


Green Revenues for Green Energy:

Environmental fiscal reform for renewable energy technology deployment in China

Jacqueline Cottrell, Richard Bridle, Zhao Yongqiang, Shi Jingli, Xie Xuxuan, Christopher Beaton, Aaron Leopold, Eike Meyer, Shruti Sharma and Han Cheng

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Executive Summary

China's economy continues to grow rapidly with corresponding increases in both energy consumption and environmental pollution. Renewable energy is a key part of China's response to this challenge. Currently, the costs of measures to facilitate the large-scale deployment of renewable energy are primarily met through an electricity surcharge—effectively a tax on electricity consumption. However, concerns have been raised that continuing to rely on the surcharge alone places a disproportionate burden on electricity consumers. In response, International Institute for Sustainable Development (IISD) and the China National Renewable Energy Centre (CNREC) identified the need for further debate on how best to fund renewable energy and reduce environmental pollution, leading to the establishment of a research project to examine the international experience of similar schemes and their relevance to China.

Key Messages

There are many international examples of environmental fiscal reform (EFR) measures linked to renewable energy. This report provides eight case studies selected to provide an illustrative range of applied instruments across a geographically and economically diverse range of countries. The case studies show a considerable diversity of policy instruments that share a common goal: the promotion of renewable energy research and development or deployment through environmental taxes, carbon trading or other environmental fiscal reform measures.

Earmarking revenues increases transparency, aids communication and reduces uncertainty for investors. Theorists contend that earmarking taxes reduces budgetary flexibility and, in general, should be avoided. However, many governments routinely ignore this principle in the case of environmental taxes, due to the strength of the perceived advantages for the communication, public acceptability and transparency of such measures. Indeed, in 2006 the Organisation for Economic Co-operation and Development (OECD) reported that around one third of environmental taxes included some level of earmarking.

International experience points toward a number of key findings that would apply to any country considering implementing EFR:

- **Economic growth:** Environmental taxes and EFR measures do not necessarily have a negative impact on economic growth. If revenues are recycled effectively, the impact can be positive.
- **Revenue stability:** Manual or automatic adjustment of environmental tax rates on a quarterly or annual basis can help maintain a constant flow of revenues and provide stable funding for spending commitments.
- **Allocating revenues:** Raising sufficient revenues to compensate groups that will see increased costs from the tax—both industries and households—and invest in renewable energy is key to the policy aims discussed here. Revenue recycling can bring potential opposition groups on board and mitigate distributional impacts resulting from increased prices, but it is essential that a surplus remains that may be invested in renewable energy.

EFR measures earmarked for renewable energy are one potential revenue source for renewable energy technology deployment in China that merits consideration. China has drawn up ambitious renewable energy targets that necessitate an increase in government spending over the next few years. If the source of revenues is drawn from taxes and charges on environmentally damaging activities, there is the opportunity to address environmental pollution, thus generating a "double dividend."

An earmarked carbon tax measure in China faces some key political challenges, including concerns about whether ring-fencing revenues for a particular policy goal can be justified, the economic performance of the measure as a whole and the need to coexist with established plans for carbon trading schemes, as well as both proposed and existing environmental taxes and charges.

Using EFR Measures to Fund Renewables

Three factors have contributed to the current pressure to increase the proportion of renewable energy in the energy mix in China:

1. High levels of GDP growth (4 per cent to 11 per cent on average between 2002 and 2011) and primary energy consumption (550 per cent between 1980 and 2011) (International Energy Agency [IEA], 2012).
2. China is a net importer of oil, coal and gas, creating pressing energy security concerns.
3. The manufacture and export of renewable energy technologies has become a strategically important industry in which China has become a global player.

These factors have led China to include a target of increasing power generation from renewable energy resources to 20 per cent by 2020 in its 12th five-year plan (FYP) (2011–2015) and have been supported by an estimated annual investment in renewable energy of US$67 billion in 2012 (United Nations Environment Programme, 2013).

EFR shifts the burden of taxation and subsidies toward environmentally damaging activities and can raise substantial amounts of revenue that could be used to meet the need for future investment in renewable energy in China. In principle, EFR sets out to internalize external costs—to use fiscal measures to incorporate the cost of environmental, social and economic impacts incurred as a result of pollution or excessive resource use into the price of goods or services.

In China, there are currently a number of EFR measures in place. For example, energy taxes of between RMB0.30 and RMB30 per tonne are levied on coal, crude oil, natural gas and other fuels. Renewable energy production and consumption are entitled to tax reductions, including a 13 per cent value-added tax (VAT) rate (normal VAT rate is 17 per cent), accelerated depreciation of assets and a 15 per cent enterprise income tax rate (normal rate is 25 per cent). An excise tax reduction is available for biodiesel, and import duty exemptions are available for advanced wind power equipment. The National Bureau of Taxation reports that resource tax revenue rose from RMB6,286 billion to RMB30,164 billion between 1999 and 2008, but declined slightly as a proportion of total tax revenues (from 0.61 per cent to 0.52 per cent) over the same period.

As well, the 12th FYP sets out China's commitment to develop a carbon trading market, with the National Development and Reform Commission (NDRC) determining seven cities and provinces (Beijing, Shanghai, Tianjin, Chongqing, Shenzhen, Guangdong and Hubei) in which to set up pilot projects to test emissions trading schemes (ETS). Finance Minister Lou Jiwei announced on July 10, 2013 at the fifth round of the China-U.S. Strategic and Economic Dialogue that China would extend environmental taxation to include carbon (Chinese Ministry of Finance, 2013), while recent statements by the Ministry of Finance have suggested that a carbon tax could be introduced by 2015. However, no policy decisions had been made at the time of writing this report (BusinessGreen, 2012). A 2009 report from the Chinese Academy for Environmental Planning and the Energy Research Institute of the NDRC stated that a carbon price of RMB20 per tonne (approximately US$3.3/tonne) was the minimum needed to bring about emissions reductions (Wang, Yan, Jiang, Liu, Yang, & Ge, 2009). Against this background, this report sets out to investigate environmental fiscal reform and market-based instruments as possible mechanisms to both raise revenue and address some of the market distortions that may slow investment in renewables.

While this report looks specifically at earmarking EFR revenues for renewable energy, the non-affectation principle requires that tax revenues are not ring-fenced, to allow flexibility in allocating spending. Indeed, the OECD warns that earmarking can create "rigidities" in the budget process, leading to economic inefficiencies and possibly the violation of the "polluter-pays" principle. Nonetheless, one third of environmentally related taxes in OECD countries were earmarked in 2006 (OECD, 2006), at least in part due to the political economy benefits of earmarking. Earmarking allows governments to present a clear link between a tax rise and a corresponding increase in spending on a specific measure, helping to increase transparency and prevent the tax increase from being viewed as a revenue-raising measure disconnected from any immediate benefits. Earmarking can also instill confidence in the beneficiaries of funds that there is a clear mechanism by which the funding will continue in the future. However, this can backfire if revenues raised do not correspond to spending requirements, as described in more detail in this report.

Structure and Findings

The report is presented in four parts. Section 1 provides the rationale for the project and provides an overview of the Chinese context. Section 2 provides a discussion of the theoretical framework of EFR examining the theory of EFR instruments and the co-benefits of EFR measures. Section 3 presents eight case studies of EFR measures that are linked to the promotion of renewable energy. The case studies include instruments from Australia, Canada, Denmark, Germany, India, Japan, the United Kingdom and the United States. Each case study provides an outline of the policy tool, a summary of the history and political economy of the scheme, an analysis of the impacts and a series of conclusions. Finally, Section 4 lists the six main findings of the study and presents some proposals for further research:

1. The impact of EFR on economic growth is a key issue. However, by recycling revenue and focussing on strategic priorities, there is the potential to develop EFR measures that promote economic growth.
2. Stable revenues from EFR instruments are important to meet spending commitments and to limit the liabilities of those who will pay. Adjustments, price caps and floors can be used to provide this stability.
3. Revenues collected from EFR measures can provide funds to promote renewable energy, protect vulnerable groups, improve competitiveness and compensate affected groups to build policy acceptance.
4. Policy stability is crucial to convince investors to commit resources to projects.
5. Multiple environmental fiscal policies, including tax and trading schemes, can and do coexist in many countries
6. Effective spending of revenues from EFR measures requires strong governance structures and clear objectives. In the absence of these, there is the potential for short-term political considerations to influence decisions leading to poor use of funds.

Further Research and Recommendations

The final section of the report proposes some directions for further research. The first proposal is the development of specific policy recommendations for the Chinese context against an analysis of fiscal measures already in place. Second, modelling of possible policy instruments could be looked at in detail. Third, the untapped potential of EFR measures to facilitate investment in renewable energy is identified as an area that would seem also to merit further in-depth research.

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Acronyms and Abbreviations

CO_2	carbon dioxide
CCA	Climate Change Agreements
CCEMA	Climate Change and Emissions Management Act
CCEMC	Climate Change and Emissions Management Corporation
CCEMF	Climate Change and Emissions Management Fund
CCL	climate change levy
CEFC	Clean Energy Finance Corporation
CELP	Clean Energy Legislative Package
CHP	combined heat and power
CNREC	China National Renewable Energy Centre
CNY	Chinese Yuan
DEFRA	Department for Environment Food and Rural Affairs
DKK	Danish Kroner
EAC	Environmental Audit Committee
ECF	Energy and Climate Fund
EFR	environmental fiscal reform
EPC	Emissions Performance Credits
ETS	emissions trading schemes
EU ETS	European Union Emissions Trading System
FDE	Fuel Duty Escalator
FIT	feed-in tariff
FYP	five-year plan
GBP	British Pound
GDP	gross domestic product
GFHG	greenhouse gas
GSI	Global Subsidies Initiative
GW	gigawatts
GWh	gigawatt hour
HMRC	Her Majesty's Revenue and Customs
IEA	International Energy Agency
IISD	International Institute for Sustainable Development
IMG	Inter-Ministerial Group
IREDA	Indian Renewable Energy Development Agency
ITC	Investment Tax Credit
JPY	Japanese Yen
kWh	kilowatt hour
MBI	market-based instrument
MoE	Ministry of Environment
MoF	Ministry of Finance
MTC	million tonnes of carbon emissions equivalent
MW	megawatts
NCEF	National Clean Energy Fund
NDRC	National Development and Reform Commission
NIC	National Insurance Contributions
OECD	Organisation for Economic Co-operation and Development
PSO	Public Service Obligations
PTC	Production Tax Credit
R&D	research and development
PV	photovoltaic
RETD	Renewable energy technology deployment
RMB	Renminbi
SEIA	Solar Energy Industries Association
SGER	Specified Gas Emitters Regulation
tCO_2e	tonnes of carbon dioxide equivalent
U.K.	United Kingdom
UNEP	United National Environment Programme
VAT	value-added tax

1.0 Introduction

1.1 Report Objectives and Rationale

In China, as in other emerging economies, a secure electricity supply is key for rapid economic development and increased prosperity, but the additional up-front costs associated with renewable energy, at least during the early stages of deployment, can be a socially and politically sensitive issue, underscoring the need for smart policies for renewable energy installation (Becker & Fischer, 2012). To work toward this need, this report explores a range of examples of smart, market-based policies for accelerating renewable energy deployment.

Specifically, the China National Renewable Energy Centre (CNREC) and the International Institute for Sustainable Development (IISD) developed this report to review international experience in the use of environmental fiscal reform (EFR) and other market-based instruments (MBIs) to raise revenues to promote and accelerate the deployment of renewable energy technologies. The report provides an overview of the current status and lessons learned from international experience with the use of economic incentives for promoting renewable energy. Drawing on examples from all over the world of environmental fiscal policy measures, particularly those used to raise revenues for the promotion of renewable energy deployment, the report will conclude with a series of key considerations and recommendations for China.

1.2 Report Structure

The report is split into the following sections:

1. Introduction and setting the scene
2. Framework for the analysis of EFR for revenue raising for renewables: This section presents the theoretical framework of EFR and the EFR instrument toolkit, categorizing the most important EFR instruments and providing a broad overview of the impacts of EFR measures in practice. It specifically examines barriers to renewable energy investment and the potential for EFR to get around them.
3. Case studies: This section covers case studies of a broad range of fiscal measures in a variety of countries. At least some of the revenues generated in these cases have been used to enhance and/or accelerate the deployment of renewable energy.
4. Conclusions and recommendations

This report will also identify possible directions of further research, and will be presented at the Global Green Growth Forum (3GF) conference in October 2013 in Copenhagen.

1.3 Setting the Scene: The Impact of Rapid Economic Growth in China

Between 2002 and 2011, annual gross domestic product (GDP) growth in China accelerated from 4 per cent to 11 per cent on average, while carbon dioxide (CO_2) emissions increased by 150 per cent in the same period. Between 1980 and 2011, primary energy consumption increased by an impressive 550 per cent (International Energy Agency [IEA], 2012). Such rapid economic and social development, in combination with a heavy reliance on the burning of fossil fuels, has made environmental pollution and resource depletion, including depletion of energy resources, an increasingly serious problem. While per capita emissions remain comparatively low, by 2006, China had become the world's largest absolute emitter of greenhouse gases (GHG), surpassing even the United States. By 2011 China accounted for 49 per cent of global coal use and 29 per cent of total global GHG emissions, emitting 9.7 billion tonnes of carbon dioxide (tCO_2) (Olivier, Janssens-Maenhout, & Peters, 2012).

China's current dependence on fossil fuel power generation is also problematic in light of the country's heavy reliance on energy imports and an associated vulnerability to volatile international energy markets. China became a net oil importer in 1993, a net natural gas importer in 2007 and a net coal importer in 2009. Today it is one of the biggest importers of fossil fuels, especially of coal, and net imports are predicted to continue to grow in the future (Energy Information Administration, 2012).

Bearing these two factors in mind, the development and use of renewable energy has become an important means for China to guarantee its energy security—to strengthen environmental protection and reduce air pollution and GHG emissions, while supporting continued economic growth. Accordingly, the Chinese government has set fixed targets to accelerate the deployment of renewable energy technologies and reduce GHG emissions and energy intensity per unit of GDP growth. The 12th five-year plan (FYP) (2011–2015) establishes targets to increase power generation from renewable energy resources to 20 per cent by 2020, and to reduce carbon intensity by 17 per cent and energy intensity by 16 per cent by 2015 in comparison with 2010 levels (Chinese State Council, 2011).

To achieve these goals, substantial investment in the renewable energy sector is required. Recognizing this, in 2012 China raised its investment in renewable energy by 22 per cent to US$67 billion, making it the world's main destination for renewable energy outlays, with 27 per cent of the global total (United National Environment Programme [UNEP], 2013). However, if the momentum behind renewable energy deployment is to continue, new sources of revenue will be needed—and new, innovative ways of raising revenues and creating a stable investment climate for renewable energy must be explored. This report sets out to investigate EFR and MBIs as possible mechanisms to both raise revenue and address some of the market distortions that may slow investment in renewables.

1.4 Current Measures to Promote Renewable Energy in China

While regulatory measures for energy and carbon intensity achieved significant results during the 11th FYP, from 2006 to 2010 (energy intensity was reduced by 19.1 per cent over that period), there is a strong international consensus that EFR and MBIs are a more effective way to balance economic growth and climate change challenges and should play a more prominent role.

There are a number of EFR measures in place in China, including pollution charging and differentiated pricing for de-sulphurized electricity. Even a carbon tax in China has been mooted in the country: recent statements by the Ministry of Finance have suggested that a carbon tax could be introduced by 2015, although no political decisions had been made at the time of writing (BusinessGreen 2012).

In addition, the 12th FYP reaffirms China's commitment to develop a carbon trading market. The National Development and Reform Commission (NDRC) has identified seven cities and provinces (Beijing, Shanghai, Tianjin, Chongqing, Shenzhen, Guangdong and Hubei) as pilots to test ETSs. Originally, trading was to start within each region by 2013, then cross-regionally and nationally as early as 2015. The timeline has been delayed somewhat, but one pilot is currently running in Shenzhen. Shanghai and Beijing are expected to start pilot programs soon.

Although no carbon pricing measures have been introduced, a number of policies are in place to stimulate the deployment of renewables in China. These include feed-in tariffs for solar power, onshore wind power, biomass power and waste power. A number of investment programs have been rolled out, such as the photo voltaic and Golden Sun demonstration programs in 2009 and the Green Energy Demonstration County and New Energy City programs in 2011.

The majority of China's taxation revenues are raised from turnover taxes, such as VAT and consumption, and from income tax. Between 1994 and 2006, these combined sources accounted for over 80 per cent of the total. In 2012 tax revenue reached RMB100 billion, 19.4 per cent of GDP (Ministry of Finance, 2012). The main environmentally related tax is the resource tax, which is applied to coal, crude oil and natural gas and ranges from RMB0.3 to RMB30 per tonne. In the energy sector, value added and enterprise income taxes are levied on the production, consumption and importation of energy. The standard VAT rate is 17 per cent and a reduced rate of 13 per cent is applied to renewable energy. The standard rate of enterprise income tax is 25 per cent; a reduced rate of 15 per cent is applied to renewable energy.

There are also several tax incentives in place for wind power: a 50 per cent reduction on VAT; exemptions from import tariffs and import VAT; and three years of income tax exemptions, followed by three years of reductions. Similarly, there is a 10 per cent income tax reduction on biomass as well as a VAT refund policy: enterprises producing denatured fuel ethanol are exempt from 5 per cent consumption tax for denatured fuel ethanol deployment of alcoholic gasoline for vehicles and also qualify for VAT refunds. From 2006 to 2010, RMB170 million has been invested in research and development (R&D) and deployment of large-scale wind energy generation, and RMB200 million for a hydrogen and fuel battery program. In addition, China has 52 high-tech demonstration projects involving wind, solar, biomass, geothermal and hydrogen energy generation.

Spending on programs that support renewable energy is projected to increase significantly over the coming years and to reach RMB740 billion in 2015. A breakdown of the estimated funds required is shown in Table 1

TABLE 1: FUNDS NEEDED TO SUPPORT RENEWABLE ENERGY IN THE 12TH FYP PERIOD (UNIT: RMB100 MILLION)

YEAR	2011	2012	2013	2014	2015	TOTAL
Subsidies for renewable energy power prices	280	381	473	557	632	2323
The Golden Sun Project	72	72	65	65	57	331
New energy cities	23	45	55	45	23	191
Green energy demonstration counties	10	10	10	10	10	50
New energy microgrid demonstration	6	6	6	6	6	30
Straw energy utilization	4	4	4	4	4	20
R&D of renewable energy technology	8	8	8	8	8	40
Total	403	526	621	695	740	2985

Source: CNREC (2013)

The revenues for such investments are raised through a surcharge on all electricity consumers—the "renewable energy electricity price add-on"—or are channelled from the central government budget through the Renewable Energy Development Fund, which was created by the Ministry of Finance in 2011. Estimates of the revenues from the renewable energy price add-on indicate a shortfall in the order of RMB100 billion over 12th FYP period to 2015 (CNREC, 2013). The CNREC has carried out research highlighting the importance of identifying additional sources of funds to fill the gap.

1.5 The Way Forward

In view of the ambitious renewable energy targets in the 12th FYP, this report will look at the potential of environmental fiscal policy and MBIs for environmental policy to complement the measures described above in the Chinese context. On the basis of an analysis of EFR in theory and environmental fiscal policy instruments in practice, this report will extract lessons learned from experience in other countries and develop a series of recommendations for China.

2.0 Framework for the Analysis of EFR for Revenue Raising for Renewables

2.1 Introduction: Stimulating Renewable Energy Deployment by Means of EFR

The potential of feed-in tariffs (FiTs) and auctioning to boost renewable energy deployment is well known and has already been employed in China, as noted in Section 1.4. However, a number of other countries have developed additional revenue-raising instruments associated with environmental fiscal policy to support the deployment of renewable energy. These instruments will be the focus of this report.

An advantage of EFR instruments over FiTs or auctioning is that EFR measures can raise revenue for government, which can be used to stimulate investment in renewable energy, while also having a positive impact on the environment by increasing the cost of polluting, using scarce resources or emitting GHGs, for example. Indeed, there is considerable evidence that EFR instruments can generate multiple benefits for the environment, the economy and society, both directly and indirectly (see, e.g., Cottrell, 2011). This report will focus on smart EFR policies designed to achieve multiple environmental policy aims.

The report will focus on instruments capable of improving the framework conditions for the deployment of renewable energy technologies in two ways:

(1) Instruments that alter the framework conditions for energy generation to improve the profitability of renewable energies, thus facilitating private investment in renewable energy products

(2) Instruments that can generate additional revenue that can potentially be used to support the deployment of renewable energies directly through government financial support.

Thus report will not evaluate ways government money can be used to directly support the deployment of renewable energies. Direct financial support has been used more in earlier stages of renewable energy technology deployment, prior to deployment at scale, when the focus has tended to shift toward leveraging private investment.

2.2 EFR: Key Concepts and Theories

2.2.1 Definitions

Definitions for the purposes of this paper are as follows:

- Market-based instruments (MBIs) "seek to address the market failure of 'environmental externalities' either by incorporating the external cost of production or consumption activities through taxes or charges on processes or products, or by creating property rights and facilitating the establishment of a proxy market for the use of environmental services" (Organisation for Economic Co-operation and Development [OECD], n.d.). They are different from regulatory instruments (which define what is legal and what is not) and from informational instruments (which pursue policy objectives by providing information and changing the awareness of actors).
- Environmental Tax Reform (ETR) is a reform of the tax system where there is a shift in the burden of taxation from conventional taxes, for example on labour, to environmentally damaging activities, such as resource use or pollution (European Environment Agency, 2005, p. 84).

- Environmentally related taxation, which does not entail tax shifting, has been defined as any "compulsory, unrequited payment to general government levied on tax bases deemed to be of particular environmental relevance" (OECD, n.d.).

EFR is closely linked to the concept of ETR; however, it focuses not just on shifting taxes and tax burdens, but also on reforming subsidies harmful to the environment (European Environment Agency, 2005, p. 84).

2.2.2 Market-Based Instruments

The most common policy instruments that create the framework conditions of a market economy are generally regulatory instruments (bans, requirements and standards), MBIs (taxes and levies, subsidies, tradable permits or deposit-refund systems) or informational instruments (publicly provided statistical services, certification systems, product labels or awareness campaigns). Regulatory instruments influence individual behaviour through the logic of legality (making certain behaviour legal or illegal), MBIs through the price mechanism (making certain behaviour more or less expensive) and informational instruments through information (allowing market actors to make better-informed choices).

One crucial difference between regulatory instruments and MBIs is that, when confronted with regulatory instruments, actors have little choice but to fulfil the standard or obey the regulation, while with MBIs, actors can be more flexible in their response. Unlike regulation, MBIs have the significant advantage of typically creating a dynamic incentive for an improved environment, meaning that improvements take place above and beyond the prescribed minimum accepted standards laid down by regulation.[1] Taxes and levies also have the added advantage that they generate public revenues, which can be used in a number of ways. For example, revenues can be used to cover the cost of the administration and enforcement of a particular instrument, or to reduce other more distorting taxes such as labour taxes. Alternatively, revenues can be used for social compensation, the reduction of fiscal deficits, or—most relevantly in the context of this report—to incentivize the application of efficient and renewable technologies.

TABLE 2: TYPES OF MBIS

REVENUE-GENERATING INSTRUMENTS	REVENUE-PROVIDING INSTRUMENTS	NON-REVENUE INSTRUMENTS
Charges, fees and taxes, permit-trading schemes where auctioning takes place	Direct subsidies, tax exemptions, etc.	Permit-trading schemes (if not auctioned), deposit-refund systems, etc.

Revenue-generating instruments make up the largest share of MBIs in use worldwide and will constitute the main focus of this report. The European Environmental Agency classifies revenue-generating instruments in three main categories, according to their respective policy objectives (European Environmental Agency, 1996):

- **Cost-covering charges** are directly levied on a specific service or act of pollution in order to provide revenue. This can either be used for:
    - o Covering the costs of environmental services and abatement measures, such as water treatment or waste collection and treatment (**user charges**)
    - o Other environmental expenditures (**earmarked charges**).
- **Incentive taxes or charges** are levied on pollution or resource consumption, with the objective of changing the behaviour of producers and/or consumers.
- **Fiscal environmental taxes** are levied on pollution or resource consumption, but primarily with the objective of raising revenues (European Environmental Agency, 2005).

[1] This does not apply to cap-and-trade schemes, as the cap sets the level of emission reductions in the scheme.

The terms "charges" and "fees" refer to "compulsory and requited payments to general government or to bodies outside general government, such as environmental funds or water management boards"—that is to say, payments for services, such as drinking water supply, water sanitation or waste disposal (European Environmental Agency, 2005, p. 40). A tax, on the other hand, is a compulsory and unrequited payment to general government. The term "cess" refers to a tax earmarked for a particular purpose, such as the coal cess in India, addressed in Section 3. A "levy" is a general term that can refer to a tax, fee or charge, as in the "climate change levy" in the United Kingdom (U.K.) (also analyzed in Section 3).[2]

In the real world, charges and cesses, taxes and tariffs, fees and levies are often hybrid instruments that show a mixture of these functions. The development of environmental taxes in Europe has generally shifted from cost-covering charges in the 1960s and 1970s, to a combination of incentive and fiscal environmental taxes in the 1980s and 1990s, to their more recent integration into comprehensive "green tax reforms," where taxes on "bads" such as pollution increasingly replace taxes on "goods" such as labour. We now explore this concept of a green tax shift.

2.2.3 Environmental Tax Reform (ETR) and Environmentally Related Taxation

ETR refers to a revenue-neutral green tax shift, as defined by the European Environmental Agency (2005, p. 84):

> Environmental tax reform (ETR) is a reform of the national tax system where there is a shift of the burden of taxation from conventional taxes, for example on labour, to environmentally damaging activities, such as resource use or pollution. The burden of taxes should fall more on 'bads' than 'goods' so that appropriate signals are given to consumers and producers and the tax burdens across the economy are better distributed from a sustainable development perspective.
>
> The economic rationale is that welfare gains are generated by reducing taxes on labour or capital and increasing taxes on externalities and hence helping to avoid 'welfare-reducing' activities. A typical case is an increase in the tax on energy, and a simultaneous reduction in labour taxes or social security contributions.

The OECD and the European Commission often refer to environmentally related taxation, which does not necessarily entail a green tax shift, but rather "any compulsory, unrequited payment to general government levied on tax-bases deemed to be of particular environmental relevance" (OECD, 2006, p. 26). Both environmentally related taxation and ETR can be levied on a number of pollutants, environmentally harmful products or behaviours or on proxies of such products and behaviours—for example, on energy, harmful emissions and pollutants, waste, natural resources, packaging, motor vehicles and roads.

The tax base for ETR and environmentally related taxation can include energy products, pollutants, motor vehicles (circulation taxes), emissions, pesticides and fertilizers, and the use of natural resources, among others. To date, by far the largest component of environmental taxation is derived from taxes on energy, and of these, a large proportion stem from the taxation of motorized transport. Other sources of environmental taxation are small but growing (OECD, 2010). Studies by the European Environmental Agency have identified environmental taxes on a very wide range of products in the European Union, including transport fuels and energy, water (effluent and abstraction), waste (landfill, incineration tax), batteries, plastics, packaging, tires, pesticides, light bulbs, lubrication oil, disposable beverage containers, paper and raw materials (European Environmental Agency, 2005).

Environmental taxes can be revenue-neutral—for example, where environmental tax revenues are used to shift the tax burden from a "good" (labour costs) to a "bad" (polluting, resource consumption or otherwise environmentally damaging behaviour). Tax shifting is typical for taxes introduced on energy in several European countries in the 1990s and 2000s, when a total of €25 billion in six European Union countries was shifted each year (Competitiveness Effects of Environmental Tax Reforms, 2007).[3]

2 In the U.K., the term "levy" was chosen in part to reduce resistance by avoiding use of the word "tax."

3 The COMETR study (NERI, Cambridge Econometrics, ESRI, IEEP, PSI, & WIIW, 2007) analyzed tax shifting in the United Kingdom, Finland, Denmark, Sweden, the Netherlands and Germany.

Revenues can also be earmarked for a specific purpose, such as investment in renewable energy technologies or flow into the general budget to meet the cost of unspecified expenditures. A discussion of the pros and cons of earmarking can be found in Section 2.5.4.

2.2.4 EFR and Reform of Environmentally Harmful Subsidies

EFR is a broad term that includes ETR and environmentaly related taxes, as well as other economic instruments for environmental policy, including:

- Deposit-refund schemes for specific products or parts of products (e.g., for bottles, jars, metal cans, tires, batteries, etc.).
- Third-party or cross-subsidies (e.g., FiTs for renewable energy).
- On-budget subsidies—payments that appear on national accounts as government expenditure (e.g., direct state support for renewable energy; tax exemptions or reduced or tax rates; or accelerated depreciation on the purchase of energy-efficient technologies).
- Off-budget subsidies—transfers resulting from specific fiscal or other regulations that typically do not appear on national balance sheets but nevertheless confer direct financial benefits to companies or individuals.

EFR also encompasses the reform of environmentally harmful subsidies, whether these are on-budget or off-budget. The OECD defines environmentally harmful subsidies as "any compulsory, unrequited payment to general government levied on tax bases deemed to be of particular environmental relevance" (OECD, 2003). The World Trade Organization's Agreement on Subsidies and Countervailing Measures (1995) offers a more comprehensive definition, agreed by 159 countries, which determines that a subsidy exists where governments:

1. Provide a direct transfer of funds or potential direct transfer of funds or liabilities
2. Forgo or otherwise fail to collect revenue
3. Provide goods or services below market rates or purchase goods above market rates
4. Provide income or price support

A subsidy can therefore be understood to include any government action that confers an advantage on consumers and producers to supplement their income or lower their costs. This includes implicit subsidies, such as reduced tax rates for industry or domestic consumers, a lack of full cost recovery or the provision of infrastructure. Some institutions use a broader definition of subsidies that also includes non-internalized external costs—for example, prices that do not encompass the cost of pollution resulting from the use of a good or service. For example, the International Monetary Fund (2013) recently estimated that fossil-fuel subsidies are in the order of US$1.9 trillion globally, with US$1.4 trillion of this sum being due to the use of "inefficient taxes" that fail to take into account the costs of externalities such as global warming and local pollution.

IISD's Global Subsidies Initiative (GSI) adopts a broad definition in order to identify all existing subsidies in a sector, regardless of whether they are considered "good" or "bad." Their definition includes most support that could be considered a "subsidy," except for environmental externalities (such as carbon emissions or pollution). GSI (2010) has a comprehensive, three-step approach to identify, measure and evaluate subsidies. The final step assesses if subsidies operate as intended, as it should not be assumed that all subsidies are necessarily in need of reform.

If politically feasible, the implementation of EFR should be accompanied by a broader analysis of the economy to identify on-budget and off-budget measures that incentivize environmentally harmful behaviour—that is to say, explicit and implicit subsidies. Such subsidies should then be quantified and evaluated to identify the extent to which they are fiscally and environmentally sustainable, including an assessment of performance against their stated objectives and whether or not they lead to unintended impacts (GSI, 2010). If possible, in parallel to other EFR measures, unsustainable or environmentally damaging subsidies should be phased out as soon as possible and politically feasible, to reduce distorting and contradictory price incentives in the economy and to create a level playing field in the market. This is of particular relevance in energy markets, because subsidy reform can in itself facilitate the deployment of renewable energy, as it corrects market distortions and rectifies the underpricing of fossil fuels, thus levelling out relative prices between energy sources.

If environmentally harmful subsidies are not reformed, they will create contradictory incentives in the economy, undermine the efficacy of other EFR measures and blur the impacts of environmental taxation, because they will create contradictory incentives in the economy. The same holds true for any kind of price regulation that does not allow market forces to fully determine the price.

2.2.5 Emissions Trading

Emissions trading—or cap and trade, as it is sometimes known—is a specific market-based instrument for the reduction of harmful emissions, whereby a regulatory agent specifies an overall level of emissions that will be tolerated (the cap). The largest trading system in the world for GHG emissions is the European Union Emissions Trading System (EU ETS). In this case, the upper limit of GHG emissions is specified in absolute terms. In the third trading period, from 2013–2020, the cap will be reduced by a factor of 1.74 per cent annually, to create a dynamic incentive to reduce GHG emissions (European Commission, 2013).

The EU ETS is currently facing serious problems, however, as an extremely large surplus of allowances has been carried over from the second trading period (2008–2012) into the third (2013–2020), which has undermined the carbon price. This was due to the impact of the global economic crisis on CO_2 emissions in the European Union, which resulted in a decrease in CO_2 emissions from what was already a relatively low level: by 12 per cent in 2009, then a further 3 per cent in 2010 and 2 per cent in 2011 (Olivier et al., 2012).

To create a stable climate for low-carbon investment, the U.K. government has introduced a carbon price floor. The introduction of the measure was in response to price fluctuations and the low price of carbon in the EU ETS, which had contributed to a lower level of investment in low-carbon technologies than was required to meet U.K. carbon reduction and renewable targets (U.K. Parliament, 2013). Now if the EU ETS allowance price drops below a certain level, an additional U.K. tax kicks in—the carbon price floor—which stabilizes the carbon price. The floor price will be introduced in 2013 at about €19 per tonne of CO_2, rising to €35 by 2020 (U.K. Parliament, 2013).

An alternative kind of emissions trading is referred to as “baseline and credit.” In this case, a number of allowances are initially allocated to emissions sources involved in the scheme. These sources must then surrender allowances to cover all emissions or purchase additional allowances from other sources that emit less than expected (European Environmental Agency, 2005, p. 16).

2.2.6 Stimulating Renewable Energy Deployment: FiTs, Renewable Purchase Obligations and Auction-Based Tariffs

Policy frameworks that governments are using in many countries to support and accelerate the deployment of renewable energies most commonly include FiTs, renewable purchase obligations (RPOs) and, to a lesser extent, auction-based tariffs. The relative effectiveness of each of these measures is beyond the scope of this report.

FiT systems raise money for the deployment of renewable energies by guaranteeing a fixed tariff for producers of electric power from renewable sources over a specified amount of time. The financial resources needed to pay the tariffs, which are higher than average electricity tariffs, are typically raised through a premium on electricity prices, though in some countries other funding mechanisms have been used, such as reimbursing utilities for costs with general government revenues. As of early 2013 as many as 99 countries (or states or provinces) had introduced some sort of FiT system[4] (REN21 2013).

[4] This figure is cumulative; in some of these cases, the policies may have been disbanded.

RPOs oblige suppliers to source at least a certain share of electricity from eligible sources, often allowing the trading of certificates of eligibility as part of the scheme. Suppliers then have the choice to meet the minimum share or to buy certificates from other suppliers who exceed minimum shares. Suppliers who fail to meet the minimum share and to show certificates are fined. As of early 2013, RPOs/quote policies had been introduced in 76 countries[5] (REN21, 2013).

Other means are auction-based tariffs, where the authorities announce their intention to purchase a certain amount of a product or service—in this case, electricity from renewable sources—and solicit competitive bids to acquire it at the lowest cost. The company offering to sell the electricity at the lowest price/tariff wins the auction. This is generally accompanied by a requirement to purchase the electricity, and the difference between the price paid and the market price is often centrally subsidized.

2.2.7 Taxes on Natural Resources

Resource taxation is a means of assigning a price to scarce public goods, such as clean water or air, or as a route to incentivizing efficiency by increasing the price of a particular resource. The most common resource taxes introduced thus far have been on waste and waste prevention, but MBIs targeting resource efficiency are not yet prevalent, revealing a significant opportunity for improvement and wider deployment (Rademaekers, van der Laan, Smith, van Breugel, & Pollitt, 2011). Resource taxes can be introduced as input taxes on the use of resources in production. In this case, they can be collected from resource-extracting companies first bringing the resources to the market, but they are passed along the value chain, embedded within the resource price. Their environmental objective is to internalize the external costs of resource exploitation, correcting market failures and improving incentives for resource efficiency. Resource taxes are not the same as mining royalties, the objective of which is to "skim off" resource rents extractive companies earn from the exploitation of public goods such as mineral resources. Consequently, royalties are usually profit or ad valorem taxes. Resource taxes, on the other hand, should be unit based, as the external effects of extraction correlate to the volume extracted.

While royalties are a long-standing source of government revenue in most countries, the implementation of resource taxes is not yet very common. The first example of resource taxes with the stated objective of reducing resource use were taxes on primary construction materials (sand, gravel and rock) levied in several European countries. The most ambitious of these taxes, the Aggregates Levy, was introduced in the U.K. in 2002, and has produced rather promising results: demand for recycled aggregates and the recycling rate of aggregates in the U.K. has risen to 25 per cent since the levy was introduced. The rationale behind taxing primary construction materials is twofold: (1) the construction sector makes up for a very relevant share of overall resource consumption and (2) construction materials are traded within limited geographical areas due to their heavy weight. A tax on primary construction materials therefore affects a very relevant part of overall resource streams while having negligible distorting effects on competition (Hogg, Baddeley, & Montag 2008).

Another approach to create incentives for resource efficiency through taxes is through a differentiated rate of the VAT, according to the resource efficiency of products. In China, VAT is an extremely important source of revenues: in 2011, domestic VAT accounted for 27 per cent of total tax revenues, import VAT and import consumption tax accounted for 15 per cent and domestic consumption tax accounted for 8 per cent (Ernst and Young, n.d.). VAT reform could have a significant influence on greening consumer behaviour. In most countries in the European Union, for example, VAT systems implement reduced tax rates, usually to increase the availability of specific products to poorer households (e.g., food, books, etc.). An extension of reduced VAT rates to energy or material-efficient products would effectively raise the consumption level and would create downstream incentives for resource efficiency.

[5] Again, this figure is cumulative.

2.3 Introduction to Some Basic Principles of EFR

2.3.1 Externalities and Price Incentives

The rationale behind EFR is provided by the existence of environmental externalities—external costs incurred as a result of environmentally polluting behaviour or resource use, which are not reflected in the price of polluting or use of resources. If these external costs are not reflected in the price of goods and services or in the cost of resource extraction and depletion, then this distorts the market. EFR can rectify this distortion by internalizing these external costs, either partially or completely. In his seminal work *The Economics of Welfare* (1920), Arthur Pigou argued that the level of environmental tax should be equivalent to the external cost it addresses, but for political economy reasons, this is often not possible when setting tax rates because tax rates are more often than not the product of a political process of negotiation than a calculation of the marginal cost of pollution.

Furthermore, due to scientific uncertainties, it is difficult in many cases to calculate the cost of externalities resulting from a particular pollutant. In order to be as efficient as possible, an environmental tax should also be levied directly on emissions creating the externality that it is intended to internalize. In reality, this may not be possible due to practical difficulties: monitoring systems may not exist that can measure the exact point-source emissions of an externality across an economy. Many EFRs are based on a proxy for the targeted externality—for example, taxing motor fuels as opposed to taxing the pollution created by the combustion of motor fuels.

This is particularly the case for GHG emissions, where it is extremely difficult to calculate the value of externalities with any degree of precision, and where complex systems are required to estimate the GHG emissions produced by a diverse set of processes across different economic sectors. In the *Stern Review of the Economic of Climate Change*, Nicholas Stern suggests that the external costs of GHGs will amount to an ongoing cost of between 5 and 20 per cent of GDP per year (2007, p. xv), demonstrating the large margin for error. This means that setting tax rates on this basis can be a matter of considerable debate, and that it is not easy to get them right. However, if the standards-and-price approach developed by Baumol and Oates in 1971 is applied—where standards are set by the legislator and taxes are used to set a price that will result in the achievement of these standards—then the problems associated with estimating and quantifying externalities are removed. Modelling can also be helpful in establishing how high a tax should be to achieve a particular environmental goal.

On a practical note, even if all environmental costs are not internalized as a result of EFR, the price of polluting behaviour will increase, and relative market prices will better reflect the costs of pollution to society. As a general rule, as noted above, environmental tax rates tend to reflect the practical need to find a rate that is politically acceptable and, thus, where implementation is feasible. If a decision has been made that a tax is the optimum instrument to bring about a change in behaviour, then for political economy reasons it may be necessary to introduce a tax at a low rate and adjust as necessary or introduce an escalator at a later date.

2.3.2 The Polluter-Pays Principle

The polluter-pays principle, which states that the polluter should bear the cost of measures to reduce pollution, has been recognized internationally in Principle 16 of the 1992 Rio Declaration on Environment and Development (United Nations, 1992). It has since been included in a wide range of environmental policy and strategy documents in many countries all over the world. Several directives in the European Union have enshrined the polluter-pays principle in law, such as Directive 2004/35/EC on Environmental Liability and the Waste and Water Framework Directives. EFR also supports the realization of the polluter-pays principle. Similarly, resource taxation gives policy-makers a means of implementing the user-pays principle, which calls upon the user of a natural resource to bear the cost of running down natural capital.[6] Many innovative instruments can have the same effect.

[6] Definitions of the polluter-pays and user-pays principles can be found on the OECD glossary of statistical terms, available online at http://stats.oecd.org/glossary/.

2.4 EFR in Practice

2.4.1 The Political Economy of EFR

EFR policy-making takes place in a complex decision-making environment, influenced by powerful interest groups, existing legislation, implementation culture, the facility to monitor or enforce a particular measure and many other factors. This means that the design of EFR instruments in practice often diverges from theoretical considerations.

As noted in Section 2.3.1, it is not always possible to design or achieve political consensus on an environmental fiscal measure that, for example, corrects for all external costs. Instead, policies reflect political realities and the specific circumstances surrounding their implementation. For example, EFR measures tend to reflect industry concerns that their international competitiveness will be jeopardized by an environmental tax on energy. As a result, total or partial exemptions are introduced, which undermine the polluter-pays principle and create inefficiencies in pollution abatement (OECD, 2006).

Discussions of EFR often focus on the possible regressive impact of EFR measures. Increased energy prices, for example, tend to have a greater impact on poorer households, as a greater proportion of their household income is spent on energy. For obvious reasons, such concerns can be a significant barrier to implementation if not properly addressed. This also influences policy design. In theory, the incentive effect should be left in place and consumers compensated by other means within the tax system; it is the progressivity or regressivity of the entire tax and social security system that is important. In practice, environmental taxes often include exemptions for low-level use—for example, through lifeline tariffs, which ensure that vulnerable households do not pay taxes or charges on consumption of a reasonable amount of water or electricity.

To reflect the importance of the political economy of EFR, there is a section in every case study that looks at the history and political economy of the measure, so the reader can understand the underlying processes and political influences on the ultimate design of the policy instrument.

2.4.2 EFR in Industrializing Economies and Economies in Transition

EFR is often associated with green tax shifting, as noted above. However, in industrializing and emerging economies, government priorities are often focussed on raising additional revenues and increasing total tax revenue to government, rather than reducing distortive taxes elsewhere in the economy. In this context, EFR can provide a relatively simple way of raising revenue while incurring low administrative costs. This revenue can subsequently be used for poverty reduction, to promote sustainable development or to secure the sustainability of various sectors of the economy, including power generation (GTZ, 2008).

Furthermore, a focus on revenue generation, rather than tax shifting, also reflects a difference in policy priorities between industrialized and industrializing economies. While one of the major policy challenges in industrialized economies is unemployment—hence the tax shift to reduce the cost of labour—in industrializing economies and economies in transition, problems such as funding environmental infrastructure investments or investing in poverty reduction are more pressing (Speck, 2009).

2.5 EFR and Renewable Energy Deployment

2.5.1 Barriers to the Deployment of Renewable Energy

In most developed countries, energy is semi-privately or privately provided, due to the massive costs and complexity involved in setting up and maintaining national energy infrastructure. To date, one of the major challenges facing renewable energy deployment has been overcoming the real and perceived competitive deficiencies of renewable energy over conventional sources. One of the most important challenges in this respect has been securing project financing, and here we explore ways in which policy-makers can use EFR measures to overcome these obstacles and create an investment climate attractive to private investors.

For financiers, the most fundamental obstacle to large-scale investment in renewable energy technologies is the perceived risk-to-reward ratio. For many renewable energy projects, the profitability of renewable energy remains too low or the repayment horizon too long term, and the perceived risks associated with investment are too high to unlock large-scale private investment. For these reasons, governments around the world have traditionally incentivized investment in renewables via public finance support.

Investing in renewables traditionally entailed a higher perceived investment risk than conventional energy sources because renewables are often capital-intensive, the technologies used are comparatively new, repayments take place over a longer time frame and there are a number of additional costs associated with the provision of grid infrastructure, particularly for offshore wind. That said, the recent histories of solar and (especially) wind energies have proven the stable, economically competitive and low-risk reality of renewable energy in the 21st century. While still not ideal for some investor classes, they have shifted into the type of predictable, long-term investment that traditionally would be considered ideal for the world's largest financiers, namely pension funds, sovereign funds and insurance funds. These institutions, traditionally very conservative in their investment strategies, have not yet begun financing renewables but are likely to do so in the near future.

Though technological advancements have made renewable energy more attractive in recent years, artificially created policy risks still exist and often reduce investor willingness to finance renewable energy projects. Chief among these is policy uncertainty resulting from fluctuations in funding or price support for renewable energy. In 2012, for example, global investment in renewable energy fell by 12 per cent compared to 2011. The main reason for this decline appears to have been investor concern over the longevity and stability of policies to support renewable energy in established renewables markets, with many countries questioning the levels of FiTs, and some taking policy action to reduce spending on renewable energy (e.g., Spain, Italy and the U.K.) (UNEP, 2013). In addition, regulatory policy and permitting constraints, as well as institutional inefficiencies, can slow or halt renewable energy projects. Poor public acceptance of renewable energy—often not addressed sufficiently by policy-makers—can also pose a significant risk to investors in the sector.[7]

Another reason for this hesitation is that, until recently, the political and investment environment tended to be overly supportive of incumbent fossil fuel energies. Not only are fossil fuel technologies "locked in" to many economies, with power grids designed for the constant supply of energy that they produce, but investment in fossil fuel energies also has a familiarity (and thus an appeal) not enjoyed by renewable energy. This is beginning to change, however, with the European Investment Bank, the largest investment bank in the world, and the World Bank, the largest development bank in the world, both having adopted policies designed to reduce future investments in fossil fuel in the summer of 2013 (EurActiv, 2013; World Bank, 2013b).

Furthermore, market failures and market distortions constitute a fundamental barrier to renewable energy technology deployment and are of greatest relevance in the context of this report. The single most important market failure, and the one we focus on in this report, is that the external costs of carbon emissions are not internalized in the price of energy—which means that the price of fossil fuel energies is lower than optimum and that renewable energy does not compete on a level playing field in the energy market. (For more on external costs, see Section 2.3.1.) Not putting a price on carbon that reflects the cost of CO_2 emissions undervalues investment in low-carbon technologies. This problem is compounded in those countries with fossil fuel subsidies, which reduce the price of fossil fuels still further and severely distort competitiveness on energy markets.

There are other market failures associated with renewable deployment, including: externalities related to capturing the full benefits of innovation; power market structures, such as barriers to market entrants and infant industries; subsidies for other energy technologies; financial market failures; and externalities related to energy security (IRENA, 2012).

[7] For an analysis of possible routes to improving the communication of renewable energy policy in order to enhance acceptance, see Bridle, Collings, Cottrell, & Leopold (2013).

There are a number of obstacles to investment in renewable energy specific to the Chinese case.[8] First, investment, operational and regulatory systems exist that concentrate on mid- and large-scale projects, but China has not yet managed to implement pricing and incentive policies that sufficiently coordinate with the interests of regular energy systems. This has meant that large-scale and high-efficiency utilization of renewables cannot be guaranteed. Second, a long-term stable fiscal revenue mechanism to support platform establishment, R&D, resource integration and in-depth cooperation is lacking. Third, current tax concessions concentrate on concessional tax rates and reduction of VAT and income tax, and pay less attention to investment in environmental protection, R&D and invisible assets. Fourth, resource and environment tax on energy is low, and VAT reform has not yet taken place, so renewable energies are still not operating on a level playing field in terms of tax concession policies. Fifth, the financial policy system cannot satisfy diversified renewable utilization activities and demand from investment and operation entities. Finally, current cost-sharing and fiscal/taxation policies cannot effectively maintain and reasonably balance interests of local entities against, for example, central government, state-owned enterprises and so on.

The most successful case studies covered in this report demonstrate that these barriers can be overcome to some extent by targeted, well-designed renewable energy policies, although it is not easy to do so, and there is considerable room for improvement. The next section will examine the role of EFR in overcoming obstacles to renewable energy deployment and flag some possible directions for future policies.

2.5.2 EFR as a Tool to Improve Framework Conditions for Renewable Energy Deployment

As noted above, market distortions and the underpricing of CO_2 emissions and other local air pollutants constitute important barriers to renewable energy deployment. If renewable energy cannot compete because it is priced out of the market as a result of non-internalized costs and subsidies to fossil fuels, it will be extremely difficult for governments to leverage private investment in the sector without guaranteeing a return on investment (e.g., by introducing policies such as FiTs). While this is not an uncommon solution, an economically efficient way of addressing this issue would be to internalize the full costs of fossil fuel emissions in the market price of energy.

An additional problem in some industrializing economies and economies in transition is that the price paid by domestic or industrial energy users is considerably less than the actual cost of supply and distribution. This leads to economic distortions and inefficiencies, as well as energy wastage, excessive pollution, GHG emissions, and significant welfare losses (Cottrell & Meyer, 2012). These economic distortions can have a very significant impact on investment in environmental technologies. In the Russian electricity sector, for example, structural barriers and low tariffs mean that only 13 per cent of energy-efficiency investments are financially viable (World Bank, 2008). In such an environment, where distortions are so pronounced, encouraging investment in renewable energy is a real policy challenge.

Under such economic conditions, EFR is an important policy tool, as it can bring about an increase in fossil fuel energy prices and rectify distortions in energy markets, fostering an investment environment within which green, low-carbon technologies can compete on a level playing field and become profitable. While implementing such a measure may be met with some political resistance, environmental taxation and other measures that put a price on pollutants are the most economically efficient response to distortions in energy markets.

Where subsidies are in place for fossil fuel energies, initial EFR measures should focus on gradually increasing prices to cover the costs associated with supply and distribution. Then, in a second stage, environmental taxes can be introduced to create dynamic incentives in favour of low-carbon energy and greater efficiency.

EFR is the most economically efficient solution to market distortions, but it is also effective as a policy measure because of the impact price changes can have on behaviour. Research has demonstrated that relative price changes—be they as a result of tax increases, fossil fuel subsidy reform, green subsidies or even changing market dynamics—have the strongest steering effects.

[8] This list is based on an author interview and contributions from Han Cheng, IISD China.

2.5.3 The Potential of EFR to Raise Revenues for Renewable Energy Deployment

There is no doubt that EFR has the potential to raise considerable amounts of revenue, as well as to save governments money by reducing their expenditure on environmentally harmful subsidies and health care. In the European Union in 2010, environmental taxation raised revenues amounting to €291 billion, or about 3 per cent of GDP. In the same year in Denmark, which was ranked number one in the European Union in environmental tax revenues, EFR measures raised €9.4 billion, or 4 per cent of GDP (European Union, 2013).

Furthermore, recent research by Vivid Economics addressed the potential for carbon-energy taxation to raise revenues for fiscal consolidation purposes in the European Union. They found that the introduction of broad-based carbon-energy taxes at the very reasonable levels included in the European Commission's revision proposal for the Energy Tax Directive—legislation that specified minimum tax rates for energy products in the European Union—had the potential to raise significant amounts of revenue (Vivid Economics, 2012). The results of the three countries modelled in depth are shown in Table 3.

TABLE 3: REVENUE-RAISING POTENTIALS OF CARBON-ENERGY TAXATION IN HUNGARY, SPAIN AND POLAND

	SPAIN	POLAND	HUNGARY
Total revenues by 2020, per annum, in billion EUR	10	5	1
Revenues as a percentage of projected GDP	>1%	1.3-1.4%	1.2%

Source: Vivid Economics (2012)

In all three cases outlined in Table 3, if the same amount of money was raised through either direct or other indirect taxes, it would likely have a more detrimental macroeconomic impact, in general because carbon-energy taxes modelled would lead to smaller falls in real wages than price changes resulting from direct taxes or VAT (Vivid Economics, 2012).

A 2009 report, *Resource Productivity, Environmental Tax Reform and Sustainable Growth in Europe*, compared several policy packages of environmental tax reform designed to reduce CO_2 emissions by 20 per cent by 2020 in the European Union, considering different levels of revenue recycling and under different assumptions regarding international cooperation on GHG emission reductions (Ekins, 2009). A very interesting finding was that, if 10 per cent of revenues were invested in green technologies and 90 per cent were recycled, a much lower carbon price would be necessary to meet the 20 per cent target, and significantly lower GDP losses would result in comparison to the other options (Ekins, 2009). These findings seem to suggest that there is a strong case for using revenues raised by EFR measures to support investment in renewable energy deployment.

The cases in this report also demonstrate the potential for environmental fiscal measures to raise revenues for renewable energy. As the report will demonstrate, a number of innovative EFR mechanisms have been used to fund renewable energy technology deployment, including various forms of environmental taxation. These include the climate change levy in the U.K.; carbon pricing in Australia; a carbon tax in Japan; the coal cess in India; the Public Service Obligation n Denmark; revenues from the auctioning of EU ETS allowances in Germany; trading of emissions performance credits and offset credits in Alberta, Canada; and tax exemptions and grants in the USA.

2.5.4 The Earmarking Debate

The non-affectation principle in tax theory requires that government revenue should not be earmarked or ring-fenced for a particular purpose, such as to support renewable energy. There are several reasons for this way of thinking.

One problem with the earmarking of revenues is that there may be a tendency to set a tax rate to meet revenue needs, which may result in tax rates below the level needed to correct for externalities (Heine, Norregaard, & Parry 2011). There is also an inherent risk in earmarking revenues from environmental taxation, as revenues may diminish over time as consumers change their behaviour—and although a tax escalator is a possible response to this problem, it may not be sufficient. On the other hand, perhaps because the vast majority of tax rates do not raise prices sufficiently to internalize costs, this risk has tended to be overstated. For example, tax revenues from transport fuels remain an important source of revenue for many governments, many years after their introduction, and have not noticeably diminished over time.

Earmarking is also criticized on the grounds that spending priorities should not be determined by the way in which governments raise revenues, and the amount they manage to raise in a particular year. There is certainly an element of risk in earmarked taxation. For example, a volatile tax base earmarked to fund research and development in the field of renewable energy would result in a volatile pattern of spending. Moreover, if earmarked revenues raised do not tally with revenues spent as a result of this volatility, the rationale behind earmarking has been undermined—particularly in the mind of the taxpayer. Finally, specifying the use of revenues in law may create an obstacle for the re-evaluation and modification of tax and spending programs later on (OECD, 2006).

On the other hand, there are several benefits to earmarking, relating to the political economy of environmental taxation. Earmarking increases the transparency of taxation, as taxpayers can see how revenues are used. For this reason, earmarking can increase acceptance of and boost support for an environmental tax or charge, and enhance trust in government (Green Fiscal Commission, 2009). Some research has also suggested that earmarking can have a positive environmental impact by facilitating a more targeted response on the part of polluters (OECD, 2006).

The OECD (2006) has suggested that the economic and environmental rationale for any earmarking should be evaluated regularly to avoid inefficient spending. The OECD also suggests a model of earmarking where a tax increase is linked in government communications to increased expenditure for a particular purpose, without creating a legally binding link between revenues and expenditures in the future (OECD, 2006).

The majority of the case studies examined in this report have earmarked revenues for a particular purpose—support for renewable energy deployment. This provides an opportunity to analyze the advantages and disadvantages of earmarking and to extract lessons learned for the design of policy instruments in the future.

2.5.5 Instruments to Use Public Financing to Leverage Private Investment

In 2007 the Secretariat of the United Nations Framework Convention on Climate Change published *Investment and Financial Flows to Address Climate Change.* This report estimated that additional investments worth approximately US$200–$210 billion would be required annually by 2030 to meet GHG emission reduction targets. The report concluded that the lion's share will need to come from the private sector, and that substantial additional public funding will be required to mobilize and leverage that private capital (UNEP, 2008).

Public investments should maximize the amount of commercial finance wherever possible. Models of public finance mechanisms typically deliver leverage ratios of between 3:1 and 15:1. This suggests that an ambitious upscaling of these mechanisms, entailing the investment of US$10 billion in public monies, could leverage between US$50–$150 billion, or perhaps more, as many public finance mechanisms also have "roll over" effects and support multiple generations of investments (e.g., by helping to create viable energy markets and infrastructure) (UNEP, 2008).

In view of this need, the question of how revenues raised by government can best be spent to mobilize and leverage commercial capital is extremely relevant. Governments have used a number of instruments to stimulate investment and create better market conditions for the deployment of renewable energy. Mechanisms linked to, or coming under the ambit of, EFR measures, include (UNEP, 2008):

- FiTs, auction-based tariffs and other mechanisms to guarantee energy price levels for investors in renewable energy.
- Pigouvian taxes on fossil fuel energy, to reduce distortions in energy markets as a result of non-internalized external costs associated with fossil fuel emissions (e.g. carbon tax, or any other mechanisms to put a price on carbon).
- Tax exemptions, accelerated depreciation, or other tax incentives to make investment in renewable energy more attractive.

- Clean energy bonds, worth just over US$2 billion in 2012, can be issued to attract finance from insurance companies, pension funds and privately managed funds attracted to the long-term nature of the loans and stable cash flows (UNEP, 2013).
- Private equity and venture capital funds investing risk capital in companies and projects.
- Carbon finance facilities that monetize the advanced sale of emissions reductions to finance project investment costs.
- Grants and soft loans to mobilize domestic sources of capital.
- Credit lines to and loan guarantees for local commercial financial institutions for providing both senior and mezzanine debt to projects.
- Debt financing of projects by entities other than commercial financial institutions.

If designed to correspond with national conditions and managed well, these mechanisms can reduce the market distortions and reduce risk for the private sector, thus helping to overcome two of the most important barriers to investment in renewable energy identified above.

2.6 Round Up

The focus of this report is narrower than the above list, and the following case studies focus almost exclusively on EFR measures introduced to implement the polluter-pays principle and in so doing raise revenues to boost the deployment of renewable energy. Case studies were selected in consultation with CNREC and look at EFR measures all over the world. The final section extracts key lessons learned and recommendations for the promotion of renewable energy in China.

3.0 Case Studies

3.1 Introduction

The case studies included in this report have been carefully selected to provide examples of different kinds of EFR measures used to raise revenues to support the renewable energy. Each case study will focus on a single policy instrument, rather than attempt to assess the entire fiscal framework of the country. Each case study will follow a common structure, which includes, wherever possible:

1. A description of the policy instrument: structure, tax rates, revenues raised and costs incurred
2. An analysis of the history and political economy of the measure
3. Environmental, social and economic impacts, and impactson renewable energy deployment
4. Links to wider policy frameworks
5. Conclusions and lessons learned

The case studies have been collected from seven regions, namely: Alberta (a province in Canada), Australia, Denmark, Germany, India, Japan, the U.K. and the United States. A summary of the cases is available in Table 4. They have been carefully chosen to cover a range of different kinds of policy instruments and because of their relevance to the Chinese case.

TABLE 4: CASE STUDY SUMMARY

CASE STUDY		DESCRIPTION
COUNTRY, PROVINCE	POLICY/ MEASURE	
Australia	Clean Energy Future Carbon Price	A carbon price initially set in legislation and designed to transition toward a carbon trading system. The policy was introduced by a coalition government and faced political opposition. The overall fiscal impact is reported to be negative. Earmarking occurs primarily through the Clean Energy Finance Cooperation (CEFC). The recent election places the future of carbon pricing in Australia in doubt.
Alberta, Canada	Specified Gas Emitters Regulation (SGER)	The SGER is an intensity target set for the most significant emitters. Those regulated under the scheme are obliged to meet an emissions intensity target, offset or pay into the Climate Change and Emissions Management Fund (CCEMF). The CCEMF provides funding for energy efficiency and renewable energy projects.
Denmark	Public Service Obligations Tariff (PSO)	Denmark operates a levy on electricity consumption. All revenues are allocated to Energinet.dk, an independent, not-for-profit body. The levy is adjusted quarterly to meet spending commitments. The structure of the mechanism gives investors a high degree of confidence.
Germany	Energy and Climate Fund (ECF)	The ECF receives revenue from the sale of EU ETS allowances. As an independent organization, it has a degree of political autonomy. The low price of carbon in the EU ETS has led to a shortfall in revenues and required additional funds to be obtained to meet obligations.
India	Clean Energy Cess on Coal	The Clean Energy Cess is a tax on coal. The revenues are allocated to a National Clean Energy Fund that provides funding to clean energy technology deployment and R&D. Some concerns have been raised about whether funding has been allocated in accordance with the original intentions of the fund, highlighting the need for strong governance.
Japan	Carbon Dioxide Tax of Global Warming Countermeasure	Japan has introduced taxes on CO_2 from petroleum, coal and gas in the face of opposition from industry. The low level of the tax means that the impacts are expected to be relatively small. The tax was reported to be under consideration for many years before finally being implemented in 2012.

United Kingdom	Climate change levy (CCL) and climate change agreements (CCA)	The U.K. introduced a system of taxes on energy use in industry and the option of an exemption from part of the tax by signing up to sector-specific target benchmarks. Much of the revenue from the scheme was recycled to reduce the impact on competitiveness, although a small portion was allocated to the Carbon Trust to support renewable energy research and development.
United States	Production Tax Credit (PTC) and Investment Tax Credit (ITC)	The PTC and ITC are tax credits that provide direct tax breaks for renewable energy generation and investment in renewable energy, removing the need for the collection and disbursement of funds. Political disagreement over extension to the schemes has led to a "stop-and-go" renewables industry, where projects are either rushed to completion or shelved to match legislative timetables.

3.2 Australia: Clean Energy Future Carbon Price

3.2.1 Policy Tool Outline

Australia's carbon pricing mechanism was introduced in 2011. The scheme is part of the Clean Energy Legislative Package (CELP) and is designed to ensure that Australia meets its emissions reduction target of 5 per cent below 2000 levels by 2020, which translates to 155 million tonnes of abatement (Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, 2013).

The carbon-pricing scheme will function initially as a fixed charge per unit of emissions and will transition into a cap-and-trade system. The scheme covers stationary emissions sources, industrial processes, emissions from landfills and fugitive emissions. The transport and agriculture sectors are excluded from the scheme, but a voluntary program called the Carbon Farming Initiative allows the accrual of tradable credits that can be sold into the market. Support to renewables through CELP is primarily through revenues provided from the carbon tax to the Clean Energy Finance Corporation, an AUS$10 billion fund established to invest in clean energy that began operations in 2013 and made its first loans in June 2013 (CEFC, 2013).

The scheme is applied directly to Australia's 500 largest emitters, those whose emissions exceed 25,000 tonnes of carbon dioxide equivalent (tCO_2e). Liable entities must surrender permits equivalent to each tonne of emissions each year. The price and availability of permits will be used to control the cost and manage the impacts. In the first period (2012 to 2015), an unlimited number of permits are available at a fixed price (starting at AUS$23 [€15.8] per tonne and increasing by 2.5 per cent in real terms each year). In August 2013 EU ETS carbon prices were being sold for around €4.3 (AUS$6.25) (Point Carbon, 2013). Thus, in this first period, the compulsory purchasing of emissions permits imposes a fixed charge for every tonne of covered emissions; emissions will not be capped or traded, but the incentive effect of an increased price should stimulate behavioural change and result in reduced emissions. In addition, free permits will be allocated under the Jobs and Competitiveness Program to reduce the impact on energy-intensive industries that would otherwise be particularly affected by the new tax. An Energy Security Fund will also provide free permits and cash payments to help highly emissions-intensive, coal-fired generators adjust to the carbon price.

In the second period, starting in July 2015, permits will be traded, the number of permits available will be limited and the price will be allowed to fluctuate between a price ceiling—set at AUS$20 above the expected international price, rising by 5 per cent in real terms each year—and a price floor, which will initially be AUS$15, rising by 4 per cent each year in real terms (Australian Government, 2012). Finally, in the third phase starting in 2018, the price ceiling will be removed and links will be established to other carbon markets, including the EU ETS, and the scheme will transition to a cap-and-trade system (Beck & Gass, 2012).

A number of government departments and organizations are involved in the administration of the CELP, including the Department of Climate Change and Energy Efficiency which, in collaboration with other departments, is responsible for policy decisions. The Clean Energy Regulator is the government body responsible for Carbon Pricing Mechanism administration, in addition to a number of other programs, including the Carbon Farming Initiative, the National Green House Gas Reporting Scheme and the Renewable Energy Target. The Climate Change Authority provides independent advice on the operation of the carbon price, targets, cap and trajectories. Finally, the Productivity Commission will provide economic advice and research to support the operation of the scheme.

3.2.2 History and Political Economy of the Scheme

Australia has one of the highest levels of CO_2 emissions per capita, in ninth place globally according to 2009 World Bank data (World Bank, 2013a), in part due to Australia's heavy reliance upon coal and strong extractive industries. Several decades of relative prosperity and years of drought have created a context in which climate change concerns have ranked highly in recent elections. The combination of wealth, exposure to climate change and powerful extractive industries create a dynamic context for climate policy.

Leading up to the adoption of the CELP, there had been historically high levels of public support for carbon pricing, though these have recently been declining. In the 2007 election, both the centre-left Labour Party and the centre-right Liberal Party included proposals for carbon pricing in their election platforms (Spencer, Senit, & Drutschinin, 2012). However, following the 2007 election, the Labour government attempted unsuccessfully to pass climate change legislation—the Carbon Pollution Reduction Scheme. Failure of the legislation was attributed to a lack of cross-party support for the proposals. The influence of climate change legislation remained substantial in Australia, however, and support for climate change legislation has also been cited as a factor in recent changes of leadership in both major political parties (Spencer, Senit, & Drutschinin, 2012).

Following the 2010 election, in which the Green Party won a seat and neither of the major parties was able to claim outright victory, the Green Party found itself in a powerful position. As a condition of forming a government with Labour, a formal agreement affirmed climate change as a political priority and established the Multi-Party Climate Change Committee (MPCCC) to develop CELP. Despite an increasingly polarized political scene, largely negatively skewed media and eroding public support, legislation was eventually passed.

The total revenue projected from the carbon price is estimated to rise from AUS$8,600 in 2011–2012 to AUS$9,580 by the end of the 2014–2015 financial year (Spencer, Senit, & Drutschinin, 2012). Over the same period, total additional spending associated with the scheme is projected to be consistently greater than revenues. A breakdown of the fiscal impacts are shown in Table 5.

TABLE 5: TOTAL FISCAL IMPACTS OF THE CELP

AUS$ MILLION	2011–2012	2012–2013	2013–2014	2014–2015
Total carbon price revenues	0	8,600	9,080	9,580
Assistance to households	-1,533	-4,196	-4,802	-4,825
Support for jobs	-26	-3,017	-3,475	-3,773
Clean Energy Finance Corporation	-2	-21	-467	-455
Energy security and transformation	-1,009	-1	-1,003	-1,042
Land and biodiversity measures	-69	-131	-506	-489
Governance	-78	-90	-106	-107
Total assistance costs	-2,717	-7,456	-10,359	-10,691
Additional measures not agreed by MPCCC	-223	-48	-322	178
Net fiscal impact	-2,939	1,096	-1,601	-933

Source: Spencer, Senit, & Drutschinin (2012)

The carbon price remains a source of debate in Australia and was a key issue in the recent elections. The leader of the opposition Liberal Party, Tony Abbott, outlined a timeline for repealing the tax prior to the victory of the Liberals at the last election. The issue has taken on such political importance that Abbot said that the repeal would be "the first thing tabled in Parliament" (Business Spectator, 2013). Meanwhile, the Labour party has announced its intention to bring forward the transition to trading to 2014 (Reuters, 2013b) and has revised the estimates of receipts from the carbon pricing mechanism from the estimates shown in Table 5, due to the proposed shift to market-based pricing and the implied reduction in the effective carbon price (Secretary to the Treasury and the Secretary of the Department of Finance and Deregulation, 2013). Media reports indicate that the impact of post-election reforms would result in a significant reduction in private funding to the renewable energy industry (The Age, 2013).

Considering the outcome of the last election, a reform of CELP appears to be likely, giving investors and businesses cause to postpone decisions until the future direction of the policy becomes clear. This uncertainty highlights the need for consensus-based policy-making and the importance of regulatory and legislative stability.

3.2.3 Environmental, Social and Economic Impacts

Since CELP was only introduced in 2012, it is very early to draw conclusions regarding the success of the scheme. However, an analysis of the concerns and criticisms of the scheme and how the scheme designers have sought to address these may provide insights as to the scheme performance.

Environmental taxes in general and CELP in particular often provoke a number of reactions, including concerns that funds will be well spent, a lack of understanding about how the scheme will function, the impact on the economy and concerns over the regressive nature of the tax (Spencer, Senit, & Drutschinin, 2012). These issues were considered in the design of CELP and measures were developed to address them.

Concerns about how the carbon market might function and the danger of a rapidly increasing carbon price have been addressed by the phased introduction of the scheme and the fixed carbon price in the period from 2012–2015. This keeps the carbon price at an acceptable level initially, while those affected develop experience with the scheme. In the longer term, price caps and links to other carbon trading systems, notably the EU ETS, have also been designed to reduce price volatility and limit the difference in carbon price between countries.

The impact on competitiveness and the economy as a whole was addressed by designing CELP so that the overall impact of the measure would be low or even negative, by offsetting additional carbon costs through tax reductions or other measures to recycle revenues. CELP included a number of schemes designed to provide assistance for industrial sectors that were considered adversely affected and vulnerable to international competition, primarily through the allocation of permits at no cost through the Jobs and Competitiveness Program and through further sector-specific programs for the coal (Coal Sector Jobs Package) and steel sectors (Steel Transformation Plan). In addition to the programs focussed on mitigating the impacts of the tax, a number of other programs would also be funded with money from the carbon tax, such as the support for the Clean Energy Finance Corporation, an organization that invests in the commercialization and deployment of renewable energy, energy efficiency and low-carbon technologies. A summary of the balance of costs and revenues from CELP is presented in Table 5.

At the domestic level, energy costs are particularly sensitive, since voters have a direct role in the political process and a straight carbon tax may be regressive, as the poor tend to spend a higher proportion of their income on energy. CELP was designed so that the average household faced an increase in weekly costs of AUS$9.90 but would receive an average of AUS$10.10 in assistance. Assistance is targeted at low- and middle-income households and provided in the form of increases in support for pensions, allowances and family payments, including the Family Tax Benefit. In addition, taxpayers with an average income of under AUS$80,000 per year will receive a tax cut worth AUS$300 per year (Australian Government, 2012; Spencer, Senit, & Drutschinin, 2012).

As Table 5 indicates, the net fiscal impact of the carbon tax will be negative. This fact may be explained partly by the need to secure support from affected groups and to address concerns about the impacts of the scheme. The perceived need for a revenue-negative package of measures indicates the challenges of securing support for a carbon tax in Australia. Despite the careful design, a Nielsen poll carried out shortly after the introduction of the tax found that 38 per cent believed they were worse off and only 5 per cent believed they were better off (ABC News, 2012).

The scale of the compensation measures available to the various interest groups is partly a factor of economic considerations and the need to maintain competitiveness, but also represents the need to appease powerful special interest groups. Wood and Edis (2011) argue that the compensation goes beyond what would be required to prevent carbon leakage and provides a windfall gain to the steel sector.

Clean Energy Finance Corporation (CEFC)

The CEFC, the body responsibly for investing funds from the CELP carbon tax on renewables, began operating in 2013. An expert review of the fund completed in 2012 provided proposals on how the fund would operate (The Australian Government the Treasury, 2012). The review included a consultation that drew submissions from 170 renewable energy companies, electricity retailers, infrastructure operators, companies and individuals. The review establishes three principles for the operation of the CEFC. First, it will maintain a focus on the clean energy sector. Within that, it is proposed that approximately 50 per cent of the fund will be allocated to renewable energy and 50 per cent to low emissions and energy-efficiency technologies. Second, the CEFC will apply a commercial filter to investment decisions. The corporation will invest in projects at a targeted rate of return equal to the government's cost of funds, thereby making possible investments that would be unattractive to private financiers, but still secure a return. In practice, this means that the CEFC will adopt a lower hurdle rate than commercial financiers. Investments will still need to be financially viable, but the cost of capital will be reduced. Third, the fund will address financial barriers by structuring investments to reduce risk and by partnering with other lenders to enable projects to reach financial close. Projects will be evaluated on a case-by-case basis and support will be tailored to match project needs. To remain transparent, the CEFC proposes to publish annual reports including audited financial statements, details of operating costs and details of all contracts (The Australian Government the Treasury, 2012).

As of August 2013, the CEFC had published its first quarterly investment report, in which it presented the first investments made by the fund. These included a co-finance agreement and two syndicated loans for renewable energy projects. The rate of return is expected to be between 5.2 and 6.4 per cent for the investments made and the total value is AUS$137.5 million (CEFC, 2013). Despite a positive start to the fund, it remains under threat from the change in government (Business Spectator, 2013).

3.2.4 Conclusions

CELP faces an uncertain future due to the changing political economy in Australia. Increasing polarization of the electorate and a new government that has been unequivocally against the tax present challenges for the future. Aside from the political obstacles facing the continued use of the tax, there are a number of observations that can be made:

- Concerns over the impact on competitiveness and costs for consumers are important, especially when the carbon price is set through a market price discovery method. Transitional arrangements and floor and ceiling prices have been used to provide more certainty.
- Consultation is important: A comprehensive consultation was conducted to collect opinions and understand the impact of the scheme.

- Some of the revenues from the tax have been allocated directly to programs targeting sectors that have been adversely affected by the tax.
- The use of revenue from the scheme was clearly articulated prior to the launch of the scheme. This transparency allows people to form a judgement on the overall costs and benefits of the scheme rather than viewing the package as an additional tax
- The use of a dedicated fund to invest a proportion of the proceeds of the carbon tax is an interesting model.
- The impact on different groups was carefully monitored, particularly on the general public. The majority of households will be directly better off under the scheme due to the tax cut and other measures to raise benefits. The focus on the domestic sector is in part due to the need to secure public support for the proposals.

3.3 Canada, Alberta: The Specified Gas Emitters Regulation (SGER)

3.3.1 Policy Tool Outline

The SGER only excludes "industrial process emissions"—processes involving chemical or physical reactions other than combustion, where the main purpose is not energy production—as well as emissions related to biomass (Government of Alberta, 2009b). In the poilicy, emissions related to electricity produced by cogeneration earn credits based on improvement beyond a baseline emission factor that assumes that heat would otherwise be sourced from a conventional gas boiler and electricity would be generated by a combined-cycle gas turbine (Alberta Environment, 2008; Doluweera, Jordaan, Moore, Keith, & Bergerson, 2010).

GHG Emissions Targets Under the Scheme

The SGER does not set an absolute quota on GHGs but sets out a formula for facilities to calculate their average "baseline" emissions *intensity*—that is to say, the amount of emissions they produce per unit of output. It then requires them to achieve improvements against their baseline intensity, with the exact target depending on how many years a facility has been in operation (see Table 6). Depending on the age of the facility, baselines are calculated either with reference to average emissions over the years 2003–2006 or the third year of a facility's operation.

The baseline does not generally change year to year beyond this initial phase-in period. That is to say, if a facility reduces its emissions intensity by 12 per cent against its baseline, no further performance improvements will be required until the baseline is revised.

TABLE 6: REDUCTIONS IN EMISSIONS INTENSITY REQUIRED BY FACILITIES UNDER THE SGER

NO. OF YEARS IN OPERATION	0-2	3	4	5	6	7	8	9+
Reduce emission intensity by...	0%	0%, establish baseline	2%	4%	6%	8%	10%	12%

Source: Specified Gas Emitters Regulation, 2013

Facilities can meet their obligation in four non-exclusive ways:

1. **Reduce emissions intensity internally.** Facilities can submit a report, verified by a third party, showing that they have reduced their emissions intensity.
2. **Purchase Emissions Performance Credits.** Emissions Performance Credits (EPCs) are granted to facilities that exceed their emissions intensity targets. One EPC is granted for each tonne of CO_2e that is offset beyond the intensity level that is legally required. Facilities can then trade EPCs with other entities that require extra credits to meet their

targets. Although electricity generated by cogeneration units is not included in emissions benchmarking, facilities with cogeneration units are awarded EPCs for the additional emissions that would have been required to generate the same heat and power externally (Leach, 2012).

3. **Purchase Offset Credits.** Entities may purchase offsets approved by the Alberta-based offset credit system. Offset Credits are awarded for each tonne of CO_2e offset in projects taking place beyond the facilities regulated by the SGER, and are managed by the Alberta Emissions Offset Registry. Projects must be located in Alberta, be "beyond business-as-usual action" and not be required by law. It must also be possible to quantify reductions using a protocol approved by Alberta Environment and reports must be third-party verified. Facilities must also show they have "clearly established ownership" of offset projects (Carbon Offset Solutions, 2011).

4. **Pay into the Climate Change and Emissions Management Fund (CCEMF).** A facility can choose to pay CAD$15 into the CCEMF for each remaining tonne of CO_2e needed to reach its emissions intensity target. The fund is managed by the Climate Change and Emissions Management Corporation (CCEMC). The CCEMC has a revenue-recycling mandate and must invest this money into projects that help reduce GHG emissions in Alberta or improve the province's ability to adapt to climate change (Government of Alberta, 2013).

Through these options, the SGER combines the features of an emissions trading system (allowing companies to reduce emissions or to purchase reductions from those who can do so more cheaply) and a carbon tax (a specific fee per tonne of CO_2e produced) with a regulatory approach (a regulated intensity standard emissions reduction target). In addition, the CAD$15 per tonne CCEMF charges effectively acts as a price ceiling for the trading system's carbon price—a "safety valve" to contain industry (Government of Alberta, 2011).

If facilities do not meet their obligations under the policy, they may be fined up to CAD$200 per tonne of CO_2e that exceeds their intensity limit. If they are found to have contravened procedures and standards related to calculating baselines, reporting emissions and having reports verified, separate fines of CAD$500,000 for a corporation and CAD$50,000 for an individual may be levied (Specified Gas Emitters Regulation, 2013).

The CCEMF

The CCEMF is managed by the Climate Change and Emissions Management Corporation (CCEMC), an "arm's length" corporation independent from government (Government of Alberta, 2009a). Projects are funded via competitive processes, beginning with a call for expressions of interest and including evaluations by both an internal Evaluation Committee and an external Fairness Monitor. The broad scope of the projects is determined by the CCEMC's call for expressions of interest—for example, requesting projects related to cleaner fossil fuel production or renewable energy projects (CCEMC, 2012a).

The SGER is set to expire in September 2014. Options for continuing, renewing and potentially strengthening the regulation are currently being debated by lawmakers and industry stakeholders. Government and industry have both put forth several proposals. One prominent model is a "40/40 proposal" with strengthened targets to reduce emissions intensity by 40 per cent while increasing the CCEMF's fee per tonne of CO_2e to CAD$40 (Kleiss, 2013). Such a model would drive deeper reductions by opening the door to increased technology improvements (with companies more likely to seek technology improvements rather than pay an increased CCEMF fee), while also creating opportunities for higher cost offset projects by installing a higher price ceiling for the system.

3.3.2 History and Political Economy of the Scheme

The primary goal of the SGER is to address GHG mitigation, while protecting the long-term viability of the oil and gas industry, including its ability to export to international markets. Due to the economic importance of fossil energy resources, in particular the province's oil sand reserves, the debate over climate change policy and economic policy are closely linked and a dominant political issue. Such resources are responsible for both a large proportion of Alberta's GHG emissions and a large proportion of provincial GDP. In 2010 activities related to fossil fuel extraction, products and pipelines generated 50.4 per cent of all industrial emissions, with electricity generation (largely coal-based) producing another 37.4 per cent; meanwhile, in 2011, the energy sector generated 27.6 per cent of Alberta's total GDP (Alberta Energy, 2013).

This backdrop creates a complex situation for climate policy. While the Government of Alberta recognizes its shared interest in mitigating climate change, it has traditionally opposed climate change agreements that seek to place an absolute cap on emissions. This stance reflects the Alberta government's position that GHG emissions are intrinsically related to economic growth, and that climate change policy ought not to set targets that restrict growth.

Within Canada, this stance has led Alberta to play an often vocal role in opposing international and federal moves to set absolute limits on emissions—for example, launching a large advertising campaign against the United Nations Framework Convention on Climate Change's Kyoto Protocol, and opposing the inclusion of GHGs in the Canadian Environmental Protection and Enhancement Act (CBC News, 2002). Yet by some measures, Alberta has acted as something of a leader among Canadian provinces, becoming the first jurisdiction in Canada to place a price on emissions (effectively CAD$15 per tonne via the CCEMF) across its industry sectors. While the GHG mitigation impact of an intensity-based approach has been greatly debated, the move to install elements of a carbon price did place Alberta at the forefront of climate change mitigation policy in North America in 2007.

Within the province, the approach to addressing climate change and protecting economic interests could be described as cautious. Alberta's province-level commitments have traditionally been formulated with respect to emissions intensity, emphasizing that transformative technology ought to provide the long-term solutions to climate change (Meadows & Crossman, 2009). Since 2008 its climate action strategy identifies both intensity and absolute GHG targets, although the absolute target is unambitious—a 14 per cent reduction on 2005 levels by 2050 (Government of Alberta, 2008). The strategy identifies three broad themes that will be pursued to achieve its GHG ambitions: conserving and using energy efficiently; implementing carbon capture and storage; and greening energy production (Government of Alberta, 2008).

Through the mid-2000s, Alberta, like the Canadian federal government, was generally considered to have made little progress in GHG mitigation policy, having only introduced two significant measures: (i) requiring coal power plants to offset sufficient emissions to make them "as clean as gas" and (ii) introducing the Climate Change and Emissions Management Act in 2003 (CCEMA) (Bramley, Huot, Dyer, & Horne, 2011). The CCEMA required facilities emitting more than 100,000 tCO_2e per year to report on the level of their emissions.[9] Although this appeared to be a weak measure at the time, it built the reporting capacity, formed a basis for the eventual national reporting approach and provided the basis for setting baselines in the subsequent SGER (Meadows & Crossman, 2009).

In 2007 the announcement of the proposed SGER came as a surprise to most stakeholders. The policy was finalized and implemented very quickly, with only four months passing between the first draft being made public and the start date of the new law (Bramley, Huot, Dyer, & Horne, 2011). This allowed little opportunity for debate and finalized rules for how the new carbon market would operate (Edmonton Journal, 2007).

Within the political economy of Alberta, this tactic probably served a dual role. At the national level, it responded to signals that the federal government was preparing to regulate GHGs under the Canadian Environmental Protection and Enhancement Act, which is only now being finalized in 2013 (Government of Alberta, 2013b). Alberta could effectively "hedge" any risk it might be under from stringent federal policy by introducing its own provincial precedent (Leach, 2012). At the provincial level, the law could be passed more easily, and more importantly, Alberta would retain control over policy design, rather than being subjected to potential federal regulation.

Given the speed of the SGER's introduction, it can be inferred that many of the design elements of the policy were intended to appeal to Alberta's political sensitivity on climate change and economic development issues for several reasons:

[9] The CCEMA has subsequently been expanded to include facilities emitting more than 50,000 tCO_2e per year.

- Its focus on emissions intensity targets made it consistent with long-standing principles in Alberta that would allow industry to continue to grow.
- Its four options for compliance and its low carbon price were likely intended to assure the province's industries that their opportunities for economic growth would not be affected, and that they would have flexibility in regard to compliance options.
- The CCEMF corresponded with the province's long-standing stance that scientific and technological innovation is of key importance to truly addressing climate change.

The decision to require all credit offsets to take place within Alberta also likely reflects a long-standing sensitivity that the province ought not lose to its neighbours any of the wealth that is generated by a federal carbon-pricing regime (McGrath, 2007; Leach, 2012).

3.3.3 Environmental, Social and Economic Impacts

According to the Government of Alberta (2012), the SGER applied to 106 facilities in 2011, representing over 50 per cent of all emissions in the province.

As summarized in Table 7, official figures state that a total of 39.9 million tCO_2e have been offset as of 2012. For an additional 26.5 million tCO_2e, no offsetting has taken place, with companies instead preferring to make payments into the CCEMF.

TABLE 7: SGER PERFORMANCE, 2007–2012

YEAR	GENERATION OF EPCS (MILLION TCO_2E)	BREAKDOWN OF EMISSIONS SAVINGS (MILLION TCO_2E)			TOTAL REDUCTIONS (MILLION TCO_2E)	PAYMENTS INTO FUND (CAD$ MILLION)	EMISSIONS EQUIV. OF PAYMENTS (MILLION TCO_2E)
		AT FACILITY	OFFSET CREDIT PURCHASES	RECOGNITION OF COGENERATION			
2007	0.2	1.3	0.9	1.3	3.4	44	2.9
2008	0.6	1.1	3.0	2.6	6.7	79	5.3
2009	1.3	0.3	3.9	2.7	6.9	63	4.2
2010	2.0	0.0	3.9	2.6	6.4	70	4.7
2011	1.0	1.1	5.3	2.5	8.9	55	3.7
2012*	0.7	1.7	2.6	3.3	7.5	86	5.7
Total	5.7	5.4	19.7	14.9	39.9	398	26.5

Source: Alberta Environment (2013)

** Results for 2012 are unaudited and may be subject to change*

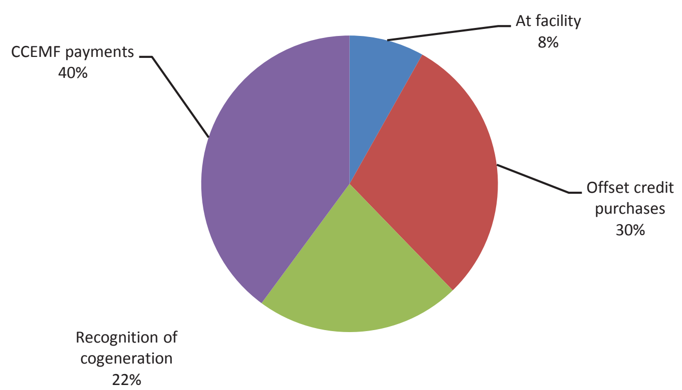

FIGURE 1. HOW FACILITIES HAVE COMPLIED WITH THE SGER, 2007–2012

Data presented in Figure 1 show that, in every year of the policy to date (with the exception of 2011) the most popular option for meeting the SGER obligation has been to make payments into the CCEMF, followed by purchasing offset credits, the use of cogeneration and finally improvements in facilities' emissions intensity. The recognition of emissions offset due to cogeneration represents a large source of offset emissions, accounting for 22 per cent of all emissions obligations in the SGER. Only 8 per cent of the targets set out by the SGER have been met through improvements in performance at the facility level.

As of May 2012 the CCEMC had disbursed around CAD$160 million to 43 clean technology projects across 11 different sectors (CCEMC, 2012b). It estimates that in over 10 years the projects will offset 8 million tCO_2e. This implies an offset cost of around CAD$20 per tonne. However, carbon reductions may not be the best measure of effectiveness, as longer-term transformative technology development may have fewer quantifiable carbon impacts. It also estimates that the total value of the projects is around CAD$830 million (CCEMC, 2012b). This means that, assuming that all projects are additional, the CCEMF funding has leveraged on average CAD$4 of private investment for every CAD$1 of public investment. The sectors receiving the largest share of support have been non-conventional oil extraction, oil and gas extraction and electric power generation, receiving around 47 per cent, 16 per cent and 16 per cent of total funds, respectively. The majority of funding has been channelled into market demonstration and commercialization—amounting to around 55 per cent and 38 per cent of total funds, respectively (CCEMC, 2012b).

As of June 2013, 142 carbon offset projects have been registered in Alberta. A total of 28.5 million tonnes of credits have been registered, of which 19.7 million have been officially "retired" to meet SGER obligations. Renewable energy projects represent the second largest source of offset credits, with wind energy, biomass energy, landfill gas capture and biogas representing 22.1 per cent, 5.5 per cent, 0.8 per cent and 0.1 per cent of credits, respectively. The most significant source is projects focused on reducing or eliminating tilling of agricultural land, accounting for 37.1 per cent of registered offsets (Carbon Offset Solutions, 2012).

Criticisms of Policy Performance

The most significant criticisms of the performance of the policy to date have focused on the offset credit system and, to a lesser extent, cogeneration under the SGER and the performance of the CCEMF.

Offset projects have been heavily criticized for not requiring companies to prove additionality. As a result, Bramley et al. (2011) report that 82 per cent of projects registered between 2008 and 2010 were begun between January 2002 and January 2007, before the SGER had been first unveiled. This makes it highly likely that many of the 19.7 million tonnes offset to date would have taken place under a business-as-usual scenario as well. Taylor (2012) has also criticized the offset credit mechanism for containing no step at which an offset credit is formally "issued" before its use by a facility to meet its end-of-year obligations. This creates a potential risk whereby any credit that is rejected will put a facility into non-compliance with the SGER, with no other options than to make payments into the CCEMF.

The CCEMF has been criticized on two counts. First, it has not succeeded in stimulating emissions reductions equal to those that would have been achieved by industries, had they met their intensity targets. Second, since its funds are largely focused on innovation, it has invested in projects with fairly long time scales, only achieving significant reductions over a period of ten years (Vanderklippe, 2013). It has been argued that, particularly if the charge per tCO_2e is increased in subsequent years, the CCEMF must change in nature, so that it also directs a proportion of funds into nearer-term emissions reductions (Taylor, 2012). One suggestion has been to create of a "sovereign risk fund" to backstop the debt risk premium for clean-tech entrepreneurs, though no plans to amend the CCEMF have been formally announced (Vanderklippe, 2013).

Criticisms of Policy Design

Most criticisms of the SGER have not been levied on policy performance but on policy design: namely, the objection that the policy's focus on emissions intensity and its low carbon price have resulted in a weak tool for combating climate change.

Ultimately, emissions-intensity targets cannot guarantee an absolute reduction in GHG emissions. Despite achieving emissions reductions, the SGER has not created a carbon price large enough to achieve Alberta's stated emissions targets: first, a reduction in GHG intensity of 50 per cent between 1990 and 2020, which the province has cast as a reduction of around 50 million tonnes per year below business as usual, and second, a GHG reduction of 14 per cent below its 2005 level of emissions by 2050 (Bramley, Huot, Dyer, & Horne, 2011). Moreover, the very low share of emissions reductions achieved at the facility level confirms that only a small incentive for performance improvements has been created among large emitters. There is no known carbon price at the current time, as there are no public reporting requirements for trade in EPCs and offset credits (Taylor, 2012); however, it can be assumed to be below CAD$15 per tonne, taking into account transaction costs. By contrast, modelling conducted for Alberta Environment indicates that a carbon price of over CAD$100 is required to achieve its 2050 target (Rivers, Peters, Tu, & Bataille, 2007).

Low carbon prices have also been criticized for creating a low revenue stream for the CCEMF (Bramley, et al., 2011). The Pembina Institute, an environmental non-governmental organization, has advocated a renewal of the SGER following a "40/40-plus-10" model, whereby an initial CAD$40 per tCO_2e charge for CCEMF payments is increased by CAD$10 per year, until it reaches CAD$100 by 2020 (Dyer, 2013). This sum would be sufficient for Alberta to meet its share of national goals for GHG reductions and create a revenue stream of between CAD$1 billion and $1.4 billion per year.

Perceived Successes

Alberta has been congratulated for having a policy at all—one of the few, and first, such policies in the world to impose carbon costs on large-scale industrial emitters—and for creating a market and capacity that can be used to develop more ambitious carbon pricing in future years. No negative economic impacts have been reported in association with the policy and, following the financial crisis, its intensity targets have proved to have some advantages, showing no weakened incentive in the face of falling production (Taylor, 2012). Its rules have also been described as "simple," with a transparent offsets registry allowing for public monitoring and evaluation, and clear protocols setting out how GHGs should be quantified (Bramley et al., 2011).

3.3.4 Conclusions

Lessons learned from the SGER:

- It is possible to create a politically viable fiscal tool to raise revenue from a jurisdiction's largest GHG emitters, without exemptions or prohibitive economic costs. The SGER shows how innovate policies can be established, addressing local conditions without waiting for national or international action.
- If carbon prices are sufficiently high, a price ceiling can be incorporated in a carbon market to ensure stability and reassure industry, while generating significant revenues for investments in specific climate change mitigation projects, such as renewable energy deployment. However, if the ceiling is too low, the carbon price may prove ineffective as a mechanism to drive transformative change.
- Technology funds like the CCEMF may help to improve the viability of a carbon-trading scheme in jurisdictions where medium- and long-term technological innovation are seen to be fundamental strategies for mitigating climate change. Keeping such funds at arm's length from government and requiring transparent decision-making processes are vital for good governance.
- If revenues can be raised in a carbon market, weak policy design in other aspects of the market, such as rules regarding carbon offsets, can substantially reduce the revenues that are raised and undermine the efficacy of carbon mitigation strategies within the scheme.
- It is likely that revenues raised by a primarily climate change-focused policy tool will need to be disbursed on both near-term and medium-to-long term mitigation technologies.

Introducing a modest, politically sellable and flexible policy in the short term may allow for the eventual adaptation of that policy into a more effective tool that raises greater revenue. However, this route may be a slow one—the first phase of Alberta's policy lasts seven years—and it requires high confidence that more stringent measures will be politically possible at a later date.

3.4 Denmark: The Public Service Obligations tariff (PSO)[10]

From 1990 to 2007 economic activity in Denmark increased by more than 40 per cent, while CO_2 emissions decreased by about 14 per cent (corrected for fluctuations in weather and electricity exchange with other countries) (Ministry of Climate and Energy, 2009). The pioneering Danish case exemplifies how persistence and a well-designed package of environmental fiscal policy measures, as well as other instruments, can contribute to a sustainable economy.

Since the 1970s environmental taxation has been integral to the Danish tax system. Today, Denmark has a broad and relatively comprehensive set of taxes, charges and other fiscal instruments for energy, transport, pollution and resources that, in recent years, have raised between €8 billion and €10.5 billion, or approximately 4 per cent of Denmark's GDP (Rademaekers et al., 2011). As a general rule, these revenues flow into the general budget, rather than being earmarked for a specific environmental purpose. This is not the case, however, for the PSO, the focus of this case study and the single-most important instrument for revenue raising and mobilization of private investment in the renewable energy sector.

3.4.1 Policy Tool Outline

The PSO tariff is a levy on all electricity consumption. According to the current Electricity Supply Act, revenues from the PSO are to be used to support renewable energy, decentralized combined heat and power (CHP) production, research and development of environmental energy production and energy efficiency, and certain expenses related to security of energy supply.

While it has several features in common with an energy tax, the PSO is classed as a tariff and is not collected by the Danish government, but by Energinet.dk, an independent, non-profit enterprise that is 100 per cent owned by the Danish Ministry of Climate, Energy and Building. Energienet.dk has the task of managing security of supply, creating objective and transparent competitive conditions on the energy market, and supporting eco-friendly energy generation and the development of green energy production technologies. It is also the transmission system operator for both power and natural gas transmission networks in Denmark (Energienet.dk, 2013).

Since Energinet.dk collects the revenues from the PSO tariff, the PSO funds reach a state-owned company, but not the state itself. For this reason, PSO revenues are not included in the state budget, although their magnitude is politically decided in accordance with the requirements of the overall energy policy.

The revenues from the PSO tariff are used to finance the subsidies paid by Energinet.dk for wind turbines, biomass plants, solar cells and decentralized CHP plants, and to fund research and development in the renewable energy sector.

There are three different models for the subsidy mechanisms:

1. Fixed FiT: For instance, the new 200 MW offshore wind park of Rødsand II received €0.084 per kilowatt hour (kWh) for the first 10 terawatt hours of production and nothing after that. This mechanism is applied to the majority of wind turbines and smaller decentralized heat and power production facilities. The level of the FiT depends on the time of construction and the technology used. The electricity purchased by Energinet.dk under the scheme is subsequently sold on Nord Pool Spot[11] at the market price, so the cost of the FiT depends on the difference between the FiT and the current market prices.

[10] Producing this section of the report would not have been possible without the support of Niels Bisgaard Pedersen of the Danish Energy Agency. We extend our sincere thanks to him and the agency for their support.

[11] Nord Pool Spot is a leading power market in Europe, owned by the Nordic transmission system operators Statnett SF, Svenska Kraftnät, Fingrid Oyj, Energinet.dk and the Baltic transmission system operators Elering and Litgrid

2. Variable premium on the price of power on Nord Pool Spot: Onshore wind turbines receive a subsidy of DKK0.25 per kWh (just over €0.03 per kWh) on top of Nord Pool Spot prices during their first 22,000 full load hours, approximately the first 10 years running time of the turbine. The value of the premium is thus dependent on the power price on Nord Pool Spot. This measure is applied to the wind farms owned by existing power producers and other facilities for renewable energy production.
3. Guaranteed annual income for power production, independent of the level of production itself, typically applied for small gas-fired CHP producers selling their power on Nord Pool Spot. Whether power producers receive a FiT or this form of subsidy is stipulated in the current Electricity Supply Act, it is not up to the company to choose which mechanism they wish to apply.

In principle, the subsidies financed by the PSO revenues correspond to the difference between the current market price for electricity on the electricity exchange market, Nord Pool Spot and a rate that is fixed in the legislation based on technical and financial assessments and depending on the type of plant.

The PSO tariff also funds R&D for environmentally friendly electricity generation and energy-efficient electricity use. Finally, it finances Energinet.dk expenses related to supplying isolated islands in order to ensure equal electricity prices for all consumers and some safety-related expenses. It is also used to cover payments made to ensure availability of sufficient generation capacity.

Because PSO revenues are not part of the Finance Act, the financial basis for the development of low-carbon energy production tends to be more stable, as revenues are not touched upon within budget negotiations. All revenues from the PSO can be earmarked for renewable energy technology deployment, rather than just a proportion (as is often the case elsewhere). Nevertheless, the rules for the PSO are laid down by Parliament, and the tariff is under political control.

Since it is largely guided by the market price of electricity, the PSO tariff is subject to far more fluctuation than a typical tax. If the market price of electricity is high, the subsidies for renewable electricity generation will diminish, and the PSO tariff will be correspondingly lower. If the market price of electricity is low, the need for subsidies will rise and the PSO tariff will be correspondingly higher. In practice, this means that the PSO tariff has a smoothing effect on the overall cost of electricity. High PSO tariffs are always combined with low electricity prices, making the subsidies less burdensome for the consumers and enterprises.

The relationship between PSO expenditures and the electricity price in the period 2001–2012 is shown in Figure 2. Notice that in 2008, when the electricity price peaked, PSO expenditures were lower than in any other year.

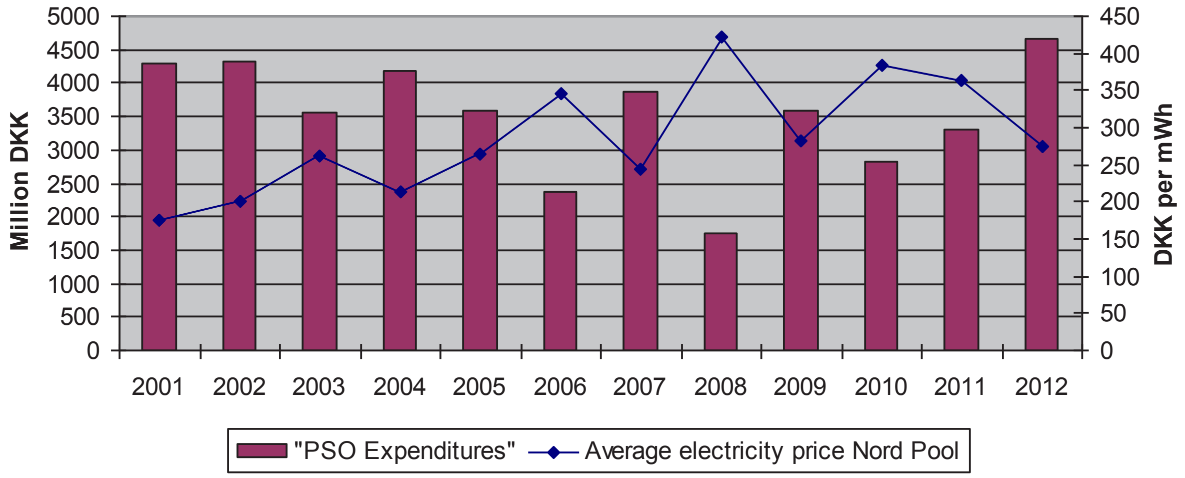

FIGURE 2: PSO REVENUES AND VARIATION IN ELECTRICITY PRICES

Source: Danish Energy Agency (2013)

The PSO tariff is reviewed four times per year based on the expected power price for the coming quarter and over/under compensation for the previous quarter. Energinet.dk sets the tariff for the next quarter.

Tax Rates, Revenues and Costs

In August 2013, the PSO tariff was €0.024 (18 øre) per kWh. It is paid by all electricity consumers—both residential and business. Large enterprises with annual electricity consumption over 100 gigawatt hours (GWh) receive a discount for the proportion of their electricity consumption exceeding 100 GWh. On average, this reduction amounts to 40 per cent of the normal PSO tariff. Companies with their own CHP plants also pay a discounted rate.

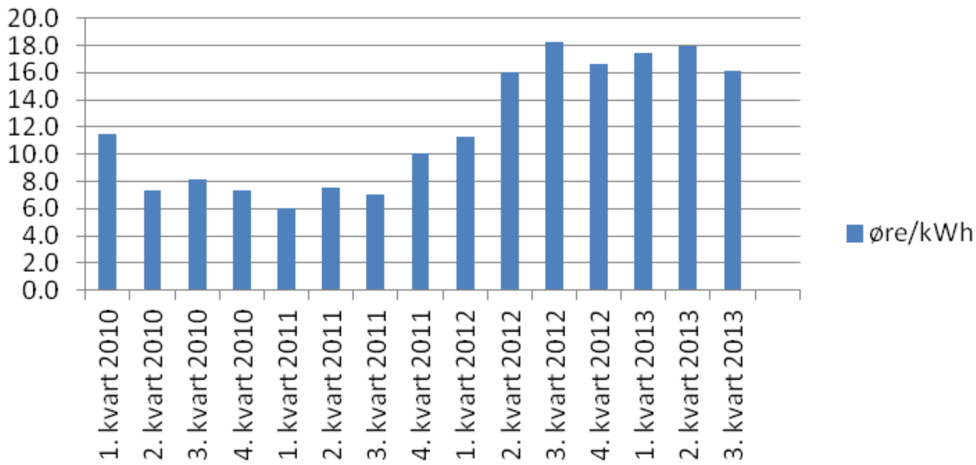

FIGURE 3: VARIATIONS IN THE PSO TARIFF BETWEEN 2010 AND 2013

Source: Danish Economic Council (2013)

In its budget for 2012, Energinet.dk estimated that the average PSO tariff would be €0.014 per kWh (10.5 øre/kWh), when in reality it turned out to be 50 per cent above that estimate due to higher renewable energy generation and lower market prices for electricity than anticipated.

The increase in the PSO tariff in 2012 compared to 2011, as shown in Figure 3, can be attributed to two factors. First, there were—and still are at the time of writing in October 2013—relatively low electricity prices at Nord Pool Spot. These low electricity prices are due to three factors: a large supply of water available for hydroelectric power generation, reduced electricity demand due to the ongoing economic crisis in Europe and very low prices for emissions certificates within the EU ETS. As explained above, because of the way the PSO works, low electricity prices create an increased need for subsidies. In 2012 the country's largest wind farm, Anholt, which has 111 wind turbines producing 400 megawatts (MW) of electricity, was phased in. Like other wind farms, Anholt receives subsidies through the PSO scheme.

The Danish government has forecast that future PSO unit charges will be relatively static, as the cost of larger volumes of renewable capacity will be offset by the falling price of the technology (IEA, 2011).

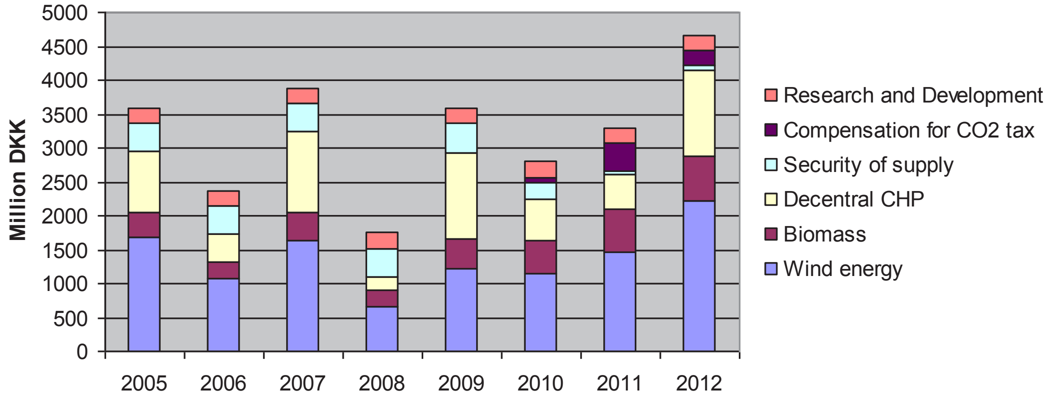

FIGURE 4: PSO EXPENDITURES 2005–2012 (IN MILLION DKK)

Source: Danish Energy Agency (2013)

The use of PSO revenues is shown in Figure 4. Subsidies for renewable energy are by far the largest component, although some revenues are used to compensate local CHP plants, which have paid CO_2 taxes on fuels for power generation and for supply of isolated islands

As shown above, expenses fluctuate, and so does the allocation of the revenue by objective. The cost of support to decentralized heat and power production varies significantly, as does the cost of support to wind, as a result of fluctuating power prices at Nord Pool Spot. The most stable element is the cost of research and development in commercialization of renewable energy and demonstration projects, which have high political attention. In recent times, a total of about DKK155 million (€21 million) has been spent annually on research, development and demonstration of technologies for environmentally friendly power generation and on small renewable energy technologies, including solar cells, wave power and biomass gasification (Energinet.dk, 2012). Each year, the Danish Minister for Climate, Energy and Building determines the focus areas to benefit from PSO-financed research and development, following recommendations from Energinet.dk (Energinet.dk 2012).

In 2012 the revenue from the PSO tariff was €630 million (DKK4.7 billion). This amount was €190 million (DKK1.4 billion) over the level of spending in 2011 and more than 50 per cent over the 2012 budget, because power production from wind turbines was unusually large in 2012 and power prices were lower than expected. There is no cap on deployment: both the private sector and utilities can access the funds if they propose viable projects that demonstrate their ability to manage the operation of the plant.

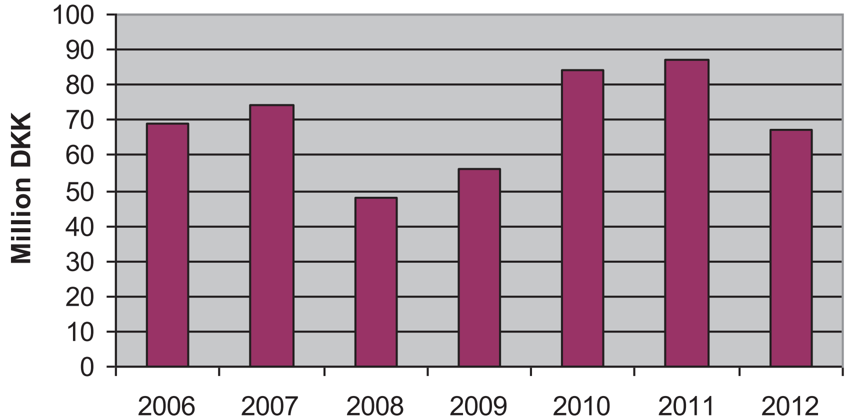

FIGURE 5: ADMINISTRATION COSTS OF PSO 2006–2012 (IN MILLION DKK)

Source: Energinet.dk (2013)

The annual administration costs shown in Figure 5 represent operation expenses, staff and overheads covered by Energinet.dk. Administrative costs are covered by the operating expenses of Energinet.dk, through the general transmission tariff (system tariff), and not by the revenues from the PSO. They fluctuate between about DKK50 million and DKK90 million, or between €7 million and €12 million, corresponding to between 1 and 4 per cent of expenses under the PSO (Energinet.dk, 2012).

3.4.2 History and Political Economy of the Scheme

History of the PSO

The PSO was introduced in 1998, along with the implementation of the European Union directives concerning liberalization of the power market in Denmark, which commenced in the middle of the 1990s. Previously, the Danish power sector was organized in two integrated monopoly structures (East and West Denmark), which were subject to a number of politically decided obligations originally related to security of energy supply, promotion of energy efficiency, promotion of renewable energy and supply of remote areas. During the 1990s, the focus shifted increasingly to renewable energy and energy efficiency.

There was political agreement that the long-term transition of the energy sector toward sustainability and renewable energy should continue. Before 1998, the utilities were already obliged to produce/purchase politically determined shares of the electricity from renewable energy sources, and a tariff for financing this so-called "prioritized production" existed at the transmission level, ensuring that all electricity customers contributed equally to the transition to renewable energy. Thus, the current system of the PSO is largely a continuation of the previous prioritized production scheme, adapted to the liberalization process.

The establishment of the PSO tariff served two objectives. First, the aim was to protect renewable energy production from the liberalized power market, thus creating a mechanism that ensured that politically defined obligations could continue to be imposed on the utilities. Second, the revision of the PSO took the costs of renewable energy subsidies out of the Danish state budget in a period when subsidies were rapidly increasing, thus taking them out of the immediate political debate. Since 1998 renewable energy subsidies have been fully financed by the PSO tariff.

Political discussions also focused on whether the tariff should be applied upstream (on production of electricity) or downstream (consumption of electricity). In the end, the solution reflected the practicalities of the Danish situation: the PSO became a tariff on the consumption of electricity, because Denmark is occasionally a large-scale importer of electricity and a production tax would have had an adverse and potentially distortive impact on the price of imported electricity in comparison to natural gas and oil.

The PSO tariff administration changed in 2005 when the two transmission system operators in Denmark were merged into one (Energinet.dk). In addition, the introduction of the EU ETS also required some smaller adjustments to the PSO administration. Perhaps as a reflection of the PSO's success, a similar levy was introduced on natural gas consumption for financing biogas development as part of the Energy Agreement of 2012.

Since it was created, the revenue from PSO has, to a very large extent, financed Danish support to renewable energy and R&D, and revenues are legally earmarked for this purpose. Traditionally, there has been general political consensus about the economic benefits of ensuring a high degree of security of supply based on domestic energy resources, the prioritization of environmental considerations and profiting from the economic opportunities that an emphasis on green economy creates (Danish Energy Agency, 2013). In spite of this consensus, the level of the PSO tariff directly reflects the ambitions of political actors, and how ambitious the PSO tariff should be has been the subject of political debate. These problems have become more obvious since 2008 and the start of the economic downturn. Nonetheless, the latest quite ambitious Energy Agreement for the period 2012–2020 was agreed by a broad majority in the Parliament.

Debate about the PSO

The influential *Det Økonomiske Råd* (the Economic Council), an independent institution that continuously analyzes and advises the Danish government and public on economic issues, has critically analyzed Danish energy policy and energy taxation several times. The political-economic discussions raised by the Economic Council are focused on the level of effort and ambition concerning deployment of renewable energy in Denmark—that is, whether Denmark's high ambitions make economic sense in relation to reducing environmental damage from energy use. These discussions are particularly pertinent because, within the EU ETS, the overall amount of emission allowances for industry in the European Union is fixed and emission permissions not used in Denmark, for instance because of renewable energy deployment, will be used by another country in the European Union. This means that ambitious policies that go above and beyond national allocations agreed within the European Union will not result in lower carbon emissions at the European or global level. In the light of this, the Economic Council contends that renewable energy expansion should be determined by the cost of CO_2 emissions, and not by politically fixed targets and subsidies in order to be efficient. It posits that it is unlikely that the deployment of renewable energy will be optimal when based on subsidies (Danish Energy Agency, 2013).

The Economic Council has also pointed out that the PSO revenues mainly support wind energy and biomass in CHP technologies that are already competitive (or close to being so) with the non-renewable energy sources in which Denmark has an international leading role based on its rapidly growing domestic markets. The Economic Council has suggested that continued subsidies to these sectors are disguised support to industries with the political aim of retaining Denmark's position as a global leader. The OECD has also suggested that the Danish government should consider "supporting technologies in a more neutral way" (OECD, 2012).

The trade organizations Danish Industry and FSE (the Association of Large Electricity Consumers) have lobbied in favour of a wider part of the business sector having more lenient terms under the PSO regulation. They argue that that the PSO negatively affects competitiveness because expenditure for electricity is increasing faster in Denmark than abroad. They also argue that exporting industries should be exempt to boost economic growth in Denmark.

However, evidence shows that electricity prices for industrial customers in Denmark are lower than average for OECD member states in Europe (IEA, 2011). In addition, energy costs in general are increasing, not only in Denmark, so it seems unlikely that the competitiveness of Danish industry is adversely affected by the PSO. The Danish Ecological Council has argued that a broader exemption of the business sector from all or part of the PSO tariff would be break with a cost-based pricing system that has been used in this part of the energy supply for many years (personal communication, staff members of the Danish Ecological Council, July 8, 2013).

The Danish Economic Council has also criticized the structure of the PSO. Until recently, the PSO's structure undermined the competitive position of electricity in relation to natural gas and oil, which has in turn proven to be a barrier to fuel switching from natural gas and oil to electricity (e.g., switching to heat pumps and electric cars) (Danish Economic Council, 2012).

3.4.3 Environmental, Social and Economic Impacts

Impacts of the PSO on Renewable Energy Technology Deployment

Revenues from the PSO have been the main driver behind the increased deployment of renewable energy in Denmark since 1990, especially the expansion of wind energy. As shown in Table 8, the expansion of renewable energy in Denmark has been very substantial, increasing from 5 per cent in 1994 to 41 per cent in 2011.

TABLE 8: PERCENTAGE OF RENEWABLE ENERGY SHARE IN DOMESTIC ELECTRICITY PRODUCTION 1994–2011

	1994	2000	2005	2010	2011
% REN-share of domestic electricity production	5	16	27	35	41

Source: Danish Energy Agency (2013)

The total installed wind generating capacity is shown in Figure 6. By the end of 2012 Denmark had installed 4,157 MW of wind capacity. According to Energinet.dk, wind power represented a 30 per cent share of the country's total electricity demand in 2012, by far the largest share of any country in the world. Wind power accounted for 10,270 GWh of electricity generation in 2012 (Danish Energy Agency, 2013).

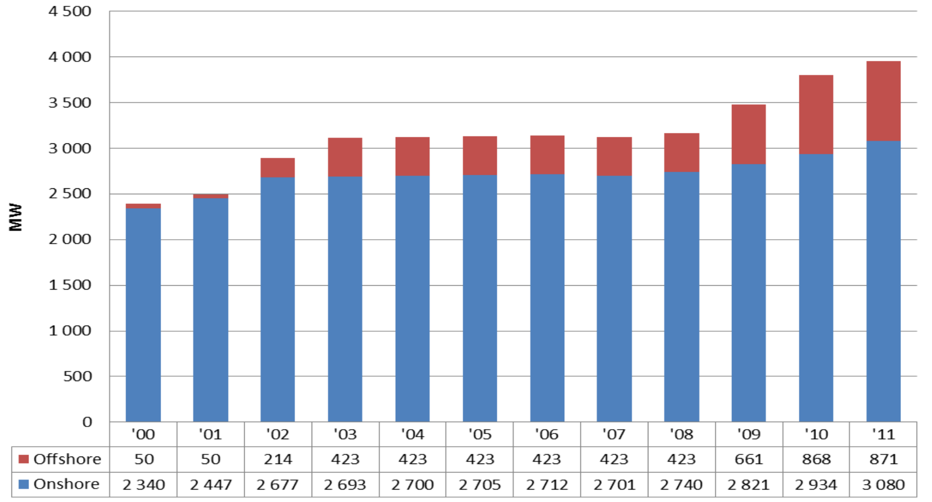

FIGURE 6: WIND POWER CAPACITY 2005–2011

Source: Danish Energy Agency (2013)

The largest contribution to renewable energy in Denmark comes overwhelmingly from wind energy, followed by solid biomass, which also accounts for an increasing share of renewable energy supply and is almost fully utilized in the CHP plants.

Revenues from the 2012–2020 PSO will continue to play a major role in Denmark's climate and energy policy. In the period between 2012 and 2020, as shown in Table 9, revenues from the PSO will finance the 2012 Energy Agreement, increasing the proportion of renewable energy in electricity supply to 50 per cent.

TABLE 9: PREDICTED REVENUES FROM THE PSO TARIFF 2012–2020

MILLION DKK	2012	2013	2014	2015	2016	2017	2018	2019	2020
PSO tariff contribution to 2012 Energy Agreement	100	100	200	200	300	800	1,100	1,500	1,400
Total envisaged PSO revenues	3, 900	4,000	4,300	4,000	3,800	3,800	4,100	4,300	4,500

Source: Danish Energy Agency (2013)

The level of PSO revenues has fluctuated in the past as a result of varying market prices for electricity, as these prices affect the support required for renewable energy. However, even with significant expansion of renewable energy toward 2020, as a result of new initiatives and already implemented policies, PSO revenues will not amount to a great deal more than they did in 2002 (Danish Energy Agency, 2013). In Denmark, this is because the need for renewable energy support per unit is falling, as renewables become more competitive with non-renewable energy sources, and because previous committed support—under FiTs and other subsidy measures—is now falling away. Further, the stable PSO costs are due to expected increases in electricity prices and reduced support for decentralized CHP.

Economic and Social Impacts of the PSO

A report by International Renewable Energy Agency and the Global Wind Energy Council (2013) suggests that the clear and effective pricing structure created by the PSO, which ensures that electricity producers can rely on stable revenues from their investments, has clearly facilitated significant investment in the renewable energy industry in Denmark. A stable investment climate and strong, stable incentives in favour of renewable energy have clearly been important enabling factors in the deployment of renewable energy in the country.

The obvious political commitment to rapid deployment of renewable energy on the part of successive governments in Denmark's series of Energy Plans since 1976 has reassured private investors of the stability of the investment climate. Indeed, this stability has stimulated the development of an innovative financing model for renewable energy—a partnership between an institutional investor of pension fund capital and an industrial partner—to facilitate the long-term investment of pension fund capital in renewable energy, such as investments in the Nysted wind farm in 2010 and the Anholt wind farm in 2012 (The Guardian, 2011). Unfortunately, no statistics on the amount of private investment leveraged as a result of the PSO are available—but it is clear that the rate of deployment (see Table 9) highlights the scale of investment in renewable energy in the country.

Measures within the PSO to support research and development have boosted the renewable energy technology sector, which is increasingly important to the Danish economy. Danish products currently account for one third of the total global wind turbine market, and renewable energy technology exports amounted to 7 per cent of total exports in Denmark in 2012 (Danish Ministry of Climate and Energy, 2013). In 2012 the wind industry in Denmark had a turnover of DKK81 billion (€11 billion), down from DKK100 billion (€13.4 billion) in 2008, before the European economic crisis hit. Wind energy exports in 2012 were worth DKK52 billion (€7 billion) and accounted for more than 4 per cent of total Danish exports (Danish Wind Energy Association, 2012).

The social impacts of the PSO have been generally positive or neutral. The renewable energy industry has had a positive impact on employment and has created a significant number of jobs in Denmark. The Danish Wind Energy Association (2012) has estimated that employees in the wind energy industry alone totalled 28,000 in 2012. Although Danish domestic energy prices are among the highest in Europe (IEA, 2011), the impact of the PSO on domestic energy prices and thus on households is not significant in comparison to other instruments, as shown in Figure 7. It should be noted that fuel poverty is not an issue in Denmark in comparison to some other European Union countries, as the housing stock tends to be insulated to a high standard.

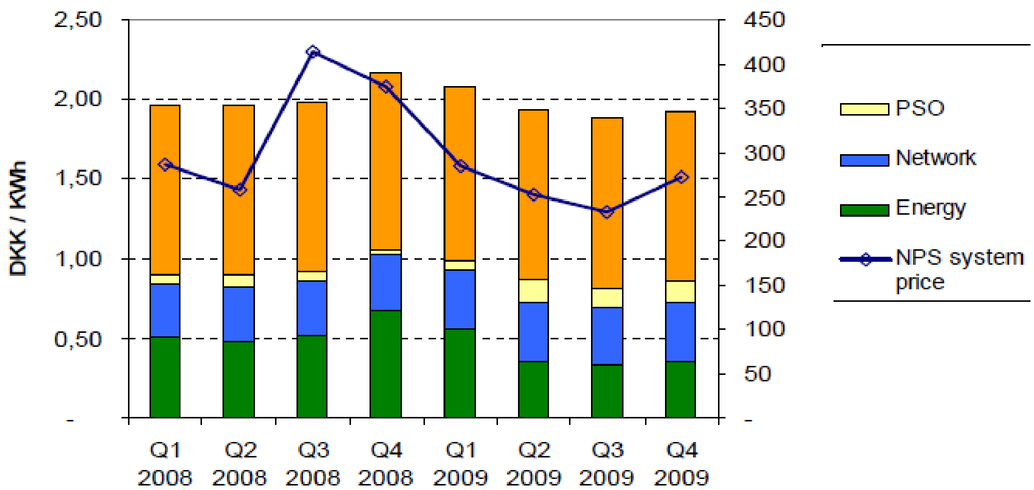

FIGURE 7: BREAKDOWN OF ELEMENTS OF ELECTRICITY PRICES FOR HOUSEHOLDS IN DENMARK

Source: Danish Energy Regulatory Authority (2010, p. 26). Reprinted with permission.

3.4.4 Links to Wider Policy Frameworks

As previously mentioned, the PSO instrument is directly linked to political ambitions regarding climate and renewable energy, and the instrument was introduced as part of the first liberalization package in Denmark. The PSO has proven to be an efficient instrument, and will play a key role in the 2012–2020 Energy Agreement, which will result in significant CO_2 emission reductions when implemented.

The PSO interacts with a number of environmental taxes placed on consumer goods that cause pollution (water, fossil fuels and electricity) or on discharges of polluting substances—of which the CO_2 tax is the most important—all of which aim at decreasing the environmental impact of power production and fossil fuel and resource consumption. It also interacts with the security-of-supply tax levied on all electricity consumption, which was introduced to cover a fiscal deficit arising from the lower revenues from a general tax on (non-renewable) energy consumption in Denmark.

PSO and the 2012 Energy Agreement

In 2012 in Denmark, a broad and very ambitious energy agreement was reached for the period up to 2020. The framework sets out the future of Danish energy policy to 2020 and includes a target of 50 per cent wind energy in 2020 that would cover 50 per cent of electricity consumption, and a reduction in GHG emissions from the Danish energy sector by 34 per cent in 2020 compared to 1990 levels (Energinet.dk, 2012).

This Energy Agreement also includes the expansion of wind power capacity by 2,000 MW in total. When these plans are realized, Denmark will generate just under 6,500 MW of wind power. This is the equivalent of wind power covering 50 per cent of Danish electricity consumption by 2020 (Energinet.dk, 2012). The Energy Agreement will be financed by increasing the PSO tariff slightly alongside the introduction of a new tariff on natural gas to finance biogas development similar to the PSO tariff, the implementation of a new security of supply tax and increased efforts on the part of Danish utilities in the field of energy efficiency.

3.4.5 Conclusions

- The transfer of the PSO administration to a state-owned enterprise that is responsible for collecting and spending the PSO revenues has simplified funding and kept the instrument clear of political debate.
- Exclusion of revenues from the state budget (the PSO is not a tax, but a tariff) seems to have been helpful in minimizing opposition to the PSO, particularly against the background of the ongoing economic crisis, as pressure on governments to cut spending has increased significantly.
- The PSO generates the same co-benefits as an energy tax, creating a dynamic incentive to improve energy efficiency and reduce energy consumption, while raising revenues to support the increased deployment of renewable energy. However, the PSO is not subject to the political wrangling a tax would be, as it is outside of budget negotiations.
- Political consensus on the benefits of a transition to renewable energy and a greener economy has been an important factor in retaining a relatively high level of ambition in the PSO tariff, and has facilitated the implementation of revenue-raising instruments to mobilize large volumes of public and private investment. As a result, Denmark has become a world leader in renewable energy deployment and renewables industries.
- The clear and effective pricing structure created by the PSO, which ensures that electricity producers can rely on stable revenues, has also facilitated investment in the renewable energy industry.
- The way the PSO works has a smoothing effect on the overall cost of electricity and thus reduces volatility on the electricity market. Fewer energy price fluctuations make energy pricing generally less of a political hot topic, and thus may also reduce opposition to the PSO.

3.5 Germany: Energy and Climate Fund

Renewable energy technology deployment (RETD) in Germany is mostly driven through a strong FiT scheme established through the Renewable Energies Act in 2000. Additionally, Germany has several MBIs in place, which support RETD, both on the revenue as well as the expenditure side of fiscal policy. On the revenue side, the most relevant instrument, which sets out to improve framework conditions for RETD, is the EU ETS. On the expenditure side, there have been a number of different programs initiated by both the federal and state governments over the past years, most importantly for R&D in renewable energies and the "market incentives program for renewable energies," which provides grants to support private investments in renewable heating installations in buildings.

This case study looks mainly at a specific institutional arrangement: the Energy and Climate Fund (ECF). The ECF was established in 2011 and constitutes a special fund separate from the federal budget. It is funded by EU ETS revenues and its resources are used to finance programs in the areas of energy efficiency, renewable energies and the development of e-mobility. The ECF is presented and discussed here because it constitutes a direct combination of the polluter-pays principle (by using revenues from the EU ETS) with the support of RETD. The RETD offers several institutional lessons regarding the earmarking of funds and the institutional arrangements of a fund.

3.5.1 Policy Tool Outline

The ECF was established to bundle and provide additional resources for the development of the German energy supply system in the context of the phase-out of nuclear energy. It is funded from revenues of the auctioning of emission allowances in the framework of EU ETS.

The EU ETS is the central instrument to combat climate change at the European Union level. It is a cap-and-trade system to reduce GHG emissions. As of 2013, it covers more than 11,000 factories, power stations and other installations with a net heat excess of 20 MW in 31 countries (European Commission, 2013). A cap is established limiting the total amount of GHGs that can be emitted by all participating installations. Allowances for emissions are distributed among participants and can be traded. The EU ETS was launched in 2005 and has entered its third trading period, which runs from January 2013 until 2020. While most allowances were distributed freely according to historic emission levels (grandfathering) in the first and second trading periods, an increasing number of allowances are auctioned from the beginning of the third period on. Currently, 88 per cent of the allowances to be auctioned are distributed to European Union Member States on the basis of their share of verified emissions from EU ETS installations in 2005. Auctions are run by auction platforms appointed by national governments. The European Energy Exchange in Leipzig acts as Germany's auctioning platform. The revenues of the auctioning of the German share of allowances are directed to the Energy and Climate Fund.

The Energy and Climate Fund Act specifies that funds are to be used for programs supporting an "environmentally sound, reliable and affordable energy supply and of climate protection." The provisions of the law allow for financing measures in the areas of energy efficiency, renewable energies, storage and grid technologies, modernization of the insulation of buildings, national and international climate protection measures, the development of e-mobility and the use of vehicles with electric powertrains—indeed, all federal program expenses for the development of e-mobility are centralized within the ECF (German Ministry of Environment, 2013a).

The most relevant programs financed in 2012 and 2013 were for e-mobility, energy efficiency, the modernization of the insulation of buildings, R&D for renewable energies and a market incentives program for renewable heating. Of the €1,083 million allocated to the ECF in 2013, €161 million is foreseen for programs supporting RETD (Kindler, 2013) (see Table 10 for more details). One particular program under the umbrella of the ECF with specific relevance to RETD is the Market Incentive Program for renewable heating. It provides grants to private households or businesses to create incentives for the installation of renewable heating installations in buildings.

The Ministry of Finance manages the ECF's resources. Resources are allocated through an annual budget and a medium-term financial plan and are approved annually by the cabinet of ministers along with general annual budget legislation. While the Ministry of Finance makes an initial proposal, the ministries of Environment and Economy are also involved in the process. Like the general federal budget, the budget of the ECF is needs the approval of the Parliament.

Even though there are no exact calculations or estimates available, the Ministry of Finance estimates that additional administrative costs for the establishment and management of the ECF are low in comparison to the administration of the funds as part of the general budget (Deutscher Bundestag, 2011). The fund is managed according to the same principles as other federal budgetary titles. To the extent that ECF programs complement existing programs or provide follow-up financing to previously existing programs, no significant additional costs arise because of the financing through the ECF. The internal ECF processes of budgeting are also similar to the budgeting of the programs in singular budgetary items of the general federal budget.

3.5.2 History and Political Economy of the Scheme

The ECF was established through the federal Energy and Climate Fund Law in January 2011. It was introduced as part of a policy package to turn around energy policy after a new coalition government of Conservatives and Liberals came to power in 2009. Initially, the new government reversed the "nuclear consensus," a nuclear phase-out agreed upon by a previous government of Social Democrats and Greens and the operators of nuclear power plants. The original consensus had foreseen limited operating permits for all nuclear power plants until 2022. The new Conservative-Liberal government extended operating permits for another 8–14 years beyond 2022. Thus, when the ECF was first established, it was funded exclusively by payments from the operators of nuclear power plants. One motivation for the establishment of the ECF at that time was the political will to skim the extra profits operators made as a result of the extension of the operating permits by forcing them to pay into the ECF. In June 2011, however, the Conservative-Liberal coalition government reversed their earlier turnaround in German energy policy in the wake of the nuclear accident in Fukushima and accelerated the pace of the nuclear phase-out. As a result, the ECF law was amended so that the ECF was then funded exclusively from revenues of the emission allowance auctions within the framework of the EU ETS.

A second motivation for the establishment of the ECF was to ensure continuous financing for support programs for an environmentally sound, reliable and affordable energy supply. The government's rationale was that, by separating the resources from the general budget, they would be less subject to highly political budgetary politics resulting in stop-and-go financing.

3.5.2.1 Environmental, Social and Economic Impacts

As indicated in the introduction to this case study, a range of different instruments have been implemented to support RETD in Germany. The overall policy mix has been very effective and caused a rapid increase in the deployment of renewable energies. In the electricity sector, the original target of a 12.5 per cent share of electricity generation in 2010 was exceeded in 2007, and renewable energies accounted for 14.2 per cent of overall electricity generation. A new target of 35 per cent in 2020 and 80 per cent in 2050 was defined in 2010. In the heating sector, the share of renewable heating increased from 2 per cent in 1990 to 11 per cent in 2011 (German Ministry of Environment, 2013c, p. 13).

To separate the effects of the EU ETS and the German FiT in the electricity sector is not trivial. In principle, the EU ETS increases the price for electricity generation from fossil fuels through a price on CO_2 emissions, and thus can have a positive effect on RETD. However, due to the low prices of allowances in recent years, the effect of the EU ETS on RETD in Germany is limited. Substitution is triggered when the opportunity costs of allowances are higher than the actual price of allowances—in other words, if it is cheaper for companies to buy allowances than take steps to reduce their carbon emissions, then they will do the former. The actual influence of the EU ETS on electricity prices depends on a number of factors, including the price of allowances, the efficiency of power plants, the specific emissions of power plants, the structure of the generation mix and competition on the electricity market. Historically, the excessive allocation of allowances has been a key factor in keeping the overall price low. For Germany, it has been estimated that an increase in allowance prices of €1 per tCO_2e results in an increase in electricity prices of €0.6 per MWh. A carbon price of €20 per tCO_2e would then result in an increase of €0.012 per kWh (Dieckmann & Horn, 2008).

The EU ETS, however, is in a deep crisis, with allowance prices below €10 per tCO_2e since 2006. After a starting phase with prices in a range of €20–€30 per tCO_2e, prices fell sharply in spring 2006 when it became clear that there were too many allowances in the system. With the beginning of the second trading period in 2008, there was again scarcity on the market. Supported by an overall boom in commodity prices, allowance prices stabilized in a range of €25–35 per tonne until the effects of the financial and economic crisis resulted in a price collapse to levels of €7–€8 per tonne again from late 2008 on. Due to the continuing economic recession, together with a lack of political will to correct the market, prices have since dropped further, ranging from €4–€5 per tonne in May/June 2013 (Matthes, 2013).

FIGURE 8: SECONDARY SPOT MARKET PRICE FOR EU ETS EMISSION ALLOWANCES 2005-2013

Source: Matthes (2013)

In 2012 the average FiT for renewable energy installations was at €0.1805 per kWh (BDEW, 2013) and thus considerably higher than the increase in the electricity price resulting from the carbon price in the EU ETS. Since FiTs are fixed, the additional effect of the EU ETS does not significantly change the overall amount of electricity from renewable sources, as long as the price increase through the EU ETS stays below the average FiT. Thus, with allowance prices currently ranging between €3–€5 per tonne, the effect of the EU ETS is limited (Diekmann & Horn, 2008; Kemfert & Diekmann 2009).

In the heating sector, the direct effects of the market incentive program for renewable energies, which is financed from the ECF, are more clear and impressive. In 2012 grants amounted to €144 million. With this amount of state support, private investments into renewable heating installations of €963 million were leveraged (German Ministry of Environment, 2013b). The latest comprehensive ex-post impact assessment of the market incentives program dates from 2010.[12] That year, grants totalled €235 million, which leveraged a volume of private investment of €1.808 million. Hence, the leverage effect of the market incentive program has proven to be very effective at six to seven times that of public investment. Renewable energy installations supported through the program in 2010 contributed 1,516.3 GWh of energy to the overall energy mix and the substitution of 1,308 GWh of energy from fossil sources, or 0.1 per cent of the total energy from fossil fuels in the heating

[12] Before the establishment of the ECF, the market incentives program for renewable energies was financed from the federal budget.

sector. The substitution of fossil fuels through the program resulted in a substitution of 0.3 per cent of overall fossil fuel exports. It was estimated that the program contributed to the creation of approximately 10,000 jobs, especially in the small installers and equipment suppliers necessary for the installation of renewable heating in buildings (Langniß et al., 2011).

The overall performance of the ECF, however, is compromised by the low price of EU ETS allowances and the resulting shortfall of revenues from their auctioning. In 2012 revenues from EU ETS auctions were forecast at €780 million, based on the assumption of an average price of allowances of €17 tCO_2. However, the average price in 2012 was actually just €7.50. The actual revenues fed into the ECF in 2012 amounted to €512 million. Of this, €452 million was allocated to projects, but only €317 million was actually spent (Kindler, 2013).

In 2013 revenues from EU ETS auctions will again be dramatically lower than projected, due to even lower allowance prices. The forecast revenues to be made available for the ECF were estimated to be €2,046 billion (Kindler, 2013).[13] However, when forecasting, the federal government had expected an average price of EU ETS allowances of €10. In March 2013, the Ministry of Finance revised the expected average price of allowances to €4.5, although even this price might prove to be optimistic, if the EU ETS is not reformed in the coming months (Kindler, 2013). After the first unsuccessful vote on the backloading proposal, the European Parliament planned to defer the sale of emissions allowances in April 2013, and allowance prices dropped below €3. At the time of writing, the Ministry of Finance's adjusted forecast for ECF funds was €888.5 million. This amounts to 43 per cent of the originally expected volume. The German Bank for Reconstruction (KfW) will compensate part of the 2013 financial deficit resulting from these inaccurate predictions; the rest will presumably be provided through a loan from the federal budget (Kindler, 2013).

TABLE 10: RESOURCES AND EXPENDITURES OF THE ECF IN 2012 AND 2013 (€ MILLION)

		2012		2013	
	FORECAST 2012	REVISED FORECAST 2012	ACTUAL EXPENDITURE 2012	FORECAST 2013	REVISED FORECAST 2013
Total expenditures	780	452	317	2,047	1,083
Total revenue	780	452	512	2,047	1,083
Energy-efficient urban redevelopment	-	-	-	18	-
Energy-efficient modernization of buildings	65	65	52	209	-
R&D renewables	29	20	19	104	78
R&D energy efficiency	21	16	14	72	63
E-mobility	301	220	156	426	426
Energy Efficiency Fund	89	40	11	232	69
Market Incentives Program for Renewable Heating	100	-	-	172	83
National Climate Initiative	100	48	29	172	96
Forest Climate Fund	-	-	-	28	7
Climate Change Adaptation Measures	-	-	-	8	2
International Climate and Environmental Protection	42	38	30	372	252
International Energy and Raw Materials Partnerships	6	3	2	8	3
Energy and Climate Foreign Policy	7	4	3	8	2
Implementation EU Energy Efficiency Directive	-	-	-	6	2

[13] Auction revenues are expected to be higher because a larger number of allowances are being auctioned after the beginning of the third EU ETS trading period in 2013.

Compensation KfW Offshore	20	-	-	64	-
Compensation KfW Int. Climate and Environmental Protection	1	-	-	-	-
Private Buildings Modernization Programme	-	-	-	51	-
Reserve	-	-	-	96	-

Source: Kindler (2013)

Overall, many observers welcomed the introduction of the ECF, as they expected continuity of funding for the programs and the avoidance of stop-and-go financing. Before the establishment of the ECF, Germany's experience with support programs for renewable energy and energy efficiency was that funding had been subject to significant fluctuations due to budget constraints and changing political priorities. The establishment of a separate fund outside the general budget promised to ensure continuous funding for the programs.

The financing of the ECF through revenues from the auctioning of EU ETS allowances was also widely welcomed as a consistent application of the polluter-pays principle. The revenues from a carbon pricing mechanisms are redirected into investments that help make the energy system less carbon intensive and shift it toward renewable technologies and thus toward climate protection (Esch & Kowalzig, 2012). The pooling of all support programs for renewable energies and energy efficiency within one centrally administered fund also has the potential to increase overall efficiency through central coordination in and between programs and clear national funding structures (Pehnt & Brischke, 2013).

In practice, however, the design and implementation of the ECF has several flaws that compromise the effectiveness of the scheme. Most prominently, the objective of making funding for renewable energies and energy efficiency independent of political discretion and budget constraints is frustrated by the fluctuation and chronically low prices for EU ETS allowances. In the two years of its operation, the forecast of the revenues to be allocated to the ECF have been significantly higher than the actual revenues raised in EU ETS auctions. The problems experienced in ensuring funding continuity for the ECF highlight a common criticism of hypothecation of revenues, which is that revenues will rarely match spending needs and that rapid shifts in revenues may prevent funds from being deployed to meet the objectives of the program. The result is either that targets are missed or, as in this case, that additional government funds must be committed to make up the shortfall.

The effectiveness of the ECF is also reduced due to institutional shortcomings. Budget planning for the ECF is done annually by decision of the federal cabinet, allowing for political discretion—if not about the overall revenues of the fund, about the allocation of funds among the individual programs within the fund. Additionally, the ECF is administered by the Ministry of Finance and not by the Ministry of Environment or any other government body responsible for the political objectives that are pursued by the programs within its purview.

3.5.3 Links to Wider Policy Frameworks

The support for RETD in Germany must be seen in the wider context of the German energy transition ("Energiewende"): in 2011, the government adopted a legislative package on future energy supply, which links the scheduled phase-out of the commercial use of nuclear power with a comprehensive concept for reaching 80 per cent renewable energies in 2050.

The most important policy instrument to reach this target is the FiT scheme, in place since 2000, whereby generators of renewable power are paid for the power they feed into the grid. The additional costs of making FiT payments to renewable generators are paid by all households in the form of a premium on electricity prices. The unit rate of the FiT is being lowered over time as technologies advance and become more competitive, but its total cost rises as more renewables are deployed.

Framework conditions for RETD are also influenced by the EU ETS, which can improve the investment conditions for renewable energies by rendering them relatively cheaper in comparison with fossil power generation. However, due to the persistently low price for allowances in the EU ETS, the effects on RETD have been limited to date.

In the context of the "energy transition" there is also a strong link between the accelerated deployment of renewable energies and measures to increase energy efficiency, the rationale being that higher shares of renewable energy will be easier to accomplish if overall energy consumption is reduced. An important instrument to increase energy efficiency is the German energy tax. While fossil fuels had been subject to taxation for a long time in Germany, rates for different fuels were raised and aligned and a new tax on electricity was introduced in the context of an environmental tax reform in 1999. The electricity tax does not discriminate between electricity from renewable and fossil sources, and accordingly has no effect on RETD.

On the expenditure side, there are also a number of programs in place to support energy efficiency. Like the programs for the support of renewables, these were also integrated into the ECF when it was established in 2011. After the revised forecast of 2013 ETS revenues, €132 million is allocated to programs supporting energy efficiency, namely R&D support, the creation of funds for a separate energy-efficiency fund and implementation of the EU Energy Efficiency Directive.

3.5.4 Conclusions

In Germany, the overwhelming effect of policy instruments for RETD has come from the FiT system in the electricity sector. The effect of the EU ETS on RETD beyond the positive effects of the German FiT system so far has been limited due to low emissions allowances prices stemming from a lack of political ambition in the design of the system.

Market incentive programs for renewable energies, which provide grants for private small-scale investment in renewable energy installations, have proven to be very effective in Germany in sectors not covered by the FiT scheme (e.g., the renewable heating of buildings in Germany).

The bundling of support programs for renewable energy in a separate and centrally managed fund is a promising policy option to make its funding for renewable energies more continuous and stable, and thus increase investment security and accelerate the deployment of renewable energies. However, several lessons can be drawn from the German experience with the Energy and Climate Fund:

- The endowment of the fund should be fixed, or financing of the fund should come from a steady source.
- Internal budget planning of a fund for the support of renewables should be long term and separate from general budget planning.
- Responsibility for the management of the fund should rest with a government body also responsible for the political objective that is promoted by the fund.
- Where revenues are derived from an environmental fiscal measure, they are subject to change. Additional government support or the flexibility to reduce spending accordingly may be required to maintain a consistent source of funding.

3.6 India: Clean Energy Cess

3.6.1 Policy Tool Outline

The Clean Energy Cess on Coal is a tax that is intended to reduce dependence on coal and to incentivize renewable energy.[14] As stated by the Ministry of Finance (MoF) when it was introduced in 2010, its primary objective is to help combat climate change (Mukherjee, 2010).

Design and Institutional Structure

The Clean Energy Cess is a tax of INR50 (US$ 0.82) per tonne on coal, lignite or peat from all domestic and imported sources (MoF, 2010). The tax applies to domestic and imported coal and gross quantity of coal before it is washed. A small penalty

[14] A cess is a tax for a specific purpose. The word cess was once used in Ireland and now has been replaced by tax; however, the term continues to be used in India.

of INR10,000 is applied for any discrepancies. The Central Board of Excises and Customs collects the tax. Revenues flow into the National Clean Energy Fund (NCEF), a non-lapsable[15] corpus, and must then be used to support clean energy technology.

Which Projects Are Financed by NCEF?

According to the MoF (2011), "any project which adopts clean energy technology and research and development is eligible." NCEF and funding decisions are managed by an Inter-Ministerial Group (IMG) that consists of senior government officials representing the MoF and the following sectors: power, coal, fertilizers, petroleum and natural gas, new and renewable energy, and environment and forests.

Projects may receive financing for up to 40 per cent of the project costs. This implies that, at a minimum, NCEF seeks to leverage US$1.5 of private finance for every US$1 of public finance provided. The project proposals can be submitted by individuals or consortiums, or by a government ministry or department. There is no competitive bidding process and the IMG cannot be approached directly by the project applicants (Kumar, 2012). Application is a multi-stage process. Project proposals are first submitted to any concerned ministries or departments for evaluation. Proposals considered appropriate are then passed on to the Planning Commission, MoF and other relevant ministries for review. The final review for approval is provided by the IMG, which reaches decisions on a case-by-case basis. The IMG may seek the technical experts to review the proposals and then monitor their progress closely (Press Information Bureau, 2011). Although rules specify that a time frame should be adopted for each stage of the application process (MoF, 2011; Pandey, Bali, & Mongia, 2013), in practice it is unclear if such a time frame exists.

Value of Projects Financed Through NCEF

The NCEF can provide projects with support either in the form of loans or through viability gap funding. Projects under INR1.5 billion (US$4 million)2 are approved by the minister sponsoring the project. Projects in excess of INR1.5 billion but under INR3 billion (US$48 million) need an additional approval from the Finance Minister. Projects exceeding INR3 billion are approved by the Cabinet Committee on Economic Affairs. The latter is the agency that approved the set up of the NCEF and instituted guidelines for utilizing the funds for projects (Pandey, Bali, & Mongia, 2013).

Tax Revenues and Administrative Costs To Date

As summarized in Table 11, in the first full financial year since its inception (2010–2011), the Clean Energy Cess raised INR10.6 billion (US$173 million) and in 2011–2012, it raised INR32.49 billion (around US$0.5 billion). In the 2012–2013 fiscal year, this grew to INR38.6 billion (US$0.6 billion). It is predicted that NCEF will raise a similar amount in the 2013/2014 financial year. Revenues have fluctuated because, although the level of the tax is fixed, the amount of imported coal varies each year (Reuters, 2013a). For example, in 2012–2013, coal imports increased over a third compared to the previous year (Reuters, 2013a).

As of the end of 2012, funds have been used to support 15 separate projects (Indian Express, 2012) worth INR19.7 billion (Pandey, Bali, & Mongia, 2013). The full revenues raised for the NCEF have not been completely utilized; indeed, around 75 per cent remain unused. Furthermore, some projects have received funding even though they do not follow the guidelines and "the process of disbursing the fund is mired in confusion" (Panda & Jena, 2012, p. 18). The latter is discussed in greater detail in Section 3.6.3.

[15] Non-lapsable refers to funds that will not exhaust at the end of the financial year. The unused funds can be carried over to the next financial year.

TABLE 11: REVENUES RAISED BY THE CLEAN ENERGY CESS ON COAL OVER TIME (INR BILLION)

	ACTUAL 2010–11	REVISED 2011–12	BUDGET 2012–13	BUDGET 2013–14
Clean Energy Cess	10.66	32.49	38.6	35.4
No. of projects approved	0	10	5	n/a
Value of projects approved	0	5.73	14	

Source: Centre for Budget and Governance Accountability (2012); Pandey, Bali, & Mongia (2013); Union Budget, Government of India (2013, line item 5.07.04)

The administration of the NCEF involves no significant additional costs over business as usual (MoF, 2010). All producers of coal, peat and lignite are registered with the central excise authority responsible for implementing the customs and sales tax. The assessment of these mines for customs and sales tax is conducted electronically and the same method of assessment is used for the Clean Energy Cess.

3.6.2 History and Political Economy of the Scheme

The Clean Energy Cess on Coal is one of a series of renewable energy and climate change policies that have followed in rapid succession in the past few years in India. In 2008 the government announced an ambitious National Action Plan on Climate Change (Wheeler & Shome, 2010), the initial focus of which was on increasing the percentage of renewables in the energy mix. In 2009 it announced an ambitious National Solar Mission and a national renewable energy policy to increase consumption of energy from renewables. In the same year, at the international climate change meeting in Copenhagen, India pledged to cut its GHG emissions by 25 per cent on 2005 levels by 2020 (Tikoo, 2009). Subsequently, among these international and national events focusing on sourcing energy from clean sources, the Finance Minister announced the imposition of the clean energy cess in the 2010–2011 budget.

Reactions to the cess from Indian industries have been mixed. The introduction of the cess did not invite any noted criticism or protest in the media, perhaps because the rate is low, at only INR50 per tonne of coal. The renewable energy industry welcomed the cess, since it was designed to fund the NCEF, which further supports research and innovative projects in clean energy (Pandey, Bali, & Mongia, 2013). Coal India Ltd chairman Partha S. Bhattacharyya welcomed the decision and said “the fund can be utilised in developing clean coal technology much on the lines of the US department of energy’s FutureGen Clean Coal Project, a facility for carbon capture and storage at commercial scale” (Roychowdhury, 2010). The increase in the price of coal has given power regulators a strong rationale for increasing and revising their tariffs, even though the impact on power production will only be an increase of 5 paise per unit (Roychowdhury, 2010).

With respect to climate change, the clean energy cess is one instrument in a suite of policy tools in India, implemented to transform the energy sector. India was supposed to achieve 5 per cent renewable energy in its overall energy mix in 2009–2010. The National Action Plan on Climate Change is supposed to improve on this by 1 per cent each year, reaching 15 per cent by 2020. To date, however, the total amount of renewable energy in the energy mix has not moved above 5.5 per cent (Deshpande, 2013).

Regarding economic objectives, the policies have also helped to drive growth of the renewable energy market in India. In 2011, for example, global investment in renewable energy increased by 17 per cent and $257 million and, within this, India had the “fastest expansion rate for investment of any large renewables market in the world… with a 62 per cent increase to $12 billion” (McCrone, 2012). The ongoing rapid development of India’s renewable energy market is one of the reasons that policies such as the cess have been introduced.

One mechanism that the cess may have been modelled on is the Indian Renewable Energy Development Agency (IREDA). It was set up in 1987 and is a public financial institution and registered “non-banking financial company.” Its main objective is to finance projects that generate or conserve electricity through new and non-renewable energy sources (Indian Renewable Energy Development Agency, 2013). The rationale for creating the NCEF, as opposed to channelling the cess funds through

IREDA, appears to stem from the fact that IREDA implements existing and mature renewable energy technologies, whereas the NCEF is intended to support more innovative applications (Economic Times, 2013).

3.6.3 Environmental, Social and Economic Impacts

Little information was initially made available about the performance of the NCEF. Recognizing this, a New Delhi-based non-governmental organization, the Centre for Budget and Governance Accountability, filed a Right to Information query. The resulting data led to some criticism of the operation of the NCEF to date. This was in addition to other reports in the media, stating that the NCEF was supporting non-research projects, as opposed to research or innovation, the original objective of the funds. In general, approved projects appear to deploy existing technology (Chauthi Duniya, 2013).

Up to November 2011, out of a total 13 project proposals that were considered by the IMG in their first three meetings, three were asked to resubmit, three were rejected and the rest were approved (Panda & Jena, 2012). Table 12 summarizes the funds that are known to have been allocated by the NCEF so far, as stated by the minutes of three IMG meetings made available upon the Centre for Budget and Governance Accountability information request.

TABLE 12: PROJECT PROPOSALS CONSIDERED IN THE FIRST THREE IMG MEETINGS

PROJECT SUMMARY	DATE	PROJECT COST (INR MILLION)	NCEF REQUEST (INR MILLION)	APPROVED FUNDS (% OF TOTAL)	SPONSOR
Subsidy for solar lantern charging facility and risk-husk-based gasifier in left wing extremism (LWE) affected areas	June 2011	133	133	133 (100%)	MNRE**
Installation of solar thermal systems in 16 states	Aug 2011	1,780	641	641 (36%)	MNRE
Installation of solar PV systems in Chattisgarh, J&K, Rajasthan, Sikkim, UP and West Bengal	Aug 2011	2,049	859	859 (42%)	MNRE
Pilot projects—5,500 community-size portable and fixed biomass cook stoves	Aug 2011	66	66	66 (100%)	MNRE
Remediation of 12 selected hazardous waste contaminated dump sites	Aug 2011	8,050	5,635	600 (7%)*	MoEF***
Preparatory activities in FY 2011–2012 under Green India Mission	Nov 2011	2,000	2,000	2000 (100%)	MoEF

**This decision was to fund detailed project reports for each site*

*** Ministry of New and Renewable Energy*

****Ministry of Environment and Forests*

Source: Centre for Budget and Governance Accountability (2012)

Recent projects financed by NCEF include developing a "green energy transmission corridor" in eight states and financing 750 MW of photovoltaic (PV) solar capacity.

Saika (2013) described the corridor as "a distribution channel that allows the flow of renewable energy into the national grid." This will be achieved by providing low-cost loans to investors. The funds will initially be given as grants to the Ministry of New and Renewable Energy, which will disburse the loans. To assist investors challenged by high interest rates, half the project funding will be given at reduced rates of interest from the NCEF grant; the other half of the project cost will have to be taken at bank interest loan rates (Express, 2013).

The 750 MW of PV solar capacity is part of the second phase of the Jawaharlal Nehru National Solar Mission (TckTckTck, 2013). The NCEF will finance 30 per cent of the project's capital costs through viability gap funding.

The NCEF has also committed to providing funding for the following future projects: the integration of coal gasification and combined power cycle generation; a hybrid coal-fired-solar-thermal power plant; low-grade heat recovery and integrated power supply that uses heat from waste flue gases of fossil fuel-fired plants; and the implementation of a 1,200 kilovolt transmission line for conserving right-of-way electricity by insulating wires and replacing them as needed.

Based on the information released following its request, the Centre for Budget and Governance Accountability (2012) made the following observations about the performance of the NCEF:

- The NCEF has been used to support several projects that are not related to clean energy technology. For example, the IMG approved a Ministry of Environment and Forests project that sought the remediation of hazardous waste dumpsites.
- The project funding requirement leads to the exclusion of many projects. NCEF rules state that 40 per cent of the funding will be provided by the NCEF, and that co-sponsoring by other ministries and departments disqualifies projects. Many innovative projects require more government support and are left out because alternate sources of funding are not listed. This may also be the reason the total amount of funded projects has, to date, been significantly less than the total revenues raised by the cess. Another anomaly is that half of the projects sponsored to date have received 100 per cent funding even though they may not be research oriented.
- The IMG has not met its due diligence obligations in assessing the viability of projects. The absence of any questions on viability gap analysis in the IMG meeting minutes has highlighted that they do not pay attention to factors that could affect the long-term performance of these projects.
- The NCEF is being used to cover budgetary shortfalls of ministries. For example, meeting minutes from the first IMG meeting revealed that the shortfalls in the National Solar Mission were to be funded through the NCEF.

3.6.4 Other Sources of Financing for Renewable Energy Projects

Fiscal support for clean energy is also available through the Indian Renewable Energy Development Agency, the Power Finance Corporation, Rural Electrification Corporation, the National Bank for Agriculture and Rural Development and other microfinance institutions, commercial banks, etc.

3.6.5 Links to Wider Policy Frameworks

India focuses on increasing renewable energy through support schemes and operating subsidies. Support schemes include Foreign Direct Investment, which permits 100 per cent investment in renewable energy and tax holidays for investors, as well as financing through IREDA. IREDA is the financing arm of the Ministry of New and Renewable Energy and provides specialized financing to promote renewable energy projects (KPMG, 2012).

The uptake of renewable energy is also supported by the Electricity Act 2003, which offers three incentives (R.V. & Yadava, 2012):

(i) **Renewable Energy Tariffs:** a preferential tariff for energy sourced from renewables

(ii) **Renewable Purchase Obligations:** The National Tariff Policy 2006 requires the state electricity regulatory commissions to source a percentage of their electricity consumption from renewables (Ministry of New and Renewable Energy, 2013)

(iii) **Renewable Energy Certificates:** a mechanism by which different states procure renewable energy in similar proportions.

Each of these incentives is determined by regulatory frameworks for renewables, which are modified and revised regularly by state governments, the Central Electricity Regulatory Commission and the Central Electricity Authority. Apart from these incentives, some states like Karnataka and Punjab have their own green energy funds that finance renewable energy projects and R&D (R.V. & Yadava, 2012, p. 13). From 2005 to 2010, the Indian government also phased in RPOs for state governments to encourage renewable energy uptake (Menon, 2013).

The Clean Energy Cess on Coal and its National Clean Energy Fund is therefore unique in the Indian context, in that revenues are raised by taxing fossil fuels, but similar to other policy tools in India to the extent that a dedicated fund to support renewables has been set up. Many of the shortfalls in the National Solar Mission have been funded by the NCEF, which appears to suggest that the NCEF has also been adapted to support other government policies when the central government revenue falls short (Paliwal, 2013).

3.6.6 Conclusions

India's coal cess and National Clean Energy Fund are relatively new policy tools. Nonetheless, from the information that exists about their operation to date, the following lessons can be drawn:

- A funding mechanism to redirect tax revenues into supporting renewable energy must have a clear, consistent and transparent evaluation process for the disbursement of those funds. For example, in India, funds were not supposed to exceed 40 per cent of total project costs, but in some instances, the IMG-approved funding exceeded this limit, and yet it rejected other proposals. Similarly, one project that was not related to renewable energy was approved. Good governance mechanisms are needed to ensure that the funds are used as intended and to allow for changes to be made to funding criteria for all projects if they prove impractical. In addition, the NCEF does not have funding targets for each year, and thus 75 per cent of the budget remains unused.
- "Innovative" is not a good single criterion for use of funds and policies seeking to drive investment in renewable energy policies, and funding for innovation may need to be flexible with respect to leveraging private funding. The IMG does not have a framework that clearly defines the qualities of an "innovative" project, nor does it indicate whether projects that are "more" innovative than others ought to receive a higher share of funding.
- A process may be needed to cultivate demand for funds from a renewable energy funding facility. Members of the IMG have not succeeded in engaging with Indian research institutions to encourage sufficient proposals to disburse all of the funds raised by the coal cess.
- Dedicated resources are required to monitor the progress of government-funded renewable energy projects against pre-decided metrics. Such resources are not available for the NCEF, and this reduces confidence in the effectiveness of the policy.

3.7 Japan: The Carbon Dioxide Tax of the Global Warming Countermeasure

While providing valuable insights into Asia's first carbon tax, this case study of the Japanese carbon tax is unable to evaluate the tax's effectiveness, as it had been in force for less than one year at the time of writing.

3.7.1 Policy Tool Outline

The Carbon Dioxide Tax of Global Warming Countermeasure was instituted as part of Japan's March 2012 tax reform and entered into force in October 2012. The stated aim of the measure is "controlling the emission of energy-originated CO_2, which accounts for about 90 per cent of greenhouse gas" emissions in Japan (MoF, 2011, p3). In particular, it taxes CO_2 emitted by crude petroleum and petroleum products (per kilolitre), gaseous hydrocarbon (per tonne) and coal (per tonne).

The rate is set at JPY289 per tonne of CO_2, based on the following calculation for each category:

- Petroleum: JPY 289/tCO_2 x 2.62kg - CO2/l = JPY 760/kl
- Gaseous hydrocarbon: JPY 289/tCO_2 x 2.70kg - CO2/l = JPY 780/kl
- Coal: JPY 289/tCO_2 x 2.33kg - CO2/l = JPY 670/kl

These rates will be applied on top of existing petroleum and coal taxes and are scheduled to gradually increase to the rate noted above over three and a half years as outlined in Table 13. When fully implemented in 2016, it is estimated that revenues will equal an average of JPY240 billion–JPY310 billion (US$2.5billion–$3.1 billion) per annum over the 2016–2020 period (Lee, Pollitt, & Ueta, 2012; Reuters, 2012). Approximately one third of this amount will come from power companies, with the remainder to be paid by other primary fossil energy consumers (Reuters, 2012). While the reform did not include any tax-shifting clauses, all revenue from the tax will be allocated to introducing renewable energies and promoting energy efficiency, as indicated in more detail in Section 3.7.3 of this case study.

TABLE 13: BASE TAXATION RATES ON FUEL CONSUMPTION PLUS CARBON TAX SCHEDULE

YEAR	PETROLEUM/PETROLEUM PRODUCTS (KILOLITER)	GASEOUS HYDROCARBONS (TONNE)	COAL (TONNE)
Base tax rate	JPY 2,040 (US $20.99)	JPY 1,080 (US $11.06)	JPY 700 (US $7.17)
Oct. 2012 increase	JPY 2,290 (US $23.33)	JPY 1,340 (US $13.65)	JPY 920 (US $9.37)
April 2014 increase	JPY 2,540 (US $25.88)	JPY 1,600 (US $16.30)	JPY 1,140 (US $11.61)
April 2016 increase	JPY 2,800 (US $28.53)	JPY 1,860 (US $18.95)	JPY 1,370 (US $13.96)

Source: Ministry of Environment (MoE) (2012a)

3.7.2 History and Political Economy of the Scheme

Japan's national climate policy began in 1998 with the Law Concerning the Promotion of the Measures to Cope with Global Warming, which depended upon voluntary commitments from industry to reduce emissions. Today, climate policy is framed largely by the 2008 revision of the Kyoto Protocol Target Achievement Plan, first introduced in 2005. Also in 2005, the Japanese Ministry of Environment announced the Japan Voluntary Emission Trading Scheme, which created a voluntary market for emissions for individual companies. Three years later, in 2008, Japanese Cabinet established the Integrated Domestic Market of Emissions Trading, which allowed industries as a whole to participate as individual actors (Rudolph & Schneider, 2012). Despite these initiatives, Japan remained unable to meet its modest national GHG emissions reduction target of 6 per cent below 1990 levels during the first Kyoto Protocol commitment period of 2008–2012. These commitments were subsequently tightened at the 2009 climate negotiations in Copenhagen to Japan's current internationally binding target of reducing GHG emissions by 25 per cent compared to 1990 by 2020, and 60–80 per cent by 2050 (Rudolph & Schneider, 2012).

These circumstances reinvigorated an old national debate over a carbon tax, an idea originally suggested by the Japanese Ministry of Environment in late 2004. From the outset, the Ministry of Economy, Trade and Industry and the business community vehemently opposed any tax on carbon emissions, claiming that it would harm the economy and force companies abroad. The possibility of a carbon tax was first formally proposed as an Environment Tax in an early 2005 version of Kyoto Protocol Target Achievement Plan, where it was proposed to implement such a tax after multi-stakeholder research was undertaken (Government of Japan, 2005). The proposed tax had similar rates to those imposed in the 2012 tax, but strong opposition from industry lobbies was expressed, in particular the Petroleum Association of Japan, which claimed the tax would overburden consumers at a time when fuel prices were already high. Tax officials estimated that the tax would have brought in approximately JPY360 billion per year (US$3.7 billion), which would have been similar to, but slightly higher than revenues expected from the current tax (MoE, 2005).

The Environment Tax remained on the table, however, appearing again in both the 2006 and 2008 revisions of the Kyoto Protocol Target Achievement Plan (Government of Japan, 2008). In 2009 nine industry groups (representing the auto manufacturers, cement, chemicals, electricity production, electronics, gas, information technology, iron and steel, oil, and paper sectors) banded together at the Copenhagen climate negotiations to protest the idea, stating: "Japan should not consider a carbon tax as it would damage the economy which is already among the world's most energy efficient" (Reuters, 2009). Japan's industry is indeed already extremely energy efficient, to the point where marginal costs to reduce emissions further have become extremely high, pushing industry to purchase Certified Emission Reductions and offsets to meet existing voluntary commitments, with sectors such as transport and housing representing the remaining low-hanging fruit for emission reductions (personal communication, Soocheol Lee, September 9, 2013).

Despite these protests and circumstances, which had led Japan to seriously consider adopting an emissions trading scheme instead of a tax, the ruling centre-left Democratic Party proposed a carbon tax in late 2010 as part of its efforts to make good on Japan's internationally binding emissions reductions pledge made in Copenhagen in 2009. The plan, adopted in 2011, was not implemented until 2012, however, due to the 2011 tsunami and Fukushima nuclear disaster. The measure passed under severe protest from industry groups, who continued to protest that it would slow economic growth, damage Japan's international competitiveness and hit small to medium-sized enterprises especially hard (Bloomberg, 2012). Nippon Keidanren, Japan's largest business lobby, continued to urge reconsideration or abolition of the tax after it was brought into force (Keidanren, 2012).

3.7.3 Environmental, Social and Economic Impacts

It must be noted that the Japanese carbon tax, as its very low rate indicates, was not intended to radically change emitter or consumer behaviour. Indeed, the Government of Japan estimated that it would only lead to an approximately 0.5 per cent to 2.2 per cent reduction in CO_2 emissions by 2020 (MoE, 2012a, p. 5). Instead, it was meant to send a signal, both domestically and internationally, that Japan is serious about meaningfully addressing climate change and providing an avenue for the government to promote development of and raise revenue to fund emission reductions technologies and initiatives (personal communication, Soocheol Lee, September 9, 2013). The funds collected from this tax, as outlined by the Ministry of Economy, Trade and Industry, will be used for facilitating the deployment of renewable energy, energy efficiency and saving measures. Specifically on renewables, the fund will aim at, among other things: technology development and deployment of improved wind power; research and development on improved solar batteries; development and promotion of geothermal technologies; technological support for development of oceanic and bio-energies; and introducing, demonstrating and promoting small hydro. On energy efficiency and savings, it will target, among other things: promoting energy and power saving in businesses, homes and other buildings; more efficient use of renewable energy and heat; facilitating uptake of next-generation vehicles; and supporting hydrogen fuel-cell development (MoF, 2011).

Since the Japanese carbon tax had been in effect for less than one year at the time of writing, information is limited as to its real-world impacts. That said, Lee et al. (2012) carried out a robust modelling exercise that analyzed the potential effects of the tax on emissions output and economic growth in four policy scenarios. They first examined the impacts of the tax as it exists today. Since the tax in its current form will have little effect on emissions, the other scenarios model various environmental fiscal policy measures that would bring GHG emissions down to Japan's Copenhagen commitment level of 25 per cent below 1990 emissions levels. The three others include one where only an increased carbon tax is levied, and two that introduce various forms of revenue recycling (mostly by reducing income taxes, and then either investing in energy efficiency or reducing employer social security contributions).

In the first scenario, the current tax will only raise energy costs by 1–3 per cent, which the authors conclude is not enough to promote behavioural change or meet national emissions reduction targets. The other scenarios, in which these targets are met in a very short period of time, would require electricity prices to increase by up to 50 per cent and fuel prices to increase by approximately 40 per cent. Lee et al. (2012) find that the first scenario will raise an average of JPY310 billion (US$4 billion) in revenue from 2012 to 2020, which the government currently plans to spend on reducing CO_2 emissions, and in the other scenarios, a vastly larger JPY11,500 billion (US$150 billion) per annum, or approximately 3 per cent of GDP. They conclude that the higher tax rates modelled in the latter scenarios alongside the revenue recycling proposed would actually increase overall GDP by increasing consumer spending and reducing labour costs to business, thus delivering the double dividend of improving environmental sustainability and improving economic efficiency of the overall national tax structure (Lee et al., 2012, p. 6–7). This modelled increase in household income and GDP does not happen in the scenario with the tax as it currently stands. Indeed, the MoE also estimates that direct costs, currently not slated to be offset via tax shifts, will amount to a burden of JPY1,228 (US$12.64) per year, as outlined in Table 14.

TABLE 14: ESTIMATED HOUSEHOLD-LEVEL BURDEN RESULTING FROM THE CARBON TAX

PRICE INCREASE PER HOUSEHOLD UNIT OF ENERGY WITH TAX		AVERAGE HOUSEHOLD ENERGY CONSUMPTION	BURDEN PER AVERAGE HOUSEHOLD
Gasoline	JPY 0.76/L	448L	JPY 1,228/year or JPY 102/month
Kerosene	JPY 0.76/L	208L	
Electricity	JPY 0.11/kWh	4748kWh	
Natural Gas	JPY 0.647/Nm^3	214Nm^3	
LPG	JPY 0.78/kg	89KG	

Source: MoE (2012a, p. 4)

Despite the extremely low level of the carbon tax and its minimal expected real-world effects, it is highly unlikely that any changes to the planned tax rates will take place in the foreseeable future. This is due both to the aforementioned concerns of industry regarding the impacts of the tax, and also because Japan is already planning to double its blanket VAT from 5 per cent to 10 per cent in 2015. This would make it very politically challenging to further suggest an increase in the carbon tax (personal communication, Soocheol Lee, September 9, 2013).

3.7.4 Links to Wider Policy Frameworks

Japan's carbon tax is a component of Japan's broader suite of national climate and environmental policies, including: the voluntary emissions reductions scheme for industry noted above as part of the Kyoto Protocol Target Achievement Plan; a FiT for renewable energy; a suite of vehicle taxes and tax breaks according to their environmental credentials; a mandatory GHG accounting and reporting system; and tax breaks for green investments, biofuels and energy-saving home improvements (MoE 2012c; MoE 2012d). On the local level, Japan also has forestry and waste management taxation in dozens of prefectures (Hyashi, 2010; MoE, 2012b).

Additionally, in April 2012, the Government of Japan adopted the Fourth Basic Environment Plan, Japan's primary environmental legislation, which sets out the long-term aims of the government as a whole. The Fourth Plan saw the creation of a Ministry of Environment committee whose aim is to comprehensively analyze the current tax system and propose reforms to promote environmental goals over the medium and long terms (MoE, 2012b). The Fourth Plan also aims to create over JPY50 trillion (US$515 billion) in markets for environmental goods and services and 1.4 million new environment-related jobs by 2020 (MoE, 2012e). Although not mentioned explicitly in any of the literature, the revenues from the carbon tax are expected to facilitate these policy objectives.

3.7.5 Conclusions

As its effects have yet to truly be felt, it is not yet possible to offer solid conclusions on the Japanese carbon tax. That said, in reflecting on the difficulty Japan had in realizing the tax, the Japan Center for a Sustainable Environment and Society noted that infighting and lack of collaboration between key ministries (specifically, the Ministry of Economy, Trade and Industry, the MoE and the MoF) severely hampered progress and played into the hands of industry over the eight years it took for the proposed tax to become law. Had this lack of cooperation and coordination been avoided, by 2013 the Government of Japan would have already had seven years of carbon taxation revenue to spend on climate change mitigation.

Furthermore, the modelling in the Japanese case[16] indicates that governments can reap the benefits of EFR if higher tax rates are implemented, as they can have a substantial impact on GHG emissions while also boosting GDP growth and creating a level playing field in energy markets between renewable and non-renewable energy sources, thus boosting renewable energy technology deployment.

3.8 United Kingdom: Climate Change Levy (CCL) and Climate Change Agreements (CCA)

3.8.1 Policy Tool Outline

The CCL is an energy tax that was introduced in the U.K. in 2001. The tax operates in conjunction with a set of negotiated agreements (CCAs) with industry whereby the levy is reduced in return for the implementation of measures to reduce emissions. The tax is levied on commercial and industrial users. Domestic, non-commercial, charitable and small businesses have been exempt from the tax since its introduction.

Tax rates on energy products within the CCL are not set to correspond directly with carbon emissions; in fact, the individual tax rates assign a significantly lower rate per unit of carbon to energy from coal than other sources. Martin, de Preux and Wagner (2009) suggested that this might be due to political ties between the Labour government and the coal industry. The relative competitiveness of the user base of different fuels has also played a role in shaping the levy.

Instead of a clear link to carbon emissions, a mixture of political and technical factors has influenced the final rates. The resulting system can be characterized as a de facto tax on energy with non-uniform rates. As further evidence of the pragmatic approach to policy-making, the negotiated scheme of CCAs offers firms an opportunity to reduce the tax burden in exchange for agreeing to binding targets for energy use or carbon emissions (OECD, 2005).

The U.K. tax authority, Her Majesty's Revenue and Customs (HMRC), administers the CCL. The Department for Environment Food and Rural Affairs (DEFRA) is responsible for developing the CCAs. These have been negotiated through umbrella agreements with key sectors, which form the basis of negotiations with individual firms. Negotiations led to the establishment of underlying agreements detailing a reduction in CCL rates.

The revenues generated through the CCL are primarily recycled through a reduction in National Insurance Contributions (NICs), an employment tax. A small fraction of the revenues are allocated to the Carbon Trust, a publicly owned company that provides advisory services and information on low-carbon development.

CCL Structure

The CCL covers electricity, natural gas, coal, coke and liquefied petroleum gas used for energy generation. The tax rate is levied per unit of energy or by weight. Levy rates were frozen from 2001 to 2007, but have increased since then in line with inflation. A summary of the historical rates is shown in Table 15.

[16] Modelling in other cases reinforces this; see, for example, the findings of a large-scale tax reform in Europe modelled by Ekins (2009).

TABLE 15: CCL DUTY RATES[1]

	TAXABLE COMMODITY SUPPLIED				
Date of change	Electricity	Gas supplied by a gas utility or any gas supplied in a gaseous state that is supplied by a gas utility	Any petroleum gas or other gaseous hydrocarbon supplied in a liquid state	Gas supplied by a gas utility to a person who intends to cause the gas to be burned in Northern Ireland.	Any other taxable commodity[2]
	(per kWh)	(per kWh)	(per kilogram)	(per kilogram)	(per kilogram)
	All values in United Kingdom pence				
01.04.01	0.43p	0.15p	0.96p	0.0p	1.17p
01.04.07	0.441p	0.154p	0.985p	0.0p	1.201p
01.04.08	0.456p	0.159p	1.018p	0.0p	1.242p
01.04.09	0.470p	0.164p	1.050p	0.0p	1.281p
01.04.11	0.485p	0.169p	1.083p	0.059p	1.321p
01.04.12	0.509p	0.177p	1.137p	0.062p	1.387p

(1) Rate at which payable if supply is neither a half-rate supply nor a reduced rate supply

(2) Coal and lignite, coke, semi-coke of coal or lignite, and petroleum coke.

Source: HMRC (2011)

The revenues raised from the CCL have remained relatively stable over time. The highest revenues were received in the financial year 2003–2004. Revenues have since declined, possibly due to changes in behaviour and increased uptake of the option to enter into CCAs. A summary of the revenues received is shown in Figure 9. The CCL was reported to add approximately 15 per cent to the energy bill of a typical U.K. business when it was introduced in 2001 (Martin, de Preux, & Wagner, 2009).

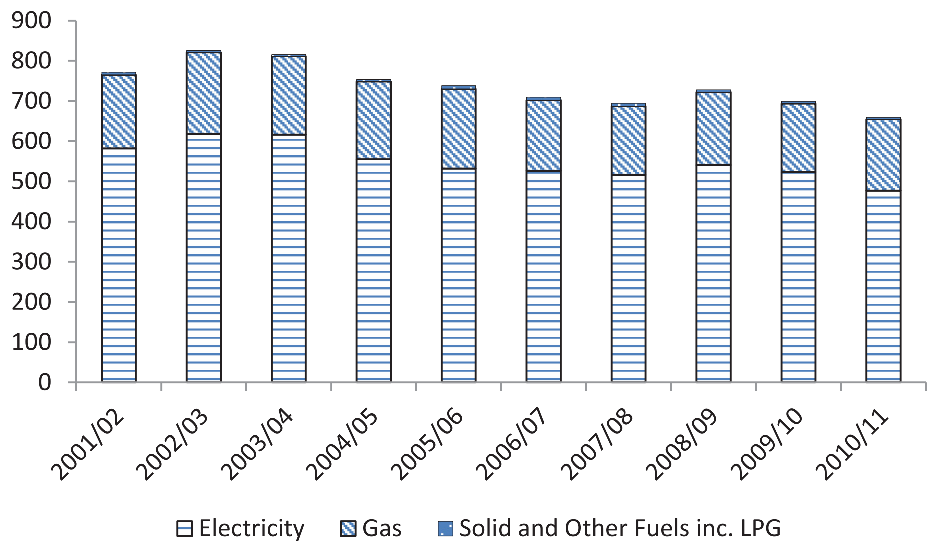

FIGURE 9: TOTAL LEVY DECLARED

Source: HMRC (2011)

The Carbon Trust

The Carbon Trust was established as the recipient of a proportion of the revenues raised from CCL revenues via a grant from DEFRA. Data are not available for all years for the total expenditure of the organization or the total grant received from government. The available data is shown in Table 16. Grant income reached a peak of GBP127.8 million (US$206 million) in the 2010–2011 financial year before falling to GBP44 million (US$71 million) in 2011–2012; the reduction reportedly reflected changed priorities in government. While the grant revenue for the Carbon Trust was rising over the period from 2001 to 2011, revenues from the CCL were falling, reaching GBP674 million (US$1,088 million) in 2010–2011 (see Figure 9). By 2011, total grant funding available to the Carbon Trust was equivalent to 19 per cent of the total revenues of the CCL.

TABLE 16: CARBON TRUST EXPENDITURES AND GRANT INCOME SINCE 2001

	TOTAL PROGRAM EXPENDITURE (MILLION GBP)	TOTAL EXPENDITURE (MILLION GBP)	GRANT INCOME (MILLION GBP)
2011-2012	58.8	66.0	44.0
2010-2011	122.5	128.7	127.8
2007-2008	88.7	95.0	N/A
2006-2007	82.2	87.2	87.9
2005-2006	64.1	68.0	73.7
2002 -2003	N/A	36	N/A
2001-2002	N/A	24	N/A

Sources: Carbon Trust (2012); Carbon Trust (2008); OECD (2005)

The Carbon Trust manages and has managed a variety of schemes to reduce carbon emissions and promote renewables. In the 20011–2012 annual report (Carbon Trust, 2012) the three roles of the Carbon Trust were described as:

- Advising businesses, governments and the public sector on their low-carbon and sustainability opportunities
- Measuring and certifying the environmental footprint of organizations, products and services
- Developing and deploying low-carbon technologies and solutions, from energy efficiency and renewable power

As of 2013 the Carbon Trust has reoriented to reflect the transitioning of funding away from government grants toward the generation of revenues through provision of commercial services.

3.8.2 History and Political Economy of the Scheme

The CCL is a product of U.K. climate change policy. A speech by then Prime Minister Margaret Thatcher to the Royal Society in 1988 in which she raised the threat of climate change is credited as marking the start of the development of climate policy in the U.K. The publication of the 1990 Environment White Paper was the first significant attempt at a comprehensive statement of environmental policy. The White Paper eventually led to the development of the Fuel Duty Escalator (FDE), a commitment to increase fuel duty by 3 per cent annually in real terms (i.e., 3 per cent above the rate of inflation). The White Paper also included the idea of an energy tax, which later developed into the CCL. Opposition to the FDE led to powerful opposition from hauliers and the transport lobby, culminating in oil depot blockades and "go slows" in 2000; by November 2000 tax reductions were announced. The FDE experience shaped the introduction of the CCL by increasing sensitivity to the concerns of interest groups.

The *Marshall Report,* led by the then head of the Confederation of British Industry Lord Marshall, was published in 1998 and was a review of mechanisms to reduce GHG emissions through taxes and levies. The *Marshall Report* urged caution over emissions trading due to a lack of experience with this kind of measure and proposed instead the implementation of an energy tax (the CCL), for which there was already a body of experience. The report also highlighted the need to protect industrial competitiveness and ensure that any proposed measures were subject to detailed consultation (Seely, 2009). In addition, the fact that the revenues raised from a tax could be recycled to industry to help to reduce opposition provided a further impetus to adopt a tax-based system. The decision to introduce a levy, along the lines suggested by the *Marshall Report*, was made by Chancellor Gordon Brown in the 1999 budget (Seely, 2009) and the CCL came into force in 2001.

To understand why the design of the CCL differs from a conventional tax on energy use or GHG emissions, it is necessary to discuss a number of political pressures facing the scheme designers. First, the Labour government that implemented the CCL had to take into account the traditional concerns of energy costs for the poor—in the U.K. in 2001, 4 million households were in energy poverty (Government of the United Kingdom, 2001). Second, the failure of earlier attempts to raise a VAT by the previous Conservative government demonstrated the sensitivity of householders to energy price increases. Third, traditional links between the declining coal industry and the labour party presented challenges to a straightforward carbon tax, a measure that would have a particular impact on coal use. Fourth, the FDE on transport fuels was facing tough opposition at the time. Fifth, industry, particularly in energy-intensive sectors, raised concerns over international competitiveness. Sixth, the approach of taxing energy use and reducing employment taxes was considered by the Trade and Industry Committee to result in a transfer from the industrial to service sector, thus undermining the case for revenue recycling for more energy-intensive sectors (Seely, 2009). Finally, the political pressure to exclude certain groups of consumers from the tax resulted in practical difficulties in implementing a carbon tax, as it would not be simple to establish the carbon intensity of electricity consumed beyond an overall average (Seely, 2009).

In light of these concerns, the CCL was designed with some key concessions to gain political acceptance for the proposals:

- Households, non-commercial organizations and the transport sector were exempt from the CCL.
- Revenues would be recycled to industry through reductions in employer's contributions to ancillary wage costs (National Insurance Contributions)
- The tax levels would not be tied to emissions impacts; instead, they would be linked to energy use.
- A system of additional exemptions would be implemented, which would be negotiated with sectors and firms providing flexibility.
- Electricity derived from renewables and CHP would be exempt from the tax.
- A system of enhanced capital allowances, a tax benefit, for energy saving investments would be introduced.

In the case of the CCL, political considerations appear to have played a significant role in the design of the scheme. The implementation of the CCL was a cross-party process, beginning with the Conservatives and finishing with Labour, spanning nearly a decade from the first speeches and white papers raising the need to introduce measures to reduce emissions to the implementation of the CCL.

Once the details of the scheme became clear, environmental groups reportedly expressed disappointment and the Confederation of British Industry welcomed the concessions to energy-intensive sectors. A number of actors, including the Environmental Audit Committee and the Liberal Democrat Andrew Stunnell, raised concerns that an upstream tax would be better suited to the aim of reducing carbon (Seely, 2009). After the CCL had been in place for several years, further criticism was made by the Liberal Democrat Treasury spokesman Vince Cable, who argued in 2006 that the government's objectives would be better served by an upstream carbon tax. The House of Lords Select Committee on Economic Affairs and the Institute for Public Policy Research, both of whom were reported to be in favour of a carbon tax, echoed this statement (Seely, 2009).

3.8.3 Environmental, Social and Economic Impacts

The 2001 budget estimated a reduction in emissions of 2.5 million tonnes of carbon emissions equivalent (MtC) a year by 2010 (Seely, 2009). At the time of the 2005 budget, an evaluation by Cambridge Econometrics estimated annual reductions from CCLs, CCAs and enhanced capital allowances of "over" 3.5 MtC per annum by 2010; if the levy were applied at a full rate across all business sectors, a further 0.5MtC would be saved in 2010 (Seely, 2009). The Environmental Audit Committee (2008) published a report on the CCL and CCAs in 2008 that calculated an estimated annual reduction in 2010 carbon emission compared to 1990 levels of 13.6 MtC (later reduced to 12.8 MtC) (Seely, 2009). The CCL was considered the second most significant climate change measure after phase II of the EU ETS. However, the report also noted that most of the emissions savings had come from the effect of the announcement of the tax and its associated agreements, rather than the tax itself (Seely, 2009). Debate remains over the extent to which the reductions in GHG emissions may be attributed to the CCL, although there is general agreement that there was a positive effect.

An assessment of the economic impact of the CCL must include consideration of the revenues raised and also the 0.3 per cent tax cut to NICs that was introduced alongside the scheme. While the scheme was designed to ensure that "all revenues will be recycled back to business," the value of the tax cut has been consistently higher than the revenues received and the value of the difference rose between the introduction of the scheme and 2007. CCL tax revenues and the approximate value of the cut in NICs are shown in Figure 10.

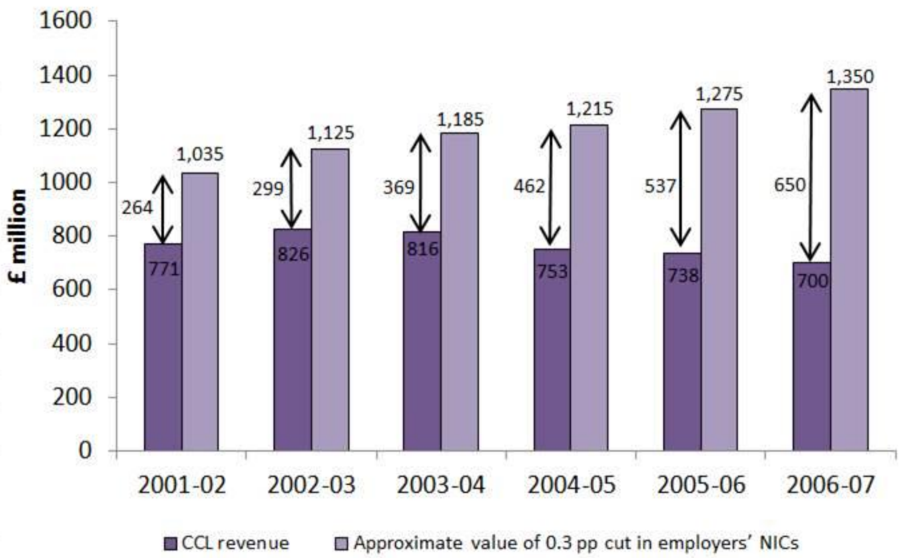

FIGURE 10: CCL REVENUES VERSUS THE 2001 CUT IN EMPLOYERS' NICS (AMOUNTS IN MILLION BRITISH POUNDS)

Note: CCL figures for 2006-07 are expected revenue.

Source: Environmental Audit Committee (2008)

In the context of the apparent net loss to the exchequer in the 2002 budget, an increase of 1 per cent was introduced to NICs across the board. This has led some groups to question whether the revenues have indeed been recycled as originally suggested or if the CCL has been used as a tool for revenue generation. This highlights the problems of linking a particular reduction in tax rates in one area with the introduction of another tax: subsequent changes to tax rates open governments up to accusations of reneging on the original principles of the scheme and risk limiting the political freedom to adjust tax rates as conditions change.

A further problem with the CCL was the conflicting pronouncements that the CCL would fund the operations of the Carbon Trust, which had an operating budget of between 4 and 20 per cent of CCL receipts, and that all revenues would be returned to business. Plainly, both of these commitments were not possible, leading to either a net loss to the exchequer or an unacknowledged change in policy resulting in the subsequent tax increase in NICs after 2002. In 2008, a report by the Environmental Audit Committee (EAC) recommended that government should be more transparent about the level of hypothecation of funds for low-carbon development and should report annually about the level and the impact of the funds. This recommendation does not appear to have been implemented.

In terms of the benefits to renewables from the CCL, the most direct effect is that renewable generators were awarded Levy Exemption Certificates for each unit of renewable electricity generated, which could effectively reduce levy payments on electricity from renewable energy sources and therefore create a financial incentive for business consumers of renewable electricity. This has been credited for the adoption of "green tariff" schemes by corporates. However, since the prices of these "green tariffs" tend to be higher than electricity from conventional energy sources, the financial benefit appears to be small. Evidence provided to the EAC by EDF Energy concluded that it has "had little impact on the development of new projects because the CCL exemption does not provide a significant financial incentive" (Environmental Audit Committee, 2008). Since energy-intensive industries are able to realize a reduction in the effective tax by signing CCAs, the incentive for energy-intensive industries to consume renewable energy is even lower than for firms that have not entered into a CCA.

The impact of the CCAs is quite mixed. Official government estimates concluded that the CCAs would contribute 7 MtC to carbon emissions reductions by 2010 (Environmental Audit Committee, 2008). Yet doubts persist over the effectiveness of the CCAs. The pressure to avoid damage to international competitiveness may have led to the negotiation of sectoral agreements that were too achievable, allowing companies to significantly reduce their tax burden in return for little environmental benefit. The EAC recommended that further tightening of the agreements could ameliorate these problems in the future (Environmental Audit Committee, 2008).

Funding for the Carbon Trust has undoubtedly had an impact on carbon emissions and the deployment of renewable energy technologies, but it is difficult to establish whether this impact has been large enough to justify the funding. On the other hand, the Carbon Trust had a number of aims, renewable energy deployment being just one of them. In a review of the CCL, the EAC found that 80 per cent of the organizations that had received advice were satisfied with the service provided by the trust, though there was anecdotal evidence that some of the advice given was "fairly generic" (Environmental Audit Committee, 2008). In addition, a number of organizations commented that further specialist knowledge was needed to support energy-intensive sectors. The Carbon Trust itself reports that, since it was established and up until the end of the 2011–2012 fiscal year, it has worked with 6,000 companies, saved GBP550 million and saved 7.5MtCO2 (Carbon Trust, 2012).

Evidence collected by the EAC on the impact of the CCL on the international competitiveness of U.K. firms appears to show that there is no damaging burden from the levy, and that, in many cases, the results may even be positive through improved resource productivity and the development of the energy-efficiency industry (Environmental Audit Committee, 2008).

3.8.4 Links to Wider Policy Frameworks

The CCL package of measures was described as being the second biggest contributor to U.K. emissions reductions and forms a central part of the U.K.'s strategy to meet targets agreed under the Kyoto Protocol. The CCL was developed under a longstanding process that enjoyed cross-party support over several decades. The policy provides incentives for increased deployment of renewable energy, both though increasing the cost of energy derived from fossil fuels and through reallocation of funds to a body with a mandate to promote renewable technology development (the Carbon Trust).

3.8.5 Conclusions

The U.K. experience of the CCL provides an example of an energy tax on consumption. The overall environmental impacts of the package of measures are considered to be positive, although there remains some debate on the magnitude of this effect. The economic impacts are less clear, in part due to the absence of clear and transparent reporting of the hypothecation of revenues. To reduce the social impacts, a number of sectors were excluded from the levy, in part due to previous experiences of imposing new taxes on energy use. At a political level, the concept enjoyed a degree of cross-party support, even if there was some dispute over the detailed implementation. The design of the measures included a number of concessions to different interest groups to secure consent, not least the commitment to recycle revenues to industry.

A number of key conclusions can be drawn from the study:

- Political considerations can be extremely important in designing a scheme that is acceptable to a broad range of stakeholders, even at the cost of economic efficiency and environmental effectiveness.
- A scheme that involves technical assessment brings risks of under- or overestimation of savings due to a lack of information.
- Understanding the positions of stakeholders through consultation and prior research helps to reduce barriers to implementation.
- Periodic assessment and refinement helps to improve a set of measures once the scheme is operational.
- Creating a link between revenues and expenditures helps to provide a narrative to justify the implementation of an environmental tax, but may limit government ability to adjust tax rates in the future.

3.9 United States: Production Tax Credit (PTC) and the Investment Tax Credit (ITC)

In the United States, both federal- and state-level policies have played key facilitative roles in driving the deployment of renewable energy. At the federal level, two of the most important incentives are the United States Federal Renewable Electricity Production Tax Credit (PTC) and the Business Energy Investment Tax Credit (ITC). Additionally, since 2009, the 1603 Treasury Grant has been key to the industry's health during times of financial uncertainty.

3.9.1 Policy Tool Outline

PTC: The PTC is essentially an open-ended subsidy that can be utilized by any qualified taxpayer and for which there is no application requirement. Specifically, when sold to a third party, the PTC provides a per-kWh tax credit to qualified producers of the following types of renewable energy: closed- and open-loop biomass, geothermal, hydropower, landfill gas, municipal solid waste and wind energy—which has been the most successful user of this policy. This case study will focus largely on wind energy.

While it initially began at a rate of US$0.015/kWh in 1992, currently the PTC offers producers an inflation-adjusted US$0.023/kWh tax credit for closed-loop biomass, geothermal and wind energy, and a US$0.011/kWh credit for other technologies eligible under the scheme. Producers can generally claim the PTC for the first 10 years of production, and any unused credits can be carried back one year and also claimed up to 20 years post-generation. The terms can be found in the section 45 of the Internal Revenue Service tax code.

ITC: The ITC is a 30 per cent tax credit for residential and commercial capital expenditures on solar, fuel cells and small wind turbines with no maximum credit.[17] Combined heat and power, geothermal systems and microturbines are also eligible for a 10 per cent credit of capital expenditures with no maximum credit limit.

Since 2005, the ITC has been expanded twice, notably making public utilities eligible for the credit, offering subsidized financing to ITC-approved projects, allowing it to be used against regular taxation, and extending the credit until the end of 2016, freeing ITC-relevant industries from the renewal uncertainty that plagues PTC industries.

1603 Treasury Grant: Since 2009, the 1603 Treasury grant gives ITC- and PTC-eligible projects the option to forgo these tax credits in lieu of a 30 per cent cash grant. While all three options provide approximately the same level of overall financial

[17] These percentages and the eligible technologies change over time, with some in this list only eligible until the end of 2013. For the most up-to-date information on eligibility and current credit information, see: http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=US02F

benefit, albeit over different timescales, most new solar and wind installations have taken advantage of the 30 per cent cash grant option since its inception (Department of Energy, 2012). This will be further discussed in the next sections.

Residential solar systems are also eligible for the grant if owned by a developer using a power purchase agreement or lease.

3.9.2 History and Political Economy of the Scheme

PTC: The PTC emerged from the Energy Policy Act of 1992, to assist alternative forms of energy in becoming more competitive with conventional energy sources. The 1992 PTC originally expired in 1999, but has been renewed every one to two years since. It has also been expanded over time. It has seen particular success in bolstering wind-energy installation, with 13.1 gigawatts (GW) of additional wind power being added in 2012 alone, amounting to over US$25 billion in investments in the sector and bringing total U.S. wind energy production up to 60 GW (Department of Energy, 2013).

Despite these impressive numbers, the story of the PTC is one of mixed messages. After its initial expiration in 1999, the PTC's continued existence has been dependent upon Congressional renewal every one to three years. These renewals have been controversial enough to lead to non-renewal and a collapse of the policy in some years. Specifically, in 2000, 2002, and 2004, the PTC was not renewed, leading to intense market uncertainty and radical drop-offs in wind-energy deployment (see Figure 11, which illustrates drops in deployment). This will likely be the case in 2013 as well, with Congress only agreeing on its continuation in a last-minute budget deal in January 2013. This came much too late for developers and financiers to begin work on new projects for 2013, and subsequently disincentivized new projects for 2013.

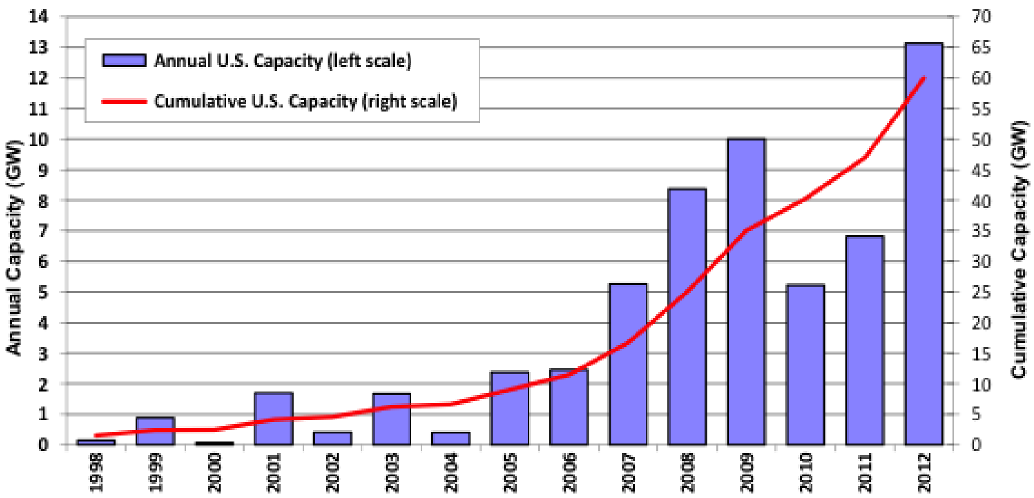

FIGURE 11: U.S. WIND DEPLOYMENT AND CUMULATIVE GENERATING CAPACITY OVER TIME

Source: Wiser (2013, slide 5). Reprinted with permission.

The controversy over the PTC stems partially from fiscally conservative politicians who disapprove of subsidies generally, but also from conventional power producers who claim the PTC is an unfair or inefficient use of resources, even though these industries receive similar tax credits (Ryan 2011; Caperton & James 2013). Incidentally, U.S. fossil fuel and nuclear credits do not suffer from the renewal uncertainty that the renewable PTC faces (Environmental Law Institute, 2009). The effects of the market uncertainty that this state of affairs created for the wind industry will be further dealt with in the section on environmental, social and economic impacts.

Beginning in 2013, wind projects must begin construction by the end of the year to qualify for the credit. This is a less strict requirement than the previous rule that a production facility must actually have produced energy to qualify. The intense rush to complete projects by the end of 2012 to achieve eligibility for what was then assumed to be the expiring PTC led to a huge ramp up of production and project development in that year, and despite the PTC's renewal it had been assumed that 2013 would be a very slow year for wind due the chaotic end of 2012. However, this new flexibility allowing projects to qualify for the PTC after having spent only 5 per cent of total project costs was seen as a second chance for wind projects that would otherwise not have qualified this year under the old set of rules. The details of this rule, however, were only defined in April 2013, and as only nine months remained for the industry to take advantage of this new framework, Bloomberg New Energy Finance estimates that 2013 wind turbine installations will likely amount to less than 25 per cent of those seen in 2012 (Rubin & Martin, 2013).

ITC and 1603 Treasury Grant: Established with the Energy Policy Act of 2005, the ITC is a federal corporate tax credit for commercial, industrial, utility and agricultural energy producers designed to promote capital investments in the renewable energy sector. It is the main federal incentive for solar energy and is available specifically to developers of solar water heat, solar space heat, solar thermal electric, solar thermal process heat, PVs, biomass, geothermal electric, fuel cells, geothermal heat pumps, CHP, solar hybrid lighting, microturbines and geothermal direct-use.

In 2008 the U.S. Congress renewed the ITC for a further eight years as part of the Emergency Economic Stabilization Act of 2008, providing the market security lacking for the PTC. Nevertheless, 2008 was not a strong year for renewable energy, as the financial crisis saw a radical reduction in the number of financial institutions actively financing renewable energy projects. While there were approximately 20 such large investors financing U.S. renewable energy in 2007, only eight were still doing so in 2008, and four to six in 2009 (Meister, 2012, p. 7–8). Available tax equity financing fell from US$6.1 billion to $1.2 billion over the same period (Solar Energy Industries Association, 2011, p. 2). Tax equity is key to the U.S. renewable energy developers who often work with very tight margins, do not have large capital stocks of their own and accordingly have fairly low tax burdens, rendering them incapable of taking full advantage of the tax credit. Traditionally, such companies looked to access fast cash by selling their PTC and ITC credits to large institutional investors on the tax equity market.[18]

With the drying up of project financing that the ITC had previously encouraged, the U.S. government realized that more would be necessary to prevent the industry from collapsing. The American Recovery and Reinvestment Act of 2009 created the 1603 Treasury Grant. Since then, the vast majority of solar and wind projects have used this option, the effects of which will be described in the next section.

3.9.3 Environmental, Social and Economic Impacts

PTC: Despite its rocky history, for wind energy in particular, the PTC was seen as the most important facilitator of rapid wind expansion, as evidenced by the rapid increases in production since its inception (see Figure 11 above). That said, for years the industry has been calling for stability of the PTC, indicating that periods of uncertainty: 1) inevitably result in regular layoffs of highly qualified labour; 2) slow wind deployment due to installation lulls; 3) increase project costs (in turn creating higher energy costs); 4) disincentivize investment in domestic manufacturing; 5) create incentives for firms to invest in smaller, quicker projects that do not offer the economies of scale necessary to bring prices to their lowest possible level; 6) create difficulties in planning transmission expansion; and 7) reduce private research and development expenditure (Wiser, 2007; American Wind Energy Association, 2008). The American Wind Energy Association and the Union of Concerned Scientists have repeatedly argued for longer-term extensions, with the former suggesting renewal periods of five years would help break these boom and bust cycles (American Wind Energy Association, 2008; Union of Concerned Scientists, 2013).

In addition to these challenges for projects actually being undertaken, with planning and permitting processes for wind farms in the United States regularly taking two years or longer, the current practice of short-term renewals has hindered many potential developers and industrial actors from entering the field at all. Indeed, the insecurities and planning challenges presented by the current system are so significant that some developers and analysts have indicated the industry as a whole would be better off without the PTC in its current form (personal communication, James Scott, August, 2013).

[18] Tax equity financing sees actors with heavy taxation burdens finance projects attached to tax incentives that they can utilize to offset future tax. Simply stated, tax equity financiers fund projects to lower their tax burden and therefore retain more income as profit. Tax equity investors are typically large and sophisticated financial firms or utilities.

Finally, while the it has been successful in terms of expanding deployment in the United States, the PTC has not been optimal, especially for small-scale developers who, due to their lower tax burdens, are incentivized to partner with outside investors that themselves have larger tax burdens and who can therefore fully utilize the PTC credit. In such cases, the tax-motivated investor acts as the majority owner and pays the landholder an annual fee in lieu of energy production revenue, and after the 10-year PTC period expires, majority ownership is "flipped" to the landowner. This type of arrangement has come to be known as the "Minnesota Flip" business model (Windustry, n.d.).

ITC: The Solar Energy Industries Association (SEIA) claims the ITC "helped to create unprecedented growth in the U.S. solar industry," (2011, p. 1), noting that installed solar PV capacity doubled after its first year. While many (primarily market) factors have played into the explosive growth of the U.S. solar industry's compound annual growth rate of 77 per cent over recent years (SEIA, 2013a), in the year of the ITC's signing into law, the United States installed only 79 MW of PV, orders of magnitude less than the 3,313 MW installed in 2012 (SEIA, 2013b).

That said, only a few years after its inception, the ITC was usurped in popularity by the 1603 treasury grant. Indeed, in a 2009 report providing guidance to developers on which credit or grant option to choose for their business, the U.S. government's National Renewable Energy Laboratory produced a report indicating that there were unambiguous quantitative benefits to choose the PTC over the grant only for geothermal, and to choose the ITC only for open-loop biomass. It concluded that, based on a number of qualitative considerations explained below, most projects would choose the grant (Bolinger, Wiser, Cory, & James, 2009).

1603 Treasury Grant: A major challenge facing U.S. renewable energy companies remains the small number of financiers available to the industry. This being the case, many companies are cash-strapped and long-term credits such as the PTC and ITC are less attractive than the up-front cash grant. While the solar industry has seen the cash grant as a major boon to the industry, the AWEA has viewed it as a temporary fix to addressing the extreme financing shortage seen after the financial crisis, a time where most have viewed cash on hand as more valuable than future tax benefits. Reports of its effectiveness vary, with some claiming it is "twice as efficient as a tax credit alone" and others claiming that the instant cash incentivizes developers to work on smaller marginal projects rather than the high-output projects incentivized by the PTC (Ryan, 2011; Department of Energy, 2012).

Regardless of debates over its economic efficiency, the 1603 Treasury Grant does offer some clear advantages over the tax credits, the most important of which is that the money, in all cases, goes directly to the project developer. The PTC and ITC, in many respects, were subsidies not to the renewables industry, but to big financial institutions that purchased renewable projects' tax equity, then charged developers management fees and required a cut of the projects' returns on top of that. In many cases, this amounted to an approximately 30 per cent fee on the tax attribute (U.S. Partnership for Renewable Energy Finance, 2011). Giving the cash directly to projects also improves access to less costly and more readily available project finance debt. These lowered overall costs, in turn, lower the cost of PPAs and increased cash on hand for further project development, translating to lower consumer energy costs and more project jobs.

As it was created in uncertain economic times to both fill the tax-equity market-financing gap and to secure jobs for Americans, an interim analysis of the grant's effects was undertaken by the National Renewable Energy Laboratory. It estimates that the 1603 grant supported, on average, between 52,000 and 75,000 jobs from 2009 to 2011 (Steinberg, Porro, & Goldberg, 2012). As of July 2013, 9,200 project developers had received the 1603 grant over for over 77,000 projects. Developers qualified for an extremely broad range of grant amounts, ranging from a few thousand dollars to over US$130 million. The total cost of the 1603 program to the U.S. government between its launch in 2009 to March 2013 is reported to be US$18.2 billion. This taxpayer money has in turn leveraged over US$62 billion in additional project financing and has resulted in over 27 GW of additional installed generating capacity to date (Department of Treasury, 2013). See figures 12–15 for breakdowns of grant funding and project capacities by type (numbers are from March 2013).

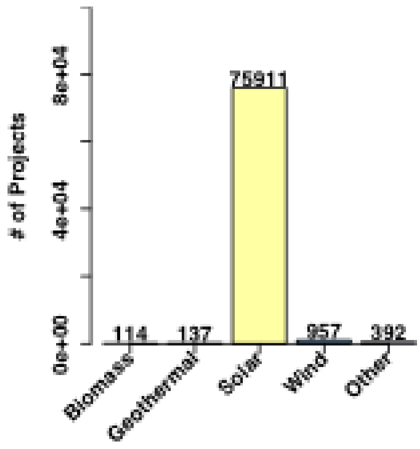

FIGURE 12: NUMBER OF 1603 PROJECTS BY TYPE

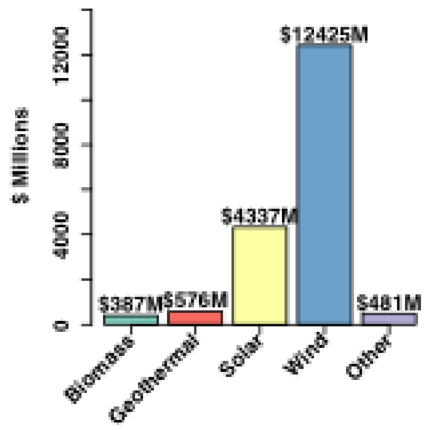

FIGURE 13: 1603 AWARDS BY PROJECT TYPE

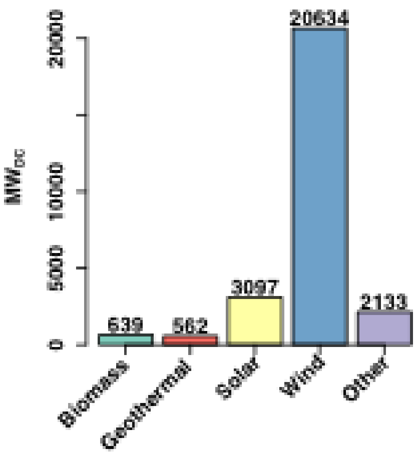

FIGURE 14: 1603 PROJECT GENERATION CAPACITY

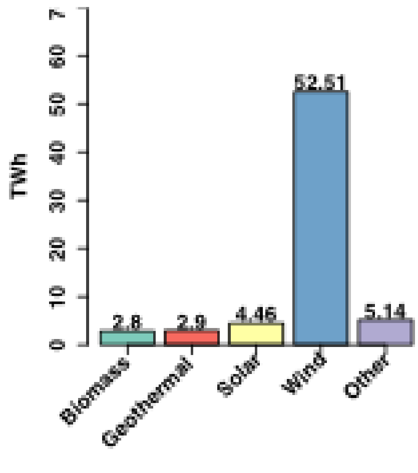

FIGURE 15: ESTIMATED GENERATION BY TYPE

Figures 12-15 reprinted with permission from the Department of Treasury (2013, p. 2)

3.9.4 Links to wider policy frameworks

These policies do not have direct links to other policy frameworks.

3.9.5 Conclusions

The United States is likely to continue supporting the industry with the PTC, ITC and perhaps also a renewal of the soon-expiring 1603 grant into the foreseeable future, although mild political opposition remains and direct subsidy schemes such as the very successful 1603 grant frequently face stronger political opposition than tax credits such as the PTC and ITC.

All of these policies have proven to be highly effective in encouraging domestic and international interest in U.S. renewable energy deployment and in research and development. That said, they each affect industry stakeholders differently. Some concluding reflections on their form and effects on stakeholders involved:

- The use of the tax system for the PTC and ITC means government is not required to raise money to pay for renewables deployment.
- Using the tax system allows incentives to be managed by the Internal Revenue Service rather than some specialized body, minimizing transaction costs and bureaucracy.
- The PTC and ITC require investors with taxable income high enough to make use of the credit, leading to increased transaction costs and complex project structures, which prevent easy participation.
- The 1603 grant avoids these complex project structures by providing a direct benefit to the renewable energy industry, rather than the roundabout benefit provided by the PTC and ITC, which both implicitly subsidize the finance industry.
- The 1603 grant may, however, incentivize less economically efficient projects than per-kWh schemes such as the PTC and ITC, which push investors to produce as much energy as possible, rather than as many projects as possible.
- Uncertainty around the PTC on several occasions has led to boom and bust that has negatively affected domestic and international investment in the U.S. wind industry, increased project costs and ultimately led to higher energy costs.

These points lead to the general conclusion that the PTC and ITC, which promote economies of scale and maximum output, are more appropriate for very large projects in mature markets. While this may be the ultimate goal of any national energy system, the decentralized and nascent nature of current renewable energy production leaves space for programs such as the 1603 grant, which is far more simple and effective in bringing large numbers of projects online quickly.

4.0 Key Issues and Findings

Observations based on the case studies are presented here as key issues or findings. For each a brief discussion is provided, drawing on the theoretical literature and examples. The implications for China are highlighted at the end of each section.

4.1 Environmental Taxes Can Be Pro-Growth and Pro-Competitiveness

A common concern raised in response to proposals for EFR measures is that the EFR measure will slow economic growth and reduce international competitiveness. All countries are concerned about this effect and have come up with some innovative ideas to limit the impact on growth in the design of EFR measures and to protect energy-intensive industry, in particular from energy price increases.

- **Emissions intensity limits**, such as in Alberta's SGER, place a charge based on emissions per unit of output, effectively providing a constant incentive that does not change due to economic activity.
- **Revenue recycling**, such as that used by Australia and the United Kingdom returns revenues to businesses so the overall effect is neutral, but a transfer is made to more efficient firms.

There is little evidence of environmentally related taxes having reduced competitiveness in any sector, largely because governments have used a proportion of EFR revenues to protect sectors vulnerable to competitiveness impacts or have exempted energy-intensive industry from EFR measures (OECD, 2006).

Since the revenues collected are spent elsewhere, the net effects of EFR on the economy are not necessarily negative. If the revenues can be diverted into a strategically important sector, can leverage private investment or can be recycled to reduce distortions in the economy, the net economic effect will probably be positive. Determining the overall economic impact of a system of taxation and spending is a complex matter, subject to much debate, and requires a detailed modelling exercise to fully understand. However, in several countries with carbon-energy taxation in Europe (see, e.g., Competitiveness Effects of Environmental Tax Reforms, 2007), and Japan (Lee, Pollitt, & Ueta, 2012) such modelling has been conducted, which indicates that slightly higher GDP growth is to be expected than in a business-as-usual scenario.

Implications for China: China's economy has grown at an unprecedented rate (11.2 per cent on average during the 11th FYP period [2006–2011]), and there are legitimate concerns that growth would be threatened by the imposition of additional taxes. However, policy instruments can be designed to limit the impact on strategic sectors through revenue recycling and compensatory measures. In addition, revenues may be used to deliver economic benefits through support to strategic priorities and sectors that may prove to have a net positive impact on economic growth.

4.2 Revenue Stability Can Be Ensured With Adjustments, Price Caps and Price Floors

The establishment of a link between an environmental tax and a program of spending is intended to provide predictability and transparency, as it establishes a clear link from revenues to spending in the future. However, it is by no means certain that this model will ensure stable revenues. On the one hand, rapid technology cost reductions, such as those seen in the PV industry in recent years, can quickly change project economics and lead to an increase in deployment and support costs. On the other hand, revenues from EFR measures, particularly those reliant on market-based pricing, may be unstable. For example, the German ECF, which allocates revenues from the auction of EU ETS permits, is currently significantly underfunded, due to the drop in emissions allowance prices in the EU ETS. Because funds did not correspond to spending requirements, the government and the German Bank for Reconstruction have had to step in to meet the shortfall. Conversely, in India, coal cess revenues have not been spent by the NCEF, largely due to poor governance. Both cases make it clear that attempting to match a potentially unstable revenue stream with an equally unstable spending requirement is a significant challenge for policy-makers.

Nonetheless, the cases have revealed some innovative responses to this problem. Adjustment mechanisms can effectively reduce volatility and lead to stable revenue generation and spending, as seen in the case of the Danish PSO, where tariff rates are reviewed every three months to ensure that revenues raised correspond to spending. Adjustment mechanisms, whether automatic or ad hoc, are also useful to compensate for falling revenues as the market reacts to the price signal, resulting in reduced levels of taxable polluting activities. In a similar vein, a price cap and/or a price floor can be imposed within the EU ETS to limit market impacts on revenues. For example, a gradually increasing price floor (US$14) and price cap (US$19) will be in place during the transitional phase of the Australian carbon pricing mechanism from 2015–2018, while in Alberta, Canada, there is an effective price ceiling of US$15 within the carbon trading system. A well-designed measure should include such mechanisms to reduce revenue and spending volatility to acceptable levels.

Implications for China: China should consider a revenue-raising mechanism designed to reflect the spending commitments of the renewable energy fund. As spending on renewable energy deployment requires long-term commitment, a mechanism that allows the policy to be reviewed regularly (and tax rates adjusted automatically or on an ad hoc basis and without political renegotiation) merits consideration.

4.3 Revenues Can Promote Renewables, Protect the Vulnerable, Improve Competitiveness and Build Policy Acceptance

Revenues from environmental taxes are generally allocated to programs that reduce the net cost to those subject to the tax (revenue recycling) or to achieve a strategic goal, such as the promotion of renewable energy. If an EFR measure does not raise enough revenues to meet its spending goals, perhaps because a tax rate has been set too low, then that is clearly a case of poor policy design. In this report, environmental taxation is examined through the lens of its potential to raise revenues, while protecting vulnerable groups from the impact of price increases. However, in the United Kingdom and Australia the overall fiscal impact of the measures examined was negative, as the cost of the various spending programs exceeded the revenues of the taxes, largely in response to the need to placate powerful opposition to EFR measures.

In Australia, the introduction of the carbon price was politically very controversial, and generous support to a number of stakeholder groups, including households and the coal and steel sectors, was deemed necessary to ensure the resulting scheme would be politically acceptable. This, in turn, led to more revenues being recycled to households or used to compensate industry than were raised by the introduction of the carbon price mechanism. In the United Kingdom, the situation was slightly different. Widespread opposition to other EFR measures and concerns over industrial competitiveness meant that the tax was implemented at the same time as a corresponding cut in employment taxes, with the aim of revenue neutrality. In fact, revenues raised could not cover the cost of the tax cut, let alone the additional commitments of the climate change levy to support renewables. Both cases exemplify how political economy concerns can lead to high levels of spending and negative fiscal impacts.

There are often good reasons to recycle a portion of revenues to assistance schemes, including protecting vulnerable groups, maintaining industrial competitiveness and reducing opposition from stakeholders. Revenue recycling measures were a feature of a number of schemes examined, and are, of course, a common feature of EFR (e.g., in Sweden, Denmark, Finland, the Netherlands, the U.K. and Germany), and should be considered during the design process of similar mechanisms. The decision to compensate, and if so, which groups and by how much, is inherently a political decision. There is a strong case for developing policies to protect vulnerable households (e.g., from energy price increases) while retaining the incentive effect of an EFR measure.

Implications for China: The impacts on stakeholder groups and the case for providing compensation through assistance programs should be included in the design of an environmental fiscal measure. It is important to consider whether revenues raised will be able to meet the total spending needs of the policy, including revenue recycling and compensation, as well as renewable energy investment needs. More ambitious policies with higher tax rates are more likely to raise sufficient revenues to achieve all of these aims.

4.4 Policy Stability Increases Leveraging of Private Finance

A key part of the effectiveness of environmental taxes and renewable energy subsidies stems from market confidence that investments will have time to come to fruition before the policy measures are reformed or phased out. This is particularly important in the case of renewable energy deployment, where projects may take several years to recover their capital—policy instability discourages investment in the sector.

EFR instruments that have endured have tended to be those built on a cross-party consensus, such as the PSO in Demark, where all the major parties were in favour of measures to support renewable energy as the country transitioned to a more liberalized electricity system. Similarly, the CCL in the U.K. was a project begun under a Conservative government and continued under Labour. Conversely, where measures have been introduced by narrow margins in the face of strong opposition, concerns over whether measures will be removed, most notably the case in Australia, may have held back investors waiting to see if the policy would survive before committing resources to the development of projects. Equally, policies that require periodic renewal coupled with a lack of political consensus, such as the ITC and PTC in the United States, have been responsible for a series of "stop-and-go" cycles that have been detrimental to the renewable energy industry.

On the spending side, the creation of a renewable energy fund run at arm's length from day-to-day decision making in government, such as Energienet.dk in Denmark, has helped to stabilize renewable energy funding in the medium term.

Implications for China: China's system of FYPs is well suited to providing policy stability over the medium to long term. However, cross-departmental (such as fiscal, energy and environmental departments) support and consensus are still challenging and present a key barrier to implementation of successful EFR measures.

4.5 Multiple Environmental Fiscal Policies, Including Taxes and Trading Schemes, Can and Do Co-Exist in Many Countries

The landscape of environmental tax policy is often complicated, as many of the case studies in the document show. In three of the cases, the U.K., Denmark and Germany, EFR measures must coexist with the impact of the EU ETS. In two further case studies, Canada and the United States, the systems of federal and provincial/state government may create conflicts with local initiatives.

However, although the co-existence of national or supranational initiatives is a challenge for the development of environmental fiscal policy measures, the cases show that these problems can be dealt with effectively. In Europe, concern over the low cost of carbon in the EU ETS has led countries to impose new (or continue with existing) environmental taxes and charges on carbon and energy. In Alberta, the threat of federal measures was one factor in establishing the SGER, a provincial measure designed to be sensitive to local concerns around restricting economic growth. The case studies show that EFR measures rarely exist in a vacuum and that interaction with other measures is both feasible and commonplace.

Implications for China: To date, China has pursued a system of carbon trading through pilot projects in seven cities and provinces, in addition to plans to introduce a carbon tax (BusinessGreen, 2012). A key question is whether the two measures will work in parallel or have only one system apply to each sector or province. Each system has advantages: where sectors involve a few large, relatively sophisticated actors, trading systems allow savings to be realized at the lowest marginal cost. On the other hand, a carbon tax provides more certainty to investors by establishing a clear price for emissions. International experience shows that there are numerous examples of EFR instruments that coexist with similar measures across jurisdictions.

4.6 Renewable Energy Revenues Need Good Management and Governance If They Are to Achieve Targeted Objectives Efficiently

The case studies show two distinct systems for managing revenue collection and spending. In the U.K. and Japan, the revenues are managed by government departments in line with earmarking commitments where they are in place. By contrast, in Germany, India, Denmark and Alberta, the revenues are allocated to funds that operate with varying degrees of political independence and are spent according to the governance structures put in place when the funds were established. The funds are either used to support one-off payments to specific projects following a competitive tender process, as in India and Alberta, or to support continuing obligations for renewable energy generation subsidies, as in Denmark. As mentioned above, it may be advantageous that such funds are distanced from annual budgetary decision-making processes and thus tend to be more stable.

In both cases, the most important factor is the establishment of clear governance structures and clear rules about how funds are to be used—otherwise there is potential for accountability problems in the allocation of funds. In India, for example, there has been some concern about the use of funds from the Clean Energy Cess. International experience shows that where earmarking measures are established with specific, targeted objectives and governance structures that provide accountability, there is less chance of mismanagement and funds being reallocated to pursue short-term political priorities at the expense of the original objectives. However, as priorities change, it may be necessary to revise objectives to meet changing needs and take account of short-, medium- and long-term goals.

Implications for China: A key rationale for the development of this project was the perceived need to identify sources of revenue that could be used to fund renewable energy deployment. If EFR were to be implemented in the Chinese case, revenues raised would meet a proportion of total renewable energy funding, with the remainder coming from the surcharge on the consumption of electricity. Because an established structure already exists—the Renewable Energy Development Fund—adding revenues to this fund should be considered to minimize duplication and coordinate spending priorities. To ensure a good transition, short-, medium- and long-term actions would be needed. In the short term, while continuing to stabilize the system of renewable energy electricity price add-ons, it would be advisable to start exploring a legislative and policy agenda of using natural resource taxes and a carbon tax to provide renewable energy with stable support, by setting up goals and building transitioning mechanisms. In the medium- and long-term, it would be advisable to smoothly and stably transition to rely more (or even completely) on using natural resource taxes and a carbon tax to fund renewable energy development, instead of the price add-on policy.

4.7 Further research

This report looked at a number of examples of EFR measures for renewable energy technology development, and made some general recommendations. More specific recommendations on the design of appropriate EFR instruments to raise revenues for renewable energy in the Chinese context would require further research and an in-depth analysis of the policy landscape within the country. Such an analysis would include not only existing EFR and other measures to support renewable energy, but would also involve the development of an inventory of environmentally harmful subsidies. Modelling of policy impacts may also be useful to compare policy impacts and predict revenues.

The report has also highlighted untapped potential for EFR measures to facilitate investment in renewable energy in many of the countries examined in the case study section. These cases merit further research to develop the conclusions of the case study sections into a series of policy recommendations for the improvement of existing EFR measures.

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