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Work Stream 3: Revenue Options from Carbon-Related Sources

Executive Summary

This paper examines five potential carbon-related sources of public revenue that could make a contribution to the $100 billion goal in international climate finance by 2020. They include: 1) redirecting revenue from a carbon tax; 2) redirecting fossil fuel subsidies; 3) redirecting fossil fuel production taxes or royalties; 4) a tax imposed by developing countries on their energy-intensive exports to developed countries with carbon pricing ("carbon optimization tax"); and 5) a tax on electricity generation in developed countries (a "wires charge"). Each of these proposals considers variations that would require national efforts and, in some cases, internationally coordinated efforts to implement. Each proposal was evaluated against the set of criteria set out in the methodology paper, specifically: range of revenue potential; reliability and predictability; efficiency; incidence and equity; practicality; and political acceptability.

While each proposal has unique advantages and disadvantages when matched against the criteria, there are a few general observations common to them all.

- **Revenue from these proposals, with the exception of the carbon optimization export tax, would be generally unaffected by fluctuations in carbon markets.** This feature could make them attractive relative to (or as complements to) alternatives that are more influenced by prices in carbon markets.

- **The relative practicality and political feasibility of each proposal will vary across countries based on unique national circumstances.** Some countries may also be willing to pursue different options at different times as public opinion evolves.

- **Among the proposals in this workstream, those that only require national governments to act have a better chance of being implemented sooner than proposals that require coordinated international action.** The latter may have the potential to raise more predictable sums and thus may be more attractive to recipient countries. However, coordinated action typically require years of international negotiation followed by domestic action.

- **National governments are more likely to divert a portion of revenue from a particular source for international climate finance, rather than the entire revenue flow.** It always difficult to convince legislatures to divert revenue raised domestically for foreign beneficiaries. This difficulty will only be exacerbated in many countries over the next decade due to austere fiscal environments.

- **For any domestic revenue sources involving taxation or general revenue, national governments will likely want to retain control over annual spending, rather than provide some kind of automated mechanism.** Such national control would provide a regular opportunity for adjustments to funding levels, but could create a tension with efforts to provide reliability.

- **Proposals that impose a new or complex administrative burden will likely be more difficult to implement than proposals that rely on existing systems.** For example, setting up a new revenue collection scheme, developing a new compliance system, or requiring significant data collection and analysis, will introduce implementation challenges that could make certain proposals less attractive.

Following are summaries of the analysis conducted on each of the proposals:

Revenue from a Carbon Tax

A carbon tax is a potentially efficient and predictable way to raise revenue for climate finance. If a carbon tax were imposed on all energy-related CO_2 emissions in the "OECD+" countries, it would raise on the order of US$10 billion in 2020 for every U.S. dollar of tax per ton of emissions. However, it is highly unlikely that all of the OECD+ countries would find it politically acceptable to impose a carbon tax, or that those that do would commit any more than a small portion of overall revenue to international climate finance. Countries that do pursue carbon taxes would most likely apply them at their own domestically determined rates and over their own time horizon. The regressive incidence associated with the direct impacts of a carbon tax means that parliaments will be under considerable pressure to use revenue to soften the distributional effects of the tax on affected constituencies and/or investment in lower emission energy technology.

Redirection of Fossil Energy Subsidies

Phasing out fossil energy subsidies has political momentum among G-20 countries. It could be politically acceptable in some of these countries to redirect a portion of their subsidies to international climate finance. Depending on the number of countries that participate, the speed at which they remove their subsidies, and the amount that they choose to redirect for climate finance, this approach could lead to a predictable source of a few billion up to $8 billion dollars a year. With respect to efficiency, redirecting a portion of these subsidies would neither introduce nor correct any economic distortions apart from any effects arising from impacts on a country's overall fiscal balance. Funding would be more predictable in the next few years than it would be over the medium- or long-term. Although political momentum exists internationally for subsidy phase-out, the domestic politics of

redirecting funds for climate finance could be difficult given competing domestic budget priorities and a likely austere fiscal environment. If collected climate finance revenues are to be effectively spent, it will also be critical for developing countries to rationalize and phase out their inefficient fossil fuel subsidies. Legislatures in some contributing countries may expect developing countries to phase out such subsidies before redirecting their own subsidies for climate finance. Such a phase out, however, could be politically difficult for some developing countries.

Revenue from a Carbon Exports Optimization Tax

A carbon exports optimization tax is an export fee levied by countries without domestic carbon pricing (i.e. carbon tax or cap and trade system) on goods exported to countries with domestic carbon pricing. Under certain scenarios, this tax could raise as much as $9 to $31 billion a year in revenue for international climate finance in an efficient manner—by reducing distortions that could otherwise arise from uneven international carbon pricing. However, it would face serious and possibly insurmountable implementation challenges, given the difficulty of tracking the carbon intensity of goods and verifying the final destination of goods. The incidence of the tax will likely be borne by a combination of producers in exporting countries and consumers in developed countries. However, this imbalance could be addressed with the allocation of revenue. There are very serious implementation challenges. Fragmented supply chains and uneven international carbon pricing will make it very difficult to decide how to set and apply the tax. Further, reconciling possible WTO issues also raise considerable practical concerns. Politically, both developing and developed countries could have serious misgivings about this proposal due to equity, competitiveness, and fairness concerns on both sides.

Revenue from Redirected Fossil Extraction Royalties or Taxes:

Redirecting a portion of existing government revenues from fossil fuel production could provide billions—and perhaps tens of billions—of dollars in climate finance. However, the proposal raises equity concerns given that a majority of fossil extraction among developed countries occurs in only five countries. An exact revenue potential figure is elusive, as it depends on: whether only federal, versus provincial or state, revenues are considered; the scope of existing revenue collection instruments considered; and what portion of revenue is considered unavailable because of the nature of existing uses of the revenue. The approach would also present a domestic political challenge to redirect revenues away from existing domestic priorities for a new international mandate without raising new funds. Potentially affected countries are more likely to pursue this approach as one of a menu of options to generate revenue for climate finance rather than through a one-size-fits-all harmonized, global approach. The reliability and predictability of revenues would depend on how the allocation of those revenues to climate finance was structured, with allocations tied to the market value of fuel production being more volatile than allocations tied to the level of fuel production. A proposal designed to rely on existing revenue structures would be easier to implement than one that adopted new policies and administrative systems.

Revenue from a Wires Charge

A wires charge on electricity is a charge on electricity generation (kilowatt hours produced). A wires charge, if implemented in the OECD, could raise around $5 billion a year in a predictable fashion for a charge of $0.0004 per kilowatt hour (equivalent to a tax of $1 per ton of CO_2 on electricity emissions in OECD countries). With respect to efficiency, it is less efficient than a general carbon tax and may introduce distortions in countries that already have carbon pricing. However, the magnitude of these effects would likely be small for a small charge and would be further minimized if the charge were linked to carbon emissions. As with other, new, carbon- and energy-related charges, it is unlikely that such a charge would be politically acceptable in all countries, or that those that did adopt such a charge would agree to divert more than a small portion of revenue for international climate finance. Implementing a wires charge on a country by country basis while challenging will be much easier than implementing on a global basis. It would also need to be defined how a wires charge would relate to existing forms of carbon taxes or cap and trade schemes in the power sector.

Chapter 1 – Carbon Taxes

In addition to being a cost-effective market-based policy instrument for reducing emissions, a tax on greenhouse gas emissions ("carbon tax") could serve as a means of generating revenue for international climate finance.

Key dimensions of a carbon tax proposal that need to be considered in its evaluation include: the set of countries that adopt such a tax, the level of the tax (defined on a "per-ton-of-CO_2-equivalent" basis), and the scope of greenhouse gas emissions within each country that are subject to the tax.

A carbon tax could either be unilaterally adopted by individual countries, or could be implemented on a harmonized, global basis. A globally harmonized tax may be applied just in developed countries, or in both developed and developing countries, with taxes in the latter potentially being set at different levels and/or phased in after taxes are imposed in developed countries. Whereas all means of raising funds in developed countries for international climate finance raise questions about how funds would be distributed from developed to developing countries, imposition of a carbon tax in developing countries raises the possibility of — and questions about — potential flows between developing countries.

A Swiss proposal for a global carbon tax is one example of a globally harmonized tax. That proposal would involve every country imposing a base levy of US$2 per ton on all carbon dioxide emissions from fossil fuel use. The base tax rate would be adjusted downward in each country to reflect an exemption on the first 1.5 tons of emissions per capita, such that each country below this level of per capita emissions would impose no tax at all, and each country with per capita emissions above 1.5 tons would reduce the tax rate by a percentage equal to the percentage that 1.5 tons is of the country's actual per capita emissions.[1]

As is suggested by the Swiss proposal, domestic carbon tax levels consistent with meeting international climate finance goals may be below the carbon price needed to achieve developed countries' near-term emission reduction goals. Therefore, a carbon tax employed by a developed country to meet its international climate finance commitment likely would be implemented in addition to other domestic emission reduction measures, such as an emission trading system. Alternatively, countries that have already adopted a carbon tax for purposes of meeting domestic emission objectives might simply devote a portion of revenue from such a tax to international climate finance. Thus, use of a carbon tax for international climate finance could either involve the imposition of a new tax on emissions, or reallocation of revenues from an existing tax.

Introduction of a carbon tax raises many issues, including: the level of the tax, and procedures for changing it; the point at which the tax is collected; compliance; enforcement; macroeconomic effects;

[1] Federal Department of the Environment, Transport, Energy and Communications, "Funding Scheme for Bali Action Plan: A Swiss Proposal for Global Solidarity in Financing Adaptation," May 27, 2008. Available at: http://www.bafu.admin.ch/klima/10343/index.html?lang=en.

possible differential treatment; use of revenues; and how to treat sequestration – activities that deliberately withdraw atmospheric carbon dioxide (CO_2).

I. RANGE OF POTENTIAL REVENUE RAISED[2]

The total level of revenue raised by a carbon tax depends fundamentally on the tax rate, the set of countries that adopt the tax, and the scope of the tax's coverage within each country. However, as compared to other proposed revenue sources for international climate finance, while political factors may limit potential revenue from a carbon tax, as a technical matter, there are no binding limits on the potential revenue that can be raised from a carbon tax.

For every U.S. dollar of tax per ton of emissions, a tax on all energy-related CO_2 emissions in the "OECD+" countries would raise on the order of US$10 billion in 2020, with the exact amount depending on the level of emission reductions from forecasted "business-as-usual" levels achieved in these countries.[3] When applied to all energy-related CO_2 emissions worldwide, including developing countries, every U.S. dollar of tax per ton of emissions would raise on the order of US$30 billion in 2020. At the same time, if the tax were only applied to emissions within particular sectors, the revenue potential would be reduced. For example, if it were only applied to CO_2 emissions associated with electricity generation in OECD+ countries, every U.S. dollar of tax per ton of emissions would raise somewhat less than US$5 billion in 2020.

Note, however, that all of the above estimates assume that 100 percent of the revenue from each U.S. dollar of tax per ton of emissions would be devoted to international climate finance. This may be an unrealistic assumption, particularly where a new carbon tax is being imposed, as opposed to the case where a portion of an existing carbon tax is devoted to international climate finance. Thus, the above estimates could be viewed as upper bounds on the revenue potential from a carbon tax.

II. RELIABILITY/ PREDICTABILITY

2 The methodology paper did not provide the necessary set of assumptions to develop estimates that are fully consistent with the proposed scenarios. Specifically, it did not provide estimates of energy-related CO2 emissions by country grouping under the three scenarios. Therefore, to remain generally consistent with the three common scenarios, the above uses forecasts from the same source document (WEO2009) and produces estimates on an "order of magnitude" basis, rather than precise estimates that would suggest precise emission estimates associated with each of the three scenarios.

3 These and subsequent values are based on the World Energy Outlook 2009 forecast of 2020 emissions for the "OECD+" countries, which include the OECD countries and other non-OECD European Union countries, in both the reference case and 450 ppm forecast scenarios.

A carbon tax could be a highly stable source of revenue for climate finance because carbon consumption is relatively stable and because the elasticity of demand is generally quite low. The tax rates needed to meet international climate finance needs would likely be too low to make a significant impact on demand. As carbon emissions fall or as the revenue need increases, the tax rate would have to be increased. While there may be some political resistance to increasing carbon taxes in certain jurisdictions, depending on the economic environment, it would be possible to establish a clear and predictable path of taxes over time.

III. EFFICIENCY

By internalizing some (or all) of the negative externality resulting from greenhouse gas emissions, imposition of a carbon tax can improve economic efficiency in countries that do not already price carbon. In countries that already price carbon through an emission trading system, the economic effects of a carbon tax will depend on the extent to which the emissions subject to the tax overlap with emissions covered by the emission trading system. If there is perfect overlap, the tax will simply lower allowance prices in the emission trading system, but otherwise will have no direct effect on domestic economic activity.[4] On the other hand, if only some of the emissions under the emission trading system are subject to the tax, the imposition of the tax could introduce inefficiencies in emission reduction efforts as some sources face both the allowance price and the tax, and others face just one or the other.[5] A similar inefficiency could be introduced if the domestic emission trading system allows for the use of international offsets. In this case, offset activities will face just the allowance price, while domestic activities will face both the allowance price and the tax.

A separate efficiency concern related to the imposition of a carbon tax is that associated with the potential for economic dislocation and associated emission leakage if only some countries impose a tax. Specifically, if energy-intensive trade-exposed industries in certain developed countries face a carbon tax that competitors in other countries do not face (or face at a lower level), this could lead to a shift in some economic activity toward countries without such a tax. Because it would be driven by differences in countries' policies toward the same global pollutant, rather than by real economic factors, such a shift would be economically inefficient and would lead to undesirable emission leakage. Various policies, such as production-based rebates to affected industry and so-called "border adjustments" imposed on

[4] As with all other proposals for international climate finance, use of tax revenue for international climate finance could have broader economic effects associated with the resulting flow of funds abroad. This broader effect, which should be common to many proposals, is not addressed here.

[5] Differences in carbon prices will encourage some sources to undertake higher cost abatement measures even when lower cost options (associated with emissions that face an allowance requirement but are not subject to the tax) remain untapped elsewhere under the emission trading system.

imports, have been proposed as means of addressing this undesirable consequence of uneven carbon pricing across countries.

Of course, the magnitude of any impact on efficiency resulting from a carbon tax for international climate finance would depend on whether that tax has an incremental effect on carbon prices, or is simply a reallocation of some revenue from existing carbon pricing. It will also depend on the level of the carbon tax. At rates of just a few dollars per ton of CO_2, any potential efficiency consequence is likely to be quite limited.

IV. INCIDENCE AND EQUITY

Incidence and equity considerations should be evaluated with respect to within-country impacts and -- for consideration of a globally harmonized tax -- across-country impacts. By definition, a carbon tax's incidence across countries would be directly related to differences in each country's taxed emissions. If the tax is imposed only on energy-related CO_2 emissions, or only on particular economic sectors, the variation in tax burdens across countries could differ from variation in total greenhouse gas emissions across countries.

Within countries, among businesses, a carbon tax is likely to have the greatest effect on energy-intensive industries such as steel, cement, aluminium and mining. At a household level, by increasing the cost of using fossil fuels, a tax will have both direct impacts on household energy expenditures, and indirect impacts on broader household expenditures, as a result of increasing the production costs for various other goods and services that households consume (e.g., food). A study of impacts in the United States found that the direct impacts on household energy expenditures are regressive, imposing greater burdens as a share of income on poorer households than on wealthier households.[6] However, indirect impacts, which are roughly comparable in size to direct impacts, were found to be neither regressive nor progressive. Of course, the magnitude of all of the above effects will depend on the level of the carbon tax. If the rate is kept low on a broad base, these effects are not likely to be large.

V. PRACTICALITY

Assuming that the design leads to taxing upstream producers or as few choke points as possible, a carbon tax would likely be a relatively easy tax to collect. It is also relatively trivial to work out the tax rate on a unit of coal or gas or fuel depending on the rate of tax on a ton of carbon emitted. If such a tax is imposed alongside countervailing trade taxes to address emission leakage concerns noted above, then the complexity of implementing the tax would increase.

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[6] See Kevin Hassett, Aparna Mathur, and Gilbert Metcalf, "The Incidence of a U.S. Carbon Tax: A Lifetime and Regional Analysis," *The Energy Journal* 30(2): 155-177.

VI. POLITICAL ACCEPTABILITY

Depending on the design option, there are several reasons for both developed and developing countries to reject a proposed global carbon tax. Developed countries may oppose it for two sets of reasons. Firstly, some countries already have very high taxes on fuel and even on other sources of energy and will resist further taxes. Secondly, some countries have very low levels of taxation on energy and may resist the imposition of the tax because of the adjustment cost that it imposes on the economy, even if these adjustment costs are microeconomic in nature. Developing countries too could oppose such a tax either because the Copenhagen agreement says that the revenue must be raised from developed countries or because the adjustment cost may be too onerous with negative distributional impacts on the poor.

As the experience with two different efforts to implement energy-related taxes in the early 1990s suggest, the political acceptability of a carbon tax within each country will likely depend on considerations that differ across countries. In 1991, Norway succeeded in introducing a tax on CO_2 emissions that, as of 2005, covered 64 percent of Norway's CO_2 emissions and 52 percent of its total greenhouse gas emissions.[7] The tax rates varied depending on the type of fuel, but were in some cases higher than US$40/ton of CO_2.[8] By contrast, in 1993, the Clinton Administration was unsuccessful in passing its proposed "Btu tax" on energy products. A British Thermal Unit (Btu) is a measure of a fuel's heat content, and the proposed Btu tax was 25.7 cents per million Btus (MMBtu) for all fuels except refined petroleum products, for which the proposed tax was 59.9 cents per MMBtu. When converted to a dollar per ton of CO_2, these rates were all below US$10 per ton, and hence well below the tax rates adopted around the same time in Norway. Yet, this plan met substantial resistance, and the law that was ultimately enacted did not include a broad-based Btu tax. Instead, the law only included a 4.3 cent per gallon tax increase on motor fuels (roughly equal to 35 cents per MMBtu for refined petroleum products).

[7] International Energy Agency (2005), *Energy Policies of IEA Countries: Norway 2005 Review*, p. 49. Some adjustments were made to the application of the CO_2 tax after Norway joined the European Union Emission Trading Scheme.

[8] Specifically, when it was introduced in 1991, the tax on emissions associated with offshore natural gas extraction was 257 Norwegian krone (NOK) per ton of CO_2. At the time, this was equivalent to more than US$40 per ton. See Mikael Skou Andersen, Niels Dengsøe, and Anders Branth Pedersen, "An Evaluation of the Impact of Green Taxes in the Nordic Countries," TemaNord 2000:561, p. 46. Available at: http://www.norden.org/da/publikationer/publikationer/2001-566/at_download/publicationfile.

Chapter 2 – Redirecting Fossil Energy Subsidies

The leaders of the world's largest economies committed last year at the G-20 Pittsburgh Summit to phase out and rationalize over the medium term inefficient fossil fuel subsidies, noting that, "Inefficient fossil fuel subsidies encourage wasteful consumption, reduce our energy security, impede investment in clean energy sources and undermine efforts to deal with the threat of climate change." Leaders further called on all nations to adopt policies that will phase out such subsidies worldwide.

Fossil fuel subsidies have been estimated globally at several hundred billion dollars per year. The IEA estimates that, in 2008, the scale of subsidies for the consumption of fossil fuels was around $550 billion. These consumption subsidies were provided predominantly in developing countries where they frequently serve as social safety nets in place of more targeted assistance programs for the poor. Developed countries, meanwhile, do not typically subsidize on net the end-user price for energy but do sometimes subsidize production of fossil fuels (as do many developing countries). Subsidies to producers of fossil fuels worldwide may be on the order of $100 billion per year, although there are not current analyses of production subsidies that systemically examine a wide range of countries.[9]

This chapter will examine the possibility of redirecting a portion of the funding currently used to subsidize fossil fuels into climate finance. As such it will focus on the question of subsidy phase out in countries that are likely to be climate finance contributors (typically developed countries). However, it should be noted that fossil fuel subsidies impede investments in clean energy sources. As such, countries that are potential recipients of climate finance will likely need to rationalize and phase out fossil fuel subsidies in their own countries in order to pave the way for effective climate finance, particularly for clean energy technologies.

I. RANGE OF POTENTIAL REVENUE RAISED

Immediate elimination of all fossil fuel subsidies in likely contributor countries and simultaneous redirection of all funds could generate near-term revenues ranging from several billion to a few tens of billions of dollars annually. As part of the G-20 commitment to phase out subsidies, several Annex 2 developed countries have indicated their plan to phase out about $8 billion per year in subsidies.[10] Some researchers have estimated the collective scale of subsidies among all developed countries to be

[9] International Energy Agency, Organization of the Petroleum Exporting Countries, Organisation for Economic Co-operation and Development, and The World Bank, 2010. Analysis of the Scope of Energy Subsidies and Suggestions for the G-20 Initiative. Available at: http://www.g20.org/exp_04.aspx

[10] G-20, 2010. Report to Leaders on the G-20 Commitment to Rationalize and Phase Out Inefficient Fossil Fuel Subsidies. Available at: http://www.g20.org/exp_04.aspx

higher. Given competing domestic budget priorities and the likelihood of fiscal austerity in many relevant countries over the next decade or longer, it is likely that only a limited amount of redirected subsidies would be set aside for international climate finance. Furthermore, since subsidies are frequently used to further a specific objective, subsidy removal will often be accompanied by a redirection of some funding into alternative measures that accomplish the same objective. For example, subsidies for domestic production of fossil fuels are often provided under an energy security rationale. Phase out of subsidies might then be accompanied by a shift towards support of other measures that are viewed to increase energy security, such as increased energy efficiency. Further, immediate removal of subsidies rarely occurs in practice; more often, a gradual phase down of subsidies is employed. A more realistic scenario for estimating potential revenue might consider the possibility of likely contributor countries gradually reducing and eliminating subsidies over the next decade, while redirecting a portion of current subsidy amounts to climate finance.

II. RELIABILITY/ PREDICTABILITY

The redirection of fossil fuel subsidies could be a relatively stable source of climate finance in the near term. It would be much less predictable over the medium- or long-term. In the near term, subsidies involve specific government outlays and foregone receipts that could be redirected if subsidies are reduced. Still, there are challenges. First, it is difficult to measure the budgetary cost of some subsidies. For example, the removal of a subsidy does not result in a new revenue source but in the removal of an expense. While the value of this expense can be estimated, its removal will most likely accrue to a government's general budget and will be hard to isolate. Second, some subsidies will not have a direct budgetary cost (e.g., some policies induce transfers between producers and consumers, such as export restrictions on domestically produced coal).

The medium- and long-term challenges to providing climate finance through subsidy phase out are far more difficult. As subsidies are reduced, it will become increasingly challenging to accurately measure the counterfactual over a series of years. For example, ten years after subsidies are removed it will be difficult to estimate what subsidies would have been had they not been reduced or eliminated. Over the long-term, to the degree that the amount of revenue generated is predictable, it should be on a downward trajectory. If developed countries are to reduce emissions in line with current projections (e.g., according to the commitments made through the Copenhagen Accord), then the use of fossil fuels will decrease in these countries and so too would any subsidies provided to fossil fuels. Finally, for this reason, the redirection of fossil fuel subsidies is not a source of climate finance that will be scalable over time.

III. EFFICIENCY

Phasing out of fossil fuel subsidies can reduce wasteful consumption and enhance economic efficiency and growth. As such, it may be a desirable policy choice apart from the question of what is done with the government revenues recovered from subsidy reform. The redirection of fossil fuel subsidies could therefore be an efficient way to generate climate finance. As noted previously, if climate finance is to be invested – not just collected – efficiently, it is imperative that developing countries also phase out inefficient fossil fuel subsidies, as these impose barriers to cost-effective investment in clean energy sources.

IV. INCIDENCE AND EQUITY

Within developed countries, the removal of subsidies will tend to impose costs on a concentrated group of producers, but consumers should not bear any significant new cost. Subsidies for fossil fuels in developed countries are often directed at domestic production and have a small impact on market energy prices. Therefore, the effect of subsidies on end prices for energy is often small or even non-existent, particularly for oil where the commodity is traded globally and the effect of subsidies on global supply is negligible. Further, subsidies are frequently targeted at specific producers who may not be the marginal producers and in these cases any "rents" associated with the subsidies will accrue to shareholders of these firms. Redirecting energy subsidies for international climate finance will, however, reduce the available tax base for other budgetary priorities.

Across developed countries, those with more subsidies will bear a heavier relative burden than those developed countries with less. To the extent that countries are contributing public funds from other sources for international climate finance, they may choose to set aside more or less of their redirected subsidies for climate finance purposes.

Although not the focus of this analysis, the incidence of subsidies in developing countries is quite different, as subsidies are more often targeted at consumption, are relatively large on a per-unit-of-energy basis, and often materially affect the end price of energy. In these cases, subsidies are often intended to benefit the poor, although in many cases they do so imperfectly or even poorly. This can particularly be the case where the poor lack energy access, and the majority of subsidies benefit middle class or even upper-income families that do have access to improved energy services as well as higher levels of energy consumption compared to the poor. In these cases subsidy removal can be a progressive policy, particularly if revenues are shifted towards providing energy access for the poor. In addition, if the new energy sources that are provided are renewable, this can insulate consumers from some of the volatility in fossil fuel energy prices.

V. PRACTICALITY

As noted above, one feature of fossil fuel subsidies is that they often come out of general government budgets. This is particularly the case in many developed countries with respect to production subsidies which are often provided through incentives in the tax code. The removal of these subsidies will increase general government revenues which could then be appropriated specifically for international climate finance. Since legislatures would presumably follow existing procedures to appropriate these funds, implementation should be straightforward once the appropriate political decisions are reached.

VI. POLITICAL ACCEPTABILITY

There is currently momentum at the international level for rationalization and phase out of fossil fuel subsidies. Beyond the commitment among the Group of 20 major economies, the Leaders of countries in the Asia-Pacific Economic Cooperation (APEC) last year similarly committed to rationalize and phase out over the medium term fossil fuel subsidies. Further, governments usually recognize the economic and fiscal benefits of subsidy reform. And the idea of redirecting funds currently spent on fossil fuel subsidies to climate finance has intellectual appeal.

Yet the political economy of subsidy removal is challenging, as recipients are often concentrated whereas the benefits of removal are dispersed. Subsidies are frequently justified on energy security grounds, and even if their total impact on domestic production is small, the political obstacles to removing support for domestic production may be large. The redirection of subsidies to climate finance adds further difficulty since subsidy recipients are domestic constituents, and climate finance goes to foreign countries (and potentially even foreign competitors). As many countries will be experiencing fiscal austerity for years to come, parliaments will be under tremendous pressure to prioritize domestic budget priorities over international ones.

Chapter 3 – Redirecting Fossil Extraction Royalties/Taxes

Governments generate significant revenue from domestic fossil fuel production. Revenue sources include royalties, severance taxes, leasing bonuses, and other one-time fees, such as an auction of lease rights. Firms engaged in fossil fuel production also pay income taxes on the profits from their operations. The importance of each source varies by country.

This chapter evaluates the possibility of countries devoting some portion of their revenues from fossil fuel production to international climate finance. Various considerations suggest that, more so than others, this proposal should be viewed through the lens of a potential means that countries could unilaterally employ to meet their climate finance commitment, rather than as a possible harmonized developed country approach to providing funds for climate finance. While the amount that is devoted to international climate finance could be a fixed percentage of government revenue from fossil fuel production, or a fixed percentage of the market value of fuels produced in each country, it could also be calculated as a fixed amount per unit of fossil fuel production. Further, if the latter approach is adopted, that fixed amount could vary by fuel type, perhaps based on the carbon content of the fuel.

While this chapter evaluates redirecting existing royalties or taxes, another possible approach would be to *increase* royalties or taxes on fossil fuel extraction as a means of raising funds for climate finance. However, compared to the redirection of existing royalties and taxes, such an approach would differ significantly in its implications with respect to several of the relevant criteria evaluated below.

I. RANGE OF POTENTIAL REVENUE RAISED

As a practical matter, government revenue from domestic fossil fuel production would only offer a meaningful source of funds for international climate finance for a limited set of developed countries, as many have little domestic fossil fuel production. In fact, just five countries account for over 90 percent of total oil, gas, and coal production by Annex II countries.[11] (Table 1) Moreover, because it would involve diverting an existing revenue stream to international climate finance, rather than increasing an existing stream or creating a new one, there is an upper bound on how much revenue could be devoted to international climate finance through this approach.

[11] Within the UN Framework Convention on Climate Change, Annex II countries include all Annex I countries except the "economies in transition" (generally the former Soviet Union nations).

Table 1. Fossil Fuel Production by Five Major Developed Country Producers

2008; million metric tons oil equivalent

	Oil	Gas	Coal
Australia	27.5	40.9	211.3
Canada	163.3	145.5	37.2
Norway	122.6	87.8	2.2
United Kingdom	76.3	61.9	9.4
United States	336.0	492.5	560.9
Total for 5 Producers	725.6	828.5	821.0
Total for Annex II Countries	756.2	932.3	882.6
5 Producers' Share of Annex II Total	96%	89%	93%
World Total	4,070.3	2,659.7	3,222.7
5 Producers' Share of World Total	18%	31%	25%

SOURCE: Preliminary calculations to be replaced with WEO2009 2020 forecast.

While this proposal could provide billions—and perhaps tens of billions—of dollars in climate finance, an exact revenue estimate is elusive for several reasons. First, unique circumstances in each country lead to different divisions between federal and provincial (or state) revenue collection. Second, different countries may use different conventions with respect to the scope of revenue instruments that are considered in quantifying revenues from fossil fuel production. For example, one question that would need to be addressed in quantifying revenue potential in a consistent fashion is whether to consider corporate income taxes assessed on companies engaged in production. Thus, as a first step toward quantifying revenue potential, a consistent approach would be needed to define the scope of revenue to be considered. Moreover, countries vary with respect to whether such revenue is already committed to specific purposes. For example, at opposite ends of the spectrum, whereas federal revenues from fossil fuel production in Australia are treated as part of consolidated revenue, Norway directs all federal income from petroleum to the Government Pension Fund-Global. Thus, an effort to estimate available revenue would need to consider how to treat revenue that is already committed to specific purposes.

II. RELIABILITY/ PREDICTABILITY

The reliability and predictability of climate finance derived from fossil fuel production revenues would depend on how the allocation of those revenues to climate finance was structured. Allocations based on a fixed percentage of the market value of fuel, or based on a percentage of government revenue (which is often directly related to the market value of fuel), would be sensitive to prevailing fuel prices and could therefore be quite volatile from year to year. On the other hand, if the allocation of revenue to climate finance was based on a fixed amount per unit of fuel produced (and, hence, likely a floating percentage of government revenue), then this source of climate finance would be more stable and predictable on a year-to-year basis. Of course, under such an allocation, funding would still be subject

to changes in production levels over time. For example, over the decade ending in 2008, U.K. oil production fell by nearly 50 percent while Canadian oil production grew by more than 20 percent.

Over the medium- and long-term, the predictability of fossil fuel production revenues as a source of climate finance could also depend on the evolution of the fossil fuel production industries in these countries as their economies shift towards cleaner energy sources. While this proposal would involve appropriations of general fund revenue in a given country, versus earmarking of a particular revenue stream, it is unclear whether this would be more or less subject to changes in funding levels as a result of future actions by legislatures, compared to other proposals.

III. EFFICIENCY

Unlike proposals that create new taxes or fees, the reallocation of existing revenues from fossil fuel production would not have any direct efficiency consequences. Rather, any implications would depend on what is done to compensate for the reallocation of those revenues. As such, the efficiency of this approach would be comparable to any other approach involving the allocation of existing general revenue funds. For example, economic efficiency will be reduced to the extent that other distortionary taxes are raised to make up for the revenue that is reallocated to climate finance.

IV. INCIDENCE AND EQUITY

As noted previously, relatively few developed countries have sufficient domestic fossil fuel production for this proposal to serve as a meaningful source of international climate finance. Related to this, if such an approach were contemplated in the context of a harmonized global approach to raising funds for international climate finance, it would impose concentrated burdens on relatively few countries. Further, these burdens would not be closely related to variation in fuel consumption or emissions across countries.

Within producing countries, distributional impacts will be determined by the source of new revenues or budget cuts used to compensate for the reallocation of revenue from fossil fuel production. As such, the distribution of impacts could be quite diffuse. Distributional impacts will also arise in situations where revenues from fossil fuel production are collected and allocated by the sub-national units of government where the resources exist. Further, unlike some other approaches involving new revenue sources, the distribution of burdens is not pre-determined by the nature of the proposal itself.

V. PRACTICALITY

Since all producing countries currently collect revenue from fossil fuel production in some manner, revenue could be diverted from existing revenue structures. Where revenues are collected nationally,

since legislatures would presumably follow existing procedures to appropriate these funds, implementation should be straightforward once the appropriate political decisions are reached. However, a given country may need to uniquely define the formulas determining how revenue from fossil fuel production is earmarked for climate finance given the specific structure of revenue streams that it earns from domestic fossil fuel production. The situation would be more complicated where revenues are collected by sub-national units of government.

VI. POLITICAL ACCEPTABILITY

This potential source is most likely to be politically viable as one that an individual country could choose to meet its climate finance commitment. Tying climate finance contributions to existing fossil fuel revenues may rhetorically link contributions to a source of greenhouse gas emissions in some countries even though there is no direct linkage. However, this proposal would likely be unviable as a global, harmonized approach to climate finance because of the concentration of production in relatively few countries, and poor correlation between production, on the one hand, and consumption and emissions on the other. Within a given country, by simply redirecting established revenue streams, the proposal may not raise significant opposition from domestic producers that bear the most concentrated burden associated with those revenue streams, as their taxes and fees would not be increased. The potential for opposition from other quarters would depend on how a country compensates for the reallocation of revenue, and the distribution of burdens associated with that approach.

Chapter 4 – Carbon Exports Optimization Tax

A carbon exports optimization tax is an export fee levied by countries without domestic carbon pricing (i.e. carbon tax or cap and trade system) on goods exported to countries with domestic carbon pricing. The tax would be put in place to address competitive distortions and associated emission leakage resulting from different carbon price levels across countries, and to raise revenues for climate finance. The tax would be set at the level of specific industries or even product categories to reduce the competitive impact of domestic carbon prices in the countries to which those products are exported. It functions in much the same way as a border adjustment tax (BAT), which is an import tax, with the crucial difference that the revenues generated should be raised by the exporting country. Some proportion of these captured revenues could be used for domestic climate finance activities. Such a tax could either be adopted unilaterally or potentially in the context of a global agreement in which all countries without carbon pricing adopt export taxes.

I. RANGE OF POTENTIAL REVENUE RAISED

A carbon export optimization tax could raise an estimated $9-12 billion for taxes of $15-20/t and up to $31 billion at $50/t CO_2e (see table 1). This assumes that the tax is set in line with global carbon market prices as defined by the scenarios of the AGF scenario paper. It assumes that exports from all non-Annex 1 to all Annex 1 countries are taxed at the point of export in the following high emission and trade exposed sectors: Chemical and Petrochemical; Iron and Steel; Non-ferrous metals; Non-metallic minerals; Pulp, Paper and Printing. This estimate is based on current export levels to Annex 1 countries and carbon intensities for the selected sectors in non Annex 1 countries extrapolated to 2020 by growing exports in line with GDP growth from 2010 onwards (exports as % of GDP remain flat from 2005 levels) while carbon intensities are assumed to fall, consistent with pledges made under the Copenhagen Accord. Table 2 shows the current export volumes in the selected sectors in 2005 and the 2020 extrapolation as well as the implied emissions in both years.

Table 1: Total Revenues from carbon export optimization tax by scenario (in real 2005 USD billion)[12]

Scenario	Price of carbon ($/t)	Global
Low carbon price	15-20	**9-12**
Medium carbon price	25-30	**15-18**
High carbon price	50	**31**

Table 2: Value of exports and implied emissions from non Annex 1 to Annex 1 countries[13]

	Unit	Value
Value of exports 2005	$ Bn	**260**
Value of exports 2020	$ Bn	**640**
Implied emissions 2005	Mt	**420**
Implied emissions 2020	Mt	**610**

It is important to note however, that there are significant uncertainties with regards to these estimates:

Firstly, it assumes that developing countries would be ready to adopt such a tax. This could be as a reaction to the imposition of BATs in developed countries, but it is unclear whether all developed countries would have BATs by 2020. For example, the debate continues over whether border adjustments will be included in U.S. climate legislation, and, if so, when they would be implemented . Similarly, the EU currently does not have explicit plans for BATs, even though they are being discussed at different levels.

[12] Assumes carbon tax on the following sectors: Chemical and Petrochemical; Iron and Steel; Non-ferrous metals; Non-metalic minerals; Pulp, Paper and Printing, no carbon tax on the following sectors on all export to Annex I countries from non-Annex I countries

[13] Covers all exports in from non-Annex I to Annex I countries in the following sectors: Chemical and Petrochemical; Iron and Steel; Non-ferrous metals; Non-metalic minerals; Pulp, Paper and Printing

Secondly, there is a question of what the appropriate export tax rate would be for sectors that are covered by a carbon price in the export market, but where domestic industries in that export market obtain free allocations of emission allowances, rather than having to pay for them in an auction. In these industries, free allocations can mitigate carbon pricing's impacts on firms' production costs, raising questions about the appropriate level of an export tax[14].. Setting export tax levels at a lower rate than the prevailing carbon price to account for such free allocations would also reduce the total amount of revenues raised.

Thirdly, the estimate is based on extrapolating 2005 trade patterns, taking into account projected overall economic growth through 2020. However, in addition to general uncertainties about the future evolution of trade patterns, the imposition of carbon pricing in key developed country markets and the imposition of import border adjustment taxes or Carbon Optimization Export Taxes may lead to changes in trade flows relative to 2005 levels. Further work would need to be done to assess the impact of changes on trade patterns on the potential revenues raised.

II. RELIABILITY/ PREDICTABILITY

A carbon exports optimization tax could prove a predictable source of revenue, but the revenue flow would change over time. These changes will most likely be due to:

- **Fluctuations in exports from non-Annex I to Annex I countries**. Based on current trade developments, these exports are likely to increase over the next ten years, but are obviously subject to the business cycle and other factors. In the most recent recession, exports from developing countries dropped by 35% within the space of 6 months between 2008 and 2009. .
- **Carbon pricing in Annex I countries**. If we assume carbon taxes are in some way tied to carbon prices in Annex I countries, then the estimates will depend on annual variation in those carbon prices, and whether caps will be tightened over time. As carbon prices rise, this could increase revenue from an export tax, depending on demand response in the importing countries. It is also expected that Annex I countries would reduce free allocations for trade exposed industries in their emission trading schemes over time, and expand the scope of emission trading, thereby expanding the scope for export optimization taxes over time.
- **Changes in carbon intensity in developing countries**. Developing countries are becoming increasingly energy efficient, and carbon intensity per GDP is likely to continue to fall. However, given that changes are unlikely to be sudden this would affect revenues in a very predictable way.
- **Carbon pricing in non-Annex I countries**. There is, of course, the possibility that non-Annex I countries were to introduce carbon trading or other forms of carbon pricing in their domestic economies, making the border adjustment or export optimization tax unnecessary. However, in this case, to the extent that allowances are auctioned, revenue that was collected through the export tax would simply shift to being collected through the auction of allowances.

[14] In phase 3 of the EU ETS, sectors at risk of carbon leakage (i.e., energy intensive sectors that are trade exposed) will receive allowances sufficient to cover 100% of their direct emissions provided they are using the most efficient technology available

III. EFFICIENCY

A carbon optimization tax should be a relatively efficient way of raising funds in an idealized case, but in reality will depend strongly on the practical implementation. There are two main considerations with regards to efficiency: the administrative cost of implementation and any associated transaction costs, and whether there would be a broader cost to the economy. The former consideration is addressed in the practicality section, below. The impact on trade will depend very heavily on how the tax was implemented. Section V discusses options in more detail. Firstly, it is important to note that a carbon tax could address inefficiencies created by taxing a global externality like carbon emissions in some countries but not in others. Secondly, carbon import and export taxes will raise prices of carbon intensive goods and hence shift demand to lower carbon substitutes, an aim consistent with initial objective of charging a price on an externality like carbon.

IV. INCIDENCE AND EQUITY

For the issue of incidence, there are three questions that need to be considered:

- What proportion of the tax is paid for by developing country producers versus developed country consumers
- What baseline should be used against which to compare the impact of the export tax: 1) a world without any border taxes or 2) a world where one would instead have an import tax
- Who receives the revenues from a border adjustment tax

On the first point, the answer depends on market structure, demand elasticity and how the tax is implemented. If the exporting nation has price setting power in the importing country, then it might be able to pass through the cost as a price increase to the consumer in the importing country who would bear most of the cost. However, if producers in the exporting country were price takers, they would not be able to pass through the additional cost and hence the tax would reduce the inframarginal rents of the producers. It is important to note, however, that, to the extent that prices in the importing country are set by producers in that country, those prices would already reflect a carbon price (the carbon price set in the domestic market). As a result, the exporter would have gained a windfall profit from the carbon price introduced by the developed countries. The export taxes would merely offset some, all, or more than all of these windfall profits (depending on the relative carbon intensity of importing relative to the exporting country). It is also important to note that, holding everything else equal, the location where a tax is raised does not affect the incidence of that tax..

On the second point, several developed countries are currently considering border adjustment taxes and the demand for adjustments is likely to increase as trade-exposed sectors face increasing carbon

pricing. Given this political context, exporting nations without carbon prices could well face a choice between import taxes and imposing their own export taxes.

This leads to the third and final question, namely who would receive the revenues from the carbon tax. This is clearly the importing nation in the case of an import tax, and the exporting nation in the case of an export tax. One important point to note is that, in the case of an import tax, revenues would not be raised where they would be needed most for mitigation (i.e., they would be raised by the importer and hence not by the exporting country with the production installation that generate the emissions). In the case of an export tax, the revenues are likely to be raised in countries with high carbon emissions – however, the amount of revenues raised will not necessarily be directly proportional to their emissions since the total amount of revenues is linked to the mix of products exported, which might not be representative of a country's economy (e.g., a country with high emissions from deforestation but low exports would not raise revenues in line with its emissions). However, this difference could be made up for by transfers from other sources provided to the country.

V. PRACTICALITY

There are a number of issues with regards to practicality that need to be considered:

- Where to raise the tax in a fragmented supply chain
- Establishing the set of products that would be subject to the export tax
- How to set the tax (flat rate per ton of CO_2 for all exports versus rates specific to particular destination markets; producer specific emission intensity values versus flat domestic values by product)
- How to calculate a tax where industries in export markets are exposed to carbon prices but receive free allocations
- How border adjustment taxes would be dealt with under the WTO
- How border adjustment taxes would interact with existing national laws
- How to deal with institutional issues

One of the most important practical challenges is likely to be the question of how an export tax deals with fragmented supply chains – an issue that makes an export tax significantly more challenging than an import tax. How would an export tax be raised if intermediate products were exported from one country without a carbon price to another developing country without a carbon price, and the final product was then exported to a developed country with a carbon price? Should the second developing country collect an export tax on the entire carbon content of the final product? If so, this would raise substantial implementation challenges in determining the appropriate tax, and would also have challenging implications with respect to the distribution of revenue collection.

A second issue would be how to establish the set of products that would be subject to an export tax. To date, domestic debates in the EU and United States have led to significant differences in the set of

industries and associated products that are being considered to be eligible for measures to address potential international competitiveness impacts of domestic climate policy. Thus, an export-oriented border adjustment would have to address different views in different export markets regarding which industries are vulnerable to competitiveness impacts.

A third important issue would be how to set the tax.

- Should the per-ton-of-CO_2 tax be set at an average rate independent of which developed country a good would be exported to, or should the tax be different depending on the destination? An average price is likely to have a negative impact on developing countries that export to developed countries with a below average carbon price, and on developed countries with a higher than average carbon price. Differentiating the tax by country is likely to lead to enforcement and design challenges.

- Should the emission-intensity applied to each product in establishing the export tax be set based on country-wide proxies for product categories, or determined by tracking emissions for each producer? The former would in effect penalize more carbon efficient manufacturers, but the tracking and monitoring required to measure carbon emissions for each producers might technically be unrealistic over the next ten years, given available data, may be open to fraud, and would create significant costs, in particular for carbon intensive, but low value, goods with long supply chains.

A fourth question relates to how carbon prices should be set for export to countries and sectors that have a carbon price, but where industries in the export markets get free allocations. For example, in the EU ETS, the plan for phase III envisages sectors that are at risk of carbon leakage (high emissions and high trade exposure) will continue to obtain free allowances (set based on a best practice benchmark) until 2020. It would need to be decided who would set the appropriate tax on exports to these countries and how the appropriate level of tax would be calculated.

A fifth practicality consideration is whether such an export tax would be consistent with the WTO. The imposition of an export tax does not in itself raise WTO concerns. However, possible WTO issues might arise if importing countries, in response to domestic political pressure, imposed border adjustment taxes on imports from some countries (such as free rider developing countries that did not impose an export tax), but not on like imports from other countries (such as developing countries that imposed export taxes, or countries that implemented environmental programs acceptable to the importing country). Such a discriminatory application of a border adjustment tax would appear inconsistent with the most-favored-nation requirement of the GATT. The GATT contains a general exception that includes measures relating to the conservation of exhaustible natural resources, but it is unclear whether such border tax adjustments would come within the scope of this exception.

A sixth consideration is whether export taxes would be consistent with domestic laws. Although national laws could potentially be amended in countries that generally prohibit export taxes, this could pose practical challenges (beyond the political challenges discussed below).

A final question relates to the institutional capacity of tax collection at international borders and their ability to verify complex carbon assessment reports that would be the basis for the tax calculations. This capacity for tax collection is likely to vary for different countries. Some developing countries appear to have good tracking mechanisms for exports, but few countries currently have export taxes, hence some new infrastructure is likely to be required to raise export taxes. Assessing and tracking of the embedded carbon emissions will also generate a further cost, in particular if it was done for every company rather than with national, product based proxies. A related issue would be how to ensure compliance with an export tax when it is difficult to determine where an exported good will ultimately be consumed. For example, a good could have multiple transit points before reaching its final destination, or could be an intermediate good.

VI. POLITICAL ACCEPTABILITY

The political acceptability within developing countries will be a significant challenge, given the potential for an export tax to reduce industrial competitiveness. Further, some developing countries will argue that their domestic producers should not share any burden with developed country consumers. In light of this, developing countries might be more likely to support such a tax as a preventative move to avoid border adjustment taxes in developed countries. Alternatively, developing countries might support such a tax as a reactive move as a result of the introduction of border adjustment taxes in developed countries. A global agreement that would lead all countries without carbon pricing to introduce export taxes would be politically very challenging and appears less likely than individual countries choosing to adopt such taxes as a preventative or reactive move.

The practicalities around the taxes would also have an impact on political acceptability, in particular whether certain countries or industries would be perceived to be unfairly disadvantaged. Further, even if such taxes proved acceptable within a few developing countries, the incentive for one or more countries to free ride could make the taxes politically unsustainable over time.

In developed countries, political acceptability would primarily be a function of whether parliaments will view export taxes as a credible policy alternative to border adjustment taxes. This would most likely be the case if developed countries had confidence that they could be raised in a reliable way, reflecting the true embedded carbon emissions, were set at an appropriate level and at least part of the funds was used for climate finance. However, there are serious questions as to whether developed country parliaments would have such confidence. Furthermore, some parliaments may view a BAT as preferable to an export tax since they would control the revenue stream and could divert some, if not all of it to domestic fiscal priorities.

Chapter 5 – Wires Charge

A wires charge on electricity is a charge on electricity generation (kilowatthours produced). It would be raised directly from the power generator. The charge could be linked either purely to electricity generation or partially or fully to the carbon emissions related to the produced electricity. Specifically, the two options for the wires charge assessed in this paper are: (Option 1) a charge per kilowatthour (kwh) of all electricity generated; or (Option 2) a charge per kwh of electricity proportional to the tons of CO_2 emitted. Note that the latter approach could be viewed as a variant on a carbon tax where all that is taxed is the emissions from electricity generation.

I. RANGE OF POTENTIAL REVENUE RAISED

Obviously, there are no hard limits on the amount of financing that could be raised by a wires charge. This paper therefore analyses the wire charges required to raise $5bn in Annex 1 countries. As a first estimate, OECD countries are used as an approximation for Annex 1 countries. The estimate also outlines what charge would be required if the tax was implemented on a global level. As table 1 shows, a wire charge of US¢0.04 per kwh (roughly equal to a 0.5% increase on household electricity prices in the United States) would be required in Annex I countries to raise $5 billion, following the WEO BAU assumption of ~12,000 Twh in the OECD to be generated in 2020. This would be the same under option 1 and 2 on average. Of course, this charge would differ for different producers under option 2, for coal it would be US¢0.09 per kwh, for gas US¢0.05 per kWh and for renewables and nuclear it would be zero.

For political reasons the total tax raised domestically might need to be higher than what would be transferred for international climate finance. In many countries, it may be very difficult to introduce a new domestic tax purely for international purposes. Assuming that a 20-30% of the total revenues raised could be transferred to international climate finance, the charge might need to be US¢0.14-0.2/kwh instead of US¢0.04.

Table 1: Required Charges to Raise US$10 Billion in Revenues

Option (Revenue raised)	**Annex 1 (OECD)**	**Global**
Option 1 ($5bn)	US¢0.04 per kwh	US¢0.02 per kwh
Option 2 ($5bn)	US¢0.04 per kwh (on average)	US¢0.02 per kwh (on average)
	$1 per tCO2e	$0.35 per tCO2e

II. RELIABILITY/ PREDICTABILITY

A common wires charge based on total electricity generation could offer a reliable and predictable source of climate finance given the year-to-year predictability of electricity demand, as well as the relatively low price elasticity of demand for electricity. A wires charge that varies based on the emission

intensity of electricity would be somewhat less reliable and predictable, given fluctuations in the year-to-year dispatch of particular types of plants. Further, to maintain a stable level of funding, a wires charge based on emission intensity would need to be increased over time to reflect the trend toward decarbonization of the electricity sector. Nonetheless, funding from either variant of a wires charge could be predicted with a reasonable degree of certainty over a multi-year horizon.

III. EFFICIENCY

One question of efficiency that would need to be addressed is how a wires charge would relate to any other carbon pricing in the power sector. Some countries like the EU already have a carbon price in the power sector through its cap and trade scheme. Others, like the US and Australia are considering legislation for the introduction of cap and trade – of all sectors, the power sector is most likely to be covered by this legislation.

Of course, having a cap and trade scheme does not mean that a wires charge would be wrong or unpractical to implement – it might in fact be desirable to charge a higher carbon price in the power sector than in other parts of the economy, given its limited exposure to trade and its strategic importance in a transition to a low carbon economy. However, a wires charge that is based on the emission intensity of generation would be more efficient than one that is constant across all generation. This is the case because variations in the former charge would be consistent with variations in the negative externality associated with emissions from combusting different fuels.

IV. INCIDENCE AND EQUITY

While a wires charge could be imposed unilaterally rather than as a harmonized developed country approach to climate finance, assuming the latter, Table 2 outlines the cross-country incidence of a wires charge raising $5 billion in Annex I for the 3 major economies, the US, EU and Japan. The choice between option 1 versus option 2 primarily has an impact on the allocation between the US and the EU. Under option 1, the US would raise US$2bn versus US$1.5bn for the EU, while, under option 2, the US would raise US$2.5bn versus US$1.2bn for the EU. Note that, at a high level, electricity generation is—albeit imperfectly—correlated with countries' total carbon dioxide emissions (see table 3).

Table 2: Incidence of Charges to Major Economies

Option ($10bn revenue raised in OECD)	US	EU	Japan
Option 1 ($5bn)	$2 bn	$1.5 bn	$0.5 bn
	US¢0.04 per kwh	US¢0.04 per kwh	US¢0.04 per kwh
Option 2 ($5bn)	$2.5 bn	$1.2 bn	$0.5 bn
	$1 per tCO2e	$1 per tCO2e	$1 per tCO2e
	US¢0.05 per kwh[15]	US¢0.035 per kwh	US¢0.04 per kwh

Table 3: 2020 BAU Estimates for Electricity Generation and Carbon Emissions (WEO)

	US	EU	Japan	World
Electricity generation as a % of world	**17%**	**13%**	**4%**	**100%**
Energy-related carbon dioxide emissions as a % of world	**16%**	**10%**	**3%**	**100%**

In the US, the required charge of US¢0.04 per kwh under option 1 and US¢0.05 under option 2 would increase household electricity prices for consumers by about 0.5% (assuming a retail price of $0.10 per kwh). Obviously, if the absolute wires charge was set at a higher level for political reasons, then the increase would also be correspondingly higher (e.g., between 1-3%) – however, these changes would still be very small compared to historical changes in electricity prices in many countries. In the UK for example, real electricity prices have increased by 60% for households between 2003-09, while in the US

[15] Indicative charge across all types of electricity generation to illustrate difference between major countries; the charge would vary by generator depending on fossil fuel content, and price change for consumers would vary by region depending on generation mix

real electricity prices have increased by 17% for households. In the EU, the price increase would be the same as for the US under option 1 but slightly lower under option 2. This lower charge for the EU under option 2 is driven by the generation mix that has less coal compared to the US.

In both the EU and the US there would likely be significant regional differences in the impacts of option 2; in regions with a generation mix weighted towards fossil fuels, increases would be higher than in regions with a low fossil fuel generation mix. The increase in electricity price will also depend on the regulatory structure of the market. In a fully liberalized market, the price is set by the marginal generator, which typically is a fossil fuel generator. Given that the fossil fuel generator would face a larger than average charge (if compared to a charge applied to all generation), the increase in market price would increase correspondingly at above average levels and more than would be the case in a cost plus regulatory system. In liberalized markets with marginal price setting, non-fossil fuel producers such as nuclear and renewables stand to benefit most under option 2, since they would get the full benefit of price increases without incremental costs.

The wires charge is unlikely to change generation mix fundamentally. If the charge were large enough it is conceivable that production may shift away from coal as the most carbon intensive source of energy, but it is unlikely that a charge would reach that level. Another possible change would be if the revenue generated were used to pay for subsidies on renewable energy.

V. PRACTICALITY

While many countries may not have existing federal taxes or fees on electricity generation, the required infrastructure, determination of individual entities' compliance burdens, and enforcement could involve a relatively limited administrative burden. To the extent that countries already, or will soon, monitor individual generators' emissions, linking the charge to carbon emissions would also be practically feasible. In countries where sub-national governments are responsible for electricity regulation and rate setting, implementation would necessarily require the participation of these regulatory authorities.

VI. POLITICAL ACCEPTABILITY

As a threshold matter, a wires charge could be an attractive method of climate finance because it would represent a tax on a sector that is a high priority for decarbonization. The power sector is the largest worldwide emitter of greenhouse gases, accounting for nearly a quarter of global emissions. However, the political feasibility of implementation of the wires charge is highly dependent on whether it is implemented on an international scale or on a country by country basis. The possibility of international implementation is low at best. As with many international taxes the likelihood that states would give up sovereignty over taxation is remote, and the desire for a supranational body to control the process is also unlikely.

The most likely course of action could be the implementation by some countries as one element of their efforts to provide international climate finance. One reason for opposition might be a loss of competitiveness for those countries who did implement a charge, but given the limited impact on electricity prices, this could be manageable. Countries might pledge to use all or a portion of the proceeds to support international climate finance efforts. If the wire charge was not coordinated internationally, there would likely be strong domestic pressure to use some of the proceeds to fund domestic priorities, but the remainder could be focused on developing world initiatives.