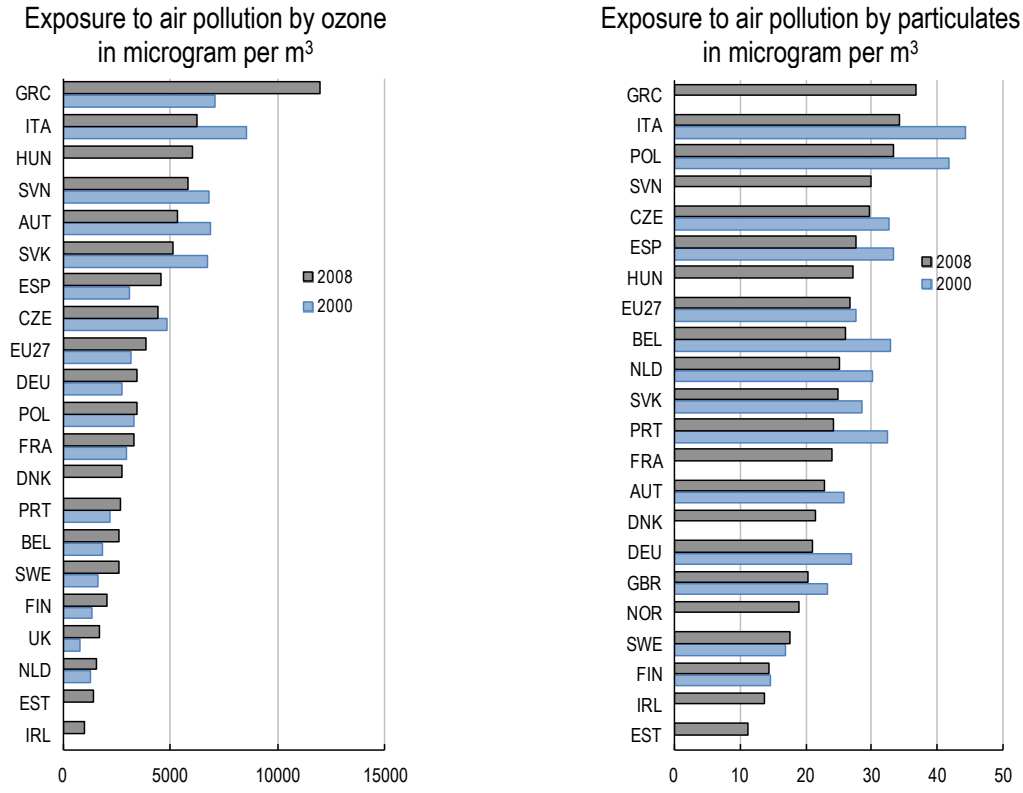
4.1.1. Outdoor air pollution

Air pollution is one of the most serious environmental factors adversely affecting human health. Exposure to outdoor air pollution, particularly ground level ozone and airborne particulate matter (PM_{10} and $PM_{2.5}$), can cause eye and respiratory irritation, cardiovascular disease, lung cancer and premature death. Even though the mechanisms through which these effects occur are not yet fully understood, it is clear that children, the elderly and those with pre-existing cardio-pulmonary diseases are particularly vulnerable. Within Europe, each year an estimated 5 million years of life are lost due to exposure to fine particles (EEA, 2010). In the US the total annual external damages from sulphur dioxide, nitrogen oxides, and particulate matter created by burning coal were about USD 62 billion in 2005. A relatively small number of plants, 10%, accounted for 43% of the damages (US National Research Council, 2009).

Economic research suggests that environmental policies resulting in improved air quality are generally cost-efficient, even when only health benefits (*i.e.* not counting social and environmental benefits) are considered. The avoidance of premature mortality forms the largest part of these health benefits. Also, policies targeting several pollutants at the same time are more efficient than single-pollutant policies (Scapecchi, 2008). A 2010 study of the total (health, social, ecological) benefits and costs of the totality of abatement policies of the U.S. 1990 Clean Air Act Amendments to the year 2020 estimated an overall benefit-to-cost ratio as high as 28 to 1 (US EPA, 2010). Although several studies have suggested that the high cost of ozone abatement policies tends to produce negative net benefits in the short term, the prevention of ozone increase and the long-term emission and concentration reductions are likely to provide positive and substantial net benefits.

Leaving aside natural sources (*e.g.* pollen, wind-blown soil particles, forest fires), air pollution is caused by local and transported over long distances emissions from a host of stationary and mobile sources. While the public's exposure to SO_2 has been most significantly reduced, the health effects of exposure to ground level ozone, NO_2, fine particulates and toxic air pollutants are of growing concern. As of 2010 almost 60% of the population of large cities in the OECD area were exposed to PM_{10} concentrations above the WHO Air Quality Guideline level of 20 $\mu g/m^3$ (Figure 4.1).

Figure 4.1. Population exposure to urban air pollution in Europe, selected countries, 2000, 2008



Source: European Environment Agency (EEA).

In most OECD countries, policy interventions have become increasingly integrated since the mid-1990s, covering both stationary and mobile sources of pollution. National strategies typically combine ambient quality standards, economic instruments, emission rules, monitoring and modelling, the designation of air management zones, air quality plans, public information, and supporting measures such as fuel quality standards.

Considerable progress has been achieved in reducing emissions from stationary sources. Command and control measures, including "Best Available Technologies", remained the main policy instrument to reduce emission from industrial combustion (power plants, refineries and the manufacturing sector). For instance, the 1998 and 2003 Australian National Environment Protection Standard (NEPM) for Ambient Air Quality set standards for air quality across all states, including targets for a range of air pollutants. The 1996 EU Air Quality Framework Directive was followed, between 1999 and 2004, by four "daughter directives" that set ambient air quality standards for SO_2, NO_2, NO_x, PM_{10}, lead, benzene, CO, ozone, arsenic, cadmium, mercury, nickel and polycyclic aromatic halogens (PAHs). Directive 2008/50/EC on ambient air quality and cleaner air for Europe contained enhanced reporting requirements intended to facilitate health impact assessment. In recognition of the growing awareness of the health risks of very fine particles, an increasing number of countries have extended regulation to encompass $PM_{2.5}$.

Some countries have complemented regulatory approaches with market-based instruments. In the U.S, cap-and-trade schemes were implemented for SO_2, NO_2 or both. It was estimated that the shift from

standard-based regulation to permit trading in the US in the late 1990s yielded compliance cost savings of USD 153-358 million. In Sweden, a tax on NO_x is credited with stimulating innovation and the diffusion of cleaner technologies.

Japan has developed a unique and effective approach based on liability for combating the health impacts of air pollution. The right of victims to compensation for pollution-related health damage is written into law, including compensation for diseases caused by air pollution. In 1988, the law became more prevention-oriented. The total amount paid in compensation between 1974 and 2006 is around JPY 2 400 billion, a figure equal to 0.5% of Japan's GDP (as of 2005). A Tokyo High Court case recognised that both the government and car manufacturers could be held liable for the asthma of some of the plaintiffs. As a result, car manufacturers will contribute JPY 3.3 billion, the national government JPY 6 billion, and the Tokyo Metropolitan government JPY 6 billion for compensation, medical programmes and a 5-year health plan. The plaintiffs will receive JPY 1.2 billion in direct compensation.

Health impacts related to air pollution are now largely due to the concentration of pollution sources in urban areas and to the increasing use of private vehicles for urban trips which exacerbate impacts of point sources of pollution (local and long-range). Gradual tightening of emission standards for new car models has helped to reduce emissions of hydrocarbons (HC), NO_x, CO and PM from motor vehicles. U.S., EU and Japanese standards have converged significantly, notably since about the middle of the last decade. The combined effect of improved car technology and improved fuel quality has considerably reduced emissions per unit of distance driven, though this has been offset by increased distance travelled. To make sure vehicles maintain performance standards, many countries require emission tests in their inspection regimes for in-use vehicles.

A variety of economic instruments have also contributed to reducing emissions from vehicles. Most countries now levy a sales tax and an annual car tax. Increasingly these taxes are linked to CO_2 emissions, and have contributed to reducing the emissions intensity of national car fleets. The Israeli car tax is novel in that it covers several air pollutants and weights them according to their health and environmental impacts (OECD, 2011a).

Taxes applied to vehicle fuels are also widely used in OECD countries. They have the advantage of targeting car usage rather than car ownership. There is also a growing interest in some countries to introduce congestion and/or toll charges. These issues are discussed further under Objective 2.

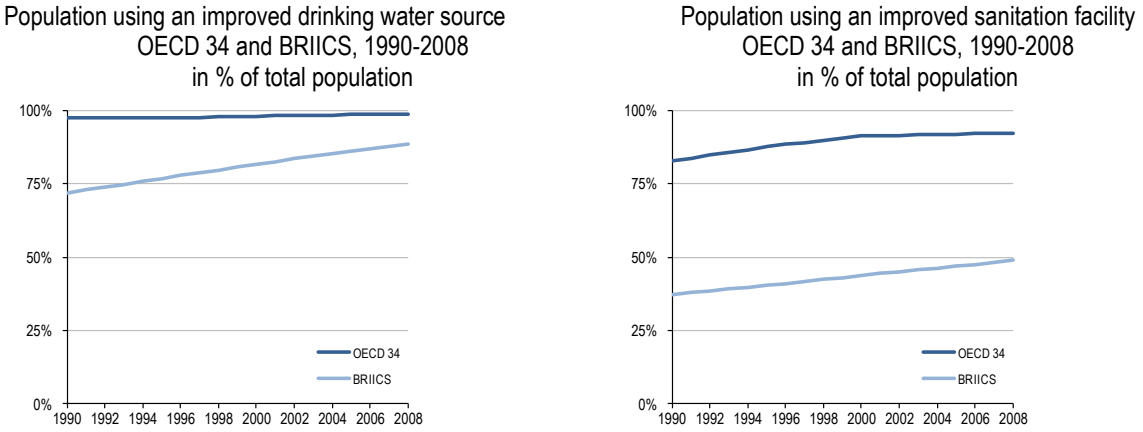
4.1.2. Water supply and sanitation

The provision of water supply, sanitation and wastewater services generates substantial benefits for public health, the economy and the environment. Benefits are substantial and outstrip costs. A US EPA study estimates the net benefits from water legislation at about USD 11 billion annually. A similar study in the UK suggested that implementing the EU Water Framework Directive would generate net benefits to England and Wales of USD 10 billion.

Many of the public health benefits from investments in water infrastructure have already been captured in most, though not all, OECD countries, and the marginal rate of return on additional investments is decreasing. Only a very small percentage of the population in OECD countries does not have access to improved sanitation facilities (Figure 4.2). Even so, over the past decade several incidents causing widespread illness and some deaths, as well as more frequent health warnings ("boil-water notices", problems with lead), have underlined the importance of effective maintenance and the need to maintain the integrity of existing water infrastructure. For example, incidents with contaminated raw water in Canada in 2000 and 2001, in Norway in 2004, and in Ireland in 2007 showed the need for additional investment, well-functioning quality assurance systems, and improved accountability. The incidents

prompted a re-examination of management practices and new drinking water legislation in several Member countries. The continued presence of old lead water pipes in city centres has caused breaches of drinking water standards, some of which were only discovered when improvements were made to the monitoring of tap water quality.

Figure 4.2. Population with access to improved water and sanitation, selected countries, 2000, 2008



Source: UNSD Millennium Development Goals.

Some OECD countries still have significant capital investments to make, particularly to achieve high standards for wastewater treatment. In all OECD countries, the costs of adequately maintaining existing infrastructure are significant. In many OECD countries, water infrastructure was constructed many years ago and will gradually have to be replaced. An OECD study assessed that the UK and France would have to increase their water spending as a share of GDP by about 20% to maintain water services at current levels; Japan and Korea may have to increase their water spending by more than 40% (OECD, 2006). As a result, water charges in many countries will continue to increase. This in turn may pose a problem to ensure continued access to water services for poorer sections of the population who cannot afford higher levels of water charges (this issue is considered further below).

In areas with a highly intensive agriculture, excessive nitrate concentration in groundwater has forced some water supply utilities to look further afield for new water sources. High nitrate concentrations in water can cause methemoglobinemia which can cause brain damage or death in infants and lead lead, under certain conditions, to the appearance of carcinogenic nitrite. Contamination of rural household wells by animal manure and poorly maintained septic tanks also remains a problem. Bathing waters not complying with recreational water quality standards, particularly in inland waters, are a further cause of gastro-intestinal diseases, even though the magnitude of the problem it is not always clear due to widespread under-reporting.

4.1.3. Chemicals

The long term impacts of chemicals on human health and the environment have been a public policy issue since the 1960s, both nationally and internationally. For 40 years, the OECD chemicals programme has supported these efforts. During the 2000s, the continued growth in chemicals production and trade prompted several responses at the global level: the adoption of the UN Globally Harmonised System of Classification and Labelling of Chemicals – GHS (2003); the entry into force of the Rotterdam Convention on Prior Informed Consent for Trade in Hazardous Chemicals and Pesticides in International Trade (2004) and the Stockholm Convention on Persistent Organic Pollutants (2004); and the adoption of a Strategic Approach to International Chemicals Management - SAICM (2006).

SAICM involves several UN organisations[34] as well as the OECD and is intended to provide a policy framework to promote chemical safety around the world. In 2008, the OECD Council adopted a Resolution C(2008)32 on the Implementation of the SAICM calling for countries to work through the OECD to ensure that, as chemicals management programmes are established or upgraded, OECD products are accessible, relevant and useful to non-members, to help developing countries to strengthen their capacities for managing chemicals.

The OECD chemicals programme focuses primarily on developing methods to test the potential health and environmental effects of chemicals, and the associated procedures to guarantee the quality of the test data produced. The 1981 Council Decision on the Mutual Acceptance of Data (MAD) in the testing and assessment of chemicals requires adherents to accept test data produced in other adhering countries when it is produced using OECD test guidelines and principles of good laboratory practice. During the 2000s, several non-Members joined this scheme. Currently there are 39 adherents.[35]

The OECD Council Decision on MAD helps to avoid duplicative testing and non-tariff barriers to trade in chemicals. The cost of testing chemicals can be significant; for example, for a pesticide company to test one new active ingredient for health and environmental effects is approximately EUR 17 million. The time needed for a government to review and assess these data is approximately 2.2 person-years. A recent study estimated that the annual savings to business and government associated with the Council Decision on MAD was approximately EUR 150 million per year (OECD, 2010a).

In parallel with developments at the international level, there were a number of important developments related to chemicals control in OECD Member countries during the 2000s. In 2008, the EU established a dedicated agency, the European Chemicals Agency (ECHA), responsible for managing the implementation of the REACH regulation in relation to the registration, evaluation, authorisation and restriction processes of chemical substances. The REACH regulation put the management of existing and new chemicals on a level playing field by requiring the assessment of all chemicals on the European market, not just new ones as had previously been the case. Furthermore, the burden of testing was shifted from governments to industry.

Several other Member countries also made significant changes in national chemicals management programmes, including by incorporating the GHS into their chemicals regime. Many of these new initiatives concern enhancement of data collection, extension of regulatory coverage to include existing chemicals, and incentives for the use of safer and more environmentally benign chemicals. For example, a 2009 amendment to the Japanese Chemical Substances Control Law (Kashinho) created a common legal framework for all new and existing industrial chemicals, introducing enhanced risk assessment procedures and the annual notification of production and import quantities of all chemical substances above a threshold (OECD, 2010; OECD 2012). In Canada, the 2006 Chemicals Management Plan has created a framework for protecting the health of Canadians and their environment from the potential risks posed by legacy chemicals that have not previously been assessed.

From the 1990s, OECD work gradually extended beyond chemicals to include pesticides, biocides and products of modern biotechnology. Most recently challenges related to safety of nanomaterials was considered in more detail. In 2006 a Working Party on Manufactured Nanomaterials was established to focus on the implications for the safety for human health and the environment of the use of nanomaterials and to establish appropriate testing and assessment methods.

34. FAO, ILO, UNEP, UNIDO, the United Nations Institute for Training and Research (UNITAR), WHO, UNDP, World Bank.

35. In addition to the 34 OECD members, these include Argentina, Brazil, India, South African and Singapore.

Despite the progress achieved through national and international efforts, the challenge of managing chemicals remains daunting. Thousands of chemicals are on the market for which information to assess human health effects is lacking, and new products enter the market each year. Uncertainties remain about impacts of "low dose" and chronic exposure to pollutants. International co-operation provides a cost-effective way to share the burden and to minimise the costs of investigating potential health and environmental impacts of chemicals which can be significant. Engaging emerging economies who are responsible for a growing share of production and trade in chemicals more actively in co-operative efforts is essential if they are to be successful.

4.1.4. Climate change

Climate change can have significant effects on human health. A warmer climate will affect the concentration and dispersion of air pollutants and hence influence air quality, notably in terms of tropospheric ozone. More frequent heat waves in temperate climate countries would lead to a rise in mortality. Allergic disorders may be worsened by changed and prolonged pollen seasonality. Infectious diseases carried by ticks or mosquitoes could increase in a warming climate. Higher temperatures combined with a changing frequency and intensity of rainfall could cause outbreaks of waterborne diseases in bathing waters or contaminate drinking water. Increased risk of flooding and forest fires would further affect human health.

Some governments have begun to assess their preparedness for health-related consequences of climate change in the context of national adaptation strategies. Systems and practices are already in place to conduct epidemiological surveillance, control communicable diseases, and respond to the effects of extreme events (Box 4.2). However, they may have to be strengthened to cope with new demands related to climate change. Emergency preparedness may also have to be enhanced to respond to damage to environmental infrastructure (*e.g.* drinking water purification stations, sewage treatment stations and pipe networks), and related second-order health effects, resulting from larger and more frequent extreme weather events. At the same time, environmental infrastructure should be made more resilient to such events, in the same way as is already happening in earthquake-prone countries.

Box 4.2. Responding to the health impacts associated with climate change in France and Australia

After a 2003 heat wave caused close to 15 000 deaths in France, the French government adopted a national heat wave plan (Plan national canicule), which assigns responsibilities for warnings, prevention and action to authorities at national, departmental and local levels. Subsequent episodes in 2006, 2009 and 2010 caused far fewer deaths than the 2003 event, perhaps in part due to the actions taken under the plan. The 2003 heat wave also caused almost a thousand deaths in Switzerland. Since then, the Swiss ministries of health and the environment have provided guidance (*e.g.* by way of a flyer with the title of "Hot days - cool heads") to citizens and health professionals about what to do during periods of extreme heat and associated high concentrations of low-level ozone.

A 2009 Australian government study on the risks from climate change to indigenous communities in the tropical North of Australia found that climate change is expected to elevate existing and create new health risks for indigenous people. These include: increasing incidence of heat stress and dehydration, respiratory illnesses and increased transferability of disease such as melioidosis. Indirect impacts such as reduction in bush food yields, disruption of fisheries, loss of livelihoods, and population displacement due to sea level rise were also assessed as significant. The holistic conception of human health articulated by many indigenous people may be a source of vulnerability in that disruptions that affect sacred sites and hunting grounds may be felt strongly and adversely affect psycho-social as well as physical well-being.

Sources: Ministère du Travail, de l'Emploi et de la Santé (2011), *Le plan national canicule*, version 2011. *www.sante.gouv.fr/IMG/pdf/plan_national_canicule_PNC-2011__VF_23_mai_.pdf*, *www.bag.admin.ch/themen/gesundheitspolitik/00403/03965/index.html?lang=de*.; Green D, S Jackson and J Morrison (2009), Risks from Climate Change to Indigenous Communities in the Tropical North of Australia, Department of Climate Change and Energy Efficiency: Canberra, *www.climatechange.gov.au/publications/adaptation/risks-from-climate-change-to-indigenous-communities.aspx*.

4.1.5. Access to nature and urban green space

Access to green spaces – gardens, parks and open countryside – has been shown to provide physical and mental health benefits for people of all ages. Benefits can be direct or indirect, and be realised through physical exercise or social contact. Studies suggest that the amount of green space in a person's residential area is positively associated with their perceived general health. Access to nature and green environments yields better cognitive functioning, more self-discipline and impulse control, and greater mental health overall. Less access is linked to exacerbated attention deficit/hyperactivity disorder symptoms, higher rates of anxiety disorders, and higher rates of clinical depression (Kuo, 2010).

Urban planners generally allow for green spaces in newly developed residential areas and there are many examples of retrofitting green space as part of the renovation of run-down parts of existing cities. Urban indicators being developed for the OECD Green Cities project[36] include indicators measuring the share of urban populations that have easy access to urban green space as part of their daily living environment.

4.2. Environmental democracy and education

The concept of environmental democracy is generally understood to embrace three distinct pillars:

- *Provision of, and access to, environmental information*, *i.e.* the right to receive environmental information held by public authorities. This can include information on the state of the environment (SoE), but also on policies or measures taken, or on the state of human health and safety where this can be affected by the state of the environment.
- *Public participation in environmental decision-making*, *i.e.* the right to participate in environmental decision-making. Arrangements are to be made by public authorities to enable the public affected and environmental non-governmental organisations to comment on, for example, proposals for projects affecting the environment, or plans and programmes relating to the environment, these comments to be taken into due account in decision-making, and information to be provided on the final decisions and the reasons for it.
- *Access to justice in environmental matters*, *i.e.* the right to review procedures and challenge public decisions that have been made without respecting the two aforementioned rights or environmental law in general.

Throughout the last decade, the implementation of the first two pillars has been more advanced than that of the third pillar. On the whole, an improvement in environmental democracy in most OECD countries can be observed, with countries fine-tuning national legislation to enshrine right-to-know principles in both general and environmental access to information laws, and improving public consultation practices. Nevertheless, progress has been uneven and in most countries there is room for further improvement.

Given the complexity and widening scope of environmental policy issues, environmental education, at all levels, is providing an increasingly important underpinning for environmental democracy.

36. See: *www.oecd.org/greencities.*

4.2.1. Access to environmental information

Legal foundations for environmental information and reporting, and for providing access to environmental information for the public, are now in place in virtually all OECD countries (Table 4.2). For example, in 2005, the principle of right of access to environmental information for the public formed part of the Environmental Charter incorporated in the Preamble of the French Constitution, alongside human rights and economic and social rights. In Ireland, the 2007 Regulations on Access to Information on the Environment provided a statutory, independent appeal mechanism, and established the office of the Commissioner for Environmental Information with the power to make binding decisions. The Commissioner publishes an annual report that gives details and statistics about the issues that have arisen during the year.

International legal acts have supported national action in this area. Such acts include the 1998 OECD Council Recommendation on Environmental Information. A landmark development was the adoption within the UN Economic Commission for Europe (UNECE) region of the 1998 Aarhus Convention on Access to Information, Public Participation on Decision-making and Access to Justice in Environmental Matters. The Aarhus Convention has been highly influential within the UNECE region, and is open for accession by states outside the region. The EU Directive on public access to environmental information (2003/4/EC) implements the Aarhus Convention at EU level.

Table 4.2. Environmental information and reporting: Legal basis in OECD countries[a]

	Aarhus Convention[b]		National legal basis	
	Convention	PRTR protocol	Environmental information & reporting	Access to environmental information
Australia	n.a. (not applicable)	n.a..	Yes	Yes
Austria	S, R	S, R	Yes	Yes
Belgium	S, R	S, R	Yes	Yes
Canada	–	–	Yes	Yes
Chile	n.a..	n.a..	Yes	Yes
Czech Rep.	S, R	S, R	Yes	Yes
Denmark	S, AA	S, R	Yes	Yes
Estonia	S, R	S, AA	Yes	Yes
Finland	S, A	S, A	Yes	Yes
France	S, AA	S, AA	Yes	Yes
Germany	S, R	S, R	Yes	Yes
Greece	S, R	S	Yes	Yes
Hungary	S, R	S, R	Yes	Yes
Iceland	S	–	n/a (not available)	n/a
Ireland	S	S	Yes	Yes
Israel	–	–	Yes	Yes
Italy	S, R	S	Yes	Yes
Japan	n.a..	n.a..	Yes	Yes
Korea	n.a..	n.a..	Yes	Yes
Luxembourg	S, R	S, R	Yes	Yes
Mexico	n.a.	n.a.	Yes	Yes
Netherlands	S, A	S, A	Yes	Yes
New Zealand	n.a..	n.a..	Yes	Yes
Norway	S, R	S, AA	Yes	Yes
Poland	S, R	S	Yes	Yes
Portugal	S, R	S, R	Yes	Yes
Slovak Rep.	A	a	Yes	Yes
Slovenia	S, R	S, R	Yes	Yes
Spain	S, R	S, R	Yes	Yes
Sweden	S, R	S, R	Yes	Yes
Switzerland	S	S, R	Yes	Yes
Turkey	–	–	Yes	Yes
United Kingdom	S, R	S, R	Yes	Yes
United States	–	–	Yes	Yes

Notes:
(a) All OECD member countries have expressed their political will to implement the following OECD Council Recommendations:
Recommendation by the Council on Reporting on the State of the Environment (adopted by the OECD Council in May 1979).
Recommendation by the Council on Environmental Indicators and Information (adopted by the OECD Council in January 1991).
Recommendation by the Council on Environmental Information (adopted by the OECD Council in April 1998).
Recommendation by the Council on Implementing Pollutant Release and Transfer Registers (PRTRs) (adopted by the OECD Council in February 1996, amended in May 2003).
Recommendation by the Council on Material Flows and Resource Productivity (adopted by the OECD Council in April 2004).
Recommendation by the Council on Resource Productivity (adopted by the OECD Council in March 2008).
(b) UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (adopted in June 1998); protocol on PRTRs adopted in May 2003.
S=signature; R=ratification; A=acceptance; AA=approval; a=accession

In the last decade there has been a considerable extension in the use of environmental reports, user-friendly brochures, headline indicators and other tools to inform senior policy-makers, legislators, the media and the general public about the state of the environment, and government actions to maintain and improve environmental quality. Apart from national environmental institutions, many other national, regional and local agencies also produce environmental reports. Arrangements for environmental reporting in OECD countries are presented in Annex 1.

In a number of countries, regular environmental reporting now concentrates on fewer products and publications, and on web-based reporting, often based on indicators. The trend has been for a greater

number of thematic reports and customer tailored products, and fewer comprehensive SoE type of publications. The regular updating of key or headline indicators is increasingly done in electronic or booklet form, and some of the most long-standing environmental reports are no longer published on paper (see Annex 2).

The internet has become the dominant pathway for disseminating environmental information during the past decade, substantially increasing the size of the potential audience. Some material nowadays is only published in electronic form. While this has advantages from an environmental perspective (savings in paper use, transport, etc.), there is a risk that it may exclude those parts of the population without easy access to the internet. Suitably equipped public libraries may help to alleviate this problem.

Box 4.3. Green Growth and green jobs in US cities

Many US cities are engaged in promoting green sector jobs, including the cities in the Chicago tri-state region that were the focus of a recent OECD study. The City of Chicago has an ambitious environmental agenda, including its Climate Change Action Plan, and the Chicago Sustainable Industries Plan. Chicago puts a strong emphasis on green manufacturing jobs. Nearby, the Milwaukee metro-region has the most significant water technology cluster in the US, based around universities such as the University of Wisconsin at Milwaukee. The number of green jobs in the Chicago Tri-State metro-region grew from approximately 38 000 in 2003 to 45 000 in 2010 (not including public transit and waste management sector, which would add about 34 000 jobs). Building-related activities account for the highest proportion (36%) of green jobs in the region, followed by energy-related green jobs (11%). The City of Chicago has the highest number of LEED certified square-footage in the US, which contributes to local demand for green energy, architecture & construction services, and energy-efficiency technologies.

Other US cities also have strong green growth agendas. Over 1 000 mayors of US cities have joined the US Conference of Mayors' Climate Protection Agreement, aiming to reduce carbon emissions in their cities below 1990 levels. Three cities in particular: Boston, Seattle and New York City, are compiling regular greenhouse gas emissions inventories (every one or two years) and have achieved reductions in per capita emissions (Kennedy *et al*., 2012). San Francisco was the first US city to require mandatory composting and recycling for all residential and commercial properties, including food establishments and events. San Francisco was considered the greenest city in North America in a study conducted by the Economist Intelligence Unit (commissioned by Siemens), based on its performance on environmental indicators in nine areas: GHGs, energy, land use, buildings, transport, water, waste, air and environmental governance.

Sources: OECD (2011c) and Kennedy, *et al.,* (2012, forthcoming).

The internet is not only a substitute for printed material: as the speed of data transmission increases, it also vastly expands the ways in which information can be presented to the public and subsequently used. The internet also allows new environmental information to be made publicly available more quickly, sometimes in real time. A number of countries have developed interactive, web-based tools, including geographic information systems and maps where users can find location-specific data (*e.g.* air quality, bathing water quality, pollutant releases). The amount of information now available sometimes makes it difficult for users to find what they are looking for. Increasingly, governments are challenged to design their environmental information services so as to be more user-friendly, including for the business community which is subject to environmental requirements.

Notwithstanding the availability of a considerable amount of environmental information in electronic form, the public may need to request environmental information. In some countries there have been complaints that the time required to receive requested information, and the costs involved, represent impediments to accessing environmental information. Clearly responding to requests for information takes time and incurs costs for environmental administrations. Nevertheless, adequate provision should be made for responding to public requests, and the costs of providing information kept to a minimum.

Large firms in the private sector have in the past ten years or so have become more accountable by publishing "triple bottom line reports", covering the financial, environmental and social dimensions of their operations. The quality of these reports is gradually improving, supported by the Global Reporting Initiative (2011), and similar mechanisms. Environmental NGOs, research institutes and independent think tanks have also contributed to the public debate through the preparation of policy reports and the dissemination of indicators and composite indices, sometimes based on independent data collection and analysis.

Another significant information source that has become more widely available during the last decade is Pollution Release and Transfer Registers (PRTRs). These allow the public to learn about the potentially harmful substances to which they may be exposed. Initially conceived as a register of point sources of toxic substances (*e.g.* the U.S. Toxics Release Inventory), an increasing number of PRTRs now include non-toxic substances and diffuse sources of pollution (*e.g.* P and N from agriculture). The OECD was instrumental in developing this initiative (Council Recommendations C(96)41/FINAL and C(2003)87), which has since been further supported by the 2003 Kiev Protocol (to the UNECE Aarhus Convention) on Pollutant Release and Transfer Registers that entered into force in October 2009. Most Member countries have a mandatory PRTR and the implementation of the OECD Council Recommendation is almost completed (see Annex 3). PRTR data are generally available to the public in electronic format, most often on a public website. Almost all data are available at the facility level and are displayed on maps. Not all countries have yet a national PRTR website, but data for EU member states are publicly available on the EU's E-PRTR website[37] and the websites of 23 OECD countries are currently linked to the Global PRTR Portal.[38]

4.2.2. Public participation

Statutory public participation processes for environmental decision-making began to be introduced in the early 1970s as part of Environmental Impact Assessment (EIA) legislation related to large public and private development projects. Public participation practices slowly evolved from the early period when the public and environmental NGOs complained that public authorities tried to avoid or subvert formal consultation requirements by various means such as splitting large projects into smaller ones, by releasing proposals just before the summer holidays, or staging EIAs late in the decision-making process. Differences among the administrative cultures of Member countries persist and such tactics have not disappeared entirely, although much progress has been made. The OECD prepared a handbook on information, consultation and public participation (OECD, 2001), intended to help public agencies to conduct open and efficient public consultation exercises. The handbook was translated into seven languages.

In the 2000s, Strategic Environmental Assessment (SEA) extended the scope of environmental assessment to land use planning, government laws and regulations, and to a variety of plans, programmes and policies by governments at all levels. In Europe, the Aarhus Convention and the EU (through directives 2001/42/EC and 2003/35/EC) did much to drive this development. Progress has also been made outside Europe: for instance, in 2002, Canada issued a Federal Policy Statement and Guidelines on Engaging Canadians, which outlines roles and responsibilities in engaging citizens in government decision-making, and which was intended to reinforce a consultative culture in the federal government.

A 2003 protocol to the UNECE Espoo Convention, which entered into force in 2010, extended the SEA concept to the transboundary context. In 2006, the DAC produced, "Good Practice Guidance on

37. See: *http://prtr.ec.europa.eu/*.

38. See: *www.prtr.net.*

Applying SEA in Development Co-operation". The DAC subsequently published several advisory notes on how SEA could be applied in specific areas.

The advent of the internet has transformed the public consultation process. Public meetings and hearings, where officials can explain their proposals and listen to the views of stakeholders, are still an essential part of consultation practices. However, environment and other ministries now routinely use their websites to publish information relevant to proposed legislation, plans and policies. Stakeholders can normally make submissions on-line if they do not wish, or are unable, to appear in person at a hearing.

Notwithstanding the progress made in most countries in providing opportunities for public participation in wide range of situations and in a variety of ways, NGOs and others still complain about the poor feedback from authorities. They consider that they are not always told why their arguments have been ignored or rejected. Responding to this concern, some countries make the full text of Cabinet papers, together with associated documents such as economic and regulatory impact assessment, available on the internet once decisions have been made. In other cases, ministries make summaries of their analysis of public submissions available on their website, together with an explanation of how submissions were taken into account. However, these "good practices" are not yet widely followed.

Environmental NGOs fulfil an important public function by bringing information and perspectives to decision making that would not otherwise be represented. Recognising this, many governments financially support NGOs; for example, by providing free office space, or in the form of contracts to perform defined tasks. In countries where stakeholder advisory bodies are part of the institutional landscape, the inclusion of environmental NGOs together with economic interests facilitates balanced and credible decision making. Moreover, it is no longer unusual for countries to include NGOs in official delegations to international environmental conferences or negotiations.

4.2.3. Access to justice

Arrangements for providing access to justice are as varied as Member countries' legal systems, democratic traditions and legal cultures (UNECE, 2008). Countries are therefore faced with their own particular legal and practical difficulties in providing access to justice on environmental matters. The experience with regards to the Aarhus Convention shows that access to justice still presents the main challenge among the Convention's three pillars. Restrictive standing for NGOs, the duration of judicial review, financial barriers, the need for pro bono legal services, and difficulties with obtaining injunctive relief are among the main obstacles observed.

Various appeal mechanisms are available regarding access to information depending on the administrative system of the country, including: courts of law, administrative courts at federal, national or regional levels, independent government appeal committees, independent tribunals, and offices of the ombudsman. These mechanisms may have been created under laws dealing with freedom of information (and/or the press), with the administration of justice, or with environmental information. Similarly diverse arrangements exist for appealing decisions taken following EIA procedures; some countries require NGOs to be officially recognised by a public agency (using criteria defined under administrative or environmental law) before granting *locus standi*, whereas no such demands are made in other countries.

A recent case (C-240/09) before the European Court of Justice ruled that the Aarhus Convention does not give EU citizens or NGOs a direct right to intervene where public or private bodies take unlawful legal or administrative decisions. Public authorities sometimes favour a narrower interpretation of terms like "affected," the "public concerned" or "environmental information" than NGOs would like. Other problems can be attributed to inconsistent definitions of various terms among different pieces of legislation. In New

Zealand, standing was made more circumscribed in 2009 to prevent economic interests from abusing the environmental permitting process to halt or slow down the development proposals of competitors.

The financial cost of bringing appeals to court also varies significantly among countries, as do the potential financial consequences of losing a case. Some countries provide legal aid to those who cannot afford to bring a case, while others waive court fees or the requirement to have formal legal representation in such cases. Often, the losing party bears the cost of the litigation (though not always the legal costs of the opposing party). Sometimes each party covers its own cost. Mediation or conciliation are also used where the case involves private parties only.

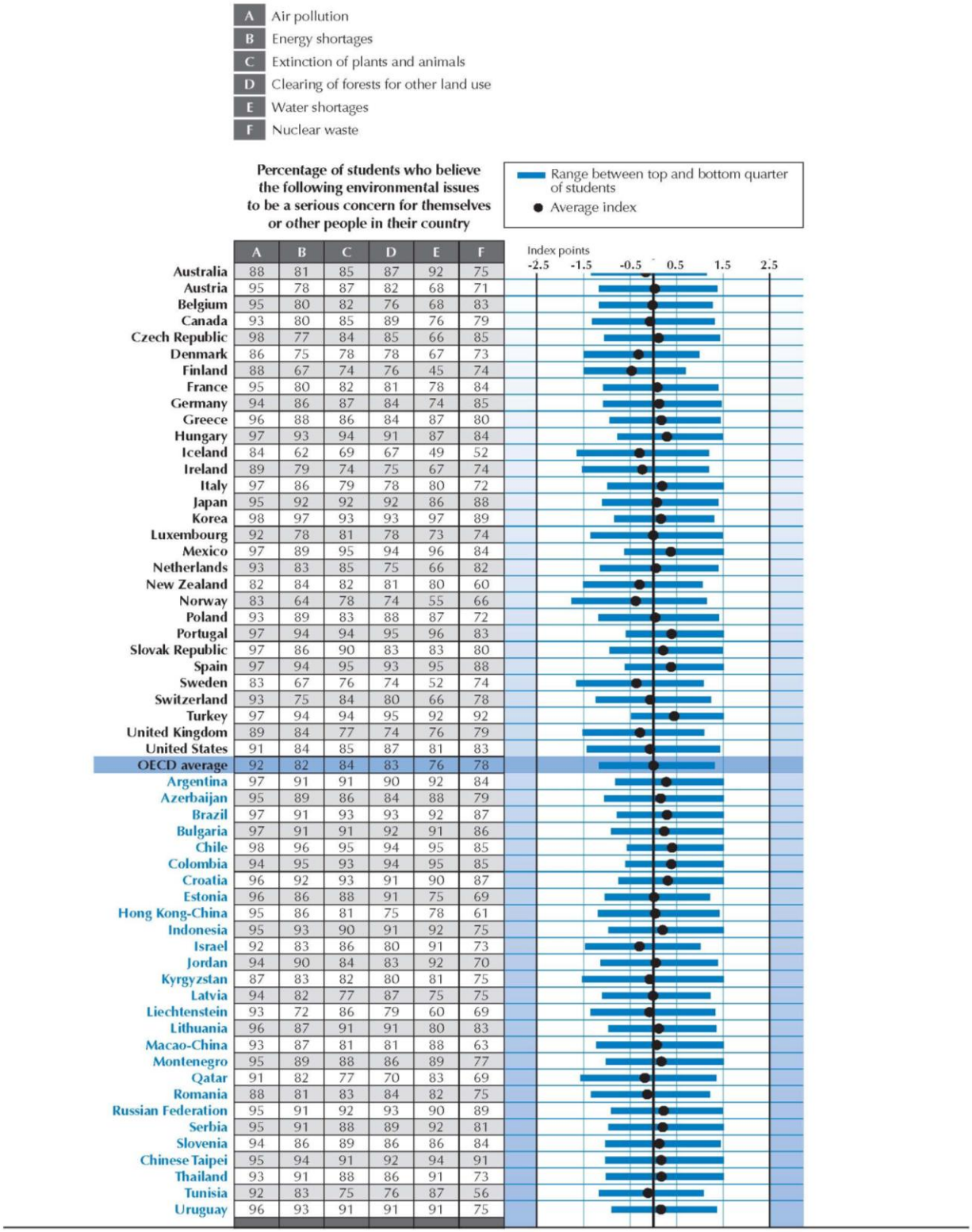
4.2.4. Environmental education

All OECD countries are fostering environmental education in a multitude of settings. Governments have introduced environmental curricula in primary and secondary schools, and promoted courses at vocational institutes and environmental degrees at universities. Governments are also supporting non-governmental organisations (NGOs) in their environmental education functions, particularly for specific topics and audiences.

At the international level, the United Nations General Assembly declared 2005-14 the UN Decade of Education for Sustainable Development, which has a strong environmental component. UNESCO leads the Decade and has developed an International Implementation Scheme for the Decade. The goals of the decade are to provide an opportunity for refining and promoting the vision of, and transition to, sustainable development through all forms of education, public awareness and training; and to give an enhanced profile to the important role of education and learning in sustainable development. The global initiative is supported by national actions such as the US Partnership for Education for Sustainable Development, and by regional programmes such as the UNECE Strategy for Education for Sustainable Development.

The OECD (2009) conducted an empirical study of environmental education for 15-year olds as part of PISA, the Programme for International Student Assessment (Figure 4.3). It found that most students in OECD countries are taught environmental topics somewhere in the curriculum: only 2% of students on average were in schools that do not include environmental science in their curriculum. In most OECD countries, environmental science material is found in several courses. An overwhelming proportion of the schools include environmental science somewhere in the science curriculum. Others treat environment as part of geography or other (non-specified) courses. At the same time a significant proportion of schools offer a stand-alone course on environmental science. These efforts have contributed to raising environmental awareness among students in all OECD countries, a large majority of whom believe that environmental issues are a serious concern for themselves and other people in their country.

Figure 4.3. Index of students' sense of responsibility for environmental issues



	A	B	C	D	E	F
Australia	88	81	85	87	92	75
Austria	95	78	87	82	68	71
Belgium	95	80	82	76	68	83
Canada	93	80	85	89	76	79
Czech Republic	98	77	84	85	66	85
Denmark	86	75	78	78	67	73
Finland	88	67	74	76	45	74
France	95	80	82	81	78	84
Germany	94	86	87	84	74	85
Greece	96	88	86	84	87	80
Hungary	97	93	94	91	87	84
Iceland	84	62	69	67	49	52
Ireland	89	79	74	75	67	74
Italy	97	86	79	78	80	72
Japan	95	92	92	92	86	88
Korea	98	97	93	93	97	89
Luxembourg	92	78	81	78	73	74
Mexico	97	89	95	94	96	84
Netherlands	93	83	85	75	66	82
New Zealand	82	84	82	81	80	60
Norway	83	64	78	74	55	66
Poland	93	89	83	88	87	72
Portugal	97	94	94	95	96	83
Slovak Republic	97	86	90	83	83	80
Spain	97	94	95	93	95	88
Sweden	83	67	76	74	52	74
Switzerland	93	75	84	80	66	78
Turkey	97	94	94	95	92	92
United Kingdom	89	84	77	74	76	79
United States	91	84	85	87	81	83
OECD average	92	82	84	83	76	78
Argentina	97	91	91	90	92	84
Azerbaijan	95	89	86	84	88	79
Brazil	97	91	93	93	92	87
Bulgaria	97	91	91	92	91	86
Chile	98	96	95	94	95	85
Colombia	94	95	93	94	95	85
Croatia	96	92	93	91	90	87
Estonia	96	86	88	91	75	69
Hong Kong-China	95	86	81	75	78	61
Indonesia	95	93	90	91	92	75
Israel	92	83	86	80	91	73
Jordan	94	90	84	83	92	70
Kyrgyzstan	87	83	82	80	81	75
Latvia	94	82	77	87	75	75
Liechtenstein	93	72	86	79	60	69
Lithuania	96	87	91	91	80	83
Macao-China	93	87	81	81	88	63
Montenegro	95	89	88	86	89	77
Qatar	91	82	77	70	83	69
Romania	88	81	83	84	82	75
Russian Federation	95	91	92	93	90	89
Serbia	95	91	88	89	92	81
Slovenia	94	86	89	86	86	84
Chinese Taipei	95	94	91	92	94	91
Thailand	93	91	88	86	91	73
Tunisia	92	83	75	76	87	56
Uruguay	96	93	91	91	91	75

Source: *OECD PISA 2006 Database*, Table A3.2.

4.3. Employment and environment

Interim reviews of the OECD Environmental Strategy in 2004 and 2008 found that the net impact of environmental policies on employment within the whole economy has so far been either neutral or slightly positive. However, individual sectors may be positively or negatively affected. One sector that has generated new employment in many OECD countries is renewable energy, as governments have actively promoted these sources of energy. A number of detailed studies of the restructuring of the energy sector towards a cleaner energy-mix have concluded that net employment gains will result for energy-related activities (OECD, 2011). However, the gains may be off-set by losses in other sectors.

Many governments reinforced their support for the renewable energy sector as part of their response to the global financial and economic crisis (OECD, 2010c). For example, the United States Council of Economic Advisers estimated that the approximately USD 90 billion of Recovery Act investments will save or create about 720 000 job-years by the end of 2012. Projects in the renewable energy generation and transmission, energy efficiency, and transit categories would create the most job-years. Approximately two-thirds of the job-years represent work on clean-energy projects, either by workers employed directly on the projects or by workers in the supply chain. Research by the Fraunhofer Institute and others (Ragwitz, 2009) conclude that implementing renewable energy policies in Europe could lead to 2.8 million new jobs in renewable energy sector by 2020, and 3.4 million by 2030. Likewise, the KRW 50 trillion being invested as part of Korea's "Green New Deal" are expected to create 960 000 jobs from 2009 to 2012, including jobs in an environmentally-friendly transportation network, water management and river rehabilitation, clean energy, green information technologies, and waste-to-energy. France's stimulus package totalled USD 33.1 billion, 21% of which was designated for green measures, with an estimated net job creation of about 80 000-110 000 in the 2009-10 period. Japan's New Growth Strategy aims to create 1.4 million jobs in environment-related sectors by 2020 (Capozza, 2011).

Labour market and skill policies can play an important role by helping workers to move from contracting to expanding sectors, and to assure a fairer sharing of adjustment costs occasioned by environmental related structural change. The OECD Green Growth Strategy suggested that there are three policy areas that should be given priority in order to promote a smooth and just transition:

- A strong skill development system and active labour market programmes that facilitate a quick re-integration of jobseekers into employment are key supply-side policy elements for reinforcing the structural adaptive capacity of labour markets.

- On the demand side, moderate employment protection and strong product market competition are important supports for vigorous job creation as environmental policies and eco-innovation create new green competitive niches.

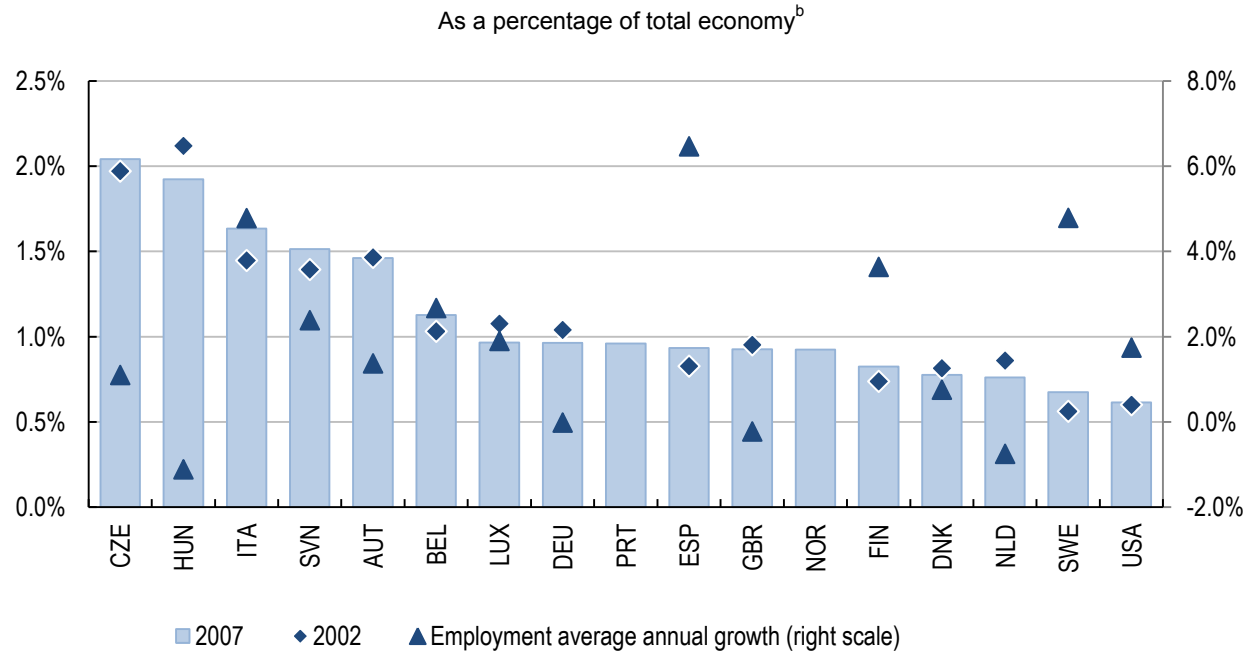
- Policies that increase the adaptive capacity of labour markets need to be combined with flanking measures, such as unemployment insurance and in-work benefits, which assure that dynamism is not achieved at the cost of excessive insecurity or inequality for workers and their families.

Environmental policies can also have locally significant effects on employment. For example, within the EU's Natura 2000 network, the Spanish network was estimated in 2008 to have generated about 13 000 jobs in 2008, while in Finland tourism in National Parks and recreation areas was estimated to have created almost 900 jobs (Gantioler, 2010). In a number of OECD countries, local and regional initiatives have aimed to integrate environment and employment objectives. In Greece, for instance, the National Employment Agency (a public institution mainly funded by contributions from employees and employers) during the 2000s provided financial assistance of up to EUR 9 000 to help unemployed people to set up environmental businesses such as waste recycling or landscape gardening. Another example is the

Canadian Environmental Careers Organization (ECO), which for almost 20 years has brought employers, workers, educators, and governments together to foster environmental employment in the Canadian economy.

A number of studies have examined employment in the environmental goods and services industry (Figure 4.4). For instance a US study found that environmental goods and services accounted for 1-2% of the total private business economy in 2007. This is comparatively small. However such estimates are dependent on how the "environmental goods and services" sector is defined, and this is the subject of ongoing analysis. Moreover, this sector does not cover the environmental component of other sectors, which is likely to be much larger.

Figure 4.4. Employment shares of some environmental goods and services industries[a]



a) Environmental industries are Recycling (ISIC37), Collection, purification and distribution of water (ISIC41) and Sewage and refuse disposal, sanitation and similar activities (ISIC90).

b) Total economy is defined as ISIC sectors 10 to 74 excluding 65 to 67.

Source: OECD (2011), *Towards Green Growth*, OECD, Paris.

There is some evidence that the environmental technology sector can deliver a greater-than average number of jobs per unit of GDP. For example, Swiss enterprises in the environmental protection field contributed CHF 6.7 billion or 1.6% to GDP, while employing 61 000 full-time workers representing 1.9% of the total workforce. Exports by environmental technology companies amount to CHF 1.4 billion, providing employment to an additional 12 500 people (OECD, 2007).

4.4. Distributional effects of environmental policies

Environmental problems, and the policy response to them, affect social groups in different ways. Managing the distributional consequences of environmental challenges and associated policies is crucial to reform success in terms of generating support and ensuring fair and positive outcomes. Concerns about distributional impacts of policies can be divided into potential competitiveness impacts on firms and welfare impacts on households. This section focuses on the latter.

Government concerns about the distributional effects of environmental policies arise when they are distributionally regressive, either in the sense that their financial burden falls disproportionately on lower-income households and/or in the sense that the environmental benefits are accrued disproportionately by higher-income households (Serret and Johnstone, 2006). A key challenge is how to redress, or compensate for, these impacts without undermining the effectiveness of the environmental policies themselves.

While the distributional effects of environmental taxes have received most attention, it is worth remembering that other environmental policy instruments will also have distributional implications. Various case studies have shown that policy measures such as direct regulation, energy performance standards for household appliances, mandatory catalytic converters on cars, or environmental subsidies also have distributional effects. However, the distributional impacts of these instruments are often less visible than economic instruments, and therefore stimulate less debate (OECD, 2011). In analysing this issue, it also important to distinguish between short-term impacts and those which are longer-term and which incorporate adjustment to the policy measure.

4.4.1. Unequal exposure to environmental and industrial risk

The more disadvantaged sectors of the population generally suffer most from poor environmental conditions and have least access to nature and green space. Some countries have begun to evaluate the social impacts of environmental policies or projects, for example through the use of Environmental Impact Assessment methodologies that explicitly require consideration of distributional effects. The United States began such assessments earlier than most countries and the EPA issued guidance documents for incorporating environmental justice considerations into developing environmental impact statements (EIS) or environmental assessments (EA) (Box 4.4). The European Commission's impact assessment guidelines require the Commission to consider for each policy proposal, *inter alia*, social impacts, including social inclusion and the protection of particular groups in society (EC, 2009).

Box 4.4. Environmental justice in the United States

The Environmental Protection Agency (EPA) has defined environmental justice as:

"…the fair treatment and meaningful involvement of all people regardless of race, colour, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EPA has this goal for all communities and persons across this Nation. It will be achieved when everyone enjoys the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, and work."

The Department of Transportation has defined three fundamental principles of environmental justice for the Federal Highway Administration and the Federal Transit Administration:

1) To avoid, minimise, or mitigate disproportionately high and adverse human health and environmental effects, including social and economic effects, on minority populations and low-income populations.

2) To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.

3) To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low income populations.

Little progress can be observed during the 2000s with respect to the generation of policy-relevant information about unequal exposure to environmental "bads". Whereas the extent of the unequal distribution of environmental "bads" is sometimes documented in "state of the environment" reports or environmental action plans for individual cities or metropolitan areas, this is not so on a national scale. Environmental indicators have been proposed that would track the exposure of urban populations subject to air pollution in excess of ambient quality standards or traffic noise above certain levels, but nationally aggregated data using standard methodologies generally have not become available.[39] The same holds for indicators about exposure to natural (flooding, landslides, earthquakes) and industrial (explosions, releases of toxic substances) risk, the incidence of waterborne diseases from drinking or bathing waters.

4.4.2. Access to nature and open green space

Information about the unequal distribution of environmental "goods" also remains scarce, but what information there is tends to suggest that poorer income groups have less access to such environmental "goods". A distinction can be made here between every-day access to green public space in cities and weekend access to (semi-) natural landscapes and forest on their periphery. Again, proposed indicators such as the share of the population living within a 15-minute walk from an urban open space or the extent of re-naturalised waterways and redeveloped waterfront areas opened up to the public are not generally available, except in state of the environment reports published by some cities.

The OECD Environmental Strategy also drew attention to urbanisation, urban liveability and revitalisation. Urban renewal policies can both improve access to urban open space and have a beneficial impact on social cohesion. There are synergies between the two objectives because living in a poor environment is not good for social cohesion as it leads to community problems such as crime. Conversely, living in problem communities does not encourage respect for the environment (EC, 2005). There are many examples of local initiatives, often under the umbrella of Local Agenda 21, bringing together community organisations, businesses and local councils to tackle problems of persistent long-term unemployment, social exclusion, and environmental degradation in a coherent fashion.

4.4.3. Affordability and access to water services

The idea of a human right to water has gained widespread, though not unanimous, global recognition in the last decade. At the international level, the UN General Assembly adopted a Resolution, supported by 122 countries, recognising access to clean water and sanitation as a human right. This principle has also been reflected in national laws. In Belgium, for example, every person has a right to a minimum supply of drinking water and all three of the country's regions have laws establishing the right of access to water (OECD, 2007). In France, the 2006 law on water and the aquatic environment includes a provision establishing the right to water.

Acceptance of access to water as a human right does not imply that it should be provided free of charge. OECD was at the forefront in elaborating the User-Pays Principle which asserts that the users of environmental services such as water and sanitation should pay for them. Well designed tariffs are crucial not only to finance the cost of constructing and operating the infrastructure, but also to provide incentives to use water efficiently. Nevertheless, even in OECD countries, tariffs rarely cover the full costs of water services. This stems partly from a lack of awareness of the economic benefits of water and sanitation, but also from legitimate concerns about impacts on poorer households. But financial sustainability and

39. The Slovak Regional Atlas described above is among few exceptions. France introduced the requirements to provide information about natural risks to the interested parties when buying or renting property, The Cartorisque allows individuals to locate their properties relative to different areas of hazards, such as flooding or earthquakes.

affordability of services are not necessarily incompatible. Artificially low tariffs for all customers may in fact benefit richer consumers and hurt poor households the most, particularly when they prevent extending services to communities that are paying much more from alternative sources. Reconciling different policy objectives is a political task and should entail a transparent, democratic, participatory process.

Social concerns have been important factors in keeping the price of water low, and effectively subsidised. The intention in many countries was to maintain tariffs at low levels to reduce the burden on low-income households, which spend a higher proportion of their income on utilities. However, such concerns are best addressed by compensating low-income households directly, for example by lower personal income taxes, tax credits or increased social benefits rather than by keeping water prices below the cost of supply. Another approach has been to use a block tariff system whereby an initial supply of water is provided at a low cost, and further supply is charged at a higher rate.

Determining "affordability" and the measures to deal with it requires careful examination. Determining tariffs involves consideration of the tariff level (which costs should be covered), the tariff structure (block tariffs, cross-subsidies), and the process (transparent and credible). In the case of water, it is important to assess the situation at the local level and to take account of particular vulnerabilities in different groups or regions (Box 4.5). Average thresholds of affordability may not take sufficient account of how it affects the poorest segments of the population. A recent OECD study calculated that the average water bill as a share of the income of the lowest decile of the population ranged from 0.8% in Ireland to 10.3% in Turkey.

Box 4.5. Tariff policy reforms based on affordability considerations in Portugal

As part of the process leading to the design of its proposed tariff reform, the economic regulator of water supply and sanitation services in Portugal, IRAR, carried out an affordability study. This identified geographically concentrated clusters of population that would fall below the affordability threshold, which had been set at 3% of household disposable income. While over 19% of Portuguese households fell below the income threshold of one minimum wage, only 10.5% faced bills in excess of the affordability criteria. These were concentrated in 60 out of 309 municipalities in the North and Tagus Valley regions, where 15-30% of households would face unaffordable bills. The affordability study, however, also showed that WSS services do not pose an affordability problem for society as a whole, as they represent a very small portion of overall expenditure by households on utility services (including electricity, gas, etc.) and are also much smaller than other expenditure categories (*e.g.* the yearly water bill is less than half the average annual expenditure on tobacco products). The design of the tariff reform considered these results by: (i) allowing flexible solutions in different municipalities to address geographically localised affordability problems; (ii) including support from IRAR to local service providers on ways to manage the transition to financial sustainability; and (iii) structuring a communication plan to the public to clarify the real situation with regard to the weight of WSS costs for Portuguese households.

Source: Pires, J.S. (2007), "Consumer Tariffs in Practice: The Portuguese Experience", presented at the OECD Expert, Meeting on Water Pricing and Financing, 14-15 November 2007, Paris, available at: *www.oecd.org/water*.

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OBJECTIVE 5

IMPROVING GLOBAL ENVIRONMENTAL GOVERNANCE AND CO-OPERATION

Assessment

Globalisation affects the environment in various ways: by promoting economic growth, changing the structure of the world economy, diffusing technologies, and influencing environmental policy choices. The relationships are complex and no global average or net effect can be measured. Reaping the benefits of globalisation requires that robust environmental policies and institutional frameworks are in place at local, national, regional and global level. Much remains to be done in this regard and to more effectively harness trade, investment and capital flows to support environmental policy objectives. Despite the progress achieved, the obstacles to multilateral environmental co-operation seem greater at the end of the decade than they were at the beginning.

One of the most important developments in the last decade has been the dramatic economic rise of emerging economies; the BRIICS (Brazil, Russia, India, Indonesia, China and South Africa). These countries now account for a growing share of environmental pressures *vis-à-vis* OECD countries, and this will continue in the future. This is posing new challenges and opportunities for both global economic and environmental governance.

The Doha Round provided an opportunity to further integrate environment into the multilateral trading system. However, the lack of progress in advancing the Doha Development Agenda in general, meant that this opportunity was lost. As a result, attention focused on the development of bilateral and regional trade agreements (RTAs). The number of RTAs with environmental provisions has increased and accounted for about 20% of all RTAs in 2011, roughly equivalent to 5-10% of global trade. While RTAs have provided an important vector for promoting environmental protection, their environmental impacts are only beginning to be assessed. They are not a substitute for a multilateral approach, even if such an approach does not seem feasible at this time.

A variety of other initiatives have been taken to green trade and investment flows. Export credit agencies have strengthened provisions for screening the environmental impacts of their projects, and also agreed that it is permissible to support environmentally related projects, initially renewable energy and water projects, on favourable financial terms and conditions. A number of financial institutions have begun to issue green bonds. The environmental chapter of the OECD Guidelines for Multinational Enterprises was updated. A number of environmental instances were reported to governmental National Contact Points, a unique feature of the Guidelines. The Equator Principles have promoted greater consideration of environmental issues in the decision making of financial institutions. However, a recent OECD analysis of bilateral investment treaties between governments concluded that relatively few included environmental provisions, and that there appeared to be a limited exchange between the investment and environmental communities on this issue.

One of the most innovative developments at the international level over the last decade has been the emergence of a carbon market. The European Union Emission Trading Scheme has been the driving force, accounting for 96% of total allowances value in 2009. The Clean Development Mechanism represented

79% of all project-based transactions. However, more remains to be done to link national carbon markets together, and to develop the rules and institutions needed to regulate the market.

Despite a considerable scaling up of Official Development Assistance (ODA) over the last decade, the level of aid fell short of the 0.7% of GNI target. Current financing allocations will not be sufficient to meet the Millennium Development Goal to reduce the number of people without access to basic water and sanitation by half by 2015. It was only after 2007 that the environment sector benefited. ODA focused on environmental protection increased by approximately 85% from 2005 to 2009, compared with an increase of 16% in total ODA over the same period. On average, over 2008-2009, OECD-DAC countries allocated about 4% of the bilateral ODA flows to the environmental sector. In addition, about 7% of aid had environment as a principal objective, and about 14% as a significant objective.

Multilateral environmental agreements (MEAs) have continued to mobilise the international community to address global and regional environmental issues. Regional environmental co-operation forms part of international environmental governance, and has generated some unique forms of environmental co-operation, tailored to the specific needs of Europe, North America, and North East Asia.

Over the last decade, OECD countries have adopted and implemented a number of important MEAs, particularly related to marine and maritime issues (Table 5.1). In the protracted climate negotiations, discussion has focused on bottom-up as well as broader multilateral approaches, somewhat parallel with developments in the trade negotiations. The tenth meeting of the Conference of the Parties to the Convention on Biological Diversity in Nagoya was considered to be a useful step forward. There have been successes in curtailing the release of ozone-depleting substances, reducing trans-frontier movements of hazardous wastes, reducing dumping of waste at sea, and protecting certain species (*e.g.* cetaceans and migratory birds). Since 2000, OECD countries made further efforts to support the implementation of MEAS in a more coherent and consistent manner, but there is still no consensus on how best to consolidate existing environmental governance institutions.

GEF continued to be an important mechanism for financing implementation of MEAs. Bilateral assistance targeting the objectives of the Rio Conventions almost quadrupled over the decade. About half went to Asia, and a quarter to Africa. Aid for biodiversity and desertification doubled, while aid related to climate change mitigation more than quadrupled. The fast-start pledge made at Cancun to increase climate financing by USD 30 billion over 2010-12 seems to be on track to be achieved, including USD 4 billion for the REDD+ initiative. However, there are continued discussions about whether the fast start funds are "new and additional." Delivering on the 2020 target of USD 100 billion per year will require a significant scaling-up of support from a wide variety of sources, public and private, bilateral and multilateral, including innovative financing mechanisms.

Introduction

The fifth objective of the *Strategy* calls for better management of the environmental effects of globalisation through improved environmental governance.

Following the recommendations of the *Strategy*, this review focuses on a number of specific issues related to the management of the environment in a globalising economy. After a brief discussion of the relationship between environment and globalisation, this section examines:

- the integration of environmental considerations into trade and investment governance;
- mainstreaming environmental considerations into development co-operation in order to support the strengthening of environmental governance in developing and emerging economies;

- the role of multilateral environmental agreements (MEAs), including financing their implementation, in international environmental governance.

5.1. Globalisation and the environment

Globalisation can be considered as a process in which the structures of markets, technologies and communication patterns become progressively more inter-nationally integrated. Several features of contemporary globalisation are particularly noteworthy from an environmental perspective:

- the growing importance of large emerging economies such as China and India, which are now major trading nations and sources of outward investment, and in the process placing growing pressures on the global environment while consuming a growing share of natural resources;

- the challenge of integrating rapidly growing populations in developing countries into the global economy, and enabling them to limit their vulnerability to the degradation of environmental and natural resources;

- the increasing geographical fragmentation of production along global value chains;

- the increased demand for energy and materials to fuel global economic development;

- the increasingly global footprint of many environmental pressures which were previously regarded as local or regional (*e.g.* biodiversity loss, coastal and marine degradation);

- the increasingly complex array of non-state actors who "co-produce" environmental policies (firms, NGOs and social movements) and intervene at the global level;

- a protectionist backlash in some countries in response to an inequitable distribution of the gains from globalisation.

In the short term, these challenges must be addressed in the aftermath of the global economic and financial downturn which has put severe pressures on many OECD governments' budgets, and which has also had a major impact on trade and investment patterns. In the longer term, these challenges will be addressed in a context where demand for food, energy and natural resources will increase dramatically in line with growing population and rising living standards. As described in the *Environmental Outlook to 2050*, these pressures will place an increasingly severe strain on the ecosystems on which future human welfare depends.

The relationship between environment and globalisation is complex, and no global average or net effect can be measured. In general, globalisation can enhance the effective use of resources, stimulate improved environmental performance and contribute to the diffusion of cleaner technologies – provided that robust environmental policies and institutional frameworks are in place at the local, national, regional and global level. In their absence, globalisation can amplify market and policy failures and intensify environmental pressures. If unchecked, this could damage the environmental basis for sustained economic development in different locations, and alter trade and investment patterns.

By stimulating economic growth, globalisation can have positive and negative *scale effects* on environmental pressures. Growth potentially intensifies environmental pressures. However, accelerated economic growth can also generate demand for a better environment as well as the resources to meet that demand.

Globalisation can promote more efficient use of resources, and reduce the pollution associated with their use. Trade and investment liberalisation concentrate production activities in areas that enjoy comparative advantage. This might be where there are low labour costs, but may also be related to endowments of natural and environmental resources (positive *structural effects*). Investments are attracted to jurisdictions with positive investment climates, many of which have high environmental standards. On the other hand, when markets fail to internalise environmental costs, globalisation may create incentives for pollution-intensive firms to locate in jurisdictions with low environmental standards.

Similarly, globalisation can create economies of scale and facilitate the diffusion of cleaner technologies (positive *technology effects*) and products in use.

The potential effects of globalisation on environmental policy development (*regulatory effects*) are also ambivalent: globalisation can contribute to the dissemination of best practices and more stringent standards for environmental performance; it may also chill environmental regulation, when governments fear that stringent policies will hamper economic competitiveness.

One argument that has often been used against the introduction of robust environmental policies is the fear that such policies would adversely affect competitiveness. Various empirical studies have concluded that there is no clear evidence that environmental requirements harm the overall competitiveness of countries.[40] It may do so in certain sectors and under particular circumstances, but these negative impacts usually find positive offsets elsewhere in the economy. Where competitive concerns do exist for individual firms or sectors, there are often practical measures that can be taken to reduce these concerns.

More positively, the *OECD Green Growth Strategy* argues that green growth strategies can foster economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies. To do this, such strategies should catalyse investment and innovation which underpin sustained growth and which give rise to new economic activities. In addition, green growth strategies should encourage greener behaviour by firms and consumers, facilitate smooth and just reallocation of jobs, capital and technology towards greener activities.

The *OECD Green Growth Strategy* proposes a mix of policy instruments to support implementation of green growth strategies. From the perspective of a globalising economy, environmental policies will be effective when they are framed in broader policy frameworks which encompass trade and investment liberalisation, innovation support and dissemination, and environmental co-operation with emerging and developing countries. Such frameworks involve state and non-state actors. Where competitiveness concerns exist, attention should be paid to predictability, transition periods, and transaction costs.

The relationship between globalisation and environment was reviewed in a recent OECD report.[41] The main message that emerged from that review was that further efforts are needed to strengthen environmental governance at all levels and to more effectively harness the forces of globalisation to support environmental policy objectives.

40. OECD (2010), "Linkages between environmental policy and competitiveness", OECD Environment Working Papers No. 13, OECD Publishing, *http://dx.doi.org/10.1787/218446820583.*

41. Environment and Globalisation, ENV/EPOC(2007)18/FINAL.

5.2. Trade and the environment

Since its establishment in 1995, the World Trade Organisation (WTO) has consistently argued that trade and environment policies can and should be mutually supportive. The Doha Development Agenda, launched in the WTO in 2001, contained several components that aimed to promote synergies between trade and environment.[42] One focus was liberalisation of environmental goods and services. The OECD Joint Working Party on Trade and Environmental supported negotiators by analysing this issue, developing a list of environmental goods and services, and analysing non-tariff barriers to trade in environmental goods and associated services. However, no consensus was achieved on which environmental goods and services should be liberalised.

A second focus was on how environmental requirements could affect market access, particularly for exports of developing countries' goods and services to OECD countries. 21 case studies were conducted to gain insights into this issue. The final conclusions emphasised the importance of openness, transparency, early notification of new requirements, and capacity development in minimising potential adverse impacts of environmental requirements on market access.

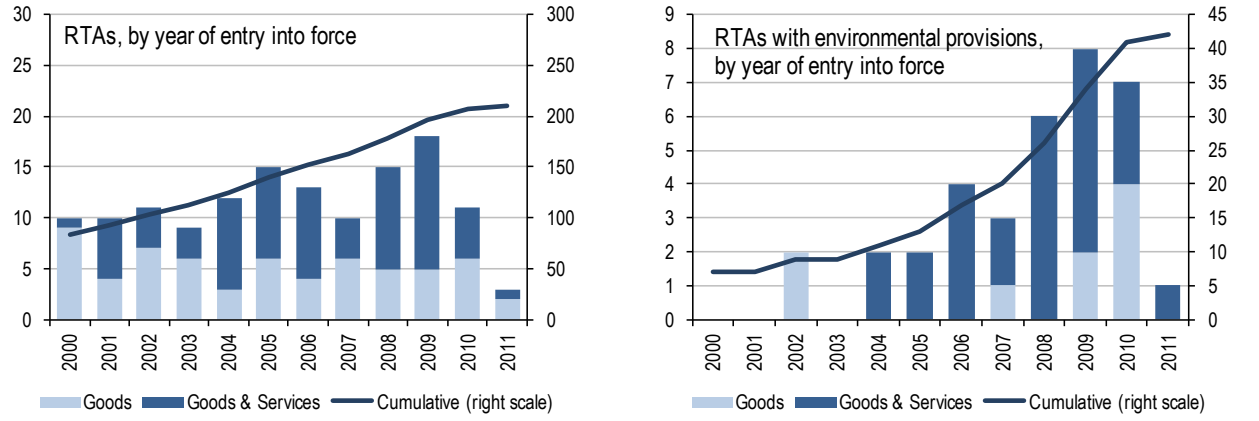
A third area of focus was eco-labelling. The OECD conducted a study of this issue which reviewed a number of factors that may make it more difficult for developing country producers to meet the requirements of eco-labelling programmes than their competitors in developed countries. On balance, a variety of procedural issues seemed to be more important obstacles than standards-related issues. Nevertheless, the study demonstrated that, in a number of cases, developing country producers had successfully participated in eco-labelling programmes.

Given the slow progress in multilateral trade negotiations during the 2000s, many countries invested significant efforts in regional trade agreements (RTAs). Multilateral trade rules provide the best guarantee for securing substantive gains from trade liberalisation for all WTO members; bilateral and regional trade agreements are a second-best solution. The unco-ordinated proliferation of RTAs may also result in an inconsistent and partial framework for trade relations that disadvantages developing countries. Nevertheless, WTO rules allow regional integration and bilateral agreements for members who wish to liberalise at a quicker pace. Regional trade agreements (RTAs) are a complement rather than an alternative to multilateral agreements.

In 2011, about 490 RTAs had been notified to the WTO, of which nearly 300 were in force. The number of RTAs with at least some type of environmental provisions more than doubled since 2000, accounting for 20% of all RTAs in 2011 or roughly 5-10% of global trade given that RTAs accounted for about half of global trade in goods. Thus, over the decade RTAs have provided an important vector for promoting environmental protection through trade relations.

42. Further information on OECD work on trade and environment can be found in Potier and Tebar Less (2008).

Figure 5.1. Regional Trade Agreements in force



Notes: Goods & Services denotes the RTAs covering jointly goods and services at the same date of notification or entry into the force, and the RTAs covering goods and services for which the RTAs on goods were extended for services at the later date. Hence, Goods & Services does not denote the same agreements as Goods, which denotes the RTAs with provisions only for goods. Cumulative denotes the total number of Goods and Goods & Services in force.

Source: WTO, RTA database, *www.wto.org/english/tratop_e/region_e/region_e.htm.*

The environmental content of RTAs varies widely. Some RTAs take a minimalist approach by acknowledging that there may be legitimate reasons for deviating from general trade rules for environmental reasons, or by committing to maintain high environmental standards. The most ambitious agreements include a comprehensive environment chapter, or an environmental side agreement, or both. Other RTAS include various approaches along this spectrum usually in the form of environmental co-operation mechanisms. Mechanisms for environmental co-operation may be broad or focused on specific issues, and vary significantly depending on factors such as levels of development, whether national borders are involved, and the trade-related environmental issues in the countries. Some RTAs include procedural mechanisms related to enforcement or dispute settlement.

The environmental benefits from incorporating environment provisions in RTAs will depend on the content of the relevant provisions but may include strengthening enforcement of environmental laws and raising the level of environmental standards, establishing or reinforcing environmental co-operation, and enhancing public participation in environmental matters. Some OECD countries have also sought opportunities in trade negotiations for accelerating domestic environmental policy reforms. Other positive outcomes for OECD countries have been capacity building, better co-operation among trade and environment officials, and enhanced regional cohesion in environmental matters.

The environmental provisions of RTAs are regularly monitored by the OECD, and workshops have been organised to support information exchange and the identification of good practices. Over the decade, there has been a considerable evolution in the content of RTAs. Attention is increasingly turning to implementation and assessment of results. While OECD countries have shown a commitment to strengthen review procedures, a number of obstacles remain, including lack of effective monitoring and control in the enforcement of environmental provisions, the absence of prior impact assessments, lack of resources, and difficulties in establishing internationally recognised baselines for assessment. Generally more could be done to take stakeholder views into account.

Box 5.1. The EU-Korea Free Trade Agreement

The EU-Korea Free Trade Agreement , signed on 6 October 2010 and provisionally applied since 1 July 2011, is part of a new generation of RTAs, including a dedicated trade and sustainable development chapter. This covers environmental and labour issues, and includes its own mechanisms for dialogue with civil society and for dispute settlement. The environmental provisions of the trade and sustainable development chapter include a commitment to effectively implement all multilateral environmental agreements to which each country is a party. The right to regulate is confirmed, but each party is required to aim for a high level of environmental protection, and to refrain from derogating from its environmental standards or failing to enforce its environmental laws, in a manner that affects trade or investment between the Parties.

An Annex to the trade and sustainable development chapter sets out an indicative list of areas of co-operation. These include trade-related aspects of the climate change regime, biodiversity including bio-fuels, deforestation and illegal logging, sustainable fishing practices, environmental regulation, fair trade, eco-labeling and corporate social responsibility. The Parties also agree to co-operate on social or environmental aspects of trade and sustainable development in the World Trade Organisation (WTO), the International Labor Organisation (ILO), the United Nations Environment Programme (UNEP) and other international fora.

In addition to the provisions of the trade and sustainable development chapter, the agreement stipulates that measures to facilitate trade shall not prejudice the fulfilment of legitimate policy objectives, including protection of the environment. There is a provision on ex-post assessment, with a general commitment to reviewing, monitoring and assessing the impact of the implementation of the RTA on sustainable development. Each Party would conduct its own assessments, through its own participative processes and institutions. In addition, both Parties would jointly review impacts through the institutions and mechanisms set up in the agreement. The Annex on co-operation makes a specific reference to sustainability impact assessments carried out by the Parties, and commits the Parties to taking these into account in an exchange of views on the impacts of the RTA on sustainable development. The agreement also includes a dispute-settlement mechanism.

Source: Council Decision of 16 September 2010 on the signing, on behalf of the European Union, and provisional application of the Free Trade Agreement between the European Union and its Member States, of the one part, and the Republic of Korea, of the other part , OJ L 127, 14.5.2011, Available at: *http://trade.ec.europa.eu/doclib/press/index.cfm?id=443.*

5.3. Investment and environment

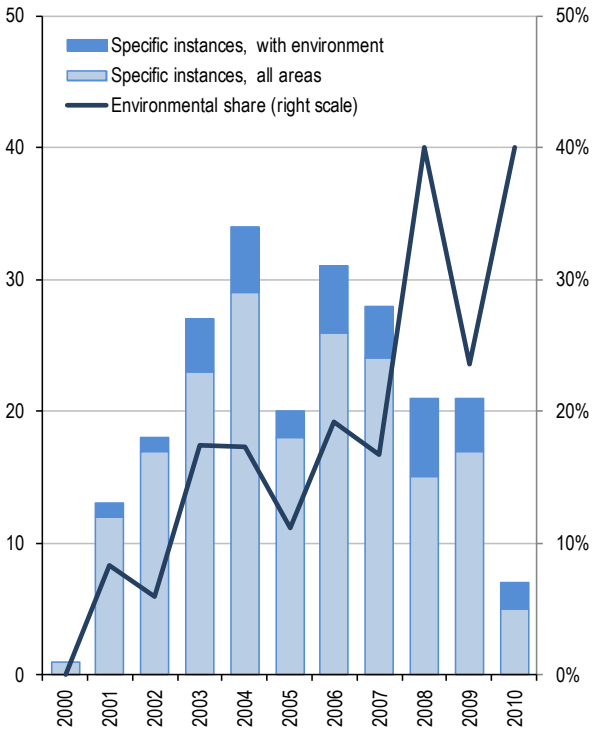
Foreign direct investment (FDI) is one of the driving forces binding countries into closer economic interdependence. It has a huge potential to facilitate the transfer of environmentally sound technology and environmental management know-how, particularly to countries with limited means for financing environmental protection and pollution mitigation. There are also risks that FDI might result in transfers of more pollution- or resource-intensive technologies, or that their operations will not be adequately supervised by environmental authorities in the receiving country. In areas such as climate change, these decisions are crucial: the types of investments made in energy, transport, industry, private and commercial property, for example, will "lock-in" greenhouse gas emissions for decades to come. In the vast majority of cases, key decisions will be made by private investors (OECD, 2012a) (OECD-IEA, 2011).

After declining sharply from the end of 2007, FDI flows increased in 2010. In 2010, OECD countries accounted for 85% of global FDI outflows (USD 1 018 billion); the G20 accounted for 72%. Whereas OECD countries hosted 55% of global FDI inflows, G20 countries hosted 72%, reflecting the growing importance of the major emerging economies. Developing countries continue to receive a relatively low but growing share of FDI flows (OECD international direct investment database, May 2011).

Measuring the environmental impacts of FDI is difficult. UNCTAD and the OECD have initiated work to better monitor investment flows in environmentally sensitive sectors (UNCTAD, 2010). Partial estimates by UNCTAD suggest that in the period 2003-09, global flows of low-carbon FDI involved 1 725 cases, and represented USD 344 billion, or about 3% of FDI flows for three sectors: renewable

energy, waste management and recycling, and environmental technology manufacturing (*e.g.* wind turbines, solar panels, biodiesel plants). The OECD estimated that 17-20% of FDI: a) flows from countries with stricter regulations to those with less stringent regulations; and b) flows from countries with higher energy efficiency to those with lower energy efficiency (OECD, 2011d). A recent OECD study supported the conclusion of many previous studies that lax environmental regimes were not a major factor in attracting foreign direct investment (Kalamova and Johnstone, 2011).

Figure 5.2. OECD MNEs guidelines: Specific instances dealing with the environment



Source: OECD, National Contact Points for the OECD Guidelines for Multinational Enterprises.

An OECD study surveyed the extent, kind and frequency with which environmental concerns were treated in a sample of 1 623 international investment agreements (IIAs) (see Gordon and Pohl, 2011). 1 593 bilateral investment treaties (BITs) and 30 other bilateral agreements with investment chapters were reviewed. Relatively few investment agreements include environmental issues though the number is increasing: 8.2%, of the IIAs and 6.5% of BITs. The language on environmental concerns in IIAs is either generic, or, where individual aspects are mentioned, dates back to the text of the 1948 General Agreement on Tariffs and Trade. More recent concerns, such as climate change and biodiversity, have not penetrated this closed set of issues, although such more recent concerns feature in the Energy Charter treaty, a multilateral agreement. This finding suggests a limited exchange between the investment and environmental policy communities.

The OECD Investment Committee is working to fill this gap in several ways: governments participating in the Freedom of Investment (FOI) Roundtable approved a Communication on Harnessing Freedom of Investment for Green Growth that addresses how the investment community can help countries achieve green growth,[43] work is underway to investigate the practicability of defining "green FDI" , and

43. See: *www.oecd.org.daf/investment/foi.*

identifying associated investment policy restrictions; some investment policy reviews will include a green growth chapter; and a report was prepared on "Transition to a low-carbon economy: public goals and corporate practices" (OECD, 2010i). As a follow-on to this report, the Investment Committee is also working jointly with the EPOCs Working Party on Climate, Investment and Development to develop policy guidance on engaging the private sector to support climate action.

Over the last decade, 42 OECD and partner countries have adopted the OECD Guidelines for Multinational Enterprises as a major international public instrument to enhance corporate social and environmental responsibility. The Guidelines were revised and strengthened in 2004 and 2011. The environmental chapter was revised as part of 2011 changes. The Guidelines, which, uniquely, are endorsed by governments, are associated with a network of National Contact Points (NCPs) which promote observance of the Guidelines. The NCPs receive reports on instances alleging non-compliance with the Guidelines concerning enterprises based in their territories. The NCPs have made considerable progress in mediation and conciliation of specific instances. While most new cases continue to relate to employment and industrial relations, an increasing number of instances involve environmental issues (Figure 5.2).

The Guidelines could be even more effective if a larger number of emerging economies were to adhere to them. Multinational enterprises could do more to engage their subcontractors in corporate social and environmental responsibility. The UN Global Compact and the Global reporting Initiative have encouraged businesses worldwide to adopt on a voluntary basis sustainable, environmentally and socially responsible policies, and to report on their implementation. The Policy Framework for Investment (PFI) is an OECD instrument that provides a comprehensive and systematic approach for improving investment conditions. It covers 10 policy areas and addresses some 82 questions to governments to help them design and implement policy reform to create an attractive, robust and competitive environment for domestic and foreign investment. Environmental protection is part of its chapter promoting responsible business conduct.

Over the last decade, there has also been substantial progress in greening financing institutions that support investment. In particular, the United Nations Environment Programme Finance Initiative (UNEP FI) and the Equator Principles (EPs) also contributed to the greening of private sector financing. The UNEP FI is a partnership between the UNEP and the global financial sector that identifies, promotes, and realises the adoption of best environmental and sustainability practice at all levels of financial institution operations. This facility provides guidelines, capacity building and other implementation tools to facilitate internalisation of environmental, social and government externalities in private sector projects. The Equator Principles (EPs), launched in 2003, complement the UNEP Finance Initiative by determining, assessing and managing environmental and social risk in project finance transactions. The EPs are adopted voluntarily by financial institutions and provide a minimum standard for due diligence to support responsible risk decision-making. Equator Principles Financial Institutions commit to not providing loans to projects where the borrower will not or is unable to comply with their respective social and environmental policies and procedures that implement the EPs. The EPs have spurred other responsible environmental and social management practices in the financial sector and banking industry, such as the US Carbon Principles and worldwide Climate Principles.

Box 5.2. Norwegian sovereign wealth fund with environment-concerned guidelines

The Norwegian sovereign wealth fund was set up in 1990 as an integrated part of the government's annual budget to ease the fiscal policy should the economy contract and to smooth the disrupting effects of fluctuating oil prices. The Government Pension Fund Global (GPFG) had a value of USD 580 billion with an annual return of 9.6% in 2010. It is the largest pension fund in Europe and the second largest in the world.

In 2004, the fund became one of the first state-owned pension funds to adopt ethical guidelines. They were revised in 2009 and new guidelines for responsible investment were adopted. Helped by recommendations from the Council on Ethics (an independent council made up of five individuals, with its own secretariat), the Ministry of Finance can exclude companies from the fund if they are in breach of the guidelines. Since 2004, 48 companies (mainly in the weapon and tobacco industries) have been excluded from the pension fund – eight of them for causing severe environmental damage. In the 2010 national budget, the government proposed NOK 4 billion in investment based on environmental criteria.

As a representative of the pension fund, Norges Bank (the country's central bank, a shareholder in more than 8 300 companies) seeks to improve companies' management of risk related to children's rights, climate change and water. It requires them to disclose policy, strategies, targets and progress in these areas. The first compliance report relating to climate change management, in 2009, showed compliance to be low overall, though better in the power generation and oil and gas industries than in transport and chemicals.

Source: Norges Bank Investment Management, *www.nbim.no/en/About-us/Government-Pension-Fund-Global/.* and OECD (2011j).

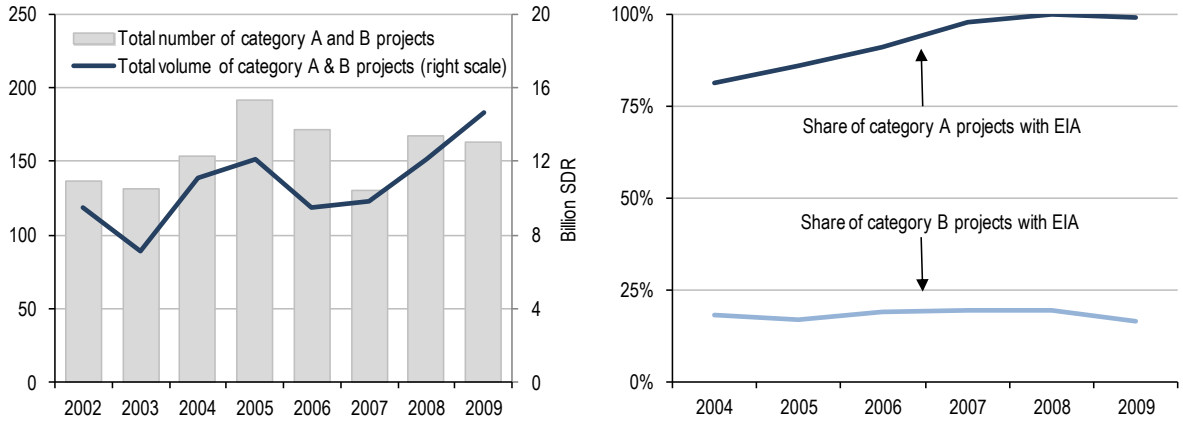
5.4. Export credits and the environment

Environmental corporate responsibility has also been encouraged through incentives provided by export credit agencies, which have facilitated and leveraged private investments through official export credits. OECD countries have made considerable progress to ensure that environmental objectives are integrated into project planning and financing decisions. In 2003, OECD countries agreed on a Council Recommendation on Common Approaches on Environment and Officially Supported Export Credits. The Recommendation called for projects supported by export credits to be screened for their potential environmental impacts, and further analysis conducted as needed. In 2007, the Council Recommendation was revised on the basis of experience gained, and the environmental impact assessments (EIA) requirements for projects that benefit from credit guarantees were reinforced. Among other things, Members are recommended to encourage disclosure of relevant environmental information, encourage prevention and mitigation of adverse environmental impacts, and enhance financial risk assessments by taking into account environmental aspects.

The volume of export-credit projects with high and medium potential environmental impacts reached nearly 15 billion in special drawing rights (SDR) in 2009.[44] In keeping with the Council Recommendation, EIAs have been increasingly conducted and now cover virtually all Category A projects that could lead to significant adverse environmental impacts (Figure 5.3). The trend has been relatively stable for Category B projects, which have less potential for adverse environmental effects. The composition of projects has changed over time, with energy and transport infrastructure projects rapidly gaining in importance. In 2009, in volume terms, Category A projects were concentrated in manufacturing (47%), energy (39%), mining (9%), and construction and water (2%) sectors, while Category B projects were concentrated in manufacturing (36%), energy (29%), transport and telecommunications (21%), and mining (11%) sectors.

44. Special Drawing Rights (SDRs) are supplementary foreign exchange reserve assets defined and maintained by the International Monetary Fund. Their value varies and in the period 2006-10 were equivalent, on average, to USD 0.6320.

Figure 5.3. Export credit projects and environment



Source: OECD-TAD, Working Party on Export Credits and Credit Guarantees.

Notes: Projects are classified accordingly to their potential environmental impacts. Category A projects potentially lead to significant environmental impacts by affecting irreversibly broader or sensitive areas, while category B projects are likely to have less adverse site-specific impacts on human populations or environmentally important areas, for which mitigation measures are more readily available than for Category A projects (OECD, 2007b).

In 2009, special rules governing the provision of support for renewable energy and water projects were established. OECD countries are now in the position to support exports in these areas with favourable financial terms and conditions to reflect the high up-front investment costs and expected useful lives of projects. OECD countries are also engaging in negotiations to address ongoing challenges related to climate change in the export credits area. Negotiations between OECD countries are under way to consider whether and how key sectors and technologies, such as energy efficiency and other low carbon projects, could become eligible for favourable financial terms and conditions, similar to those for renewable energies.

5.5. Green bonds

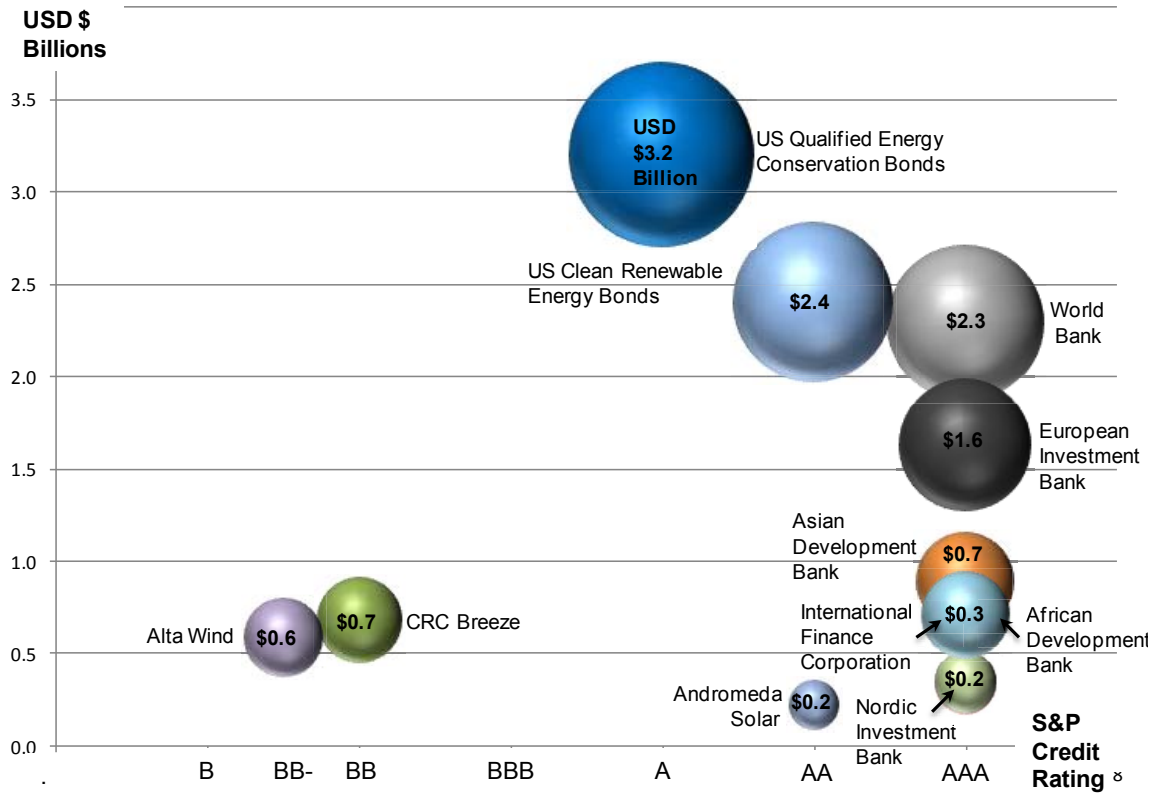
An OECD study (Della Croce *et al*., 2011) has examined some of the initiatives that are currently under way to assist pension funds in mobilising capital for green projects. With USD 28 trillion in assets in OECD countries, pension funds - along with other institutional investors - potentially have an important role to play in financing environmental initiatives. The study reviews the market for 'green' bonds such as those issued by the World Bank and IFC, and other alternative investments in existing renewable energy technology. It is through innovative instruments such as these that additional pension fund assets could be tapped for financing green growth related projects.

Indeed, fixed-income investments have recently received more attention in the universe of institutional investors with an interest in socially responsible investment. There have been a number of issues of green bonds by states, multilateral banks, investment banks and hedge funds. The yields and strong credit ratings of these issues also make them attractive to more mainstream investors. In most OECD countries pension funds, bonds remain by far the dominant asset class in portfolio allocations, accounting for 50% of total assets under management on average.

The market size for green bonds is still small (compared to global bond markets) and was valued at approximately USD 16 billion as of August 2011. Despite the interest in these instruments, pension funds' asset allocation to such green investments remains low. This is partly due to a lack of environmental policy support, but other barriers to investment include a lack of appropriate investment vehicles and market

liquidity, regulatory disincentives and lack of knowledge, track record and expertise among pension funds about these investments and their associated risks.

Figure 5.4. Volume and credit-rating of green bonds



Source: OECD Analysis (Della Croce, Raffaelle, Christopher Kaminker and Fiona Stewart (2011), "The Role of Pension Funds in Financing Green Growth Initiatives", OECD, Paris, and Bank for International Settlements Quarterly Review.

5.6. Development co-operation and the environment

Reaping the opportunities provided by globalisation requires that the benefits are distributed widely among and within countries. The integration of developing countries into the global economy provides opportunities for them to benefit from trade and investment flows and to lift millions more people out of poverty. Although extreme poverty has been reduced, many of the world's poorest countries have barely benefited from globalisation. Recognising that aid alone cannot end poverty or create growth, OECD countries have sought to promote greater coherence across a range of policies that affect developing countries including agriculture, trade, investment, and migration, as well as development co-operation.

Members of the Development Assistance Committee (DAC) of the OECD[45] considerably scaled up aid assistance in the last decade. Following the 2002 Monterey Conference on Financing for Development, donors committed to increase their aid by USD 50 billion - from USD 80 billion in 2004 to USD 130 billion (in 2004 dollars), or 0.36% of estimated GNI in 2010. By 2010, total net official development assistance (ODA) peaked at USD 129 billion, and represented 0.32% of GNI, equal to 2005

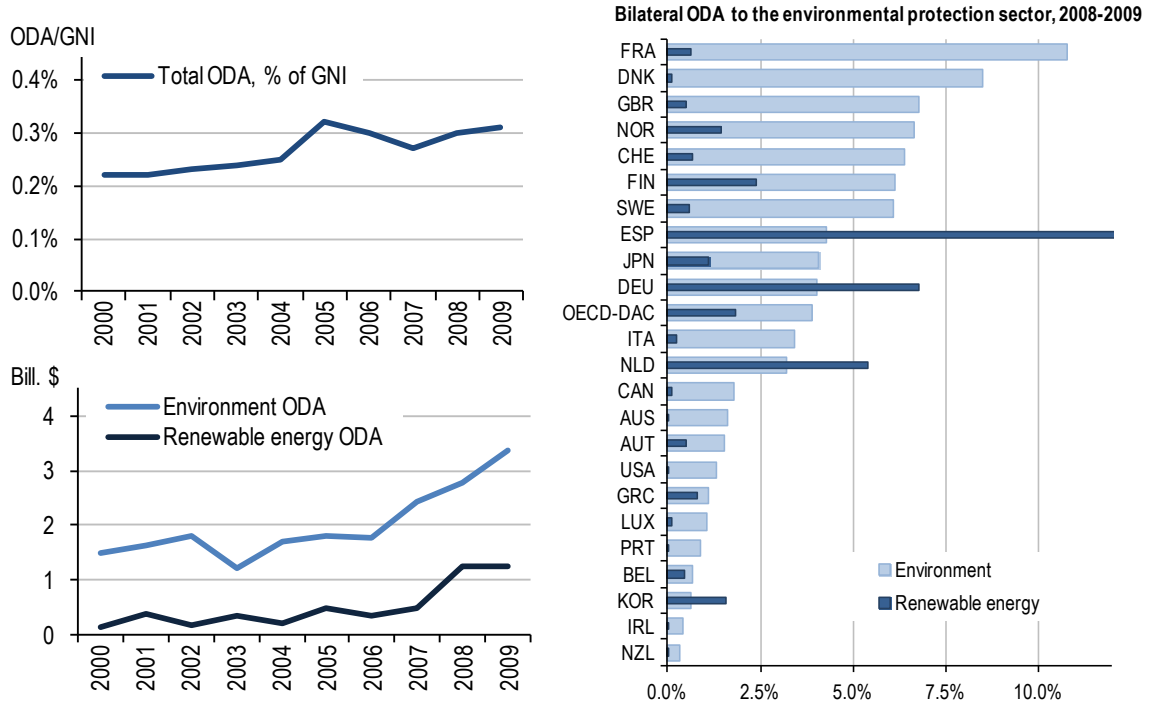
45. OECD DAC members: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States and European Union Institutions.

and higher than any other year since 1992. In 2010, the largest donors by volume were the US, the UK, France, Germany and Japan. In 2010, only Denmark, Luxembourg, the Netherlands, Norway and Sweden met or exceeded the UN ODA target of 0.7% of GNI.

The last decade also witnessed the emergence of non-DAC donors which accounted for 8% of total aid in 2009 (Zimmermann and Smith, 2011). Nearly half of non-DAC aid came from Saudi Arabia, Eastern Europe (including non-DAC OECD members) and Turkey. China provided an estimated USD 1.9 billion in gross ODA.

Many low-income countries are highly dependent on natural capital for livelihoods and to reduce poverty, making them vulnerable to the mismanagement or degradation of the resources on which they depend. Many are among the most vulnerable to environmental pressures which originate from their borders. These include climate change, desertification and imports of hazardous wastes. Opportunities to address some global environmental issues are often most cost-effective in developing countries. In accordance with the principle of "common but differentiated responsibility", effective burden-sharing arrangements are required to address a range of global environmental issues.

Figure 5.5. Trends in ODA for the environment and renewable energy, OECD DAC members



Notes: Members of the OECD's Development Assistance Committee (DAC); Total ODA as % of GNI relates to net disbursements of bilateral and multilateral ODA as a % of gross national income; Bilateral ODA commitments are considered for the environment and renewable energy. Environment-related ODA is here defined narrowly as bilateral ODA in sector on general environmental protection as a % of sector allocable bilateral ODA.

Source: OECD-DAC, Development Aid database.

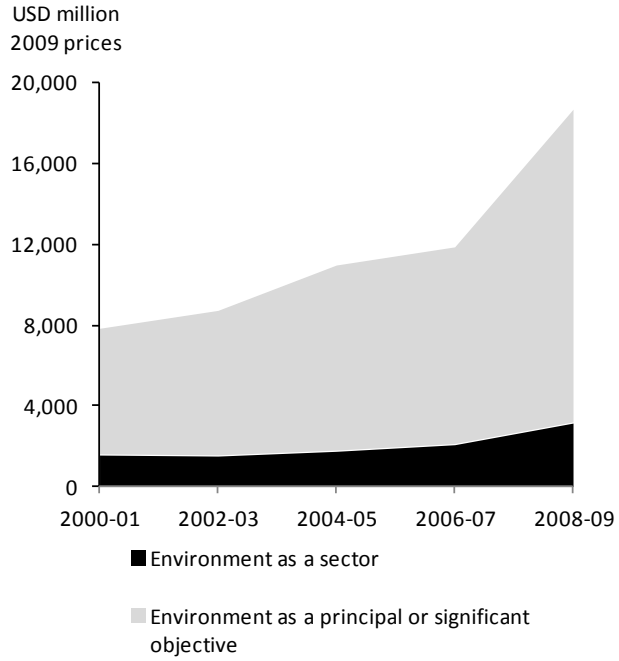
Given the economic significance of environment and natural resource issues, development co-operation provides an important mechanism for integrating environmental considerations into the national development strategies of developing countries. However, this need is not always recognised in developing countries due to the gap between private returns from environmental investments and the overall benefits that accrue to society. As a result, the environment is frequently assigned a low priority in developing countries, and there is resistance to what is sometimes seen as a developed country agenda. Development

co-operation can help developing countries to identify and close the gap between private and social returns. In addition, it can support the development process by disseminating relevant experience, supporting capacity development, transferring clean technologies, and supporting investments in environmental infrastructure and ecosystem services.

Until relatively recently, the environment did not gain much from the increased availability of aid resources. Between 2000 and 2007, ODA flows targeted at the environmental protection sector grew about three times slower than total ODA flows.[46] From 2007 onwards, the situation improved. ODA focused on general environmental protection increased by approximately 85% from 2005 till 2009, compared to an increase of 16% in total ODA over the same period. Aid for renewable energies has recently increased at a higher pace than aid for non-renewable energy.

On average, OECD-DAC countries allocated about 4% of bilateral ODA flows to the environmental protection sector over 2008-09. In addition, about 7% of aid allocated to other sectors had environment as a principal objective and about 14% as a significant objective. Using this definition, environmentally related aid flows more than doubled over the last decade, reaching about USD 19 billion in 2008-09.[47] Relatively, France and Denmark were amongst the largest donors, with their environmental shares of bilateral aid exceeding 8%. Spain and Germany were the leaders in ODA flows aimed at renewable energies, with respective shares of 11% and 6%. The relatively low share of environment in overall aid is partly due to increases in non-sector specific ODA, such as aid allocated to debt relief, and to emergencies and reconstruction needed to address catastrophic events, such as 2010 Haiti earthquake.

Figure 5.6. Bilateral aid in support of environment



Source: OECD-DAC, Development Aid database.

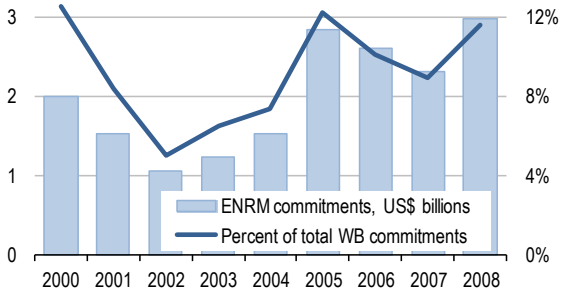
46. General environmental protection sector includes activities such as environmental policy and administrative management, biosphere protection, bio-diversity, site preservation, flood prevention/control, environmental education/training, and environmental research.

47. These figures exclude activities on water and sanitation not targeting environment as a principal or significant objective.

Aid to water and sanitation has risen sharply since 2001. In 2008-09, total annual average aid commitments to water and sanitation amounted to USD 8.1 billion. Bilateral aid to water increased at an average annual rate of 18% over the period 2002-09 and multilateral aid also rose by 10% annually. However, it is estimated that roughly a doubling of the annual rate of investment is needed for meeting the drinking water and sanitation MDG target (OECD, 2011i).

Apart from grant-based support, an important part of financing for the environment is provided through loans secured by multilateral development banks (MDBs). The World Bank has the largest portfolio of worldwide projects with clear environmental objectives. The Environment and Natural Resource Management (ENRM) accounted for about 9% of total new lending over the last decade. This share dipped after 2000, then rebounded, but in 2008 was still less than the 2000 level. The World Bank's lending activity mainly related to pollution management (24%), climate change (21%) and environmental policies (21%). However, the biodiversity portfolio has recently gained in importance and now accounts for nearly USD 2 billion, with an additional USD 1.6 billion from trust funds managed by the World Bank.

Figure 5.7. World Bank's Environment and Natural Resource Management Portfolio (ENRM)



Source: IEG World Bank, Annual Review of Development Effectiveness

Box 5.3. Priorities identified by the OECD High Level Meeting on Environment and Development, May 2008

- To further deepen the work by the OECD on adaptation, including integrating adaptation within existing aid modalities and environmental assessment processes, evaluating progress on adaptation, tracking aid for adaptation, incentivising private sector engagement, and examining the costs and other economic aspects of adaptation.
- To examine synergies between greenhouse gas mitigation and adaptation in the context of development objectives, to support the integration of responses to climate change into national development strategies, as well as analysis of incentive mechanisms such as for reducing emissions from deforestation and the Clean Development Mechanism.
- Comprehensive guidance on building capacity for integrating environmental considerations in national and sectoral plans and budgets, identifying approaches for "mainstreaming" and "upstreaming" environmental issues in sector policy dialogues, and testing the results of the work at country level. Capacity development in the context of climate change was of particular interest.
- Sharing of best practices with regard to capacity development and governance for environment, in the context of both the Paris Declaration on Aid Effectiveness and the Accra Agenda for Action. This should involve intensified collaboration between development co-operation and environment agencies.

Within the OECD, the DAC and EPOC developed their co-operation through the 2000s to better mainstream environment into development co-operation. An important aspect of this co-operation was how to integrate environment into the changing aid architecture which, in line with the 2005 Paris Declaration on Aid Effectiveness, called for a shift from an issue-centred approach to one that supported country

priorities as expressed in national programmes and budgets. Another major new focus of co-operation was on the need to assist developing countries to adapt to climate change. These and other issues were discussed at an OECD High Level Meeting on Environment and Development in May 2008.

Within the DAC peer review programme, increased attention was given to mainstreaming environment in aid programmes, and to examining the environment from a policy coherence perspective. A Synthesis Report (OECD, 2011g) recently assessed six development co-operation systems and identified good practices that provided evidence policy coherence.

Box 5.4. Environment and development: Policy coherence in Austria

The Austrian Federal Development Co-operation Act (2002) defines preservation and protection of natural resources as one of the three key objectives of Austrian development co-operation. Austria's Strategy on Sustainable Development (2002) recognises Austria's responsibility to promote sustainable development in developing countries. Its Umweltförderungsgesetz (Environment Act) of 2008 (§ 35 and §39 [1],6) specifies that any projects undertaken in developing countries under the flexible mechanisms of the Kyoto Protocol must respect the goals and principles stated in the development co-operation act, as well as international provisions. Austria is one of only a few DAC members to have taken this step towards policy coherence for climate change. Climate change is highlighted as a major global challenge in the Three-Year Programme 2008-10.

Strategic guidelines on environment and development are currently being developed through an inter-ministerial process, led jointly by the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry, Environment and Water Management. Co-ordination mechanisms are in place between the ministries and there is interest in joint strategy and analysis of key issues that link the two policy areas. In spite of Austria's great efforts towards policy coherence, further progress could be made by intensifying commitment to and moving forward on the policy coherence agenda by publishing clearly-prioritised and time-bound action agendas, clarifying mandates and responsibilities for policy coherence for development, and building a system for analysis, monitoring and reporting, which includes perspectives and experiences from the field.

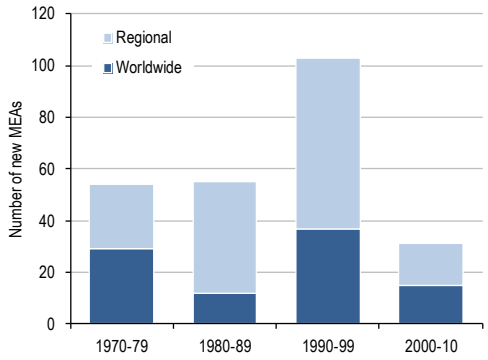
Source: OECD (2009a).

5.7. International environmental governance

Global, regional and bilateral environmental agreements are fundamental elements in the international system of environmental governance. They are complemented by a range of softer instruments that are not legally binding but which reflect commitments made by governments or Ministers. OECD Council Recommendations and Declarations fall into the latter category. In many cases the chain of negotiation-signature-ratification-implementation-results is long, and sometimes interrupted.

During the last decade, there appears to have been a shift from developing to implementing and amending global and regional environmental agreements.

Figure 5.8. Worldwide and regional MEAs by entry into force



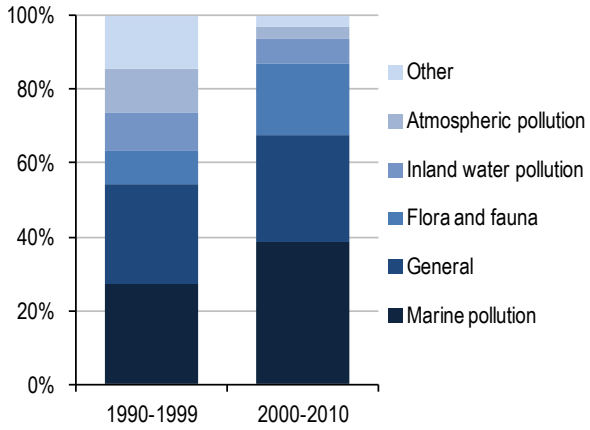
Notes: Data refer to selected major multilateral agreements concerning the environment. Included are agreements, conventions, treaties, protocols and amendments that were signed or ratified by at least three OECD countries. Ratification refers to accessions, acceptances, approvals and successions.

Source: UNECE, Council of Europe, IAEA, ILO, IMO, IUCN - Environmental Law Centre, OECD, UN, UNEP.

5.7.1. Multilateral environmental agreements

Multilateral environmental agreements (MEAs) have continued to mobilise the international community to address global and international environmental issues. They have also contributed to the further evolution of global environmental governance through the establishment of legal and policy instruments, as well as supporting institutional arrangements. Over the last decade, OECD countries have adopted and implemented a number of important MEAs, and further efforts have been made to support the implementation of MEAS in a more coherent and consistent manner. The focus shifted from signing new agreements to adopting protocols and amendments of existing MEAs.

Figure 5.9. MEAs by areas, signed 1990-2010



More than one-third of the MEAs signed since 2000 concerned marine issues. General MEAs accounted for about another third of recent MEAs. This category includes MEAs on more cross-cutting issues such as the 2003 Protocol on Pollutant Release and Transfer Registers (PRTR). Biodiversity accounted for 20% of the MEAs. The 2003 Cartagena Protocol on Biosafety, supplemented in 2010 by the Nagoya-Kuala Lumpur Protocol, was an important step towards ensuring an adequate level of protection in the transfer, handling and use of genetically modified organisms, which have potentially adverse effects on the conservation and sustainable use of biological diversity. In 2010, the Nagoya Protocol to the

Convention on Biological Diversity has provided a legal framework to secure a fair and equitable sharing of benefits from genetic resources.

Since the early seventies, OECD countries have signed over 250 major MEAs open for signature to all countries, but not all countries have ratified them. On average, OECD countries have ratified about 40% of the major MEAs. Most OECD countries could do more to ratify MEAs.

It is not feasible to assess the effectiveness of MEAs overall. Actions taken in relation to climate change and biodiversity are addressed under Objective 1. There have been important successes in other areas such as efforts to curtail the release of ozone-depleting substances, reduce trans-frontier movements of hazardous wastes, reduce dumping of waste at sea, protect certain species (*e.g.* cetaceans and migratory birds), and establish a framework for protecting the environment from maritime transport (see Box 5.5). Nevertheless, enforcement of MEAs remains a major challenge. Only a few MEAs have enforcement provisions.[48] The OECD (2008) has suggested that some of the main obstacles to stronger environmental co-operation include the public good nature of the environment resulting in asymmetries in the distribution of costs and benefits of co-operation; multilateral governance limitations including lack of trust and coherence in negotiations; low-profile of environmental issues on the foreign and domestic policy agendas; political and capacity constraints in non-OECD countries; weak analytical base with great uncertainty about the underlying data and the analysis of environmental problems and policy options that prevent some countries from full engagement in global co-operation.

Box 5.5. Maritime transport and the environment

Ocean shipping is the most important transport mode in international trade, and volumes are growing rapidly as a consequence of trade liberalisation. OECD countries have led in establishing the international regime. While Denmark, Greece, Japan, Norway are home of some of the largest fleets, memories are marked in Europe, North America and North-East Asia by tanker accidents. The shares of ocean shipping in CO_2 emissions, NO_2 and particulate matter are increasing and oil discharges continue to occur as a result of shipping operations (*e.g.* deballasting, tank washing, dry-docking, fuel and discharge oil). The risks of maritime accidents along several coastal areas and in straits are high, due to the heavy shipping traffic and fishing activity. For instance, it is estimated that about 220 000 vessels of more than 100 tonnes each cross the Mediterranean each year discharging 250 000 tonnes of oil, putting the Bonifacio, Bosporus, and Gibraltar straits at risk. A comprehensive international framework to prevent pollution, to respond to pollution and to scrap end-of-life ships has been completed largely in the recent decade, and is being progressively implemented with positive results.

The MARPOL 1973/78 Convention for the Prevention of Pollution from Ships covers technical aspects of preventing pollution from ships. Since August 2007, the oil fuel tanks in all ships with an aggregate oil fuel capacity of $600m^3$ and above must be located inside a double hull. Under the Safety of Life At Sea (SOLAS) Convention, double hulls have been required in all passenger ships. To reduce air pollution from ships, MARPOL Annex VI sets limits on SO_x and NO_x emissions from ship exhaust and prohibits deliberate emissions of ozone-depleting substances. Ships must either install an exhaust gas cleaning system or limit SO_x emissions. The Baltic and North Seas have been designated as a SO_x Emission Control Area (SECA). The IMO is also developing options to address greenhouse gas emissions from ships and is updating its greenhouse gas inventory from ships with a view to contributing to the development of a carbon indexing system. The recent goals of the Paris Memorandum of Understanding on Port State Control (1980) include inspecting at least 25% of foreign merchant ships each year. The International Convention on Oil Spill Preparedness, Response, and Co-operation (OPRC Convention) requires the establishment of measures for pollution incidents.

Liability and compensation regimes for oil pollution incidents are covered by the 1992 Protocols to the International Convention on Civil Liability for Oil Pollution Damage and the 2001 International Convention on Civil Liability for Bunker Oil Pollution Damage. In 2005, the 1992 International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage entered into force. The 2000 Protocol to extend the Convention to cover hazardous and noxious substances (HNS), entered into force in June 2007. The International

48. The Kyoto Protocol to the UN Framework Convention on Climate Change is an important exception, with a new compliance mechanism launched in March 2006. This convention successfully demonstrates a possible way to integrate the enforcement mechanisms within the MEAs.

Convention on Liability and Compensation for Damage in Connection with the Carriage of HNS by Sea, as superseded by its 2010 Protocol, is not yet in force.

Between 400 and 700 sea-going ships of over 2 000 dead weight tonnes (dwt) are dismantled for recycling worldwide each year, mostly in India, Bangladesh, Pakistan, Turkey and China. As a result of the contraction of trade associated to the financial and economic crisis, and the decommissioning of many single hull carriers, a high share of the present shipping fleet will be dismantled in the coming years. While vessels are mostly composed of steel and other metals that can be recycled, they also contain hazardous materials such as asbestos, oils and oil sludge, heavy metals and persistent organic pollutants (POPs). Since the 1980s, ship breaking has increasingly moved to Asian countries, driven by the demand for scrap steel and the higher price of steel in those countries, the low labour costs in some Asian countries, and tighter environmental regulations in Europe and North America. Beyond previously available guidelines, the IMO established a Ship Recycling Fund in 2006 and managed the preparation and adoption in 2009 of the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships. The Convention addresses the main concerns related to ship recycling, including the handling of environmentally hazardous substances in ships sold for scrapping, as well as concerns about the working and environmental conditions at ship recycling locations. It establishes an enforcement mechanism for ship recycling, incorporating certification and reporting requirements. In 2008, the EU adopted an EU strategy for environmentally sound ship dismantling. The United States government has established inter-agency committees to review and co-ordinate ship recycling and scrapping policies to ensure that health and environmental regulations are followed. Japan is participating actively in the establishment of major ship dismantling facilities in the Philippines.

The proliferation of MEAs has stimulated a debate on environmental governance: whether to strengthen the capacity of UNEP by establishing universal membership in its Governing Council and increase its financial resources, or create an overarching management body such as a "World Environment Organisation". Thus far no consensus has been achieved. In the meantime, a number of steps have been taken to better co-ordinate existing arrangements and to provide broad support for implementation of MEAs, including efforts to promote synergies among the "chemicals conventions",[49] and the establishment of the Strategic Approach to Integrated Chemicals Management (SAICM).

5.7.2. Financing MEAs

The Global Environment Facility (GEF) is one of the main funding channels supporting the implementation of the Rio Conventions, the Montreal Protocol, and the Stockholm Convention on Persistent Organic Pollutants. Since its establishment in 1991 through to 2009, the GEF raised USD 8.8 billion and mobilised an additional USD 38.7 billion in co-financing from bilateral agencies, recipient countries, and the private sector. The largest share of financing went to climate change projects, representing 33% (USD 1.96 billion) of all projects in 2009. Out of 234 projects worth USD 6.0 billion in 2009, biodiversity accounted for USD 1.3 billion, international waters for USD 1.1 billion, persistent organic pollutants for USD 0.2 billion, land degradation for USD billion 0.04, and the remaining sum for ozone-depleting substances and multi-focal projects. The multi-focal projects are aimed at creating synergies between different focal areas. The pattern of recipient countries has not changed much since 1991, with Asia accounting for the largest share (41%) in 2009, followed by Africa (30%), Latin America and Caribbean (16%), and Europe and Central Asia (8%).

49. The Stockholm Convention on Persistent Organic Pollutants (POPs), the Rotterdam Convention on Prior Informed Consent (PIC), and the Basel Convention on Control of Transboundary Movements of Hazardous Wastes and their Disposal.

Figure 5.10. The GEF portfolio by focal area of allocation

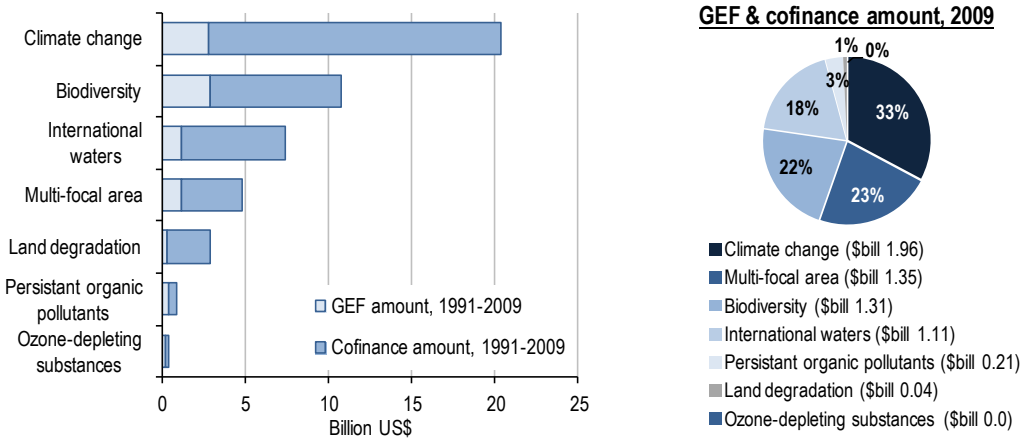
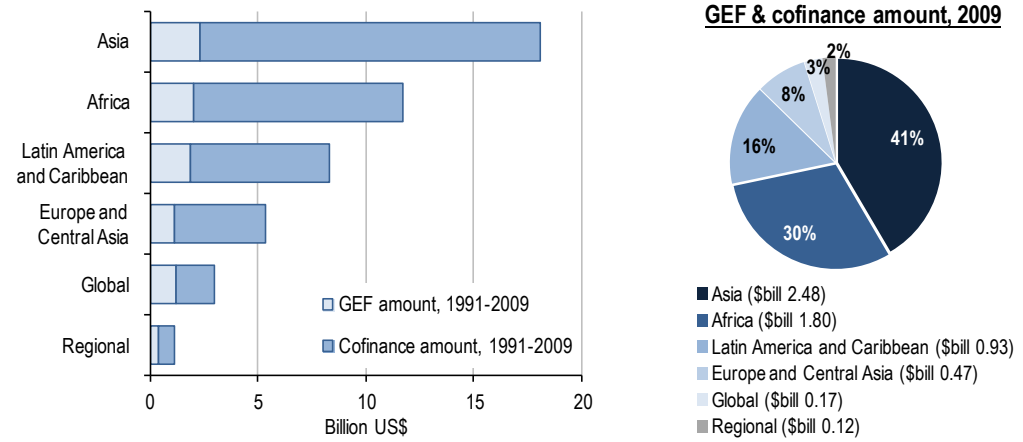


Figure 5.11. The GEF portfolio by region

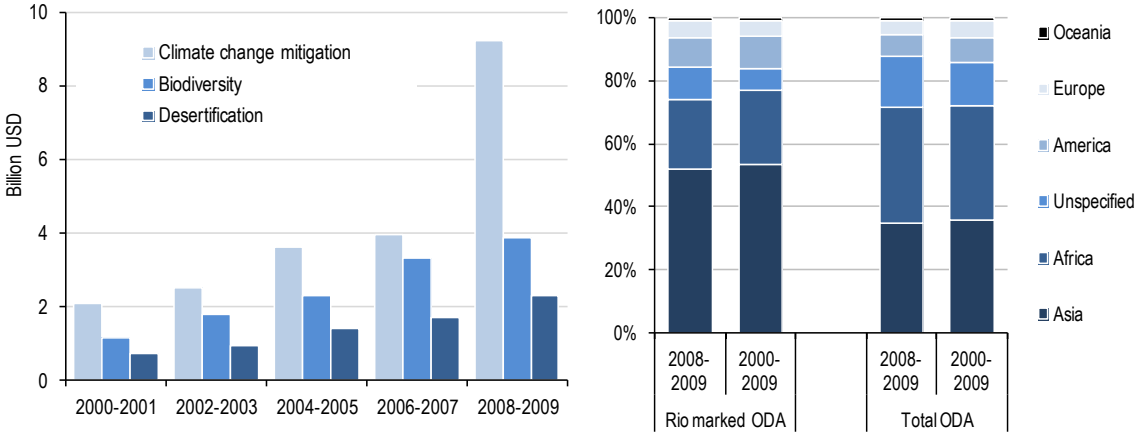


Notes: The total amount refers to value of projects financed by the GEF resources and the resources mobilised by the GEF through co-financing from development partners, including global and regional projects.

Source: World Bank, Global Environment Facility, *www.thegef.org/gef*.

Environmentally-focused aid has not been evenly disbursed across regions. About half of all aid marked for the Rio Conventions has been distributed to Asia, followed by Africa with a 24% share over 2008-09. Eastern Europe accounted for about 5% in the same period. These shares have remained fairly stable from 2000 until 2009.

Figure 5.12. Aid targeting the objectives of the Rio Conventions, OECD-DAC members



Notes: Members of the OECD's Development Assistance Committee (DAC), two-year averages, commitments at constant 2008 prices. Although a majority of activities targeting the objectives of the Rio Conventions fall under the DAC definition of "aid to environment", there is no exact match of the respective coverages. An activity can target the objectives of more than one of the conventions, thus there is a risk of double counting when adding the respective ODA flows.

Source: OECD-DAC, Development Aid database.

The Cancun Agreements, adopted the UNFCCC COP-16 in December 2010, included a commitment by developed countries to deliver fast-start finance of USD 30 billion for 2010-12, and a longer-term goal to mobilise USD 100 billion per year by 2020 from public and private sources. Governments also committed to create a Green Climate Fund. WRI estimates that the fast-start financing pledge is close to being achieved. This includes USD 4 billion for the REDD+ partnership (Reducing Emissions from Deforestation and Forest Degradation). However, there is continued discussion about the extent to which fast-track funds are "new and additional."[50]

The UN Secretary General established a High Level Advisory Group on Climate Financing which reported in November 2010 (UN, 2010). The Advisory Group considered that raising USD 100 billion per year was challenging but feasible, and called for decisions to be taken at an early stage. Delivering on the 2020 target will require a significant scaling-up of support from a wide variety of sources, public and private, bilateral and multilateral, including innovative sources of finance. Since 2008, through the International Climate Initiative, the German government has allocated a share of revenue generated by the auction of CO_2 emissions permits to climate protection measures in developing countries (OECD, 2012b). Other examples of innovative instruments include the financial transaction tax, recently proposed by the European Commission, which could provide support for adaptation to and mitigation of climate change for developing countries, as well as for financing development co-operation.

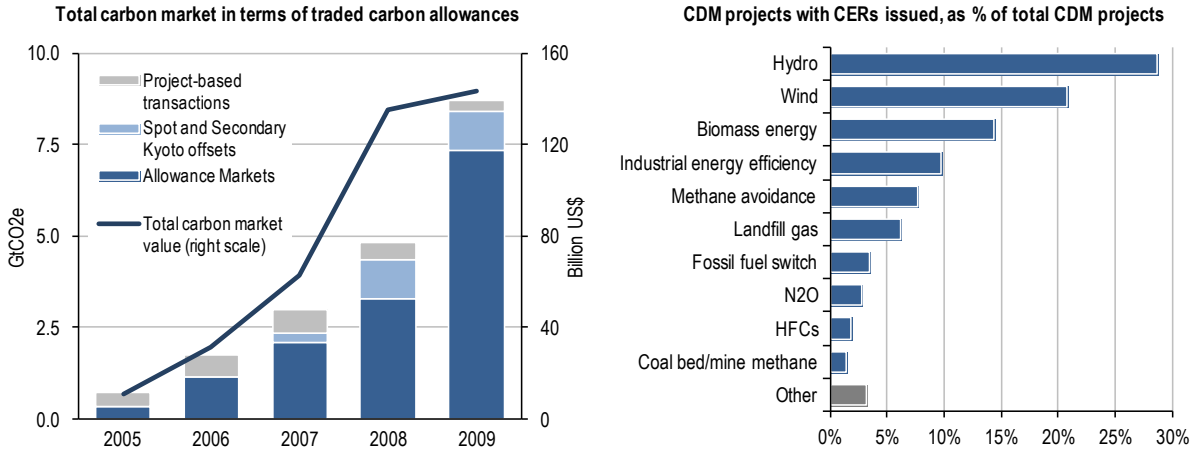
5.7.3. Emergence of an international carbon market

One of the most innovative developments at the international level over the last decade has been the emergence of a carbon market. In order to reduce the cost of achieving GHG reductions and facilitate investment in related projects, the 1997 Kyoto Protocol incorporated three mechanisms, *i.e.* "Emissions Trading", "Joint Implementation", and the "Clean Development Mechanism". A few emissions trading markets have been established over the recent years, the largest being the EU Emissions Trading System (ETS) launched in 2005.

50. See: *www.wri.org/publication/summary-of-developed-country-fast-start-climate-finance-pledges.*

The carbon market expanded rapidly since the establishment of the ETS, though it was affected by the global economic and financial crisis. On the demand side, reduced industrial output has led to lower demand for carbon allowances. On the supply side, investors responded to the crisis by diversifying portfolio positions towards safer asset markets. In spite of depressed demand exerting downward pressure on the carbon price, the market increased its value by 6% to USD 144 billion in 2009, for the amount of 8.7 Gt CO_2 traded allowances. The upsurge was followed by a slight decline in 2010, with the market value estimated at USD 142 billion.

Figure 5.13. Carbon market financing



Notes: LEFT PANEL - The figure refers to trading of carbon allowances in terms of volume and value of offset transactions, based on known volumes of sales of units and estimates of average offset prices. Allowance markets include European Union Emissions Trading Scheme (accounting for 96% of total allowances value in 2009), Assigned Amount Units, Regional Greenhouse Gas Initiative, New South Wales Greenhouse Gas Reduction Scheme, and Chicago Climate Exchange. Project-based primary transactions include Clean Development Mechanism (79% of value in 2009), Joint Implementation and, where data are available, Voluntary Market transactions. RIGHT PANEL - The shares are based on the number of CDM projects in the pipeline, as of January 2011. Total number of CDM projects includes registered projects and the projects at validation and requested registration. Rejected projects are excluded as well as the projects where validation has been terminated. Industrial energy efficiency category includes energy efficiency in industry and power generation from waste gas and waste heat recovery.

Source: World Bank State of the Carbon Market reports 2006-2010 (World Bank and Bloomberg New Energy Finance and Ecosystem Marketplace for data on the voluntary market); UNEP, Risoe CDM/JI Pipeline Analysis and Database.

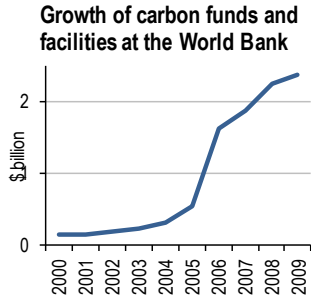
The European Union Emission Trading Scheme has been the driving force of the carbon market, accounting for 96% of total allowances value in 2009. The EU ETS turnover almost doubled to 6.3 GtCO_2 in 2009 compared to the previous year. In 2010, the EU carbon market growth stalled at USD 120 billion with the traded volume down by 4% relative to 2009. Allowances traded in other markets decreased from USD 4.3 to 1.1 billion over 2009-10. The sharpest decline came from North America where the Regional Greenhouse Gas Initiative's (RGGI) traded volume fell 76% from 2009 to 2010, in spite of a close to 10-fold increase (to USD 2.2 billion) in 2008-09. The Chicago Climate Exchange plummeted from USD 309 to 50 million in 2008-09, and its traded volume shrank by a further 76% in 2010. In Australia the New South Wales GHG Abatement Scheme continued to decline since the 2008-09 fall (from USD 183 to 117 million). Recently, New Zealand launched an emissions trading scheme, which is the first mandatory economy-wide scheme outside Europe. Since July 2010, this scheme has already covered half of national emissions and is expected to cover all emissions by 2015.

Project-based transactions also contracted as a result of the economic and financial crisis. The value of Clean Development Mechanism (CDM) projects representing 79% of all transactions, declined by 59% (2009/08) in response to the crisis. China remained the key seller of Certified Emission Reductions (CERs) issued by the CDM projects (41% of CDM projects). While traditionally attractive investment in landfill gas projects has declined, renewable energy and industrial energy efficiency projects now represent about

two thirds of the market. Given that key financial players in the carbon market operate in European exchange markets, the European region of OECD countries accounts for the lion's share (62%) of total demand for CDM projects.

Box 5.6. Carbon market finance funds and facilities at the World Bank

The World Bank Carbon Finance Unit (CFU) mobilises carbon funds through contributions of governments and companies in OECD countries to purchase project-based greenhouse gas emissions reductions in developing countries and countries with economies in transition. The total capital of the CFU's funds has grown from USD 145 million to USD 2.3 billion since 2000. The World Bank also issues green bonds to support World Bank-funded projects addressing climate change issues.



The Prototype Carbon Fund is the first and the largest (USD 180 million) among these mechanisms. It was launched in 2000 to provide an opportunity to its stakeholders to gain experience with the market for project-based greenhouse gas emission reductions. This initiative helped to catalyse markets for emissions mitigation and sustainable development, currently supported by 14 carbon funds and financing facilities of the World Bank. These mechanisms cover various activities. For example: the Community Development Carbon Fund (CDCF) is a public-private initiative designed in co-operation with the International Emissions Trading Association and the UNFCCC which provides carbon finance to projects in the poorer areas of the developing world that are bypassed by the carbon market; the BioCarbon Fund (USD 90 million) was designed to demonstrate and benchmark the use of carbon finance in forestry and agriculture projects with strong co-benefits in terms of biodiversity, land protection and poverty reduction; the Partnership for Market Readiness is a grant-based, capacity building trust fund that provides funding and technical assistance for the collective innovation and piloting of market-based instruments for greenhouse gas emissions reduction.

Source: World Bank, Carbon Finance Unit; *http://go.worldbank.org/51X7CH8VN0.*

International financial institutions have actively supported the emergence of an international carbon market. The World Bank has several mechanisms in place with an estimated capital of roughly USD 2.3 billion in 2009 (Box 5.6). The Multilateral Carbon Credit Fund (MCCF) of the European investment Bank (EIB) and European Bank for Reconstruction and Development (EBRD) has funding commitments of EUR 208.5 million, with carbon credits generated from various projects, such as energy efficiency, renewable energy, fuel-switching, and sequestration of greenhouse gases. In 2009, the Asian Development Bank's (ADB) Future Carbon Fund (FCF) had funding commitments of USD 115 million from several governments and private companies, and will complement the ADB's Carbon Market Initiative that provides financial and technical support for CDM projects.

Regional lending activity has also emerged through climate investment and technology funds to help developing countries initiate projects that support low-emissions and climate-resilient development. These funds are mainly channelled through the Asian Development Bank, African Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank and World Bank Group.

The Asian Development Bank (ADB) is helping countries in the Asia-Pacific region to mitigate the causes, and adapt to the consequences, of climate change by expanding the use of clean energy. Since its establishment in 2007, the ADB's Clean Energy Financing Partnership Facility had allocated USD 64 million to 69 projects (Buchner *et al*., 2011). The Climate Investment Fund (CIF) is channelled through the African Development Bank (AfDB) in the form of grants, concessional loans and risk mitigation instruments to developing countries. The CIF embraces two institutions. The Clean Technology Fund mobilised USD 4.4 billion worldwide to finance scaled-up demonstration, deployment and transfer of low emission technologies. The Strategic Climate Fund mobilised USD 1.8 billion worldwide for targeted programmes with dedicated funding for forest investment, the scaling up of renewable energy and the piloting of new approaches to initiate transformation with potential for scaling up climate resilience.

5.7.4. Regional environmental co-operation

OECD countries have also undertaken various forms of regional environmental co-operation. For example In Europe, beyond the EU, there have been a variety of initiatives, often within the framework of the UN Economic Commission for Europe (UNECE). Within this framework, Member states have adopted five environmental conventions, including one on transfrontier air pollution which has been instrumental in reducing air pollutants emissions. A variety of other mechanisms, such as the Environment for Europe process and the environment, transport and health programme are also carried out within this framework. In North America, the Commission for Environmental Co-operation, which was established in conjunction with the NAFTA free trade agreement, has fostered co-operation between Canada, Mexico and the US since 1993. In Asia, a variety of co-operative mechanisms are active, including tripartite ministerial meetings between China, Korea and Japan; the Northeast Asia Conference on Environmental Co-operation; ECOAsia; and the Asia-Pacific Forum for Environment and Development.

These mechanisms form part of international environmental governance, and have generated some unique forms of environmental co-operation, tailored to the specific needs of their regions. However, in addition to the obstacles facing global environmental co-operation, regional environmental co-operation must often address territorial disputes and other local conflicts that have sometimes been unsolved for generations.

Following the political and economic changes that began in central and eastern Europe in the late 1990s, the OECD supported a mechanism – the EAP Task Force – to help integrate environmental considerations into the process of economic and political reform.

Box 5.7. The EAP Task Force

The EAP Task Force (Task Force for the Implementation of the Environmental Action Programme for Central and Eastern Europe) was established in 1993 within the Environment for Europe process. Secretariat support since then has been provided by OECD. The main objective was to establish a framework to support both national actions and international assistance for environmental reconstruction in the transition economies of central and eastern Europe. Sharing and adapting the experience of OECD countries was central to that task.

During the 1990s, work was primarily focused on the countries of central Europe, and was credited with helping to create a good basis for those countries to begin their accession dialogue with the European Union. The EAP Task Force also provided the model for a programme of regional environmental co-operation in south-east Europe following the break-up of the former Yugoslavia.

Toward the end of the 1990s, the work of the EAP Task Force shifted to Eastern Europe, Caucasus and Central Asia (EECCA). The new programme of work was implemented increasingly through demonstration projects that were designed to either develop or test tools that could support policy and institutional reform. The new approach helped secure important outcomes. For example, the preparation of finance strategies for water supply and sanitation has enabled some EECCA countries to provide more predictable and stable financing for this sector. Other activities have resulted in the adoption of integrated pollution prevention and control, the strengthening of environmental

inspectorates, and the establishment of schemes to rate industry's environmental performance. More attention has also been given to capacity development, including through training of civil servants. Activities were implemented in close co-operation with both aid agencies and environment ministries.

Following the 2011 Environment for Europe Ministerial Conference in Astana, Kazakhstan, the EAP Task Force's work will concentrate on financing water resources management, including adaptation to climate change, and on green growth.

Selected recent MEAs, by OECD country, 2000-2010

Date	Place	Title		CAN	MEX	USA	JPN	KOR	AUS	NZL	AUT	BEL	CZE	DNK	FIN	FRA	DEU	GRC	HUN	ISL	IRL	ITA	LUX	NLD	NOR	POL	PRT	SVK	ESP	SWE	CHE	TUR	GBR	EST	SVN	CHL	ISR
WORLDWIDE AGREEMENTS																																					
2000	London	Amendment to the 1992 protocol amending the FUND 1971 convention (limits of compensation)	Y	R	R		R	R	R	R		R		R	R	R	R	R	R	R	R	R	R	R	R	R	R		R	R	R	R	R	R	R		R
2000	London	Protocol to the 1990 Conv. Oil pollution preparedness, response and co-operation - Pollution incidents by hazardous and noxious substances (OPRC-HNS)	Y				R	R	R					R	S	R	R	R						R		R	R		R	R				R	R	R	
2000	Montreal	Cartagena Protocol to the 1992 Conv. Biological diversity - Biosafety	Y	S	R		R	R		R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S	
2001	Canberra	Agreem. under the 1979 Conv. Conservation of migratory species of wild animals - Conservation of albatrosses and petrels (ACAP)	Y						R	R						R								R				R				R			R	
2001	London	Conv. Civil liability for bunker oil pollution damage	Y	R				R	R			R		R	R	R	R	R	R		R	R	R	R	R	R			R	S			R	R	R		
2001	London	Conv. Control of harmful anti-fouling systems on ships	Y	R	R	S	R	R	R			R		R	R	R	R	R	R		R		R	R	R	R			R	R			R	R	R		
2001	Stockholm	Conv. Persistent organic pollutants	Y	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S	R	R	R	R	R	R	R	R	R	R	R	R	R	R	S
2003	London	Protocol (supplementary fund) to the FUND PROT 1992	Y	R			R	R	R			R		R	R	R	R	R	R		R	R		R	R	R	R		R	R			R	R	R		
2004	London	Conv. Control and Management of Ships' Ballast Water and Sediments		R	R			R	S						S	R								R	R				R	R							
2006	London	Amendment to Annex I of LC PROT 1996 to the Conv. on the prevention of marine poll. by dumping of wastes and other matter (storage of CO2)	Y	R	R	S	R	R	R	R		R		R	S	R	R			R	R	R	R	R	R				R	R	R		R		R	R	
2006	Geneva	Revised agreement Tropical timber		R	R	R	R	R	R	R	R	R	S	R	R	R	R	S	S		R	R	R	R	R	R	R	R	R	R	R		R	S	R		
2007	Nairobi	Conv. International convention on the removal of wrecks												S		S	S					S		S										S			
2009	Hong Kong	Conv. Ships Recycling														S						S		S								S					
2010	Nagoya	Protocol to the 1992 Conv. Biological diversity - Access to genetic resources and the fair and equitable sharing of benefits arising from their utilization			S		S	S			S	S	S	S	S	S	S	S	S			S	S	S	S	S	S		S	S	S		S		S		
2010	Nagoya	Kuala Lumpur Supplementary protocol on liability and redress to the Cartagena protocol on biosafety									S	S	S	S	S	S	S		S		S	S	S	S		S	S		S	S	S				S		
REGIONAL AGREEMENTS																																					
2000	Lucerne	Protocol to the 1991 Conv. Protection of Alps - Transport	Y								R					R	R					S									S					
2000	Lucerne	Protocol to the 1991 Conv. Protection of Alps - Dispute settlement	Y								R					R	R					S									S					
2000	Florence	Conv. - European landscape convention	Y									R	R	R	R	R		R	R		R	R	R	R	R	R	R	R	R	R	S	R	R		R		
2000	Geneva	Agreem. - International carriage of dangerous goods by inland waterways (AND)									R		S			S	S		R			S	R	R				S									
2001	Sofia	Amendment to the 1991 Conv. Environmental impact assessment in a transboundary context									R		R				R		R				R	R	R	R		R	R	R	R			R			
2002	Valletta	Protocol to the 1976 Conv. Protection of the Mediterranean Sea against pollution - Preventing pollution from ships and, in cases of emergency, combating pollution	Y													R		S				S							S			R			R		S
2002	Gand	Agreement Meuse	Y									R				R	R						R	R													
2002	Gand	Agreement Scheldt	Y									R				R								R													
2003	Kiev	Protocol to the 1991 Conv. Environmental impact assessment in a transboundary context - Strategic environmental assessment	Y								R	S	R	S	R	S	R	S	R		S	S	R	R	R	R	S	R	R	R			S	R	R		
2003	Kiev	Protocol to the 1992 Conv. Transboundary effects of industrial accidents and to the 1992 Conv. Protection and use of transboundary water courses and international lakes - Civil liability and compensation for damage caused by the transboundary effects of industrial accidents on transboundary waters									S	S		S	S			S	R				S		S	S	S			S			S	S				
2003	Kiev	Protocol to the 1998 Conv. Access to env. information and public participation in env. decision-making - Pollutant Release and Transfer Registers (PRTR)	Y								R	R	R	R	R	R	R	S	R		S	S	R	R	R	S	R	R	R	R	R			R	R	R	
2003	Kiev	Conv. Protection and Sustainable Development of the Carpathians	Y										R						R							R		R									
2005		Agreem. Transfrontier co-operation with Saarlorlux-Rhineland-Palatinate-Walloon regions - French and German communities of Belgium														S	S						S														
2008	Madrid	Protocol to the 1976 Conv. Protection of the Mediterranean Sea against pollution - Integrated Coastal Zone Management for the Mediterranean														S		S				S							S					S			
2008	Lisbon	Additional protocol to the agreement Co-op. for the protection of the coasts and waters of the North-East Atlantic														R										R			S								

Source: UNECE, Council of Europe, IAEA, ILO, IMO, IUCN - Environmental Law Centre, OECD, UN, UNEP.

Notes: Data refer to major multilateral agreements concerning the environment. Included are agreements, conventions, treaties, protocols and amendments that were signed or ratified by at least three OECD countries. Ratification refers to accessions, acceptances, approvals and successions; Y = in force, S = signed, R = ratified.

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ANNEX A
ENVIRONMENTAL INFORMATION AND REPORTING: INSTITUTIONAL ARRANGEMENTS IN OECD COUNTRIES

	Environmental data		Environmental indicators		Environmental reporting & assessments		Environmental accounting		Sustainable Development indicators	
	Lead agency*	Other	Lead agency*	Other	Lead agency*	Other	Lead agency*	Other	Lead agency*	Other
Australia	NSO, EA	Various agencies	MIN, NSO	Various agencies	MIN	Various agencies	NSO, MIN, EA	Various agencies	MIN	Various agencies
Austria	MIN, NSO, EA	–	MIN	EA	MIN	EA	MIN	NSO, EA	MIN	SD Comm., NSO
Belgium	depends on region, + federal		depends on region, + federal		depends on region, + federal		depends on region, + federal		depends on region, + federal	
Canada	MIN	MINoth, NSO	MIN	MINoth, NSO	MIN	MINoth, NSO	NSO	–	MIN, NSO	Various agencies
Chile	NSO, MIN	Various agencies	MIN	–	MIN	–	MIN	–	MIN	Copper Commission
Czech Rep.	NSO, MIN	Various agencies	MIN, NSO	EA, RES	MIN, NSO	EA, other	NSO, MIN	RES	SD Council, MIN	Various agencies
Denmark	EA (MIN)	NSO, RES, other	EA (MIN)	NSO, RES	EA (MIN)	RES (MIN)	NSO	–	MIN	RES (MIN)
Estonia	EA	NSO	EA	NSO	EA	NSO	NSO	–	NSO	–
Finland	NSO	EA, other	EA	NSO, other	MIN	EA, NSO	NSO	–	MIN, EA	NSO, EA, RES
France	MIN	–	MIN	–	MIN	–	MIN	NSO	MIN	NSO, other
Germany	EA, NSO	–	EA	–	EA	–	NSO	–	NSO	–
Greece	MIN	NSO	MIN	EA	MIN	EA	NSO	Various MIN	MIN (EA)	–
Hungary	MIN, NSO	Other MIN	MIN	NSO, other MIN	MIN	NSO, other MIN	NSO	MIN	MIN, NSO	Other MIN
Iceland	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ireland	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Israel	NSO	MIN	NSO	MIN	NSO, MIN	–	NSO	–	NSO	MIN, RES
Italy	EA, NSO	–	EA, NSO	–	MIN	EA, NSO	NSO	EA	EA, NSO	–
Japan	MIN	–	MIN	–	MIN	–	MIN	–	MIN	–
Korea	MIN	NSO	MIN	–	MIN	NSO	MIN	NSO, Bank	MIN	–
Luxembourg	MIN	Various agencies, RES	MIN	EA	MIN	–	NSO, MIN	–	MIN	SD Committee
Mexico	MIN	NSO	MIN	NSO	MIN	–	NSO	MIN	MIN	Various agencies and ministries (MDG indicators)
Netherlands	NSO	Various agencies	EA	NSO, RES, other	EA	NSO, RES, other	NSO	EA, RES	EA	RES, NSO
New Zealand	MIN	NSO, other	MIN	Other agencies	MIN	Other, RES	NSO	RES, MIN, other	NSO	MIN, other
Norway	NSO, EA	MIN	MIN	EA, NSO	MIN, EA, NSO	–	NSO	–	MINfin	NSO, MIN, others
Poland	NSO, EA	MIN	EA, MIN	NSO	EA	MIN, NSO	MIN, NSO	MINeco	MIN	NSO
Portugal	EA, MIN, NSO	Various agencies	EA	NSO	EA	Various (RA, LA)	NSO	MIN	EA	NSO

	Environmental data		Environmental indicators		Environmental reporting & assessments		Environmental accounting		Sustainable Development indicators	
	Lead agency*	Other	Lead agency*	Other	Lead agency*	Other	Lead agency*	Other	Lead agency*	Other
Slovak Rep.	MIN, NSO	EA, other	MIN	NSO, EA, other	MIN	NSO, EA, other	NSO	MIN	NSO	MIN, MINoth
Slovenia	NSO, EA	–	NSO, EA	–	NSO	EA	NSO	–	NSO	–
Spain	NSO, MIN	EA	MIN	NSO	NSO, MIN	Various (RA, LA)	NSO	MIN	presidency	NSO
Sweden	EA	NSO, other	EA	NSO, other	EA	NSO, other	NSO	RES	MIN	NSO
Switzerland	EA, MIN, NSO	–	EA, MIN, NSO	–	EA, MIN, NSO	–	NSO	EA, MIN, MINeco	NSO	EA, MIN, other
Turkey	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
United Kingdom	MIN	EA, RES	MIN	EA, RES	MIN	EA, RES	NSO	MIN	MIN	Other agencies
United States	MIN	–	MIN	–	MIN	–	n/a	n/a	n/a	n/a

*) MIN=ministry of environment or ministry under which environmental matters are dealt with; NSO=national statistical office; EA=agency associated to ministry; Aoth=other agency associated to ministry; RES=research institute; ADV=advisory body.

MINeco-ministry of economy, MINfin=ministry of finance, RA=regional authorities, LA=local authorities, MINoth=other ministries

ANNEX B
NATIONAL STATE OF THE ENVIRONMENT REPORTS, DATA COMPENDIA AND INDICATOR REPORTS

	National SoE reports[a]			National Data Compendia[a]			National indicator reports[a]			
	Periodicity	**Publication years**	**Web**	**Periodicity**	**Publication years**	**Web**	**Periodicity**	**Publication years**	**Web**	**Comments**
Australia	Regular, every 5 years as of 2006	1986,87,96, 2006, 2011	✓	Regular	1980,86,92,96,2001, 2003 annual since 2006	✓	a) Every 5 years b) annual	a) 1998, 2000, in SoE: 2006, 2011 b) 2002, A since 2006	✓	a) Environmental indicators combined with national SoE report b) SDI: Measures of Australia's progress (headline indicators): annual since 2006
Austria	Biennial, triennial as of 2001	1988,93,96,97,99, 2001,04,10	..	Regular	1978,82,85,88,91, 94,96,98	--	..	a) 2000, 2008, 2011 b) 2004,06,07,09 c) 2007,09	✓	a) Indicators linked to environmental quality objectives b) SDI c) Headline indicators
Belgium Federal	every 4 years as of 2010	1979,1990 (discontinued) 2010	✓	annual	2000	✓	biennial	biennial since 1999	✓	SDI
Flanders	Regular, annual since 2001	Flanders: 1994,96,98,99, annual since 2001	✓			✓	annual	a) since 2004 b) since 2006	✓	a) combined with SoE report (MIRA) b) SDI
Wallonia	Every 5 years since 2003??	every 5 years since 2003??	✓			✓	annual	since 1987	✓	SoE dashboard
Brussels	Every 2 years since 2004	1996,2001,2003,2004,2007,2009	✓							
Canada	Regular	1986,91,96 (replaced by indicator reports)	✓	Regular	1978,86,91,94, 2000, Annual since 2002	✓	Regular	a) 1991, 1993, 2003 b) A since 2004	✓	a) National set of indicators: environmental signals; b) Canadian environmental sustainability indicators (CESI)
Chile	regular	1999, 2002, 2005, 2009 As of 2011: every 4 years	..	Annual	Since 2000	✓	Ad hoc	..	..	Work limited to MDG indicators (obj 7); study on SDI for mining done in 2002
Czech Rep.	Annual	1989,1991, 93- … 2008	✓	Annual	Since 1992, … 2010	✓	annual	--	✓	Core set associated with SoE report
Denmark	Regular, every 4 years	1991,94,98, … , 2009	✓	Regular	1990,94, A since 1998	✓	Annual ✪	Since 1991	✓	Thematic focus
Estonia	Regular	2001,05,09	✓	*Regular*	*Yearbook from 2000 to 2008; database now*	✓	Annual	a) Since 1998 b) 2009, 2011	✓	a) SoE indicators b) SDI
Finland	Regular	1982,…,92, 96, 2000, …, 2008	✓	Annual	1973,77,81,87,94, A since 2000	✓	Biennial ✪	a) 1996, 2000 b) since 2000	✓	a) Performance indicators b) Sustainable development indicators
France	Regular every 4 years	1978,80-92, 1994,98, 2002,06,10	✓	Regular	1974,78,82,86,94, 2000	✓	Regular	a) 1996, 2000 b) Annual c) Annual	✓	a) Performance indicators b) Key indicators c) SDI
Germany	Regular every 4 years	2002,04,10 Combined with data report	✓	~Biennial	1979,85,87,89, … 98 Online: continuous	✓	a) annual b) biennial	a) 1993,95, A since 1998,… b) biennial since 2006	✓	a) Key indicators linked to targets/goals b) SDI
Greece	--	2009??	--	--	1985	--	--	--	--	
Hungary	Annual	1990,91, A since 1996…	✓	Annual	1987, A since 1996	--	a) annual b) biennial	a) 1994, A since 2000, … b) biennial since 2010	✓	a) Key indicators b) SDI
Iceland	Biennial	..	..	..	..	--	-- ✪	--	--	
Ireland	Regular	1985,96,2000,04,08	✓	--	1987,93	--	Regular	1999	--	Publications planned ~ every 4 years

	National SoE reports[a]			National Data Compendia[a]			National indicator reports[a]			
	Periodicity	**Publication years**	**Web**	**Periodicity**	**Publication years**	**Web**	**Periodicity**	**Publication years**	**Web**	**Comments**
Italy	Regular	1987,89,92,97 2001,05,09	✓	Regular	1984,91,93,98 2003,05,07,08,09	✓	a) annual b) annual	a) from 2001 to 2010 b) from 2002 to 2010	✓	a) environmental indicators (data) yearbook b) SDI (CIPE (Inter-ministerial Committee for Economic Planning) Deliberation no. 57/2002
Israel	..	2002, 2011 (combined with indicators)	✓	..	2006		~ Regular	a) *ad hoc* (cf SoEr) b) 2006,08,10	✓	a) environmental indicators b) SDI
Japan	Annual	Since 1969 (white paper)	✓	Regular	1979, 2002, …, 2010	--	Annual	Since 2006	--	Indicators as part of Environment Plans
Korea	Annual	Since 1980	✓	Annual	since 1988	✓	--	2007 (pilot), planned to be biennial	--	Indicators as part of NSSD. Focus on environmental sustainability.
Luxembourg	*Ad hoc*	1993	..	--		--	--	a) 2002,06 b) 1998, 2003	✓	a) SDI b) Environmental indicators (l'environnement en chiffres)
Mexico	Biennial	1986,88,90,93, 94,98, 2000,02,05,08,	✓	~ Biennial Annual	1997,2000,03,05,06 Annual since 2008	✓	Regular (printed), Annual (CD) Continuous (online)	1998, …, 2005, Annual since 2008 Online: continuous since 2007	✓	a) National System of Environmental Indicators (including Performance and key indicators); b) SD indicators (MDG indicators, Goal 7)
Netherlands	Regular	1989,91,94,97,00, …. Env balance: annual Env outlook: regular	✓	~Biennial since 69	1974,77,79,83,86,…, 96,99 2005, …	✓	Regular	1993, –	--	a) Performance indicators, included in national outlook reports and data compendia
N.Zealand	..	1997, 2007	✓	..	1993	--	--	a) 2007 b) 2002, 2009	--	a) 22 core indicators used in SoE report b) SDI: 85 indicators
Norway	Biennial (dis-continued)	1999-2007 Web-based State of the Environment Norway since 2000	✓	Regular, annual since 1983,	1976,78,83, …., 2009 Discontinued temporarily, now booklet only	✓	Biennial ✪ Annual	a) 1999-2007 b) A since 2008	✓	a) Indicators included in annual government budget proposal to Parliament and in State of the Environment Norway (*www.environment.no*) b) Annual report on sustainable development indicators. National SDI-set: 17 indicators
Poland	Regular, every 4 years	1991,93,97,98 2006,10	✓	Annual	Since 1972	✓	Regular	2000	--	Indicators now included in SoE report
Portugal	Annual	Since 1987	✓	Annual	Since 1987	✓	Regular Annual	a) since 1999 b) 2000,07	✓	a) Since 1999, indicators included in SoE report, presented to Parliament with annual budget and programme proposal b) SDI: core set updated annually
Slovak Rep.	Annual	1993-2010 Annual since 1993	✓	Annual	Since 1992	--	Annual	Since 2004	✓	Environmental indicators: annual electronic updates SDI: ad hoc
Slovenia	–	--	--	--	-- thematic only	--	Regular	2010	✓	SDI: annual updates planned
Spain	Annual	Since 1984	--	--	--	--	Annual	–	✓	Thematic reports only Indicators included in annual SoE report
Sweden	Regular	1979,82,87,94,95, (99) A since 1998, online (quality objectives)	✓	Regular	1975- 77,79,81,84,87,90,93,96, 00	✓	Annual ✪	a, b) 1994, A since 1998 c) 2006	✓	a) large set linked to quality objectives b) key indicators used in gov. budget bill c) SDI
Switzerland	Regular	1990,93,97,(02) 2007,09,11	✓	Regular	cf indicators	✓	Regular	b) since 2005	✓	a) Large SoE indicator set developed in 2009 b) SDI: MONET database
Turkey	Regular	1981,83,85 2004,2007,2011	✓	Irregular	2003,2006	--	Regular Annual	A since 2007 2008,2010	✓	a)Environmental indicators b) Indicators now included in SoE report
United Kingdom	..	1992	..	Annual since 1978	1976 Pocket booklet or by theme only	✓	Regular Annual	1996,98,99 A since 2004	✓	a) environmental indicators: pocket book b) SD indicators (large set & headline)

	National SoE reports[a]			National Data Compendia[a]			National indicator reports[a]			
	Periodicity	Publication years	Web	Periodicity	Publication years	Web	Periodicity	Publication years	Web	Comments
USA	Regular	Annual from 1970 to 1997 2003(draft), 2008	✓	--	1978,81,83	✓	--	Online: continuous	✓	Environmental indicators developed in 2001; included in SoE report

Notes:

a) Includes only comprehensive periodic national reports. Sub-national, thematic or sectoral reports are not included here.

✪ Joint publication with other Nordic countries on environmental indicators, published in 1997 by the Nordic Council of Ministers.

BEL) No comprehensive national report since the early 1990s. Periodic SoE reports are published at sub-national level by Walloon, Flanders and Brussels regions, and also include indicators. Periodic reporting at federal level got a new framework and published a first report in 2010.

CAN) Production of comprehensive paper report discontinued; is replaced with a new state of the environment series based on specific themes and area assessments; indicator-based. Canada also publishes a series of indicator bulletins, each of which is updated regularly.

CHE) No comprehensive report, but various thematic brochures including data.

DEU) The German report on environmental data combines SoE reporting and data compendium.

ESP) No comprehensive indicator publication, but series of thematic reports.

FRA) No comprehensive data report published between 1994 and 1999, but series of thematic flyers. As of 2000, regular publication of a brochure with key figures, aimed at the general public, and of a statistical synopsis, aimed at a specialist and professional audience.

JAP) Summary version also published as a comic strip.

MEX) Format changed from SoE report to statistical Compendium for the 1997-98 report published in 2000.

LUX) No comprehensive publication. Web portal on the environment.

NLD) Environmental outlook report; also includes environmental indicators.

NOR) SoE report: white paper published biennially in the period 1999-2007 and transmitted to the Parliament. Was both a state of the environment report and an indicator report. The web-based State of the Environment Norway is updated more or less continuously. Data compendium: Comprehensive reports have been published in 1976, 1978, 1983 and 1994. The report on natural resources and the environment has been published annually since 1983 in both Norwegian and English. The report was discontinued in 2009. Publications and outputs are currently under review. Environmental data available at *www.ssb.no/english/*.

SWE) 1999: report on Sweden's 15 environmental quality objectives; close link to indicators.

TUR) No comprehensive data report, but thematic reports on air quality, municipal waste, etc.

UKD) Data compendium: since 2000, published on internet only. The UK's environmental indicators work is an integral part of its work on sustainable development indicators that includes a comprehensive set of more than 100 indicators and a small set of headline indicators.

USA) Annual report "Environmental quality" prepared by the White House Council on Environmental Quality (CEQ) discontinued. Used to include a compilation of environmental data. No alternative reporting established. In the early 2000s, the EPA has initiated the preparation of a new indicator-based environmental report. Sustainable development indicators were developed by an interagency group reporting to the CEQ, and a first report was published in 1999.

Source: OECD.

ANNEX C
POLLUTANT RELEASE AND TRANSFER REGISTERS (PRTRS): STATUS IN OECD COUNTRIES

	Is your country having a PRTR in place or under planning?	First year of data collection	Mandatory or voluntary	Scope			Report cycle	Public availability of					Are emissions of GHG included in the national PRTR?	If yes, are the GHG data in the PRTR used by the agency responsible for national GHG inventories reported to the UNFCCC?
				Reporting facilities (number)	Environmental media covered	Listed chemicals (number)		Full (raw) data	Aggregated data sets	Site/source specific data	Geographical data	Data in electronic form		
Australia	Yes	1998	Mandatory	4208	A,W,L	93	Annual	Yes	Yes	Yes	Yes	Yes	No	No
Austria	Yes	2007	Mandatory	~150	A,W,L	91	Annual	Yes	Yes	Yes	Yes	Yes	Yes	No
Belgium	Yes	1992	Mandatory	864	A,W,L	91	Annual	No	Yes	Yes	Yes	Yes	Yes	No
Canada	Yes	1993	Mandatory	~8500	A,W,L	347	Annual	Yes	Yes	Yes	Yes	Yes	No	N/A
Chile	Yes	2005	Mandatory	6979	A,W, L	120	Annual	Yes	Yes	Yes	Yes	Yes	Yes	Not yet
Czech Republic	Yes	2004	Mandatory	1325	A,W,L	93	Annual	Yes	Yes	Yes	Yes	Yes	Yes	No
Denmark	Yes	1996	Mandatory	~1000	A,W,L	ARS	Annual	Yes	Partly	Yes	Yes/soon	Yes	Yes	No
Estonia	Yes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Finland	Yes	1988	Mandatory	~500	A,W,L	50	Annual	No	Yes	Yes	Yes	Yes	n/a	n/a
France	Yes	1987	Mandatory	9389	A,W,L	124	Annual	No	Yes	Yes	Yes	Yes	Yes	Yes
Germany	Yes	2007	Mandatory	> 4000	A,W,L	91	Annual	Yes	Yes	Yes	Yes	Yes	Yes	No
Greece	Yes	2001	Mandatory	140	A,W,L	91[15]	Annual	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hungary	Yes	2007	Mandatory	651	A,W,L	91	Annual	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Iceland	Yes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ireland	Yes	1995	Mandatory	308	A,W,L	Per list	Annual	Yes	Yes	Yes	Yes	Yes	planned	Under investigation
Israel	Planned, see note	2012	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Italy	Yes	2007	Mandatory	~2400	A,W,L	91	Annual	Yes	Yes	Yes	No	Yes	Yes	Yes
Japan	Yes	2001	Mandatory	40000	A,W,L	462	Annual	Yes	Yes	Yes	Yes	Yes	No	N/A
Korea	Yes	1999	Mandatory	3012	A,W,L	388	Annual	Yes	Yes	Yes	Yes	Yes	n/a	n/a
Luxembourg	Yes	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Mexico	Yes	2004	Mandatory	2800	A,W,L	104	Annual	Yes	No	Yes	Yes	Yes	Yes	Yes, partially
Netherlands	Yes	1976	Both	~500	A,W,L	180	Annual	Yes	Yes	Yes	Yes	Yes	n/a	n/a
New Zealand	No, see note	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Norway	Yes	1992	Mandatory	2200	A,W,L	ARS	Annual	Yes	Yes	Yes	Yes	Yes	Yes	Yes, partially

Poland	Yes	2007	Mandatory	2711	A,W,L	67	Annual	Yes	Yes	Yes	Yes	Yes	Yes, except SF_6	No
Portugal	Yes	2007	Mandatory	755	A,W,L	91	Annual	No	Yes	No	No	Yes	Yes	No, in future yes
Slovak Republic	Yes	2004	Mandatory	~200	A,W,L	56/91	Annual	Yes	Yes	Yes	Yes	Yes	Yes, except F-gases	No
Slovenia	Yes	2007	Mandatory	~170	A,W,L	91	Annual	Yes	Yes	Yes	Yes	Yes	Yes	No
Spain	Yes	2001	Mandatory	~6000	A,W,L	115	Annual	Yes	Yes	Yes	Yes	Yes	Yes	Yes, partially
Sweden	Yes	2001	Mandatory	~1000	A,W	91	Annual	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Switzerland	Yes	2007	Mandatory	200	A,W,L	86	Annual	Yes	Yes	Yes	Yes	Yes	Yes	No
Turkey	Planned/pilot done	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
United Kingdom	Yes	1996	Mandatory	6000	A,W	209	Annual	Yes	No	Yes	Yes	Yes	Yes	No
United States	Yes	1987	Mandatory	23000	A,W,L	666	Annual	Yes	Yes	Yes	Yes	Yes	No	N/A
EC	Yes	2007	Mandatory	24000	A,W,L	91	Annual	Yes	Yes	Yes	Yes	Yes	Yes	No