EVALUATION OF ENVIRONMENTAL TAX REFORMS: INTERNATIONAL EXPERIENCES

Annexes to Final Report

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Disclaimer: The arguments expressed in this report are solely those of the authors, and do not reflect the opinion of any other party.

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Annex 1: Detailed cases of existing carbon and energy tax systems

1.1 Carbon tax in Australia

Summary
A carbon tax was introduced in Australia in July 2012. The tax covers about 60 per cent of domestic GHG emissions and applies to around 500 of the largest emitters. Some energy products and energy used for certain purposes (e.g. transport fuels used by private and light commercial vehicles and for agriculture) are exempt from the tax. From July 2015 the tax will be replaced by a tradable permit system. The carbon tax is to be revenue neutral with revenues recycled via an increase in the tax-free threshold for income taxes, a boost in pension and family tax benefits, incentives to invest in cleaner energy programmes and shift to cleaner production processes, and support for jobs and competitiveness.

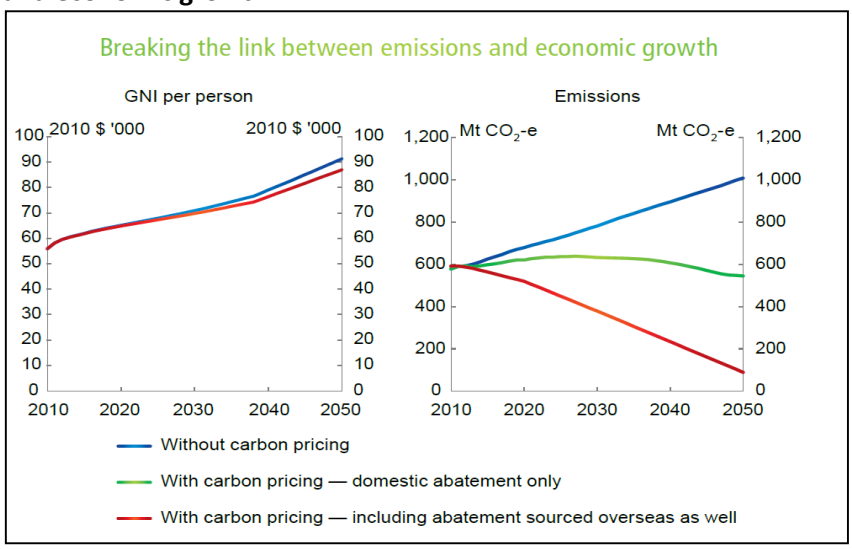
Objectives and design	
Goals and objectives of the tax	The 'Carbon Pricing Mechanism' (CPM) was launched in July 2011 and applies from July 2012. For the first three years the carbon price will be fixed (i.e. a carbon tax), before moving to an emissions trading scheme in 2015. It was introduced as the central part of the Federal Government's plan to move to a clean energy future (see below) and is the Government's primary approach for achieving Australia's emission reduction targets (Australian Government – Climate Change Authority 2012). Its introduction was motivated by both environmental objectives (Australia has the highest level of GHG emissions per capita of any developed country) and economic objectives (growth and job opportunities from the transition to a low carbon economy). The CPM aims to trigger the transformation of the Australian economy and create incentives to reduce pollution and invest in clean energy (Australian Government 2012).
Wider ETR context	The CPM was introduced as part of the 'Clean Energy Future Plan' presented by the Federal Government in July 2011. Other measures in the package include the promotion of innovation and investment in renewable energy (through *inter alia* a new commercially oriented Clean Energy Finance Corporation); encouraging energy efficiency (through *inter alia* the provision of advice and funding to support activities in households and business); and creating opportunities in the land sector to cut carbon pollution and increase the amount of carbon stored on the land (through *inter alia* the Carbon Farming Initiative) (Australian Government 2011).
How the taxable base is defined	The CPM started in 2012 with a fixed price scheme and will shift to an emissions trading system in three years to allow industries sufficient time to adapt to carbon prices. It applies to 'large emitters' (those which generate over 25,000 tonnes of CO2-e emissions each year) and is expected to cover around 500 of the biggest polluters in the country and around 60 per cent of Australia's GHG emissions (Australian Government 2011).

	The CPM applies to the stationary energy sector, industrial processes, non-legacy waste, and fugitive emissions. Only landfill facilities with direct emissions of 25,000 tonnes CO2-e a year or more will be liable. In relation to transport, the CPM does not apply to on-road use of fuels by households and light commercial vehicles (4.5 tonnes and under) nor does it apply to off-road fuel use by the agriculture, forestry and fishing industries. A carbon price will be applied to domestic aviation, domestic shipping, rail transport, and non-transport use of fuels. Users of these fuels can opt-in to the mechanism under the 'Opt-in Scheme' (Australian Government 2012).
The tax rate applied	During the fixed price stage (1 July 2012 - 30 June 2015), the carbon price will start at AUD23 per tonne. It will rise by 2.5 per cent each year in real terms assuming inflation of 2.5 per cent a year, which is the mid-point of the Reserve Bank of Australia's target range for inflation. The carbon price will thus be AUD 24.15 per tonne in 2013-14 and AUD 25.40 per tonne in 2014-15. From 1 July 2015, the price will be set by the market and the number of permits issued by the Government each year will be capped (Australian Government 2011 and Australian Government 2011b). A price ceiling will apply for the first three years of the flexible carbon price period. The price ceiling will be set at AUD20 above the expected international price and will rise by 5 per cent in real terms each year (Australian Government 2012). The government initially envisaged also having a price floor set at AUD15, rising by 4 per cent each year in real terms. The price floor has however subsequently been axed and replaced by a quantitative limit on the use of international emission units and linking the Australian system with the EU ETS (see below) (Speck 2012).
Implementation	
Specific measures and/or derogations	- The CPM does not apply to on-road use of fuels by households and light commercial vehicles (4.5 tonnes and under) nor does it apply to off-road fuel use by the agriculture, forestry and fishing industries. - Renewable fuels such as ethanol, biodiesel and renewable diesel are also not subject to the CPM. - Non-transport use of fuel and some off-road transport face an effective carbon price through changes to current fuel taxes. - The Government aims to apply an effective carbon price on heavy on-road vehicles from 1 July 2014. - Gaseous fuels such as LPG, LNG and CNG used for on-road transport will not be subject to the carbon price as their eligibility for a fuel tax credit is reduced to zero due to the Road User Charge. - For emissions from bottled LPG and reticulated gas, an effective carbon price will apply through a reduction in the automatic remission or exemption of excise. - Large users of liquid fuels will be able to voluntarily opt-in to the CPM from 1 July 2013 (Australian Government 2012).

	- An allocation of free carbon units and cash payments is to be provided to strongly affected coal-fired electricity generators. These allocations will be conditional on electricity generators publishing Clean Energy Investment Plans showing how they will reduce their pollution and meeting power system reliability standards (Australian Government 2012).
Revenues from the taxes	Given that the tax was only introduced in July 2012, actual data on revenues are not yet available. The Government estimates that the CPM will raise AUD 7.690 million (2012-2013), AUD 8.610 million (2013-2014) and AUB 9.200 million (2014-2015) (Australian Government, n.d).
Use of tax revenues	The carbon tax is to be revenue neutral. Revenues from the carbon tax will be recycled to households via increases in pensions, allowances, family payments and income tax cuts. It is estimated that around 8 million households will receive some form of assistance through tax cuts, payment increases or both (Australian Government 2012). Recycling measures include the following (Australian Government 2011 and Australian Government 2012): - Pensioners and self-funded retirees will get up to AUD338 extra per year if they are single and up to AUD510 per year for couples; - Families receiving Family Tax Benefit Part A will get up to AUD 110 extra per child - Eligible families will get up to an extra AUD69 in Family Tax Benefit Part B; - Allowance recipients will get up to AUD218 extra per year for singles, AUD234 per year for single parents and AUD390 per year for couples; - Taxpayers with annual income of under AUD80, 000 will receive a tax cut with most receiving at least AUD300 per year. Around 40 per cent of revenues from the CPM will be used to help businesses and support jobs (Australian Government 2012). Revenues will be returned to industries through incentives to invest in cleaner energy programmes and shift to cleaner production processes. The Jobs and Competitiveness Program (JCP) will provide AUD 8.6 billion of assistance between 2012 and 2015 (Australian Government 2012). This assistance will be targeted at around 40-50 of 'emissions-intensive trade-exposed' industrial activities such as steel, aluminium, cement and zinc manufacturing (which produce over 80 per cent of the manufacturing sector's emissions). There will be two categories of assistance: the most 'emissions-intensive trade-exposed' activities will receive assistance to cover 94.5 per cent of industry average carbon costs in the first year of the carbon price, while less emissions-intensive trade-exposed activities will receive assistance to cover 66 per cent of industry average carbon costs. Assistance will be reduced by 1.3 per cent each year. Regular reviews of the JCP are planned (Australian Government 2011). In addition to the JCP, the Government is implementing a Clean Technology Program of AUD1.2 billion to help improve energy

	efficiency in manufacturing industries and support R&D in low pollution technologies. In addition, an AUD300 million Steel Transformation Plan will support and assist the industry transition to a clean energy future while an AUD1.3 billion Coal Sector Jobs Package will provide transitional assistance to help the coal industry implement carbon abatement technologies for mines that produce the most carbon (Australian Government 2011). An Energy Security Fund will be established comprising of: - An allocation of free carbon units and cash payments to strongly affected coal-fired electricity generators. These allocations will be conditional on electricity generators publishing Clean Energy Investment Plans showing how they will reduce their pollution and meeting power system reliability standards. - The Government will seek to negotiate the closure of around 2,000 megawatts (MW) of highly polluting generation capacity by 2020 (Australian Government 2012).
Future developments in ETR	A new independent body, the Climate Change Authority (CCA) has been established to track Australia's pollution levels and provide independent advice to the Government on the performance of the CPM and other initiatives (Australian Government 2011). The CCA is currently working on the first review of Australia's emissions caps (the so-called 'Caps and Target Review'). The review will recommend a target for emission reductions for 2020 and a proposed pathway to that target. As part of this Review, the CCA will also recommend annual emissions caps (or limits) for Australia's carbon pricing mechanism for the period 2015-16 to 2019-20. The final report of the review will be presented in early 2014 (Australian Government – Climate Change Authority 2012). The CCA will also review and make recommendations on the carbon price (excluding household assistance and the JCP) in the second half of 2016 with subsequent reviews in 2018 and then every five years (Australian Government – Climate Change Authority 2012a).
Interactions with other policies	
Compatibility with EU ETS	The carbon tax will shift to an emissions trading system (ETS) by 2015. A price ceiling will operate until 2018 so to avoid price spikes and reduce the risk for businesses. The government is to set a price ceiling for 2015-16 by 31 May 2014. The price ceiling will be AUD20 above the expected European allowance price for 2015-16 and will rise by 5 per cent in real terms in 2016-17 and 2017-18 (Australian Government 2013). The trading system is to be linked to international carbon markets and emissions trading schemes from its commencement. In August 2012, the Government announced it will link the Australian ETS with the EU ETS, starting with an interim link operating from 1 July 2015 which will allow Australian liable entities to use European allowances for

	compliance under the Australian scheme. A full two-way link, by means of the mutual recognition of carbon units between the two systems is to commence no later than 1 July 2018. The Government will consider future bilateral links with credible international schemes on a case-by-case basis (Australian Government 2013). Safeguards are in place to ensure only credible international permits will be eligible for use in the Australian scheme. Moreover, until 2020, liable businesses will have to meet at least half of their annual obligation with domestic permits rather than international permits. The CCA will review this restriction in 2016 (Australian Government 2013).
Revised EU Energy Tax Directive 2003/96/EC	N/A
County context	
GDP	USD 40 790 billion curr. PPPs (2010) (OECD 2012) AUD 1,488 billion current prices, sa (2012) (OECD 2013)
Total primary energy supply	124.7 million tonnes of oil equivalent (Mtoe) (2010) (OECD 2012)
Energy intensity (TPES per unit of GDP)	0.15 Toe per '000 USD (2010 figures) (OECD 2012)
Electricity generation by fuel	Electricity generation from coal and peat: 74.81 per cent Electricity generation from oil: 1.31 per cent Electricity generation from natural gas: 15 per cent Electricity generation from nuclear energy: - Electricity generation from hydro energy: 5.16 per cent Other electricity generation*: 3.72 per cent (IEA 2012) * Includes geothermal, solar, biofuels, waste, tide, wave, ocean, wind and other fuel sources (IEA 2012)
Economic structure	Real value added of industry (-0.1 per cent in 2010); agriculture, forestry, fishing (9.1 per cent in 2010); services (3.3 per cent) (OECD 2012)
Demand elasticities	According to a report by the Government's Commission on Productivity, estimates of the elasticity of demand for electricity are in the range of -0.2 to -0.7. With respect to own-price elasticity of demand for road transport, the Commission uses low and high elasticity values of -0.25 and -0.75 respectively. These values are based on estimates of long-term elasticities in the literature (Australian Government – Commission on Productivity 2011).
Key environmental impacts	
Nature and degree of impacts on the environment	The Government has committed to reducing GHG emissions by 25 per cent by 2020 compared to 2000 levels and by 80 per cent by 2050 compared to 2000 levels (Australian Government – Department of Climate Change and Energy Efficiency, n.d.) Given the recent introduction of the carbon tax, it is too early to assess the impacts on the environment. However macro-economic modelling carried out by the Treasury suggest that with an initial domestic carbon price of AUD20 in 2012-13, domestic emissions will be 621 Mt CO2-e with a carbon price in place compared to 679 Mt CO2-e without a

	carbon price. By 2050, the model suggests that domestic emissions reach 545 Mt CO2-e with a carbon price in place compared to 1008 Mt CO2-e without a carbon price (Australian Government 2011a) – See Figure 1. The modelling by the Treasury also found that a carbon price is projected to reduce electricity emissions by 60 per cent below current levels by 2050, as industry and households improve energy efficiency and generators switch to lower emission technologies, and also drive down transport sector emissions (Australian Government 2011a). **Figure 1: Ex ante assessment of impact of carbon price on emissions and economic growth**  Source: Australian Government (2011) Some recent data shows positive environmental impacts of the CPM. For example in January 2013, it was reported that carbon emissions from the electricity sector had fallen sharply under the first six months of the CPM with increases in energy efficiency and renewable energy generation (KPMG 2013).
Key social impacts	
Impacts on income distribution	Given the recent introduction of the tax, actual data on its impacts are not yet available. On average the Government estimates that households will experience cost increases of AUD9.90 per week, but receive assistance of AUD10.10 per week (Australian Government 2011). According to modelling by the Treasury, although carbon pricing will lead to a small increase in overall prices, millions of households, particularly pensioners and low income households, will be better off as they will receive generous assistance which they can pocket if they transfer consumption to less emission-intensive goods or improve their energy efficiency (Australian Government 2011a).
Unintended social impacts	No information available
Key economic impacts	
Administrative cost	A new body - the Clean Energy Regulator has been established to

	administer the CPM, the National Greenhouse and Energy Reporting System, the Renewable Energy Target and the Carbon Farming Initiative (Australian Government – Clean Energy Regulator 2013). Given the recent introduction of the CPM, information on administrative costs are not yet available.
Impacts on competition, employment, growth, innovation	Given the recent introduction of the tax, actual data on its impacts are not yet available. However modelling by the Treasury estimates that under a carbon price, average incomes will increase by about 16 per cent from current levels by 2020 while national employment is projected to increase by 1.6 million jobs by 2020 (Australian Government 2011). Moreover the emission intensity of GDP is estimated to decrease by 2020 from 0.39 kg CO_2-e/AUD without carbon pricing to 0.36 kg CO_2-e/AUD with carbon pricing and in 2050 from 0.28 kg CO2-e/AUD without a carbon price to 0.15 kg CO2-e/AUD with a carbon price (Australian Government 2011a). Carbon pricing is expected to slow Australia's average income growth by around 0.1 of a percentage point per year – see Figure 1 above (Australian Government 2011a).
Unintended economic impacts	No information available

References

Australian Government (2011) Securing a clean energy future: The Australian Government's climate change plan in summary, Commonwealth of Australia 2011, http://www.cleanenergyfuture.gov.au/wp-content/uploads/2011/07/securing-a-clean-energy-future-summary.pdf [accessed 12/3/2013]

Australian Government (2011a) Modelling overview, http://archive.treasury.gov.au/carbonpricemodelling/content/overview.asp [accessed 13/3/2013]

Australian Government (2011b) Securing a clean energy future - THE AUSTRALIAN GOVERNMENT'S CLIMATE CHANGE PLAN, Commonwealth of Australia, http://www.cleanenergyfuture.gov.au/wp-content/uploads/2012/06/CleanEnergyPlan-20120628-3.pdf [accessed 28/03/2013]

Australian Government (2012) An overview of the Clean Energy Legislative Package, http://www.cleanenergyfuture.gov.au/wp-content/uploads/2012/05/CEF-overview_Apr2012.pdf [accessed 13/3/2013]

Australian Government (2013) The Clean Energy Plan – Factsheet on International linking, http://www.cleanenergyfuture.gov.au/international-linking/ [accessed 13/3/2013]

Australian Government (n.d.), Mid-year economic and fiscal outlook 2011-2012, Appendix A: Revenue Measures (Continued), Climate Change and Energy Efficiency, Clean Energy Future — Putting a Price on Pollution — revenue from sale of carbon units, http://www.budget.gov.au/2011-12/content/myefo/html/08_appendix_a_revenue-03.htm [accessed 19/6/2013]

Australian Government – Clean Energy Regulator (2013), http://www.cleanenergyregulator.gov.au/Pages/default.aspx [accessed 13/03/2013]

Australian Government – Climate Change Authority (2012), Caps and Target Review, http://climatechangeauthority.gov.au/caps [accessed 13/3/2013]

Australian Government – Climate Change Authority (2012a), Carbon Pricing Mechanism, http://climatechangeauthority.gov.au/caps [accessed 13/3/2013]

Australian Government – Department of Climate Change and Energy Efficiency (n.d.), Australia's Emissions Reduction Targets, Factsheet, http://www.climatechange.gov.au/government/reduce/national-targets/~/media/government/reduce/NationalTarget-Factsheet-20111201-PDF.pdf [accessed 13/3/2013]

Australian Government – Productivity Commission (2011) Carbon Emission Policies in Key Economies, http://www.pc.gov.au/__data/assets/pdf_file/0003/109830/carbon-prices.pdf [13/3/2013]

Flannery, T., Beale, R., Hueston, G. (2012) The Critical Decade: International Action on Climate Change, The Climate Commission, Commonwealth of Australia (Department of Climate Change and Energy Efficiency) 2012.

KPMG (2013) KPMG Green Tax Index, Carbon and Climate Change, http://www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/green-tax/Pages/carbon-climate-change.aspx [accessed 3/5/2013]

OECD (2012) Australia - Country statistical profile, http://www.oecd-ilibrary.org/economics/country-statistical-profile-australia_20752288-table-aus [accessed 13/3/2013]

OECD (2013), Main Economic Indicators, Volume 2013, Issue 4, OECD Publishing.

IEA (2012) Energy Balances of OECD Countries – 2012 Edition, OECD/IEA, 2012, Paris

For further details on the redistribution of revenues from the carbon tax and other details of the CPM, please see: http://www.cleanenergyfuture.gov.au/clean-energy-future/our-plan/ [accessed 13/3/2013]

1.2 Carbon tax in British Columbia (Canada)

<table>
<tr><th colspan="2">Summary</th></tr>
<tr><td colspan="2">A carbon tax was introduced in British Columbia (BC) in 2008. It is one of the broadest and most comprehensive carbon taxes in the world covering GHG emissions from the combustion of all fossil fuels in BC (plus peat and used tires when used to produce heat or energy). When it was introduced, the carbon tax applied to 77 per cent of BC's GHG emissions, but that fell to 70 per cent in 2012 with the increase in non-combustion emissions from growing natural gas production. The tax rate applied was CAD10 (EUR8) per ton of CO2 equivalent on 1 July 2008 when it was introduced, with a schedule of four annual increases of CAD5 (EUR4) per ton of CO2 to reach CAD30 (EUR24.2) per ton of CO2 equivalent on 1 July 2012.

Although the carbon tax was designed to be revenue neutral, it has in fact been revenue negative as tax cuts and credits have exceeded revenues generated from the carbon tax, due to a growing share of revenues going to corporate income tax cuts as well as lower than anticipated revenues from the carbon tax revenues. The carbon tax as a share of income shows a regressive pattern (i.e. higher relative burden for lower income households) which has increased with the tax level rises since 2008.

A review of the carbon tax in 2012 concluded that the tax rates will be maintained at CAD 30 per tonne of CO2e for the foreseeable future. Moreover it was decided not to expand the tax base nor broaden it to include industrial process or other non-combustion emissions. It was decided that when other jurisdictions, especially those in North America, introduce similar carbon taxes or carbon pricing; the government may then review and consider changes to the carbon tax (British Columbia Ministry of Finance 2013).

The carbon tax approaches an economist's ideal of an economically efficient policy in that it applies the same price for every unit of GHG emissions from fossil fuels across the economy, it started at a moderate level and was gradually increased at a set schedule, and it is designed to be revenue neutral with tax revenues used to decrease taxes on corporate and personal income, thus dampening the effect of the tax on economic activity (Jaccard 2012). It provides a good example of the successful introduction of a homogenous carbon tax which has achieved its policy objectives, indicating that carbon taxes designed in line with theoretical ideals are possible (Speck 2013).</td></tr>
<tr><th colspan="2">Objectives and design</th></tr>
<tr><td>Goals and objectives of the tax</td><td>The carbon tax was introduced in 2008 to help reach the goal of reducing BC's greenhouse gas (GHG) emissions by at least 33 per cent below 2007 levels by 2020 (British Columbia Ministry of Finance 2013).</td></tr>
<tr><td>Wider ETR context</td><td>The introduction of the carbon tax should be seen against the backdrop of the BC government's climate policy agenda presented in 2007 which included a commitment to reduce the province's GHG emissions by 33 per cent by 2020, match California's tailpipe standards for motor vehicles, ensure at least 90 per cent of electricity is derived from renewable energy sources, and for new and existing electricity production to have net zero emissions by 2016 (Harrison 2012).

By the end of 2008, a number of climate related measures were in place in addition to the carbon tax including: renewable energy requirements for electricity generation, legislation to enable participation in an economy-wide cap and trade system as part of Western Climate Initiative, a low carbon fuel</td></tr>
</table>

<table>
<tr><td></td><td>standard, tighter energy efficiency targets and regulations, tighter vehicle emission regulations, expanded investment in public transit, requirements for carbon neutrality in provincial government operations and obligations on municipal governments for GHG reductions (Jaccard 2012).

When the carbon tax was introduced, it was expected that other jurisdictions would implement similar carbon pricing policies and work with BC on cooperative solutions such as a North American cap and trade system. Although some jurisdictions in Canada and the US have smaller, targeted carbon pricing mechanisms, and Quebec and California have cap and trade systems in place, a national or North American broad-based carbon pricing strategy has not yet materialized and it does not seem likely in the near future (British Columbia Ministry of Finance 2013).</td></tr>
<tr><td>How the taxable base is defined</td><td>The carbon tax applies to GHG emissions from the combustion of all fossil fuels in the province (plus peat and used tires when used to produce heat or energy). It is based on the CO2 equivalent emissions of each particular fuel. When it was introduced, the carbon tax applied to 77 per cent of BC's GHG emissions, but fell to 70 per cent in 2012 with the increase in non-combustion emissions from growing natural gas production (Harrison 2012).

The tax does not cover emissions from non-combustion sources including industrial processes such as cement, lime and aluminium production, 'fugitive' emissions from coal, oil and natural gas extraction, agriculture emissions, landfills, international aviation and shipping (Lee 2011). There are no provisions to tax imported goods based on their embedded emissions or to reimburse domestic manufacturers for carbon taxes paid on goods that are exported. Exports of fossil fuels that produce emissions outside BC are however excluded from the tax (Harrison 2012).</td></tr>
<tr><td>The tax rate applied</td><td>The tax rate applied was CAD10 (EUR 8) per ton of CO2 equivalent on 1 July 2008 when it was introduced, with a schedule of four annual increases of CAD5 (EUR 4) per ton of CO2 to reach CAD30 (EUR 24.2) per ton of CO2 equivalent on 1 July 2012 (British Columbia Ministry of Finance 2013). The gradual increases in the tax were intended to minimize potential adjustment costs associated with the tax shift (Rivers and Schaufele 2012).

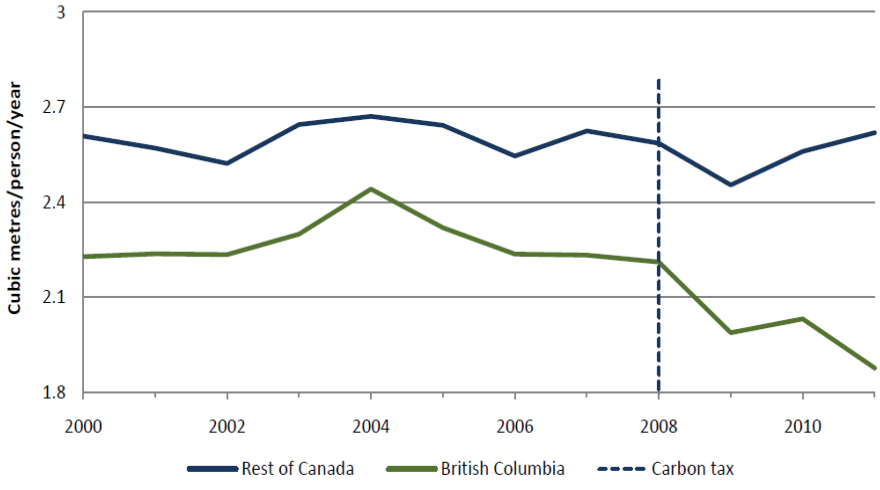
The same rate is applied for all GHG emissions that originate from fossil fuel combustion across the economy (Jaccard 2012), thus all sectors and activities (e.g. home heating, fuelling a vehicle, generating electricity etc.) are treated the same (British Columbia Ministry of the Environment 2012). See Table 1 for a sample of carbon tax rates by fuel as of 1 July 2012.

Table 1: Selected carbon tax rates by fuel
<table>
<tr><th></th><th>Units for tax rate</th><th>Tax rate, 1 July 2012</th></tr>
<tr><td>Gasoline</td><td>¢/litre</td><td>6.67</td></tr>
<tr><td>Diesel (light fuel oil)</td><td>¢/litre</td><td>7.67</td></tr>
<tr><td>Jet Fuel</td><td>¢/litre</td><td>7.83</td></tr>
<tr><td>Natural Gas</td><td>¢/cubic metre</td><td>5.70</td></tr>
<tr><td>Propane</td><td>¢/litre</td><td>4.62</td></tr>
<tr><td>Coal - high heat value</td><td>$/tonne</td><td>62.31</td></tr>
</table></td></tr>
</table>

	Coal - low heat value	$/tonne	53.31
	Source: British Columbia Ministry of Finance (2013a)		
Implementation			
Specific measures and/or derogations	As noted above, the tax does not apply to non-combustion emissions from industrial processes, e.g. those associated with cement, lime and aluminium production, 'fugitive' emissions from coal, oil and natural gas extraction, agriculture emissions, landfills, international aviation and shipping, exports of fossil fuels and imports. While recognising that the tax may harm the competitiveness of energy-intensive industries, the government did not adjust the policy to address this but established a task force to consider sector specific impacts of the rising tax and possible mitigation options (Jaccard 2012). In 2012, the government granted the first concession on competitiveness ground in the form of a one-time grant of CAD 7.6 million to commercial greenhouse vegetable and floriculture growers (Harrison 2012). This was extended in the 2013 budget (see below). Furthermore, local governments and schools are rebated their carbon tax payments if they sign the government's Climate Action Charter which required a commitment to have carbon neutral operations by 2012 (Harrison 2012).		
Revenues from the taxes	Revenues from the carbon tax were CAD 306 million in 2008-2009, CAD 542 million in 2009-2010, CAD 741 million in 2010-2011 (Sustainable Prosperity 2012), CAD 959 million in 2011-2012 and estimated to be CAD 1,172 million in 2012-2013, CAD 1,236 million in 2013-14, CAD1,252 million in 2014-15 and CAD 1,273 million in 2015-16 (British Columbia Ministry of Finance 2013). Related *tax expenditures* were CAD 1,141 million in 2011-2012 and estimated to be CAD 1,375 million in 2012-2013, CAD 1,236 million in 2013-2014, CAD 1,386 million in 2014-2015 and CAD 1,491 million in 2015-2016. Thus tax cuts exceed carbon tax revenues (British Columbia Ministry of Finance 2013). According to Government estimates the carbon tax will account for 5.5 per cent of total tax revenues in 2012/2013 (British Columbia Ministry of Finance 2013a).		
Use of tax revenues	A key principle underlying the introduction of the carbon tax was it would be revenue neutral. Indeed there is a legislative commitment to return all revenues from the carbon tax to individuals and firms through reductions in other taxes (and a threat to cut the Minister of Finance's salary by 15 per cent if this is not done). Revenues from carbon tax are returned via adjustments to personal and corporate taxes as well as credits and lump-sum transfers. Successive increases in the tax necessitated further cuts to achieve revenue neutrality, thus specific tax credits have been added over the years (Harrison 2012). Tax reductions for the 2012/13 include: - A 5 per cent reduction in personal income tax rates for the first two tax brackets; - A low income tax credit of CAD 100 per adult and CAD 30 per child;		

	- A Northern and Rural Homeowner Benefit; - Seniors' Home Renovation Tax Credit, - Children's Fitness Credit and Children's Arts Credit; - Increase in the small business venture capital tax credit, - Training tax credits for individuals, - A 2 per cent reduction in the corporate income tax rate and in the small business tax rate; - The industrial school property tax credit; - 50 per cent reduction in school property tax for land classified as 'farm'; - Increase in corporate income tax small business threshold; - Industrial school property tax credit; - Interactive digital media tax credit; - Training tax credit for businesses; and - A one-time Climate Action Dividend of CAD 100 per adult in 2008 in the form of a direct payment. (Harrison 2012 and British Columbia Ministry of Finance 2013) Although the carbon tax aimed to be revenue neutral, tax cuts and credits by the provincial government have exceeded revenues generated from the carbon tax, making the tax 'revenue negative' (Lee 2011). For example in 2011-12, expenditures exceeded revenues from the carbon tax by CAD 182 million while in 2012-2013, expenditures are expected to exceed revenue from the carbon tax by CAD 203 million (British Columbia Ministry of Finance 2013). The threat to the Minister's salary creates an incentive to err on side of tax cuts; moreover revenues from the carbon tax revenues have been lower than anticipated (Harrison 2012).
Future developments in ETR	In 2012, the government launched a review of the impact of the carbon tax on BC as part of the Budget 2013 process. The review concluded that carbon tax rates will not be increased but will be maintained at CAD 30 per tonne of CO2e. Moreover it was decided not to expand the tax base nor broaden it to include industrial process or other non-combustion emissions. It was considered that maintaining the current rates and base will help to ensure BC does not substantially diverge from policies in competing jurisdictions. It was noted that when other jurisdictions, especially those within North America, introduce similar carbon taxes or carbon pricing, the BC government may review and consider changes to the carbon tax (British Columbia Ministry of Finance 2013). Some exemptions were approved as part of the Budget 2013 including the provision of a carbon tax relief grant for commercial greenhouse vegetable and floriculture growers from 2013 which will be set at 80 per cent of the carbon tax paid on specified fuels. The government will also introduce legislation in autumn 2013 to provide a carbon tax exemption for farmers for the purchase of coloured motor fuel for use in farm equipment such as tractors and fuel used in eligible farm vehicles (fuel is considered to be 'red' when it is used for certain purposes including in forestry, mining, farm and other business equipment). These measures are expected to provide a combined benefit of about CAD 11 million annually (British Columbia Ministry of Finance 2013). The government also notes that when other jurisdictions, particularly in North America, introduce similar carbon taxes or carbon pricing mechanisms, the BC

	government may review the tax again and consider changes to it (British Columbia Ministry of Finance 2013). A future increase in the carbon tax is however likely to require a partial tax exemption for trade-exposed industries or support to help them move away from GHG emitting technologies and fuels (Jaccard 2012).
Interactions with other policies	
Compatibility with EU ETS	N/A - however the carbon tax is expected to be integrated with complementary measures such as a cap and trade system (which was expected to be developed among members of the Western Climate Change Initiative) as these measures are designed and implemented (British Columbia Ministry of Finance 2013a). It is not clear how the carbon tax would interact with any future trading system however the ETS is expected to cover non-combustion sources exempt from the carbon tax (Harrison 2012). Another option is for large industry and perhaps fossil fuel energy products to be covered under the ETS while the rest of the economy remains under the domestic carbon tax (Jaccard 2012).
Revised EU Energy Tax Directive 2003/96/EC	N/A
County context	
GDP	Of Canada in 2010: USD 1 327.3 billion curr. PPPs (OECD 2012) Of BC in 2010: CAD 167.1 billion (in 2002 chain-weighted $) and estimated to be in 2011 170.5 billion (in 2002 chain-weighted $) (British Columbia Ministry of Finance 2012)
Total primary energy supply	Of Canada: 255.3 in million tonnes of oil equivalent (Mtoe) (2010 figures) (OECD 2012)
Energy intensity (TPES per unit of GDP)	Of Canada: 0.24 (TPES per unit of GDP) in Toe per '000 USD (2010 figures) (OECD 2012)
Electricity generation by fuel	*Figures for Canada:* Electricity generation from coal and peat (per cent of total) 2010 figures: 1.83 Electricity generation from oil (per cent of total) 2010 figures: 1.19 Electricity generation from natural gas (per cent of total) 2010 figures: 1.94 Electricity generation from nuclear energy (per cent of total) 2010 figures: 38.94 Electricity generation from hydro energy (per cent of total) 2010 figures: 44.71 (IEA 2012) It is worth noting that British Columbia's electricity supply is predominantly a hydroelectric generation system (accounting for 86.3 per cent of the 2009 estimated five-year average electricity supply), and that over 90 per cent of electricity generation is from renewable sources (British Columbia Ministry of Energy, Mines, and Natural Gas, 2013).
Economic structure	Of Canada: Real value added of industry (15.3 per cent in 2010); agriculture, forestry, fishing (-0.8 per cent in 2010); services (0.8 per cent).
Demand elasticities	A study on the salience of the carbon tax and gasoline demand found that the point estimate on the carbon tax equals -0.0210 which, for a carbon tax of CAD 25 tCO2e, implies a 10.6 per cent decrease in gasoline demand. An equivalent

	increase in the market price of gasoline predicts a 2.2 per cent reduction in demand (the coefficient equals -0.0043). Thus, the carbon tax generated a demand response 4.9 times greater than an equivalent increase in market prices (Rivers and Schaufele 2012).
Key environmental impacts	
Nature and degree of impacts on the environment	Fossil fuel sales in the province have decreased since the carbon tax was implemented for all of the main fuel types – the decrease was greater than that experienced in the rest of the country and as such cannot be explained by the recession or global oil prices alone (British Columbia Ministry of the Environment 2012). A 2012 assessment of the carbon tax shows that it has been effective as BC's petroleum fuel consumption per person dropped by 15.1 per cent from 2008-2011 and declined by 16.4 per cent more than the rest of Canada. From 2000-2007, per capita fuel consumption in BC declined by 2 per cent more than in the rest of Canada annually; whereas from 2008-12, it declined by 5.6 per cent more than in the rest of Canada. BC's fuel consumption per unit of GDP has also dropped by 16.7 per cent compared to the rest of Canada since 2008 (Sustainable Prosperity 2012) - see Figure 1. The tax is also considered to have helped reduce gasoline consumption and prompt efforts to conserve energy by consumers - since 2008, per capita gasoline use in BC declined by 7.3 per cent more than in the rest of Canada (Sustainable Prosperity 2012). Figure 1: Sales of refined petroleum products subject to BC carbon tax, per capita  Source: Sustainable Prosperity 2012 Although it is not possible to definitively conclude that this change in behaviour in fuel consumption is the result of the carbon tax or indeed of other climate policies in the province, the divergence in average behaviour and indicators across so many of the fuels and sectors covered by the carbon tax 'does suggest that the carbon tax may be starting to provide the broad structural incentive in the economy that was intended' (British Columbia Ministry of the Environment 2012). According to the BC government, emissions in BC went down by 4.5 per cent from 2007-2010, while GDP growth through 2011 was above the Canadian

	average (British Columbia Ministry of the Environment 2012). From 2008 to 2010, BC's per capita GHG emissions declined by 9.9 per cent, which outpaced the reductions in the rest of Canada by more than 5 per cent (Sustainable Prosperity 2012). According to another estimate, over the first four years of the policy, the carbon tax led to a total reduction in emissions of over 3 million tCO2e when compared with a counterfactual scenario of no tax (Rivers and Schaufele 2012). Although it is difficult to assess how much of this decline was due to the carbon tax as BC's GHG emissions were already declining relative to the rest of Canada prior to 2008, the reductions are consistent with expected effects of a carbon tax and are in line with the reductions seen in fuel use during 2008-11 (Sustainable Prosperity 2012).
Key social impacts	
Impacts on income distribution	According to Lee (2011), the impact of the tax on lower-income households was initially fully offset by corresponding tax cuts and credits. However successive increases in the tax rate have not been matched by sufficient increases in the low income tax credit and this has resulted in an increasingly regressive carbon tax regime. For example, in 2010, households in the bottom 10 per cent would pay 1.3 per cent of their income in carbon tax, whereas households in the top 10 per cent would pay only 0.3 per cent, and the top 1 per cent would pay 0.2 per cent. This regressive pattern worsened as the carbon tax rose between 2010 and 2012. When taking tax cuts and credits returned to households into account, the top 10 per cent, on average, receive more in tax cuts and credits than paid in carbon tax and the top 1 per cent receive a net benefit of 1 per cent of income in 2010, growing to just over 2 per cent in 2012 (Lee 2011).
Unintended social impacts	None identified in literature
Key economic impacts	
Administrative cost	The carbon tax is applied and collected in essentially the same way that motor fuel taxes are applied and collected (with the exception of natural gas which is collected at the retail level). This minimizes the administrative cost to the government and the compliance cost to those collecting the tax on the government's behalf (British Columbia Ministry of Finance 2013a).
Impacts on competition, employment, growth, innovation	According to a recent assessment, BC's economy has outperformed the rest of the country over the period that the carbon tax has been in place. Although the carbon tax is one of many factors affecting the overall economic picture and 'while it would be a stretch to claim that the tax shift has had a positive impact on the economy, the data appear to indicate it has not had a negative effect' (Sustainable Prosperity 2012). Although the 2012 government review of the carbon tax concluded that the carbon tax at current rates has not had a significant impact on BC's overall economic performance; a number of sectors expressed concerns about the impact of the carbon tax on their competitiveness (British Columbia Ministry of Finance 2013). Economic analysis conducted for the BC government's review of the carbon tax indicates that the carbon tax has had, and will continue to have, a small negative impact on GDP in the province. The government concludes that increasing the carbon tax beyond the current CAD 30 per ton of CO2 or expanding the base to include industrial process emissions would increase costs

	for BC businesses and have a stronger negative effect on economic growth. The government's analysis also indicates that the economic impact of the carbon tax varies by industry with some industries (e.g. cement production, petroleum refining, oil and gas extraction and some other manufacturing subsectors with high emission intensities) more impacted than others (British Columbia Ministry of Finance 2013).
Unintended economic impacts	BC has attracted green investment and green technologies at twice the Canadian average adoption of hybrid vehicles, 20 per cent of all Canadian LEED gold building registrations since 2007, and a 48 per cent increase in clean technology industry sales from 2008-10 (British Columbia Ministry of the Environment 2012). Moreover, the carbon tax has had a significant impact on the capital project decisions of local government officials (Harrison 2012). Furthermore, as a result of the corresponding tax cuts, BC now has the lowest income tax rates in Canada for people earning up to CAD120,000 and a general corporate income tax rate which is among the lowest in North America and G7 nations (British Columbia Ministry of Finance 2013a).

References

British Columbia Ministry of Finance, (2013), Budget and Fiscal plan 2013-2014 – 2015-2016, February 2013, http://www.bcbudget.gov.bc.ca/2013/bfp/2013_Budget_Fiscal_Plan.pdf#TaxMeasures [accessed 3/3/3013]

British Columbia Ministry of Finance (2013a), Carbon tax review and carbon tax overview, http://www.fin.gov.bc.ca/tbs/tp/climate/carbon_tax.htm [accessed 3/3/2013]

British Columbia Ministry of Finance (2013b), Estimates Fiscal Year Ending March 31, 2013, http://www.bcbudget.gov.bc.ca/2012/estimates/2012_Estimates.pdf [accessed 22/4/2013]

British Columbia Ministry of Finance (2012) Budget and Fiscal Plan 2012/13 – 2014/15, http://www.bcbudget.gov.bc.ca/2012/bfp/2012_Budget_Fiscal_Plan.pdf [accessed 19/6/2013]

British Columbia Ministry of Energy, Mines and Natural Gas, also responsible for Housing, http://www.empr.gov.bc.ca/EPD/Electricity/supply/Pages/default.aspx [accessed 4/3/2013]

British Columbia Ministry of the Environment (2012) Making Progress on B.C.'s Climate Action Plan http://www.env.gov.bc.ca/cas/pdfs/2012-Progress-to-Targets.pdf [accessed 4/3/2013]

Harrison, K., (2012) The political economy of British Columbia's carbon tax, Centre for Tax Policy and Administration, Environment Directorate, OECD, COM/ENV/EPOC/CTPA/CFA(2012)42

Jaccard, M., (2012) The political acceptability of carbon taxes: lessons from British Columbia in Milne, J., and Skou Anderson, M., (eds.) (2012) Handbook of Research on Environmental Taxation, Edward Elgar Publishing: Cheltenham UK and Northampton, MA, USA

Lee, M., (2011) Fair and effective carbon pricing: Lessons from BC, February 2011, CCPA–BC and Sierra Club BC, http://www.ldlc.on.ca/uploads/2/7/8/8/2788943/ccpa-bc_fair_effective_carbon_full_2.pdf [accessed 4/3/2013]

Rivers, N., and Schaufele, B., (2012), Carbon Tax Salience and Gasoline Demand

Speck, S., (2013) 'Carbon taxation – two decades of experience and future prospects', *Carbon Management*, April 2013 (forthcoming)

Sustainable Prosperity (2012) British Columbia's carbon tax shift: The first four years , June 2012, University of Ottawa

1.3 Carbon and energy tax reforms in Denmark

Summary
Denmark is often considered one of the leading countries in implementing ETR. An energy tax on fossil fuels (oil products, coal and electricity consumption) was introduced in 1977 as a response to the crisis in the 1970s. The CO_2 tax was introduced in two phases: in May 1992 it was applied to energy products consumed by households and in January 1993 it was extended to businesses (Speck and Jilkova, 2009). The Danish energy and carbon taxes were increased throughout the 1990s, but this changed at the beginning of the 2000s: The nominal tax rates were frozen from 2002 to 2007 and only in 2008 can a slight increase be reported. In 2012 the CO_2 tax rate was EUR 21.3 per tonne of CO_2 and energy tax rates are now indexed to inflation (Speck and Jilkova, 2009, Speck, 2012, OECD, 2012). The energy tax system currently in place consists of the following three types of taxation: • An Energy Tax on bottled gas, fuel oil, gas oil, coal, electricity and natural gas (DEPA 1999); • A CO2 tax on oil, coal, gas and electricity, where the rate for different fuels is determined according to their CO2 content; • A SO2 tax on all fuels containing sulphur which are used by households and industry. In 1996, the level of CO2 tax reimbursements to industry was lowered and reimbursements were conditioned on the conclusion of voluntary energy efficiency agreements between companies and the Danish Energy Agency.

Objectives and design	
Goals and objectives of the tax	Danish energy taxes on the consumption of mineral oils, gas, coal and electricity were originally introduced in 1977 mainly for revenue raising purposes (to reduce the soaring deficit in the National balance of Payments), but also in response to the oil crisis in the 1970s, to promote energy savings and to provide an incentive to substitute away from oil to other energy sources (DEPA 1999). The energy taxes were raised considerably in 1986 - again primarily for fiscal reasons, spurred by a drop in world fuel prices (UCD, 2008). In the 1994-1998 period, the ETR's objective was to reduce the marginal tax rates levied on personal income; this was achieved primarily by increasing energy tax rates rather than CO2 tax rates (Jensen, 2001 in Speck, 2012) but also the introduction of new taxes (e.g. energy tax on natural gas, SO2 tax). The launch of the CO2 tax aimed to encourage energy efficiency and switching towards fuels with less CO2 content. The CO_2 tax introduced in context of meeting objective to reduce CO2 emissions by 25 per cent by 2005 compared to 1990 levels (Barde, 2004). The SO2 tax was part of the 1995 tax reform was introduced in the context of the UNECE Convention on Long Range Trans-boundary Air Pollution, CLRTAP to attain a national emission ceiling of 90,000 tonnes SO2 in 2000.
Wider ETR context	ETR in Denmark is rather comprehensive and has been implemented in **three phases** (Speck and Jilkova, 2009): **First phase (1994-8)** targeted mainly at the household sector. The political objective was to reduce marginal tax rates levied on personal income. The revenue losses following the income tax rate reduction amounting to approximately 2.3 per cent of GDP in 1998 were partly offset by increasing

	revenues from environmental taxes amounting to an expected 1.2 per cent of GDP and payroll taxes amounting to around 1 per cent of GDP (Speck and Jilkova, 2009). In addition to a **CO2 tax** other environment taxes were introduced including a tax on tap water, wastewater tax, tax on plastic and paper bags. **During the second phase (1996-2000)** the main sector affected was industry**.** Revenues raised through increased environmental taxes (primarily increasing energy tax rates but also via the introduction of a sulphur tax and an energy tax on natural gas) were used to reduce employers social security contributions. The level of CO2 tax reimbursements to industry was lowered and reimbursements were conditioned on the conclusion of voluntary energy efficiency agreements between companies and the Danish Energy Agency. **The third phase (1999-2002)** saw a further increase in environmental taxes to reduce personal income tax rates and taxes levied on the yield of pension savings and share yields. Energy taxes were increased In 1998 as part of an overall fiscal move to dampen an overheated economy (UCD, 2008). In 2001, the Danish government committed to a "tax freeze" which prohibited any kind of tax increase, unless strictly necessary for environmental reasons or to respect EU obligations. However in 2010, the Ministry of Taxation announced a range of energy and environmental tax increases - see section on future of ETR. Over the past decade, Denmark has had the goal of meeting the emission reduction targets under the Kyoto Protocol and the EU Burden Sharing Agreement in a cost-effective way. It set itself an ambitious target of cutting emissions by 21 per cent over 2008-12 relative to 1990 levels and called for new measures including the introduction of a cap-and-trade system which was introduced for electricity generation in 2001, with a free allocation of permits based on firms' past emissions and provisions for banking. The system was extended in 2003 and replaced in 2005 by the EU ETS. Another measure included the harmonisation and increase in the carbon tax rate. Differences in rates across industries were reduced in 2005 and abolished in 2008 (Table 1). More recently, the government announced a target to reduce GHG emissions by 40 per cent in 2020 from the 1990 base, which is, with Norway, the largest reduction pledged by a developed country. This comes on top of Denmark's commitment to reducing GHG emissions in sectors outside the EU ETS by 20 per cent by 2020 as part of its obligations under the 2008 EU climate and energy package. In addition to this commitment, the government has announced its intention to phase-out fossil fuels by 2050 without the use of nuclear energy and reached an agreement to have 50 per cent of electricity consumption from wind power by 2020 (Jamet, 2012).
How the taxable base is defined	The **Energy Tax** is levied on all fossil fuels (bottled gas, fuel oil, gas oil, coal, natural gas) and electricity (DEPA 1999, OECD, 2013). The tax rates applied vary according to the energy content of each fossil fuel and are indexed to inflation. Fuels used for electricity production are not liable to the tax; there is instead a tax on the output (i.e. electricity). Consequently, the tax in itself does not provide an incentive to shift to less polluting fuels in electricity production. The motivation for taxing electricity rather than the fuels applied in electricity

production is mainly related to concerns over competitiveness (DEPA 1999, pp56). The energy taxes initially mainly affect households but this changed with the second ETR which extended energy taxation to industry.

The **CO2-tax** applies to oil, coal, gas and electricity, where the rate for different fuels is determined according to their CO2-content. Since 1995, companies also started to pay CO2 taxes, depending on the process the energy is used for. In most cases, rates between households and industry differ although energy used for heating purposes in businesses are subject to the same tax rate as households, (see section on exemptions below). This approach of setting different rates for businesses versus households had more to do with political issues than economic ones, as it was seen as a political necessity in a small country with high export ratios in industries regarded as trade sensitive (Andersen, 2005).

Thus, while the energy and CO2-taxes cover all energy consumption (oil, gas, coal and electricity) they are not charged for certain applications such as energy products used for electricity production, air and sea transport, public transport (trains and boats) and abroad, including the extraction of oil from the North Sea.

The table below shows energy and CO2 taxes on various fuels, presented in Euro to facilitate interpretation. Note that if the tax rates had been expressed in Danish Krone (DKK), it would be clear that the rates have not increased since 2002, and in real terms the rates are slightly lower than they were in 2002 (Nordic Council, 2006).

Table 1: Total Tax Burden of different energy sources

		1985	1990	1996	2000	2002	2005
Light fuel oil (euro cent/l)	energy tax	4.61	22.4	20.25	23.21	24.63	25
	CO_2 tax	4.61	22.4	3.67	3.63	3.23	3.23
	Total tax			23.92	26.83	28.26	28.23
Heavy fuel oil (euro cent/kg)	energy tax	5.11	25.2	22.56	26.16	27.72	28.09
	CO_2 tax	5.11	25.2	4.35	4.29	4.31	3.9
	Total tax			26.9	30.45	32.03	31.99
Natural Gas (euro cent/nm^3)	energy tax			0.14	21.47	27.19	27.42
	CO_2 tax			2.99	2.95	2.96	2.69
	Total tax			3.13	24.42	30.15	30.11
Pit Coal (euro cent/kg)	energy tax	1.62	9.8	11.69	17.44	19.25	19.49
	CO_2 tax	1.62	9.8	3.26	3.22	3.23	2.96
	Total tax			14.95	20.66	22.47	22.45

Source: Speck et al, 2006

The above table reflects that while Danish energy taxes increased importantly between 1985 and 1990 and energy and carbon taxes also increased throughout the 1990s this changed at the beginning of the 2000s. The nominal tax rates were frozen during the period 2002 to 2007, leading to a reduction in the real value of energy and CO2 tax rates. As a result, by 2006, tax rates in real terms were slightly lower than in 2002 (Speck et al, 2006).

The SO2 tax also applies to households and industry, on all fuels containing sulphur. The rate depends on the SO2-content of the fuels or the net SO2 -

	emission on combustion. The rate is either EUR2.7 per kg. sulphur or EUR 1.35 per kg. SO2 (DEPA 1999: 93-94).
The tax rate applied	In the second phase of the ETR the industrial energy taxation scheme was overhauled. Energy tax rates increased in the late 1990s and total taxation (including VAT) amounts to about two thirds of the consumer price (DEPA, 1999). The rate for energy used for other purposes than motor fuel was approximately EUR 6.85 per GJ. Industrial energy consumption was subdivided into three components: space heating, light processes, and heavy processes. The rationale behind this reform was that industry should, in part, face the same energy tax rates as households. Industry had the same tax burden as households for energy used for space heating; that is, industry paid the full energy tax as well as the full CO2 tax. However, energy used for activities other than space heating was still fully exempt from energy tax and a reduced CO2 tax rate applied, differentiated according to actual purpose. In the third phase of the ETR the tax on petrol, light fuel oil, and heavy fuel oil was raised by 5-7 per cent, the tax on diesel by 16 per cent, coal by 12 per cent, electricity by 15 per cent, and natural gas by 33 per cent (Speck and Jilkova, 2009). From 2008, energy taxes have been indexed to inflation (Danish Ministry of Taxation, 2009). When the CO2 tax was introduced in 1992 the standard tax rate was set at approximately EUR 13 per tonne of CO2. This standard CO2 tax rate was applied between 1992 and 1999. The "tax freeze" from 2001 onwards meant that the burden of energy taxes (including CO2- and SO2-taxes) gradually fell with inflation (UCD, 2008). In 2005, the CO2 tax rate was lowered to 90DKK (EUR12) per ton CO2 emissions and to maintain the overall tax burden, the energy tax was increased accordingly (Nordic Council, 2006). The rate was raised to €20 per tonne of CO2 in 2008, which was the expected carbon price in the EU ETS. Since then, the carbon tax rate has been increased by 1.8 per cent each year (Jamet 2012). As of 2012, the CO2 tax rate was EUR 21.3 per tonne of CO2 and applies to emissions from households and industry which are not covered by the EU ETS (OECD, 2012) As shown in the table below, the actual effective tax rate for industry was considerable lower than for households, and lower still when there were voluntary agreements in place. **Table 2: Tax burdens by sector (EUR/tonnes of CO2 equivalent, nominal)**

		1993	1996	2000-04	2005	2008	2011
Households (basic rate)		13.17	13.59	13.4	12.10	20	21.3
Light Industry	Heating (basic rate)	13.17	13.59	13.4	12.1	20	21.3
	With Agreement*		6.79	9.12	9.15	20	21.3
	Without Agreement	6.58	6.79	12.07	12.11	20	21.3
Heavy Industry/	With Agreement		0.41	0.40	0.40	20	21.3

Energy intensive processes	Without Agreement	0.66	0.68	3.35	3.36	20	21.3

Source: Speck et al., 2006, Jamet, 2012
*see section on exemptions below

Implementation

Specific measures and/or derogations

In the 1970s, **energy taxes** only covered households and non-VAT-registered businesses (including public bodies). In order to preserve international competitiveness and employment, energy taxes paid by VAT-registered businesses were fully reimbursed (except for petrol used in passenger cars). In order to promote its use, natural gas was not included in the early energy tax schemes (UCD, 2008). Similarly pure biomass is not taxed in order to promote the use of renewable energy (DEPA, 1999).

Industry was not subject to any taxes levied on energy products until the introduction of the CO2 tax in 1992 although when the **CO2 tax** was introduced in 1992 it was still accompanied by the granting of special tax provisions to industry. During the period 1993-1995, industry was granted a 50 per cent reduction in the CO2 tax rate (Speck and Jilkova, 2009, 2009, Speck, 2012). In addition energy intensive industries were eligible for a special CO2 tax refund scheme according to the CO2 tax liability measured with respect to value added (Nordic Council of Ministers, 1994). Thus, a three-tiered reimbursement scheme granting further tax relief according to the energy intensity of each business was put in place. The refund scheme was differentiated based on actual energy costs paid and in relation to total sales (Malaska et al, 1997, Speck and Jilkova, 2009):

- If the CO2 tax burden was between 1 and 2 per cent of the difference between sales and purchases (i.e. net sales), the company was eligible for a tax refund of 50 per cent of the sum exceeding the 1 per cent limit.
- If the CO2 tax burden was between 2 and 3 per cent of the difference, the tax refund amounted to 75 per cent of the sum exceeding the 2 per cent limit.
- If the CO2 tax burden was above 3 per cent of the difference, the tax refund was 90 per cent of the sum exceeding the 3 per cent limit. Companies falling under the 90 per cent refund scheme could receive additional tax support covering the remaining part of the CO2 tax burden. However, this support was limited to three years and the company had to pay at least DKK 10,000 (EUR 1,320) in CO2 tax.

Electricity consumption in manufacturing industry is subject to a number of special tax provisions (unless the use is for specific heating purposes, e.g. radiators or water heaters (UCD, 2008).

From 1996 the industrial energy taxation scheme was overhauled and companies started paying CO2 taxes which varied according to usage. Industrial energy consumption was subdivided into three components: space heating, light processes and heavy processes. The rationale behind this reform was that industry should, in part, face the same energy tax rates as households (Speck and Jilkova, 2009). Companies started to pay CO2 taxes depending on the process energy is used for and the energy tax base was expanded to cover business use of energy for "household type" purposes (Speck 2012). Industry had the same tax burden as households for energy used for space heating; that is, industry paid the

full energy tax as well as the full CO2 tax. However, energy used for activities other than space heating was still fully exempt from the energy tax and a reduced CO2 tax rate applied according to actual purpose - energy used for process purposes, differentiating between heavy and light processes, were generally exempt from any energy taxation (Speck and Jilkova, 2009).

In 1996, the level of CO2 tax reimbursements was lowered and reimbursements were conditioned on the conclusion of voluntary energy efficiency agreements between companies and the Danish Energy Agency in which companies commit to investments in certain measures to improve energy efficiency[1]. Except for energy used for space heating, all energy-intensive industries are entitled to a considerable reduction in the CO2 tax in return for entering into voluntary agreements on energy efficiency with the Danish Energy Agency. Thus, energy used for light or heavy processes which are categorized in a list of energy-intensive processes is eligible for extensive CO2 tax rate reductions (Speck et al., 2009). Starting in 1996 natural gas was also included in the energy and CO2-tax bases. Biofuels are still not taxed, as they are regarded as emission neutral on a lifecycle basis.

Since 2001, the list of energy intensive processes eligible for the highest level of reimbursement has been extended and a new full refund for CO2-taxes paid for energy used for heating purposes in plants covered by the EU ETS is in place. The CO2-tax is partly refunded (75 per cent of the CO2-tax paid) for energy used for heavy energy intensive process purposes. "Heavy processes" are defined in a special appendix to the law. To be included on the list a CO2 tax rate of EUR 6.7 on the energy consumption of a particular process should not result in a tax that exceeds 3 per cent of the value added or 1 per cent of the turnover. In addition, competitiveness issues and concerns about administration and control play an important role in the decision whether or not to include the process on the "heavy process" list (UCD, 2008).

Table 1: Business CO_2- and energy tax refunds

Energy used for:	
(a) heat production, space and water heating/no agreement	No refunds
(b) space and water heating/with agreement	22 per cent of energy and CO2-taxes
(c) process use/no agreement	100 per cent of energy taxes
(d) process use/with agreement	Around 24,4 per cent of CO2-taxes +

[1] The Danish scheme on voluntary agreements (VAs) on energy efficiency in industry was launched in 1996 with the aim to encourage energy efficiency in industry so as to reduce CO2 emissions and maintain the competitiveness of Danish industry. The agreement scheme mainly targets energy-intensive industries that have the option to enter into VAs with the Danish Energy Authority (DEA). Under the VAs, companies commit to undertaking a number of tasks promoting energy efficiency. In return the companies obtain a CO2 tax rebate. The VAs are signed for a three-year period. Companies can enter them either individually (individual agreements) or as a group, typically an industrial sub-sector (collective agreements). The VA scheme has been evaluated and revised several times over the years (Ericsson, 2006). Evaluations by the DEA show that the VA scheme has reduced energy use in participating companies and led to an estimated CO2 emission reduction of 6% over 1996-2005. The majority of the CO_2 emission reductions (60 per cent) are assumed to be a result of implementing and maintaining an EMS (Ericsson 2006). Continuous evaluations and revisions of the scheme and a strong relationship between the DEA and industry have helped to improve its efficiency and relevance (Ericsson 2006).

	100 per cent of energy taxes
(e) heavy process use/no agreement	Around 72,2 per cent of CO2-taxes + 100 per cent of energy taxes
(f) heavy process use/with agreement	Around 96,7 per cent of CO2-taxes + 100 per cent of energy taxes

Source: Nordic Council, 2006, in UCD, 2008

Eurostat (2012) notes the following exemptions from the CO2 tax:
Fuels:

- Fuels used for processes comprised by ETS
- Mineral oil etc.: Oil and gas used for fishing vessels, vessels in foreign trade and transport of passengers or goods by ferry.
- Jet fuel etc. for aircrafts for business purposes.
- Fuels produced and consumed at refineries.
- Coal etc. used in steamships and trains.
- Gasoline for technical purposes other than motor operation.
- Goods exported.
- Goods consumed by diplomatic services and international organisations.

Electricity:

- Enterprises using electricity for energy intensive processes (heavy processes on a list) are partly exempt from paying the tax on electricity.
- Electricity produced in plants with a capacity less than 150 kW.
- Electricity produced in emergency generators.
- Electricity produced and consumed in vehicles.
- Electricity produced by wind or water or the sun etc. and consumed by the producer. In some cases special conditions must be fulfilled.
- Electricity exported.
- Electricity consumed by diplomatic services and international organisations.

Revenues from the taxes

Tax revenues generated from energy taxes account for the largest share of all environmental taxes in Demark. The result of the first phase ETR (1994-8) were revenues from increased energy taxes accounting for 7.5 billion DKK (1 billion EUR) of the projected 12 billion DKK (1.6 billion EUR) generated from environmental taxes (Speck and Jilkova, 2009).

The size of the tax shift programme in the phase 2 ETR (1996-2000) was smaller than in the first phase as revenues generated from environmental taxes were projected to amount to 2.45 billion DKK (330 million EUR) – approx. 0.2 per cent of GDP in 2000 (Speck and Jilkova, 2009).

The size of the tax shift programme in the phase 3 ETR (1999-2002) was planned to be in the range of around 6.4 billion DKK (850 million EUR) over the period 1999-2002, amounting to approximately 0.3 per cent of GDP in 2002 (Speck and Jilkova, 2009).

Table: Tax revenues from energy taxes in Denmark 2000-2011

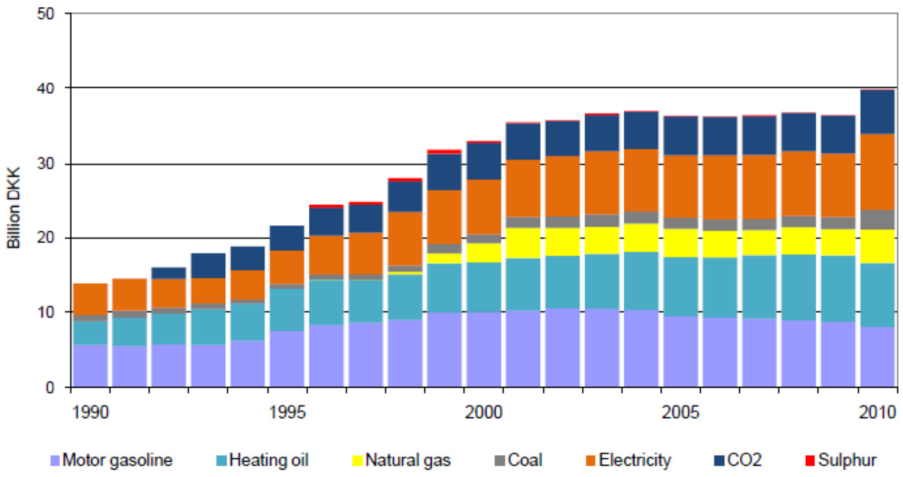
Year	Annual tax revenue (millions)	Currency	Tax revenue as % of GDP	Tax revenue as % of total tax revenue

2011	42,039.98	DKK	2.35	4.92
2010	40,038.94	DKK	2.27	4.79
2009	36,440.89	DKK	2.19	4.58
2008	36,790.73	DKK	2.10	4.39
2007	36,409.44	DKK	2.15	4.39
2006	36,281.88	DKK	2.22	4.48
2005	36,370.29	DKK	2.35	4.63
2004	36,999.38	DKK	2.52	5.14
2003	36,653.82	DKK	2.62	5.44
2002	35,789.48	DKK	2.61	5.44
2001	35,507.38	DKK	2.66	5.48
2000	32,987.23	DKK	2.55	5.16

Source: Eurostat (2013a) "Taxes in Europe" database

In 2011, energy taxes amounted to about DKK 42 billion (about EUR 5,6 billion), i.e. accounted for 4.9% of total tax revenues in Denmark. Energy represented a share of environmental taxes of 57 per cent. Revenues are stated in prices for the relevant year and include taxes on CO2 and sulphur in addition to energy taxes. Since 1990, revenues have increased by 200%. Since 1990, revenues from taxes on motor gasoline, heating oil and electricity have gone up respectively by 37%, 205% and 177% (DEA, 2012). See figure below.

Figure 1: Revenues from energy, CO2, and sulphur taxes (2012 prices)



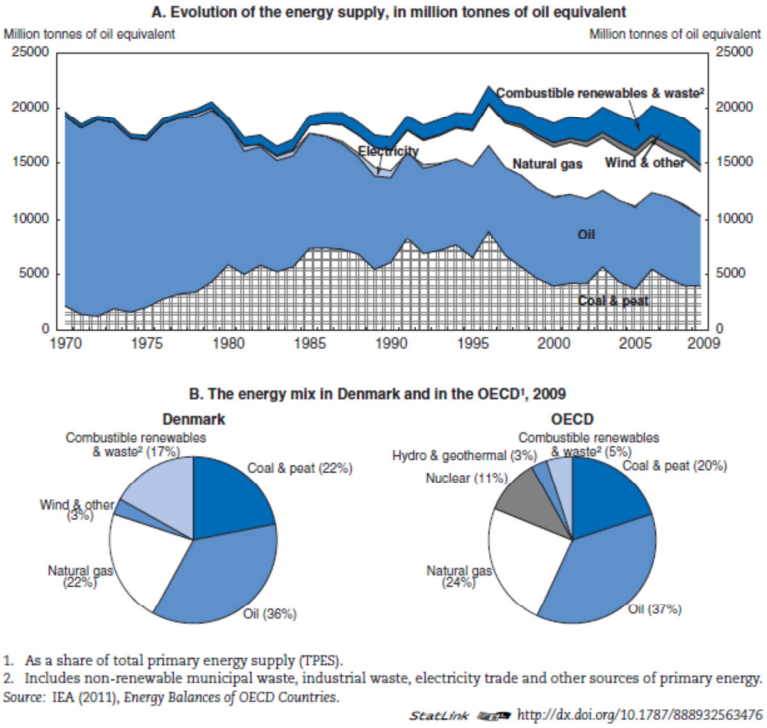
Source: (DEA, 2012)

In 2010, total environmental tax revenues (which include energy taxes) as a share of GDP represented 4.01 per cent. Thus, total energy tax revenues as a share of GDP represented almost 2.3 per cent (Eurostat). In 2008, the revenues from the CO2 tax were approximately EUR 650 million (Sumner et al, 2009).

Use of tax revenues	The revenue raised by increasing the energy taxes, as well as introducing the sulphur tax and energy tax on gas in the 1995 programme of tax shifts were used to reduce employers social security contributions and to provide subsidies for investment in energy efficiency programmes. More specifically, the additional revenues raised by raising energy taxes in the 1995 tax reform (ETR phase 2 which mostly affected industry), implemented during the period 1996-2000, were used to reduce employers' social security contributions and to provide subsidies for investment in energy efficiency programmes. The main recycling mechanisms adopted in relation to industry have been (Speck and Jilkova, 2009): (i) provision of investment grants for energy-saving measures; (ii) recycling of a fraction of the revenues to private enterprises comprising two elements: - a reduction in employers' contributions to the additional labour market pension fund amounting in 1996 to 1,325 DKK (177 EUR) per years, per employee, compared to 1,166 DKK (156 EUR) in 1995; - a reduction in employers' national insurance contributions according to the Act on Labour Market funds: contributions to be lowered by 0.11 percentage points in 1997, 0.27 in 1998, 0.32 in 1999, and 0.53 in 2000; (iii) establishment of a special fund for small and medium-sized enterprises. It is noteworthy that the recycling mechanisms implemented clearly reflected the contribution of the two different economic sectors. Industry and households received the amount which they were expected to be paying as a consequence of the reform process. Moreover, the personal income tax reduction in Denmark mainly affected those with lower and medium incomes and compensation for pensioners was also included. As mentioned above, the main revenue raising policy was to increase energy tax rates. This is in itself significant, however, because the industrial sector is not greatly affected by energy tax increases due to the special tax provisions that apply (Speck and Jilkova, 2009).
Future developments in ETR	In 2009, as part of the so-called Spring Package 2.0, the Government announced an increase in energy, transport and environmental taxes to support the government's energy and climate policy objectives. Total **energy taxes** are to be increased by nearly DKK 4 billion through a number of different measures (Danish Ministry of Taxation, 2009): • Increased energy taxation of businesses and households. In general energy taxes – except petrol and diesel – will be increased with around 15 per cent and energy taxes will be levied on business and industry at a rate of 15 DKK per GJ. • Continued yearly price indexation of energy taxes from 2015. • Uniform taxation of all heating from combined heat and power production. • Tax on air conditioning. • Tax on road lighting. • Tax on lubricants. • Reduction of thresholds in CO2 tax. • Tax on greenhouse gases (other than CO2). • Revenue from sale of CO2 quotas (ETS).

	As part of the tax reform a number of **environment taxes** will be introduced or increased. In total the revenue from these taxes are estimated to be over DKK 1 billion. Environment-related taxes to be introduced or increased include (Danish Ministry of Taxation, 2009): • Introduced road pricing for lorries. • Increased tax on cars without "particle filter". • Increased registration tax for taxies. • Increased tax on company cars. • Introduced annual tax on vans depending on fuel consumption standards. • Increased waste water tax by 50 per cent. • Increased tax on waste. • Reduced tax on retail packaging. • Increased tax on CFC gasses. Since 2010, taxes were increased on energy, waste water, packaging, driving. Further increases in environmental taxation are to be phased in between 2010 and 2019.
Interactions with other policies	
Compatibility with EU ETS	The CO2 tax applies to emissions from households and industry, which are not covered by the EU ETS (OECD, 2012) The carbon tax is not levied on fuels used by sectors subject to the EU ETS. As a general rule, fuels used for generation of power are therefore not taxed. However, a CO2 component is still levied on electricity consumption through the energy tax (OECD, 2013). The general structure of energy taxation was changed as of the beginning of 2010, with the aim of improving its interaction with the EU ETS. The aim of this reform was to ensure a similar carbon-related burden between ETS and non-ETS sectors and to avoid overlap between the Danish carbon tax and the EU ETS (OECD, 2013). To ensure some uniformity of abatement efforts between ETS and non ETS sectors as well as to identify additional cost-effective measures to meet the EU burden sharing target, a benchmark of €16 (DKK 120) per tonne of CO2eq. was set as a basis for implementing domestic measures outside the sectors covered by the EU ETS. This benchmark can be adjusted over time. The carbon tax coverage has been reviewed after the introduction of the EU ETS but some sectors are still taxed twice. This is the case for producers of district heating that are covered by the carbon tax regardless of whether they are inside or outside the EU ETS (Jamet, 2012). In order to take into account the free quotas given to firms covered by the ETS, a credit for the CO2 tax was granted to energy-intensive firms that are not subject to the ETS (small plants electricity producers or energy intensive production processes). According to the Ministry of Taxation (2009) from 2013, allocation of CO2 emission permits will no longer be free of charge, but the majority of permits will be sold on auctions and other GHG than CO2 are included in the CO2 tax base. The revenue from the auctioning of the permits will be used to finance the tax reform. More generally, the OECD (2012) points out that as long as the cap on emissions

	remains unchanged at the EU level, abatement from additional overlapping instruments in Denmark frees permits for higher emissions in other EU countries (OECD, 2012). The carbon tax is currently applied to fuels used for heat generation by combined heat-and-power plants and large district heating plants on top of the EU carbon price implying CO2 emission cuts exceeding what is cost effective. This double regulation makes energy from these plants more costly and hence moves energy consumption from the ETS to the non-ETS sector where coal is used, leading to more GHG emissions (Danish Economic Council, 2011). Exempting heat-and-power plants from the carbon tax while increasing taxes on coal, oil, and gas would reduce emissions in non-ETS sectors (Jamet, 2012).
County context	
GDP	219.3 billion USD (in 2010) (OECD 2012)
Total primary energy supply	19.7 million tonnes of oil equivalent (Mtoe) (2010) (OECD 2012)
Energy intensity (TPES per unit of GDP)	0.12 TPES per unit of GDP (2010 figures) (OECD 2012)
Electricity generation by fuel	Electricity generation from coal and peat: 43.77 per cent Electricity generation from oil: 1.93 per cent Electricity generation from natural gas: 20.39 per cent Electricity generation from nuclear energy: - Electricity generation from hydro: 0.05 per cent Electricity generation from other sources: 33.85 per cent * Includes geothermal, solar, biofuels, waste, tide, wave, ocean, wind and other fuel sources (IEA 2012)
Economic structure	Real value added of industry (2.7 per cent in 2010); agriculture, forestry, fishing (15.5 per cent in 2010); services (1.3 per cent) (OECD 2012)
Demand elasticities	A study (Bjorner and Jensen, 2002) estimating price elasticities of energy demand in Denmark found that the "elasticities strongly differ between pooled and company fixed effects estimation and that fixed effects should be used". The elasticity estimates also depend on the level of energy price. The average energy price elasticity is -0.44, and is lower for energy-intensive companies and higher for not energy intensive ones (with a range between -0.2 and -0.7).
Key environmental impacts	
Nature and degree of impacts on the environment	During the 1980s and 1990s, total energy consumption remained fairly constant. In the 1990s it increased by only 0.3 per cent p.a. (DEPA 1999). 'The various primary energy sources' share of the total energy supply however changed significantly. Denmark went from being almost totally dependent on imported oil, to a situation with a diversified energy supply and a position as a net exporter of oil. In the late 1990s the supply was based on oil (45 per cent), coal (26 per cent), natural gas (20 per cent), and renewables (9 per cent). Since the early 1990s, the share of coal and oil in total energy consumption has tended to decline and that of natural gas and renewables to rise but since 2000, the fall in the use of coal has stopped (OECD, 2012). Figure 1 below provides an overview of the Danish energy mix over time. **Figure 2: Evolution of the energy supply, in million tonnes of oil equivalent**



1. As a share of total primary energy supply (TPES).
2. Includes non-renewable municipal waste, industrial waste, electricity trade and other sources of primary energy.

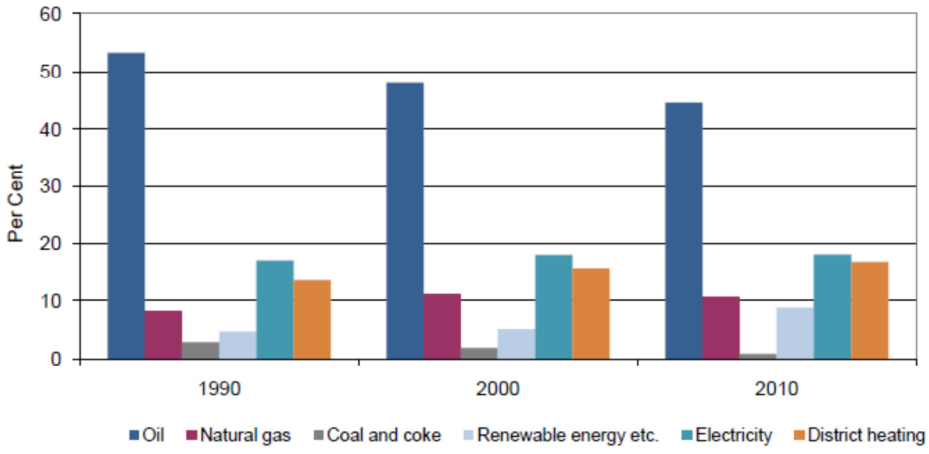
Source: IEA (2011), *Energy Balances of OECD Countries.*

StatLink http://dx.doi.org/10.1787/888932563476

In 2010, oil was still the dominant fuel in final energy consumption due to the development in the transport sector. The share of oil was 44.6% compared to 53.3% in 1990. Other important fuels in final energy consumption are electricity and district heating. In 2010, the shares of electricity and district heating were 18.1% and 16.8 respectively. The shares of natural gas and renewables & waste were 10.7% and 8.8% respectively.

Since 1990, final consumption of natural gas has increased by 35.4 %, while the consumption of electricity and district heating grew by 11.2% and 30.5%, respectively. Compared to 1990, consumption of renewable energy has almost 100 doubled (DEA, 2012).

Figure 3: Final energy consumption by fuel



Source: DEA, 2012

Since 1990, the energy efficiency has improved significantly in Denmark. A rough indicator for this is the development in the primary energy intensity which from

	1990 to 2010 has declined by 26.3%. The energy efficiency of final consumers (measured as a three-year moving average) improved by 20.2% from 1990 to 2010. The bottom-up index, referred to as ODEX, experienced a decrease from 111.2 in 1990 to 88.8 in 2010. All sectors have contributed to this significant improvement in energy efficiency. In the period 2000-2010, the energy efficiency has increased by 11.2%. Again, all sectors have contributed to the improvement. (Danish Energy Agency, 2012) Andersen (2004) notes that among the Nordic Countries, Denmark's scheme, which combines taxes with subsidies for energy efficiency, seems to have attained the most marked results, although the achieved reductions also reflect the higher carbon content of the Danish energy sector. Danish industry reduced its CO2 emissions by 25 per cent per produced unit in just seven years from 1993 to 2000 (Andersen, 2005). Danish GHG emissions (excluding emissions from Land Use, Land Use Change and Forestry – LULUCF) peaked in 1996 and have steadily declined thereafter, to just above 60 million tonnes in 2009, i.e. 10% below their 1990 levels. This GHG emission reduction is relatively high as emissions increased OECD-wide over the same period (Jamet, 2012). An ex-ante assessment expected that the tax might contribute around 5% of the 20% Denmark's CO2 reduction target of 20 per cent by 2005 (Infras and Ecologic, 2007). The Danish EPA estimates that total CO2 emissions were reduced by 13.5 million tonnes CO2 equivalent between 1990 and 2001 compared with a business-as-usual scenario (DEPA, 2005 in Speck et al., 2006), essentially a 24 per cent reduction. According to provisional estimates of CO2 emissions in the period 2008-2012 made by the Ministry of Climate, Energy and Building, Denmark is expected to outperform the Kyoto target and reduce GHG emissions by 21.5 per cent. An independent study later pointed in the same direction, concluding that business energy taxes have contributed to an overall reduction in energy consumption levels of 10 per cent over the period 1983-1997. Taken alone, the energy efficiency agreements led to a reduction in energy consumption of 9 per cent. The slightly higher effect on CO2 may be attributed to a (limited) substitution in the agreement companies from fuels with high CO2 emission to fuels with low CO2 emission (Bjørner and Jensen, 2002). Enevoldsen (2005) considers the impacts of the CO2 tax on emissions of the industry-sectors and compares the approach of the Danish CO2 tax with voluntary agreements in the Netherlands and concludes that the Danish earmarked CO2 taxes have been much more effective than the Dutch long-term agreements (Enevoldsen, 2005).
Key social impacts	
Impacts on income distribution	A study on the distributional consequences of environmental taxation in Denmark comes to the conclusion that that Danish CO2 taxes are regressive, and this result holds for direct as well as indirect CO2 tax payments (the latter resulting from price effects in the purchase of energy-intensive goods and services when CO2 taxes are imposed on industry). While both types of CO2 tax

	payments increase with disposable household income, they constitute a still smaller share of the budget as income increases. The CO2 taxes are found to be more regressive than the average Danish levy, including VAT taxes, and direct CO2 taxes are more regressive than the indirect CO2 taxes. The same regressive result holds, to a lesser extent however, when applying total household expenditure instead of disposable income. The social disparities of indirect environmental taxation on lower income groups were compensated through reductions in low-income taxation and an increase in child support (Wier et al. 2012). Ideas to rectify the socially adverse distributional effects of environmental taxation through regulatory design, e.g. the introduction of personal green allowances, have been discussed in Denmark. However, the administrative costs expected from maintaining progressive green tax systems have been seen as too high (Danish Ministry of Taxation, 2002 cited in Wier et al. 2012). A study by Jacobsen et al. 2001 found that energy taxes (which also include the CO2 tax) are regressive, however when total expenditure instead of disposable income is used as the basis of calculation, the regressivity of energy taxes nearly disappears.
Unintended social impacts	A Danish study (Wier et al., 2005) distinguishes between direct and indirect CO2 tax payments (the latter resulting from price effects in the purchase of energy-intensive goods and services when CO2 taxes are imposed on industry). It concludes that in Denmark, the higher direct tax burden on rural households is partly offset by their lower indirect tax payments. A net disadvantage for rural households remains but is fairly small (adding an additional 0.04 percentage points to the CO2 tax's share in disposable income). The distinction made by Wier et al. (2005) between direct and indirect CO2 taxation of households is also interesting in a broader sense. They conclude that the regressive effect of indirect CO2 taxation is generally less pronounced than the effect of direct CO2 taxation (EEA, 2011).
Key economic impacts	
Administrative cost	In Denmark, the administrative costs expected from maintaining progressivity directly in the green tax systems themselves have been seen as to high (Wier et al, 2012).
Impacts on competition, employment, growth, innovation	A comprehensive assessment of the CO2 tax was carried out by the Danish Ministry of Finance in 1999. The assessment illustrates that the tax has an overall positive impact on economic growth (additional burden vs. lower labour costs/social contributions), but that it became a minimal additional burden of 0, 03 per cent of GDP over the period 1990-1995. (Danish Ministry of Finance, 1999) The study by Infras and Ecologic (2007) suggest that the tax seems to have had a positive short-term effect (0.02% of GDP), followed slightly negative effect (-0.03%) five years after introduction (higher energy costs can no longer be compensated by short-term effect of lower supplementary wage costs). The 6FP COMETR study, was more positive, concluding that GDP impacts from the ETR were positive. In addition, the measures taken alongside the introduction of the CO2 tax (e.g. reduction of marginal tax rates levied on income) means that there were no

	negative effects on employment: The COMETR study estimates that the ETR contributed to a growth in employment by up to 0.5% (Andersen et al 2007). A major achievement of the Danish energy policy, in which the energy taxes play an important role, is that the traditional positive correlation between energy use and economic growth has been broken. In other words, economic growth is no longer accompanied by a corresponding increase in energy use' (DEPA 1999: 57).

References

Andersen, M.S. (2005) Do 'green' taxes work? Decoupling environmental pressures and economic growth. - Public Policy Research 12(2): 79-85.

Andersen, M.S., Dengsoe, N., Pedersen, A.B. (2001), An Evaluation of the Impact of Green Taxes in the Nordic Countries, Nordic Council of Ministers, TemaNord 2001:566, Copenhagen, Denmark.

Barde, J-P., (2004) Green tax reforms in OECD countries: An overview, OECD Environment Directorate, Il Taller Regional de Politica Fiscal y Medio Ambiente en America Latina y el Caribe, Santiago de Chile, 27 de deero de 2004

Bjørner, T.B. and Jensen, H.H. 2002. Energy Taxes, Voluntary Agreements and Investment Subsidies - a Micro-panel Analysis of the Effect on Danish Industrial Companies' Energy Demand. Resource and Energy Economics, 24, pp. 229-49.

CIA World Fact book (2013) Denmark Country profile (Economy – GDP Composition by Sector), URL: https://www.cia.gov/library/publications/the-world-factbook/geos/da.html

Danish Economic Council (2011), Economy and Environment 2011, May.

Danish Energy Agency (2012) Energy Efficiency Policies and Measures in Denmark – Monitoring of Energy Efficiency in EU 27, Denmark (ODYSSEE-MURE), URL: www.ens.dk/en-US/Info/FactsAndFigures/Energy_statistics_and_indicators/Indicators/Documents/Structure%20National%20Report%20ODYSSEE%202012.pdf

DEA (Danish Energy Agency), 2009. Large drop in energy consumption and CO2 emissions in 2008. http://ens.dk/sw80769.asp

DEPA (Danish Environmental Protection Agency), 1999, 'Economic Instruments In Environmental Protection in Denmark', Danish Environmental Protection Agency, Ministry of Environment and Energy, pp. 55-57, pp93-96, 150. www.mst.dk

Danish Ministry of Taxation (2009) Danish Tax Reform 2010 – Paper to the OECD WP 2 meeting November 2009, URL: http://www.skm.dk/public/dokumenter/engelsk/Danish_per_cent20Tax_per cent20Reform_2010.pdf

Danish Ministry of Taxation, 2002. Miljbafgifter. Internt notat. Spydspidsmodul. (Environmental Taxes. Internal Working Paper) Danish Ministry of Taxation, Copenhagen.

Eurostat (2013a) "Taxes in Europe" database, URL: http://ec.europa.eu/taxation_customs/tedb/taxSearch.html

EEA (2011) Environmental tax reform in Europe: Implications for income distribution

Enevoldsen, M., (2005): "The Theory of Environmental Agreements and Taxes – CO2 Policy Performance in Comparative Perspective", Edward Elgar, Cheltenham, UK.

Ericsson K. (2006) Evaluation of the Danish voluntary Agreements on Energy Efficiency in Trade and Industry, URL: www.aid-ee.org/documents/011Danishvoluntaryagreements.PDF

Eurostat (2013) Total environmental tax revenues as a share of GDP, URL: http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=ten00065&plugin=0

Finansministeriet (1999) Evaluering af grønne afgifter ag erhvervene, URL: http://www.fm.dk/publikationer/1999/evaluering-af-groenne-afgifter-og-erhvervene/

Infras and Ecologic (2007) Erfahrungen mit Energiesteuern in Europa – Lehren fuer die Schweiz.

Jamet S. (2012) Towards Green Growth in Denmark: Improving Energy and Climate Change Policies, Economics Department Working Papers No. 974, URL: http://search.oecd.org/officialdocuments/displaydocumentpdf/?cote=ECO/WKP(2012)51&docLanguage=En

Jacobsen, H.K., K. Birr-Pedersen and M. Wier (2001), 'Fordelningsvirkninger af energi- og miljöafgifter', (Distributional effects of energy and environmental taxes), Risö National Laboratory, Roskilde.

Speck S., Andersen, M., H. O. Nielsen, A. Ryelund C. Smith (2006) The Use of Economic Instruments in Nordic and Baltic Environmental Policy 2001-2005, URL: http://www.norden.org/en/publications/publikationer/2006-525

Speck S, Jilkova J. (2009) Design of environmental tax reforms in Europe, In: Carbon-Energy Taxation: Lessons from Europe. Andersen MS, Ekins P (Eds.). Oxford University Press, Oxford, 24-52.

Nordic Council of Ministers, 2006, The Use of Economic Instruments in Nordic and Baltic Environmental Policy 2001-2005, TemaNord 2006:525, National Environmental Research Institute, Denmark, URL: http://www.norden.org/en/publications/publikationer/2006-525

Malaska, P., Luukkanen, J., Vehmas, J., and Kaivo-oja, J. (1997) Environment-Based Energy Taxation in the Nordic Countries. Ministry of Environment. Helsinki, Finland.

OECD (2012) OECD Economic Surveys Denmark January 2012. Paris (2012), URL: http://www.oecd-ilibrary.org/economics/oecd-economic-surveys-denmark-2012_eco_surveys-dnk-2012-en

OECD (2013) Taxing Energy Use – Denmark, URL: http://www.oecd-ilibrary.org/docserver/download/2313021ec011.pdf?expires=1362754703&id=id&accname=ocid177558&checksum=53C63D5E7B42F9F5ABDB5DEA8FB57DC0

Sumner J., L. Bird, H. Smith (2009) Carbon Taxes: A Review of Experience and Policy Design Considerations, URL: http://www.nrel.gov/docs/fy10osti/47312.pdf

UCD (2008) Economic Instrument in Environmental Policy, Economic Instrument – Charges and taxes

– Energy Taxation (Denmark). URL: http://www.economicinstruments.com/index.php/climate-change/article/120-

World Nuclear Association (2013), Nuclear Energy in Denmark, URL: http://www.world-nuclear.org/info/inf99.html

Wier, M., Birr-Pedersen, K., Jacobsen, H.K., Klok, J. (2005): Are CO2 taxes regressive? Evidence from the Danish experience, in: Ecological Economics 52 (2005), S. 239-251

Wier M, K. Birr-Pedersen, H. Klinge Jacobsen, J. Klok (2012) Environmental taxation and distributional consequences, URL: http://orbit.dtu.dk/fedora/objects/orbit:70279/datastreams/file_10833494/content

1.5 Environmental tax reform in Finland

<table>
<tr><th colspan="2">Summary</th></tr>
<tr><td colspan="2">Finland provides an interesting example of ETR as it was the first country to introduce a CO_2 tax over 30 years ago and since then has developed its energy and CO_2 taxes through a number of stages. This development has been influenced by the use of other policy instruments (such as voluntary agreements trying to reduce energy consumption), EU policy (anticipation of an EU Energy Tax), concerns regarding violation of trade agreements (tax on imported electricity) as well as party political aims (the balance between income tax and energy tax). This long history has enabled Finland to mainstream energy taxation and environmental tax reform (ETR) into its broader policy making process. ETR is now seen as a normal, integral part of the Finnish policy environment.

The early ETR reforms were not only used as a means to achieve environmental objectives, but as a means to raise revenue to partly compensate the significant reduction of the tax burden on labour which was made to encourage employment.

The present energy tax system consists of duties on transport fuels and heating fuels, and on electricity. The fuel duty is divided into an energy component and a CO_2 component. The energy component of liquid fuels is largely based on energy content but differentiated according to local emissions of CO_2. The CO_2 component is based on a lifecycle approach to CO_2 emissions. There is an output tax on electricity, which falls into two classes: a lower rate for industry and greenhouse cultivation and a higher rate for households and the service sector (Ministry of the Environment website, 2012a).

According to the National Energy and Climate Strategy (Government of Finland, 2013), Finland will meet its renewable energy target of 38 per cent for 2020. The 2008 climate and energy strategy set the energy savings target at 37 TWh (as calculated from final consumption) by 2020. Electrical energy accounted for 5 TWh of this target, and thermal energy and transport fuels for the rest. Final energy consumption would then amount to 310 TWh in 2020. With respect to electricity, this goal will be met primarily due to slower economic growth and structural changes in the economy. As regards other forms of energy, this target may not be met, in which case the final consumption target of 310 TWh will not be fully achieved. Finland's long-term goal is a carbon-neutral society, which can be achieved by following the roadmap towards 2050, involving an increase in energy-efficiency and the use of renewable energy and drafted on the basis of various strategies. Work on the roadmap will begin in 2013 (Government of Finland, 2013).</td></tr>
<tr><th colspan="2">Objectives and design</th></tr>
<tr><td>Goals and objectives of the tax</td><td>The initial introduction of the CO2 tax in 1990 was made by the Green Party on environmental grounds but during the political negotiations the Greens had to agree to cuts in income tax. Other objectives have been the aim to prepare for an EU energy tax, which did eventually not materialize, leading to subsequent changes. As can be seen from the description below of the wider ETR context, the goals and objective behind the ETR have varied over the years.</td></tr>
<tr><td>Wider ETR context</td><td>In 1990, Finland was the first country in the world to introduce a CO_2 tax on fossil fuels on environmental grounds. The tax covered light fuel oil, heavy fuel oil, coal, natural gas and peat and was based on the carbon content of the fuel. The carbon tax was raised in 1993 and in 1994 the structure of the tax was changed through the 75/25 tax model. This model consisted of a 75 per cent tax based on the carbon content of the primary energy source and 25 per cent on the energy content. An important reason for introducing an</td></tr>
</table>

	energy component into the tax system was to take into account the externalities involved in nuclear power and reduce the fiscal advantage on nuclear power production. It was also decided that the CO_2 component of the tax for peat be reduced (by 30 per cent compared to coal) due to employment and energy security reasons. An excise tax was also put on electricity generated by nuclear power and on imported energy (Sairinen, R., 2012). Complementing this decision was the first energy conservation programme in 1992, which emphasised the simultaneous use of carbon taxation and voluntary instruments. The approach was for the taxation to influence energy production and for voluntary agreements to influence energy consumption. During the 1990s, the promotion of energy efficiency became a stronger and more consistent goal in Finnish energy policy (Sairinen, R., 2012). Between 1994 and 1996 the structure of energy taxation was altered due to the anticipated EU energy tax not materialising and the EU Commission's claim that the Finnish tax imposed on imported electricity violated trade agreements. Hence, the focal point of energy taxation was transferred from production fuels to electricity. In practice this meant that the focus of taxation would be moved from production to consumption. The electricity tax was hence aimed at households, which have a higher tax rate than industry. The carbon tax was removed from electricity production, but at the same time heat production was to be taxed completely based on the carbon content. Tax reductions were put in place for natural gas and peat (Sairinen, R., 2012). The Finnish basic energy tax system has been more or less unchanged since 1997, with only tax rate changes being adjusted and some additions/exemptions. In 2008 the car registration system was changed and differentiated according to the specified fuel consumption of the car. Since 2010 the annual car owner's tax has been based on the car's CO_2 emissions (Sairinen, R., 2012). The state budget proposal for the year 2011 called for a hike in energy taxation, which brought in EUR 750 million in revenue. Taxes on fuel for heat and power plants and energy taxes on electricity were raised in connection with structural tax reforms, to help offset the tax revenue losses incurred by the abolition of the employers' national pension contribution (Sairinen, R., 2012).
How the taxable base is defined	The present energy tax system consists of duties on transport fuels and heating fuels, and on electricity. The fuel duty is divided into an energy component and a CO_2 component. The energy component of liquid fuels is largely based on the energy content but differentiated according to local emissions of CO_2. The CO_2 component is based on a lifecycle approach to CO_2 emissions (Ministry of the Environment website, 2012a). The current structure of energy taxation encompasses three tax levies. The overall tax rates are driven primarily by the energy content component and the CO_2 component (which considers CO2 emissions and local emissions). An additional surcharge, the strategic stockpile fee, is included in the final total

	(OECD, 2013a). The energy content component is levied on both fossil fuels and biofuels, according to their volumetric energy content. Higher rates apply to fuels used in the transport sector. Lower rates apply for agriculture usage in the case of light and heavy fuel oils, and for electricity (OECD, 2013a). Since 1997, taxes have not been applied on fuels for electricity production; rather an output tax on electricity applies with a lower rate for industry and greenhouse cultivation and a higher rate for the households and the service sector (Ministry of the Environment website, 2012a).
The tax rate applied	The CO_2 and energy related charges applied are as follows (Ministry of Environment, 2012c): **CO2 tax:** **Tax base:** Motor petrol, diesel oil, light and heavy fuel oil, kerosene, aviation petrol, coal, natural gas; and bio-substitutes. Fuels for electricity production are exempted. **Tax rate:** €50 (traffic) or €30 (heating) per tonne of CO_2 as of 1.1.2011 €60 (traffic) or €30 (heating) per tonne of CO_2 as of 1.1.2012 **Energy tax and CO_2 tax on fuels and electricity:** **Tax base:** Motor petrol, diesel oil, light and heavy fuel oil, kerosene, aviation petrol, coal, peat, natural gas, electricity, pine oil, bio-substitutes. Electricity production exempt. **Liquid fuels for traffic and heating in 2011:** **Tax rate**[2]: Individual tax rates for all substances. For example motor petrol has an energy tax 50.36 cents/l and a CO_2 tax. **Tax rates applied on other fuels (traffic and heating) and electricity**[3]: Coal: Energy tax of 54.54 EUR/tonne and a CO_2 tax of 72.37 EUR/tonne. Peat[4]: Energy tax of 1.90 EUR/MWh (2011-2012), 4.90 EUR/MWh (2013-2014) and 5.90 EUR/MWh (2015 -) Natural gas: Energy tax of 3.00 EUR/MWh and CO_2 tax of 5.94 EUR/MWh (2011-2012); Energy tax of 5.50 EUR/MWh and CO_2 tax of 5.94 EUR/MWh (2013-2014); Energy tax of 7.70 EUR/MWh and CO_2 tax of 5.94 EUR/MWh (2015-) Electricity: Rate I (households, service industry): Energy tax of 1.69 EUR/kWh; Rate II (mining, manufacturing and greenhouses): Energy tax of 0.69 EUR/kWh.
Implementation	
Specific measures and/or derogations	The CO_2 component is based on the CO_2 emissions of the fuel in question, and for this reason biofuels are subject to a rate of CO_2 tax which is reduced from 50 per cent to 100 per cent if they meet the sustainability criteria. Therefore the CO_2 tax for biofuels is 8 cents/l, for RES biofuels it is 4 cents/l

[2] In addition there is a small stockpile fee.
[3] In addition there is a small stockpile fee.
[4] Does not include a stockpile fee

	and for RES (Art 21(2)) biofuels there is no CO_2 tax (Ministry of the Environment, 2012c). CO_2 taxes for fossil fuels used in combined electricity and heat production (CHP) are also lowered by 50 per cent. For energy-intensive industry where the CO_2 and energy taxes paid by a company for electricity, coal, natural gas, and other products exceed 0.5 per cent of the company's value added during the accounting period, the company is entitled to apply for a refund of 85 per cent of the amount of the excise duties paid for the products or the excise duties contained in their acquisition price. Only the part exceeding EUR 50 000 of the thus calculated tax refund is repaid. The maximum refund can only be as high as the excise duties paid (OECD, 2013a). Until 2010, there was no energy tax on natural gas, only a carbon tax. In the 2011 tax reform an energy tax on natural gas was agreed. To be on an equal footing with other fossil heating fuels the energy tax ought to be 7.70 EUR/MWh. However, it was decided that the energy tax should be increased in stages to make it easier to adapt to the new tax. Therefore the energy tax will be staggered from 3 EUR/MWh (2011-2012) and 5.50 EUR/MWH (2013-2014) until it reaches 7.70 EUR/MWh in 2015. Therefore the lower tax rate for natural gas can be seen as a subsidy, which will be abolished in 2015. The CO_2 tax for natural gas does not include a tax subsidy and is on equal footing with other fossil heating fuels. (Government of Finland, 2011) Since July 2005 peat has been exempted from energy taxes. In a similar manner to natural gas, the energy tax will be introduced in stages. The tax rate will increase progressively in stages from 1.90 EUR/MWh (2011-2012), to 4.90 EUR/MWh (2013-2014) and finally to 5.90 EUR/MWh (2015-) (Ministry of the Environment, 2012c). To improve the competitiveness of renewable energy sources and to partly compensate for the output tax applied on electricity, subsidies are granted to electricity produced by e.g. wind, small-scale hydropower and recycled fuels. (Ministry of the Environment website, 2012a).
Revenues from the taxes	The amount of environmental energy taxes increased significantly between 1990 and 1996 from EUR 0.1 billion to EUR 0.5 billion. CO_2 tax revenues in 2010 were approximately EUR 500 million (some 15 per cent of total energy taxes) (Ministry of the Environment website, 2012b). The revenues from energy and CO2 taxes and the strategic stockpile fee is given in **Error! Reference source not found.** (Statistics Finland,2011) and (Ministry of the Environment website, 2012a)(Eurostat, 2012)) **Table 1: Total revenues from the excise and strategic stockpile fee** on energy and CO2 taxes(excise duty) **in million EURs.**

Year	Excise duty	Strategic stockpile fee	Total	Proportion of total	Share of GDP[6]

					tax revenues[5]	
	2005	2 885	49	2934	4.3 per cent	1.7 per cent
	2006	2 946	50	2 996	4.1 per cent	1.6 per cent
	2007	2 938	50	2 988	3.8 per cent	1.6 per cent
	2008	3 192	49	3 241	4.0 per cent	1.8 per cent
	2009	3 149	45	3 194	4.3 per cent	2.0 per cent
	2010	3 252	48	3 300	4.4 per cent	1.8 per cent
	2011	3 938 (budgeted)	50 (est.)	3 988	-	-
	2012	4 356 (budgeted)	50 (est.)	4 406	-	-
Use of tax revenues	The ETR that started in 1997 was not planned to be revenue neutral. The motivation of the tax reform programme was to reduce general taxes by FIM 5.5 billion (around 0.9 per cent of GDP). The reduction in the state personal income tax amounted to FIM 3.5 billion while the reduction in employers' social security contributions and in the local personal income were around FIM 2 billion. The fall in revenues was partly compensated by revenues generated from the CO_2 tax (as well as the landfill tax). The revenues from the CO_2 tax was FIM 1.1 billion in 1997 (if the revenues from the landfill tax are added, then this sums up to around FIM 1.4 billion or 0.2 per cent of GDP) (Andersen et al 2007). The ETR phase agreed in late 1997 and implemented in 1998 also did not aim to be revenue neutral. The objective of this programme was to reduce labour taxes further and offset some of the reductions by increases in, *inter alia*, environmental taxes. The target for the reduction in labour taxation was FIM 1.5 billion for 1998 and FIM 3.5 billion in 1999, i.e. reduction of around 0.5 per cent of GDP. (Andersen et al 2007) The underlying assumption of this policy of reducing taxes levied on labour was that it would lead to an increase in employment followed by an increase in labour related tax revenues.					
Future developments in ETR	The new National Energy and Climate Strategy was published in March 2013. It does not include any suggestion for ETR in the future.					
Interactions with other policies						
Compatibility with	The introduction of the EU ETS has not led to any major changes in the					

[6] Adapted and recalculated from Statistics Finland (2011), Eurostat (2012), 2012and Ministry of the Environment (2012).
[5] Adapted and recalculated from Statistics Finland (2011) and Ministry of the Environment (2012).

EU ETS	carbon tax system for those emissions that are part of the trading system. However, the general strengthening of climate policy, such as those of ETS, have made room for developing the energy and CO_2 taxes (Sairinen, R., 2012).
Revised EU Energy Tax Directive 2003/96/EC	
County context	
GDP	EUR 194 billion (Statistics Finland, 2013)
Total primary energy supply	34.3 Mtonne (OECD 2013b)
Energy intensity (TPES per unit of GDP)	0.20 kg/USD (TPES per unit of GDP at 2000 prices and PPPs for 2011) (OECD 2012)
Electricity generation by fuel	Electricity generation in 2010 figures (IEA, 2012): Coal and peat: 26.55 Oil: 0.6 per cent Natural gas: 14.0 per cent Nuclear Power: 28.6 per cent Hydro: 44.71 per cent Other*: 14.61 * Includes geothermal, solar, biofuels, waste, tide, wave, ocean, wind and other fuel sources
Economic structure	Annual Growth: Real value added of industry (6.3 per cent in 2010); agriculture, forestry, fishing (6 per cent in 2010); services (0.2 per cent) (OECD 2012)
Demand elasticities	-
Key environmental impacts	
Nature and degree of impacts on the environment	In 1999 a government working group on environmental taxation assessed the effects of environmental taxes. It found that energy and carbon taxes reduced carbon emissions by over seven per cent during 1990-1998 (Sairinen, R., 2012). The ETRs caused a reduction in fuel use was in Finland (4.8%) which also had the largest fall in emissions (5.9).
Key social impacts	
Impacts on income distribution	The Social democrats criticized the energy and carbon taxation in 2010 for their impacts on social justice, the distribution of income among social groups and negative impacts on low-income people, mobility or rural areas (Sairinen, R., 2012).
Unintended social impacts	-
Key economic impacts	
Administrative cost	No information could be found.
Impacts on competition, employment, growth, innovation	According to the results of the 6FP research work – COMETR (Andersen et al 2007) - the ETR leads to an increase in GDP which varies over time, but averages at around 0.5 per cent in 2012. The study also find that Finland has a short-term boost to GDP from the effects of the taxes on fuel demand, as a reduction in the demand for imported fuel improves the country's trade balance. Moreover, it is interesting to note that the increase in GDP in Finland occurs without any revenue recycling. The main reason being that the taxes fall almost exclusively on imports of energy products and thus when

	energy demand falls there is an improvement in the international trade balance. (Andersen et al 2007).
Unintended economic impacts	

References

Andersen, M.S., Barker, T., Christie, E., Ekins, P., Gerald, J.F., Jilkova, J., Junankar, S., Landesmann, M., Pollitt, H., Salmons, R., Scott, S. and Speck, S. (eds.), 2007: Competitiveness Effects of Environmental Tax Reforms (COMETR). Final report to the European Commission. National Environmental Research institute, University of Aarhus. 543 pp. - http://www.dmu.dk/Pub/COMETR_Final_Report.pdf

EnviroFinland, (2013), Finland updates its energy and climate strategy, accessed 13.3.2013, http://www.energy-enviro.fi/index.php?PAGE=2&NODE_ID=4&LANG=1&ID=4552

Energy Market Authority (2012), National report 2012 to the Agency for the Cooperation of Energy Regulators and to the European Commission, Finland, 13.7.2012, http://www.energiamarkkinavirasto.fi/files/National%20Report%202012%20Finland.pdf

Eurostat (2012), Total environmental tax revenues as a share of GDP, accessed 12.3.2013 http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=ten00065&plugin=1

Government of Finland (2011), Hallituksen esitys eduskunnalle laeiksi nestemäisten polttoaineiden valmisteverosta annetun lain liitteen sekä sähkön ja eräiden polttoaineiden valmisteverosta annetun lain muuttamisesta, 2011, Accessed 17.4.2013.

Government of Finland (2013), National Energy and Climate Strategy, Government Report to Parliament on 20 March 2013 http://www.tem.fi/files/36292/Energia-_ja_ilmastostrategia_nettijulkaisu_ENGLANNINKIELINEN.pdf

IEA (2012), Energy balances of OECD countries, 2012 http://www.iea.org/w/bookshop/add.aspx?id=609

Ministry of the Environment website, (2012a), Economic Environmental Policy Instruments, accessed 12.3.2013 http://www.ymparisto.fi/default.asp?node=11131&lan=en

Ministry of the Environment website, (2012b), Environmentally related energy taxation in Finland, accessed 12.3.2013, http://www.environment.fi/default.asp?contentid=147208&lan=en

Ministry of the Environment (2012c), Environmentally related taxes and charges in Finland (January 2012), latest update 26.3.2012. Accessed 15.4.2013.
http://www.environment.fi/download.asp?contentid=134385&lan=en

OECD (2013a), "Finland", in *Taxing Energy Use: A Graphical Analysis*, OECD Publishing.
http://dx.doi.org/10.1787/9789264183933-13-en

OECD(2013b), Country statistical profile: Finland 2013, accessed 13.3.2013, http://www.oecd-ilibrary.org/docserver/download/191100071e1t004.pdf?expires=1363219366&id=id&accname=freeContent&checksum=5A833E3E169F5BE66D9E9BFA0CC727CB

Sairinen, R, (2012) Regulatory reform and development of environmental taxation: the case of

carbon taxation an ecological tax reform in Finland in Milne, J., and Skou Andersen, M., (Eds.) (2012) Handbook of Research on Environmental Tax Reform, Edward Elgar, Cheltenham/Massachusetts

Statistics Finland, (2011), Liitetaulukko 2. Ympäristöverojen tuotto ja osuus valtion kokonaisverokertymästä vuosina 1990–2011 (milj. euroa), http://www.stat.fi/til/yev/2011/yev_2011_2012-11-07_tau_002_fi.html
Statistics Finland, (2013), Gross domestic product contracted by 0.2 per cent last year, 1 March 2013, accessed 13.3.2013 http://www.stat.fi/til/vtp/2012/vtp_2012_2013-03-01_tie_001_en.html

1.5 Energy tax reform in Germany

Summary

Germany introduced an environmental tax reform (ETR) in 1999 by gradually increasing existing taxes on transport fuels, natural gas and light heating and heavy oil fuels and by introducing a new electricity tax between 1999 and 2003. The reform was inspired by both environmental and economic objectives. Gradual phasing-in of the reform with predictable increases over a 5-year period provided industry the opportunity to adjust to the situation which may have increased acceptability and reduced risk of negative effects such as relocation of industries to other countries. The reform included a number of derogations for manufacturing and energy-intensive industries which weakened its potential environmental impact considerably. The main derogations include the full tax exemption for some energy intensive industry processes and reduced tax rates for certain manufacturing businesses.

The main changes were implemented during the first phase which was completed in 2003. In 2006, mainly in the context of implementing the EU energy taxation directive, some further adaptations were implemented. A wider ETR that was discussed at the time was not further pursued due to strong political opposition. Most of the revenues from the ETR (around EUR 17 billion annually) are recycled via the social security system. It is assumed that this reduces statutory pension contributions by 1.7 per cent annually.

Studies indicate that the overall environmental and economic impacts of the taxes have been positive. GHG emissions were expected to be 3 per cent lower in 2010 compared to a business as usual scenario and employment to have rather increased as a result of lower labour costs. The highest impacts are in the transport sector in terms of reduced fuel consumption. Negative social impacts were rather limited as a result of the recycling mechanisms, although low income households and families were hardest hit by the ETR. In 2010, as part of the government's 'Zukunftspaket' which aimed at reducing public expenditure by EUR 80 billion, some derogations were reduced, albeit by less than what was initially envisaged by the government after facing strong opposition from industry. Some derogations from the energy and electricity taxes have been granted to the industry on condition that industry meets objectives set in voluntary agreements between industry and the government. This was first linked to a climate agreement with GHG emission reduction targets which expired at the end of 2012 and was then succeeded by a voluntary agreement on energy efficiency targets measured in terms of energy intensity. As of 1 January 2011 a nuclear fuel tax was introduced.

Objectives and design	
Goals and objectives of the tax	Two main objectives were pursued with the ETR (Deutscher Bundestag, 1998): 1) More efficient use of energy by incentivising energy savings and the promotion of renewable energy sources; 2) Reduction of labour costs by decreasing employers' and employees statutory social security contributions by 0.8 per cent in order to increase employment, while preventing negative impacts on the competitiveness of German industry. Social security contributions are to be reduced to below 40 per cent of gross salaries.
Wider ETR context	In the 1990s the concept of an ETR gained increasing attention in Germany. The debate was at the time stimulated by various studies and analyses most of them pointing to the potential benefits of an ETR in terms of a 'double dividend'. At the same time there was strong opposition from industry and the public that an ETR would weaken industrial competitiveness and increase the tax burden for

industry and citizens (Bach, 2009; Ludewig et al., 2010). This diversity of interests is reflected in the ETR eventually adopted which is shaped more by fiscal objectives and political opposition than environmental objectives (Bach, 2009).

Due to the derogations granted to industry, positive environmental impacts of the ETR have been rather limited and the rather high energy efficiency potential in this sector has remained mostly untapped due to insufficient price signals. The second phase of the ETR was initially supposed to be a wider Environmental Fiscal Reform including the reduction of environmentally harmful subsidies but was given up due to strong political resistance (Speck and Jilkova, 2009). As part of the latest revisions of the ETR adopted in 2010 and 2011 as part of a bigger package to consolidate the federal budget, it was decided in 2010 to reduce the derogations granted to industry. These changes were however much weaker than initially envisaged reflecting strong opposition from industry which argued that the derogations do not constitute a special treatment but prevent negative impacts on the energy-intensive industry which employs 870,000 people in Germany (BDI, 2010). Derogations that were to cease at the end of 2012 were extended until 2022. No further revisions are planned at this stage.

How the taxable base is defined

The tax applied to mineral oil products, natural gas, liquefied natural gas, and electricity. Coal use for heating was exempt from taxes until 2006 when the EU energy taxation directive was implemented and a minimum tax rate introduced. The tax rate is merely based on quantity and does not take account of the CO_2 content or the energy intensity of the taxed fuel.

The tax rate applied

The first phase (1999-2003) included a gradual increase of existing energy taxes (transport fuels, natural gas and light heating fuels as well as heavy fuel oil) and the introduction of an electricity tax. In a second phase, from 2006 onwards, in the context of implementing the EU energy taxation directive in national law, the heating fuel tax on natural gas and on heavy fuel oil was adapted.

	Tax rates before 1 April 1999	Increase as a result of ETR			Energy taxation act 2006	Total increase		
		1999	2000-03 (annual)	2003		cent	EUR/GJ	EUR/CO2
Transport fuels								
Gasoline per liter	50.1	3.07	3.07			15.35	4.74	65.87
Diesel per liter	31.69	3.07	3.07			15.35	4.29	57.97
Natural gas (heat) per kWh	0.19	0.164		0.2		0.364	1.01	18.04
Light heating oil (heat) per liter	4.09	2.05				2.05	0.57	7.77
Heavy oil (heat) per kg	1.79			0.71		0.71	0.18	2.31
Coal (heat) per GJ					33	33	0.33	3.24
Eletricity per kWh*		1.02	0.26			2.05	5.69	37.96
* Average 0,56 kg CO2-emissions per kWh								
Source: Bach 2009, p220								

When the ETR was adopted in 1999 it was designed for a gradual introduction between 1999 and 2003. No further increases were foreseen at the time. Since energy taxes have remained unchanged since 2003 (apart from some adaptation in 2006, as described above), taxes have decreased in real terms since then (Speck and Jilkova, 2009).

Implementation

Specific measures and/or derogations

In the first phase of the ETR's introduction (1999-2003), the increases in the tax rates for energy products, other than transport fuels, imposed on the manufacturing industry and the agricultural sector were lower than the standard increases because of the fear of negatively affecting the competitiveness of German industry (Speck and Jilkova, 2009). Derogations were introduced to ensure the international competitiveness of German industry. Energy intensive companies with high energy expenditure and low staff numbers which thus benefit less from the lower social insurance contributions under the ETR are granted additional derogations ('Spitzenausgleich').

The following main derogations were included from the beginning but changed/adapted over time:

1) ***Manufacturing industry, agriculture, fishery, and forestry*** were initially entitled to a tax relief of 80 per cent for energy products other than transport fuels on those tax rates imposed as part of the ETR, if they spent more than EUR 511 per annum on electricity and heating fuels ('*Sockelbelastung'*). This derogation was reduced to 40 per cent and the threshold was increased to EUR 512.50 in 2003, which means that relevant companies had to pay 60 per cent of the standard tax rate. As part of the energy taxation reform in 2006, as of 2007 the derogation was extended to all energy taxes for natural gas and liquefied natural gas, and was increased to 80 per cent on the tax rate for heating oil imposed as part of the ETR. As of 2011 the threshold was increased from EUR 512.50 to EUR 1000 and the derogation was streamlined to 25 per cent of the standard tax rate for all energy products other than transport fuels, including electricity (Article 54 of the energy taxation law and Article 9(b) of the energy taxation law). This translates to the following consumption thresholds after which the reduced tax rate of 25 per cent applies: 48,73 MWh for electricity, 16,297 litre for heating oil, 181 MWh for natural gas and 16,502 kg for liquefied natural gas. Before the threshold was increased in 2011, 100,000 out of 630,000 eligible manufacturing companies benefitted from this derogation (DIHK, 2011), which will have decreased as a result of the increased threshold. According to preliminary figures, in 2011 around 34,000 companies benefitted from these derogations (Deutscher Bundestag, 2012). The following table provides a summary of number of beneficiaries:

Financial benefit	Energy taxation law (Article 54)	Electricity taxation (Article 9(b))
Up to EUR 1,000	4,360	7,087
Up to EUR 10,000	4,506	9,879
Up to EUR 100,000	1,604	5,109
More than EUR 100,000	216	1,170
Total	10,686	23,245

Source: Deutscher Bundestag (2012, p34)

The derogation was worth EUR 317 million in 2009 and is expected to decrease to EUR 150 million in 2012 under the energy taxation law and was worth EUR 2.2 billion in 2009 and is expected to decrease to EUR 1.1 billion in 2012 under the electricity taxation law (BMF, 2011). In

	2011 the exemption was worth EUR 274 million under the energy taxation law and EUR 354[7] million under the electricity taxation law (Deutscher Bundestag, 2013). 2) In addition, the ***manufacturing industry***[8] was initially entitled to a 100 per cent environmental tax refund for those tax payments that were more than 20 per cent per cent of the reduction in the statutory pension contributions received (‘*Spitzenausgleich’*). As a consequence of that derogation, some industries had an effective tax rate of zero per cent (Speck and Jilka, 2009). The derogation was reduced to 95 per cent per cent in 2003 and to 90 per cent per cent in 2011. Since 2007 the statutory pension contribution of 2006 has been fixed as maximum reference case to avoid that with increasing contributions the derogations increase. This derogation, as opposed to the ‘Sockelbelastung’ (described above), is linked to a voluntary agreement between industry and the government (Article 55 of the energy tax law, Article 10 of the electricity taxation law). The derogation was initially limited until end 2012 and linked to a climate mitigation agreement (‘Klimaschutzvereinbarung’[9]) between the government and industry, as required under the EU energy taxation directive and as approved by the European Commission under its environmental state aid guidelines. As part of the government’s energy concept (‘*Energiekonzept’*) adopted in autumn 2010 it was decided to extend this derogation until the end of 2022. This was followed up in 2011 on the basis of a new voluntary agreement on energy efficiency between the government and industry (*‘Effizienzvereinbarung’*), which replaces the climate mitigation agreement that expired at the end of 2012, and runs from 2013 until 2022 (BMWI, 2012). On the basis of this agreement the current legislation foresees that this derogation is only granted to companies that have implemented an energy management and auditing system. These conditions are however only applicable as of 2014 (BMWI, 2012). Between 2013 and 2015 the energy intensity of the German manufacturing industry is supposed to increase by 1.3 per cent and should gradually increase to 5.25 per cent in 2016. Energy intensity reduction targets for the subsequent years will be fixed on the basis of an evaluation in 2017. The agreed energy intensity path was however criticised as being too close to business as usual projections (Deutsche Umwelthilfe, 2012). It also benefits from the nuclear phase out due to the low energy efficiency of nuclear energy since, according to international standards; nuclear power plants have an efficiency of 33 per cent as compared to modern gas power plants with an efficiency of

[7] According to preliminary figures the exemption was worth EUR 907 million (Deutscher Bundestag, 2012, p35)

[8] The eligible manufacturing industry is defined by reference to the standard defintion and classification of the German national statistics office as follows (Article 2(3) of the electricity taxation law): ‚*Unternehmen des Produzierenden Gewerbes: Unternehmen, die dem Abschnitt C (Bergbau und Gewinnung von Steine und Erden), D (Verarbeitendes Gewerbe), E (Energie- und Wasserversorgung) oder F (Baugewerbe) der Klassifikation der Wirtschaftszweige zuzuordnen sind, sowie die anerkannten Werkstätten für behinderte Menschen im Sinne des § 136 des Neunten Buches Sozialgesetzbuch, wenn sie überwiegend eine wirtschaftliche Tätigkeit ausüben, die den vorgenannten Abschnitten der Klassifikation der Wirtschaftszweige zuzuordnen ist*‘.

[9] German industry committed to decrease GHG emissions, as included in the Kyoto Protocol, by 35 per cent by 2012 compared to 1990 levels.

	60 per cent and renewable energy technologies with an efficiency of 100 per cent (Deutsche Umwelthilfe, 2012). As a consequence every unit of nuclear power plant replaced by a unit of natural power plant of renewable energy contributes to a reduction in energy intensity. This derogation was worth EUR 146 million in 2009 and is expected to increase to EUR 220 million in 2012 under the energy taxation law and EUR 1.78 billion in 2009 and is expected to be EUR 2.08 billion in 2012 (BMF, 2011). In 2011 the exemption was worth EUR 170 million under the energy taxation law and around EUR 1.9 billion under the electricity taxation law (Deutscher Bundestag, 2013). 3) Since the 2006 energy taxation reform, energy-intensive processes[10] benefit from a complete exemption from energy taxes including electricity tax (Article 51 of the energy taxation law, Article 9(a) of the electricity taxation law). This derogation was worth EUR 586 million in 2009 and is expected to increase to EUR 630 million in 2012 under the energy taxation law and was worth EUR 367 million in 2009 and was expected to increase to EUR 580 million in 2012[11] under the electricity taxation law (BMF, 2011). According to preliminary figures, in 2011 the exemption was worth around EUR 565 million under the energy taxation law and around EUR 556 million under the electricity taxation law (Deutscher Bundestag, 2013). Moreover, other main derogations or special provisions include:[12] - ***Power plants*** are exempted from the energy tax (Article 53 of the energy taxation law). ***CHP plants*** with a minimum utilisation rate of 70 per cent are partially exempt from the energy tax, the minimum tax rate pursuant to the Energy Taxation Directive applies (Article 53(b) of the energy taxation law); highly efficient CHP as defined in Annex III of Directive 2004/8/EC are fully exempt from the energy tax (Article 53(a) of energy taxation law); this derogation is worth around EUR 2.3 billion; this derogation constitutes the most important of all federal tax derogations in terms of monetary value for its beneficiaries (BMF, 2011). - Electricity from ***renewable sources*** meant for the use of the producer is exempt from the electricity tax (Article 9(1) of the electricity taxation law);

[10] These include electrolysis and chemical reduction processes, the production of glas and cearmic products, and metal production and processing, the latter two being defined as follows (Article 51 of the energy taxation law, Article 9(a) of the electricity taxation law): "für die Herstellung von Glas und Glaswaren, keramischen Erzeugnissen, keramischen Wand- und Bodenfliesen und -platten, Ziegeln und sonstiger Baukeramik, Zement, Kalk und gebranntem Gips, Erzeugnissen aus Beton, Zement und Gips, keramisch gebundenen Schleifkörpern, mineralischen Isoliermaterialien, Asphalt, Waren aus Graphit oder anderen Kohlenstoffen, Erzeugnissen aus Porenbetonerzeugnissen und mineralischen Düngemitteln zum Trocknen, Brennen, Schmelzen, Erwärmen, Warmhalten, Entspannen, Tempern oder Sintern der vorgenannten Erzeugnisse oder der zu ihrer Herstellung verwendeten Vorprodukte" and „für die Metallerzeugung und -bearbeitung sowie im Rahmen der Herstellung von Metallerzeugnissen für die Herstellung von Schmiede-, Press-, Zieh- und Stanzteilen, gewalzten Ringen und pulvermetallurgischen Erzeugnissen und zur Oberflächenveredlung und Wärmebehandlung".

[11] The increase is due to the fact that the tax rate used as basis for the calculation has changed. Until 2010 the reduced tax rate of EUR12.30/MWh was used, whereas from 2011 onwards the standard tax rate of EUR20.50/MWh is used.

[12] These derogations have been adjusted since the introduction of the ETR in 1999 at various occasions.

	- Local public transport benefits from a reduction of the standard tax rates for gasoline (Article 56 of the energy taxation law). The reduced rates are 60.048 Cent/litre for gasoline (standard rate: 65.45 Cent/litre), 41.638 Cent/litre for diesel (standard rate: 47.04 Cent/litre), 16.695 Cent/kg for liquid gas (standard rate: 18.03 Cent/kg) and 1.29 Cent/kWh for natural gas (standard rate: 1.39 Cent/kWh); this derogation was expected to be worth EUR 71 million in 2012 (BMF, 2011). - Public railways benefit from a reduced electricity tax of 1.142 Cent/kWh amounting to 56 per cent of the regular tax rate (2.050 Cent/kWh) (Article 9(2) of the electricity tax law); - A reduced tax rate of EUR 13.90 per MWh natural gas and of EUR 180.32 per 1,000 kg liquefied natural gas as compared to a standard tax rate of EUR 31.80 and EUR 409 respectively applies to natural gas and liquid and natural gas when used as fuel until 31 December 2018 (Article 2(2) of energy taxation law); - Advanced and high blend biofuels are exempt from the energy tax until 31 December 2015 (Article 50 of the energy taxation law). Exemptions for biomass for heating purposes expired at the end of 2009, exemptions for biodiesel and vegetable oil expired at the end of 2012. This derogation is expected to be worth EUR 125 million in 2012 (BMF, 2011). With effect of 1 January 2011 a tax on nuclear fuel was introduced until 1 January 2017. The tax rate is EUR 145 per gram of nuclear fuel. The purpose of the tax is to generate additional tax revenues for the consolidation of the public budget, in particular in view of the costs for cleaning up the low- and intermediate-level nuclear wastes disposed of in the salt mine repository at Asse in Lower Saxony, for which the Federal Republic of Germany is responsible. Annual revenues are estimated to be EUR 1.55 and 1.4 billion in 2012 and 2013 respectively.
Revenues from the taxes	In 2003, the last year of the first phase, the total additional revenues of the ETR was EUR 18.6 billion (approx. 0.9 per cent of GDP) of which approx. EUR 10.3 billion were generated by the tax on petrol and diesel and EUR 6.5 billion by the new electricity tax (Speck and Jilkova, 2009). Due to the unchanged rates since 2003 the revenues as share of GDP have decreased. In 2008 the revenues were 0.7 per cent of GDP (Bach, 2009). 2008 was the last year when the revenues from the ETR were reported separately, since 2009 revenues are reported for the energy tax and electricity tax. In 2011 revenues from the electricity tax were EUR 7.2 billion and were expected to be EUR 6.9 and 6.4 billion in 2012 and 2013 respectively. For the energy tax revenues were around EUR 40 billion in 2011 and are expected to remain at this level in the following two years (BMF, 2012). According to the budget plans for 2013, the energy tax represents 47.5 per cent, the electricity 9.2 per cent of all federal tax revenues. In 2011 the revenues from the electricity tax and the energy tax constituted 2.9 per cent and 16.1 per cent respectively of all tax and related revenues (BMF, 2012). In 2011 revenues from the electricity tax and the energy tax constituted a share of 0.3 and 1.5 per cent of GDP respectively.
Use of tax revenues	In principle, the ETR was designed to be revenue neutral as the major share of the revenue was used to equally decrease employers' and employees' social security contributions (public pension contributions). This recycling mechanism

resulted in a reduction in employers' and employees' pension contributions from 20.3 per cent in 1998 to 19.5 per cent in 2005. Since pension contributions are shared equally between employers and employees the reduction was 0.4 per cent for each party. Taking account of the economic and demographic development in Germany, Speck and Jilkova (2009) estimate that without the introduction of the ETR, the total pension contribution would have been around 21.2 per cent 2003. It is estimated that the recycling for the ETR revenues allowed reducing pension contributions by 1.7 per cent as compared to a business as usual scenario (Knigge/Görlach, 2005: Bach, 2009). Between 2003 and 2008 between EUR 15 and 16 billion were recycled in the German pension system annually (Bach, 2009). In 2011 EUR 10 billion were recycled in form of an additional federal contribution (‚zusätzlicher Bundeszuschuss') to the pension system (Deutsche Rentenversicherung, 2012).

However, a small fraction of the revenues were used for a programme to promote renewable energy. In addition, as a temporary measure EUR 1 billion was used to consolidate the federal budget as a temporary measure (EEA, 2005).

Effects of ETR in Germany (in billion euros)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Additional revenue from excises on fuels and electricity	4.3	8.8	11.8	14.3	18.7	18.1	17.8	17.4	17.8	18
Recycling of revenues	4.6	8.5	11.4	13.9	16.6	16.5	16.4	16.1	16.2	16
Transfer to the public pension system	4.5	8.4	11.2	13.7	16.1	16	15.9	15.5	15.6	15.4
Support programme renewable energy	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2
Other					0.4	0.4	0.4	0.4	0.4	0.4
Reduction of contribution rate public pension system (in percentage points)	-0.6	-1	-1.3	-1.5	-1.7	-1.7	-1.7	-1.7	-1.7	-1.7
Changes to pension adjustment (in per cent)	0	0	0.62	0.81	1.14	1.14	1.14	1.14	1.14	1.14

Source: Bach, 2009, p222

Future developments in ETR

Analyses of the existing ETR in Germany suggest that future developments should focus on the coordination with other policies, in particular the ETS, tackle the derogations and put more consideration on the energy and CO2 content when defining the tax base.

There is currently no debate on how to further develop the ETR. The debate in Germany very much focuses on possible reforms to the existing support policies for energy generation from renewable energy sources. This discussion reflects concerns about increasing energy prices for industry and households alike and how further increases can be prevented. After the relatively strong increase of the levy financing the German feed-in tariff system taking effect in 2013, the main focus is on possible changes to the feed-in tariff system.

Interactions with other policies

Compatibility with EU ETS

The interactions between the EU emissions trading and energy taxation are already well established and defined overlaps exist in some sub-sectors (Ludewig et al, 2010). Direct overlaps are relevant for power plants and industrial facilities covered under the ETS, indirect affects apply to private households and businesses bearing the costs for emission allowances under the EU ETS included in the final electricity prices and the additional taxes introduced under the ETR. However, some (in-) direct overlaps may be justified given the goals pursued under the ETR and the ETS are not exactly the same. Moreover,

	the substantial derogations granted to industry and the power generation sector minimises potential negative impacts from double regulation.
Revised EU Energy Tax Directive 2003/96/EC	Based on the European Commission's proposal the impacts on the energy and electricity taxes in Germany would be limited. It seems that the minima proposed in the Directive would not affect the existing tax rates in Germany. The only major expected impact would be an increase of the tax rate on diesel due to the required difference between tax rates imposed on gasoline and diesel. The proposed requirement that tax rates need take account of the CO2 and energy content of the taxed fuel would require structural changes to the tax system in Germany.
Country context	
GDP	2,643 in 2012 (Eurostat)
Total primary energy supply (2010)	331.5 (OECD 2012)
Energy intensity (TPES per unit of GDP)	0.14 (OECD 2012)
Electricity generation by fuel in per cent (in kWh, 2011) (IEA, 2012)	Coal: 45.76 Oil: 1.15 Natural gas: 13.81 Nuclear energy: 17.75 Hydro: 3.02 Other renewable energy sources: 18.51 * Includes geothermal, solar, biofuels, waste, tide, wave, ocean, wind and other fuel sources (IEA 2012)
Economic structure	Real value added of industry (10.3 per cent in 2010); agriculture, forestry, fishing (-0.4 per cent in 2010); services (1.9 per cent). Imports of goods and services (40.8 per cent in 2010); Exports of goods and services (46.1 per cent in 2010) (OECD 2012)
Demand elasticities	No information available.
Key environmental impacts	
Nature and degree of impacts on the environment	Various ex-ante and ex-post evaluations have been carried out which seek to explore the potential impacts of the ETR in Germany. Broadly, these come to the same conclusions. The derogations for the manufacturing and energy-intensive industry lowered the overall potential positive environmental impact, although modifications to the derogations introduced in 2003 increased the calculated CO2 emission reductions compared to previous calculations. Kohlhaas (2005) expects that by 2010 CO2 emissions could be around 3 per cent lower compared to the reference scenario without ETR in place. The extent to which the derogations reduce the potential impact of the ETR is

	underlined by the fact that in 2003 80 per cent of the manufacturing industry's electricity consumption in the year 2003 was subject to the '*Spitzenausgleich'* which implies a factual reduction of the tax rate to 3 per cent of the standard tax rate. Of the remaining 20 per cent, 16 per cent was taxed with tax rate reduced by 40 per cent and only 4 per cent was taxed normally (Knigge/Görlach, 2005). The highest environmental benefits were achieved in the transport sector (Bach, 2009). However, the actual impact of the ETR is difficult to measure due to various factors that come into play including increasing oil and gas prices, which are independent of tax increases. For example, in Germany there have been intense debates on whether the reduction in transport fuels by 3.8 million tons (or 6.8 per cent) between 1999 and 2003 was a result of the ETR or other factors. Sceptics of the ETR argued that despite this reduction more kilometres were driven and that there was increased refuelling in neighbouring countries with lower fuel costs. By contrast, empirical studies show that higher fuel costs influences consumer behaviour and strongly suggests that at least part of the fuel consumption was a result of the ETR (Umweltbundesamt, 2005). As result of the changes introduced in 2012 some derogations ('*Spitzenausgleich'*) are only granted if companies introduce environmental management systems/audits. In order to avoid administrative burden SMEs may use alternative measures to comply with this requirement. This can help to increase awareness and result in positive environmental impacts. However, the required progress in energy intensity is rather unambitious and hence misses an opportunity to provide incentives to exploit the existing energy efficiency potentials (Küchler and Ruhbaum, 2012). However, there is no requirement to implement identified measures and it is for each company to determine which measures are cost-effective.
Key social impacts	
Impacts on income distribution	Overall the impacts of the ETR are revenue neutral for private households as the revenues are recycled via lower contributions to the social security system. However low-income households are most exposed to the ETR with 1 per cent of their income being affected, as compared to only 0.5 per cent among the high income households. Unemployed and pensioners are not exposed to net negative impacts as a result of the ETR (Bach, 2009). Since pension levels in the German pension system are linked to pension contribution, the reduction in pension contribution as a result of the ETR resulted in an increase of 1.14 per cent in state pensions.
Unintended social impacts	No information available.
Key economic impacts	
Administrative cost	No information available.
Impacts on competition, employment, growth, innovation	No negative macroeconomic impacts were identified. It is expected that employment has rather increased as a result of lower labour costs (Bach, 2009). Modelling by Kohlhaas (2005) shows that employment could be 0.46 per cent higher and GDP 0.13 per cent higher in 2010 compared to a reference scenario without ETR in place. The strong increases in energy prices in Germany can only partially be explained

	by the ETR. By 2008 around half of the price increases for diesel and gasoline is related to ETR, whereas its influence on gas and heating oil is rather low. The impact is highest on electricity which was however to a certain extent compensated by the decreasing electricity prices after the liberalisation of electricity markets (Bach, 2009). Overall the ETR did not result in major stimulus for structural changes towards a more labour intensive and less energy intensive industry. One reason is that the derogations strongly decrease the marginal tax rate and hence do not sufficiently encourage change.
Unintended economic impacts	No information available.

References

Bach, S. (2009): Zehn Jahre ökologische Steuerreform: Finanzpolitisch erfolgreich, klimapolitisch halbherzig. Wochenbericht des DIW Berlin, 14/2009

BDI (2010): BDI warnt bei Ökosteuer-Plänen vor Einbußen bei Wachstum und Klimaschutz, Pressemitteilung 49/2010, 11. Juli 2010, http://www.bdi.eu/download_content/Pressemitteilung_Energiesteuer.pdf [06/03/2013]

Bundesministerium der Finanzen (BMF) (2011): Dreiundzwanzigster Subventionsbericht: Bericht der BMF über die Entwicklung der Finanzhilfen des Bundes und der Steuervergünstigungen für die Jahre 2009 – 2012.

BMF (2012): Bundeshaushaltsplan 2013, Einzelplan 60, Allgemeine Finanzverwaltung.

Bundesministerium für Wirtschaft und Technologie (BMWI) (2012): Vereinbarung zwischen der Regierung der Bundesrepublik Deutschland und der deutschen Wirtschaft zur Steigerung der Energieeffizienz vom 1. August 2012.

Deutsche Umwelthilfe (2012): DUH-Hintergrund: Spitzenausgleich nur für Energiesparer?, http://www.duh.de/uploads/media/DUH-Hintergund__Spitzenausgleich_20120823.pdf [06/03/2013]

Deutscher Bundestag (1998): Entwurf eines Gesetzes zum Einstieg in die ökologische Steuerreform, Gesetzentwurf der Fraktionen SPD und BÜNDNIS 90/DIE GRÜNEN, Drucksache 14/40, 14.Wahlperiode, 17. 11. 98.

Deutscher Bundestag (2012): Antwort der Bundesregierung auf die Kleine Anfrage der Abgeordneten Lisa Paus, Hans-Josef Fell, Dr. Thomas Gambke, weiterer Abgeordneter und der Fraktion BÜNDNIS 90/DIE GRÜNEN, Drucksache 17/10515, 17. Wahlperiode 20. 08. 2012.

Deutscher Bundestag (2013): Antwort der Bundesregierung auf die Große Anfrage der Abgeordneten Rita Schwarzelühr-Sutter, Rolf Hempelmann, Dirk Becker, weiterer Abgeordneter und der Fraktion der SPD, Drucksache 17/12246, 17. Wahlperiode 31. 01. 2013.

Deutsche Industrie- und Handelskammer (DIHK) (2011): DIHK-Merkblatt Ökosteuer, Ermäßigungen für das Produzierende Gewerbe, Stand: 18.1.2011.

Deutsche Rentenversicherung (2012): Jahresbericht 2011.

IEA (2012): Energy balances of OECD countries, OECD/IEA.

Knigge, M.; Görlach, B. (2005) Effects of Germany's Ecological Tax Reforms on the Environment, Employment and Technological Innovation. Summary of the Final Report of the Project: „Quantifizierung der Effekte der Ökologischen Steuerreform auf Umwelt, Beschäftigung und Innovation" Research Project commissioned by the German Federal Environmental Agency (UBA)

Kohlhaas, M. (2005): Gesamtwirtschaftliche Effekte der ökologischen Steuerreform, Band II des Endberichts für das Vorhaben: „Quantifizierung der Effekte der Ökologischen Steuerreform auf Umwelt, Beschäftigung und Innovation" Forschungsprojekt im Auftrag des Umweltbundesamts FuE-Vorhaben Förderkennzeichen 204 41 194.

Küchler, S.; Ruhbaum, C. (2012): Bewertung des aktuellen Vorschlags zur Energie- und Stromsteuernovelle vor dem Hintergrund der Energiewende in Deutschland

Ludewig, D.; Meyer, B.; Schlegelmilch, K. (2010): Greening the Budget: Pricing Carbon and Cutting Energy Subsidies to reduce the financial deficit in Germany, Heinrich Böll Stiftung.

Speck S, Jilkova J. (2009) Design of environmental tax reforms in Europe, In: Carbon-Energy Taxation: Lessons from Europe. Andersen MS, Ekins P (Eds.). Oxford University Press, Oxford, 24-52.

Umweltbundesamt (2005): Was bringt die Ökosteuer – weniger Kraftstoffverbrauch oder mehr Tanktourismus?, http://www.umweltdaten.de/verkehr/downloads/oekosteuer.pdf [05/03/2013]

1.6 Carbon tax in Ireland

Summary	
A carbon tax was introduced in Ireland in late 2009. The tax applies to CO2 emissions from the non-traded sectors (i.e. those outside the EU ETS). It has been implemented in three phases over the 2009-2013 period. The tax rate was EUR15 per tonne of CO2 emitted when it was introduced and is envisaged to increase to EUR30 by 2014. Although the revenues raised from the carbon tax do not allow a major reduction in labour taxes, they help to prevent (further) increases in labour taxes. Given the recent introduction of the tax, data on its impacts are still limited, however a number of ex ante assessments have been carried out and provide an indication of the effects of the tax.	
Objectives and design	
Goals and objectives of the tax	The 2007-2012 Programme for Government included a commitment to introduce a carbon tax over the lifetime of the Government. The carbon tax was seen as important tool to help reduce greenhouse gas emissions and also contribute to revenue raising objectives necessitated by the fiscal crisis (Department of Finance 2010). Under the 2008 EU Climate and Energy Package, Ireland is committed to reducing GHG emissions in non-ETS sectors by 20 per cent by 2020 compared to 2005 levels; achieve a renewables target of 16 per cent of gross final consumption of energy by 2020. A non-binding national energy efficiency target of 20 per cent by 2020 relative to consumption in the years 2001-2005 is also in place (Department of Environment, Community and Local Government 2011).
Wider ETR context	The 2007-2012 Programme for Government included a commitment to reduce greenhouse gas emissions by 3 per cent per year on average and that 'appropriate fiscal instruments, including a carbon levy, will be phased in on a revenue-neutral basis'. A Commission on Taxation was also set up to explore *inter alia* the introduction of a carbon tax (Department of the Taoiseach 2007). The report of the Commission was published in 2009 (Commission on Taxation 2009) and many of its recommendations were picked up in the design of the carbon tax set out in the 2010 Budget and Finance Act and first introduced in December 2009. Ireland led the way in the EU by being the first fiscally stressed country to introduce a carbon tax on all energy products not covered by the EU ETS (mainly transport and heat in buildings). The introduction of the tax followed a failed earlier attempt to introduce a carbon tax in Ireland in the early 2000s. The carbon tax was introduced as part of a package of government measures to respond to the financial and economic crisis. Other measures include the move to domestic water meters and a water pricing system based on use above a free allowance (Department of Environment, Community and Local Government, n.d.) and changes to the basis for vehicle registration tax (VRT) and annual motor tax in July 2008 from engine size to open market selling price and CO_2

	emission levels. Previous taxes on pollution and resources introduced include the plastic bag levy (introduced in March 2002) and the landfill levy (introduced in July 2002). Other taxes on energy include a mineral tax and taxes on the consumption of electricity (OECD 2013).
How the taxable base is defined	The carbon tax applies to CO2 emissions from the non-traded sectors (i.e. those outside the EU ETS) and is based on the carbon content of the fuel in question. In total, the carbon tax applies to around one third of total Irish GHG emissions (NESC 2012). It has been implemented in three phases: It applied to transport fuels (petrol and auto-diesel) since December 2009 and to non-transport fuels (kerosene, marked gas oil (or 'green diesel' which is commonly used by industry, agricultural machinery and home heating), fuel oil, Liquid Petroleum Gas (LPG) and natural gas) since May 2010. It will apply to solid fuels (coal and commercial peat) from May 2013 on a phased basis (see below) (Convery 2012 and Tax Strategy Group 2011). The extension to solid fuels was delayed due to concerns about possible cross-border movements of coal and the effect on low-income groups (NESC 2012).
The tax rate applied	The tax rate was EUR15 per tonne of CO2 emitted when it was introduced in 2010 and was envisaged to increase to EUR30 by 2014 (Ministry of Finance 2010). The rate was increased to EUR20 per tonne of CO2 for petrol and auto-diesel from December 2011 and from May 2012 to kerosene, Marked Gas Oil, Liquid Petroleum Gas (LPG), fuel oil and natural gas (Gargan 2012). The extension to solid fuels will be phased with a rate of EUR10 per tonne of CO2 applied from May 2013 and a rate of EUR20 per tonne of CO2 from May 2014. While there is a general commitment in the Memorandum of Understanding with the Troika to consider an increase in carbon tax, there is no specific commitment in respect of rates (NESC 2012). In terms of impacts on prices, the projected impact of the initial carbon tax was an increase in petrol prices of 3.5 per cent and in natural gas prices of 6 per cent (NESC 2012).
Implementation	
Specific measures and/or derogations	• The carbon tax does not apply to companies participating in the EU ETS. There is a full relief from the tax for gas and solid fuel which is shown to the satisfaction of the Revenue Commissioners to have been supplied for use in the generation of electricity, and for a partial relief from the tax for any gas delivered for use in an installation that is covered by a greenhouse gas emissions permit (Joyce et al 2012). • Full relief for biofuels and the biofuel content of blended

	fuels. • A partial relief for certain high efficiency Combined Heat and Power (CHP) with a capacity of 50 kW (Gargan 2012). • Relief from the carbon tax is also provided for fuel used for generation of electricity which is required to comply with EU Energy Tax Directive (Tax Strategy Group 2011). • A double income tax relief is provided for farm diesel from 1 May 2012 (Gargan 2012). There is a relief for the actual total costs (including the increase in carbon tax) of farm diesel and relief for the extra cost attributable to a higher carbon tax rate (NESC 2012). • Coal and peat were exempted until 2013
Revenues from the taxes	The tax was introduced as a mechanism to help address issues of falling tax revenues in other areas. The tax raised EUR 246 million in 2010, EUR 330 million in 2011 (Tax Strategy Group 2011), EUR 400 million in 2012 and is expected to raise about EUR 500 million in 2013 if the rate is increased to EUR25 per tonne (Convery 2012). This amounts to 3-3.5 per cent of revenues raised from income tax (Convery 2012). In 2010, revenues from energy taxes represented 1.46 per cent of GDP and 5.18 per cent of total tax revenues (Eurostat 2013)
Use of tax revenues	Although when initially discussed in the 2007-2012 Programme for Government, the carbon tax was envisaged to be revenue neutral (Department of the Taoiseach 2007), to date, the finance generated by the Irish carbon tax has gone to the general exchequer, to be used flexibly (NESC 2012). Revenues from the tax have not been used to reduce labour costs or increase welfare rates and given high public sector deficit, it seems unlikely that it will be used to reduce income taxes/raise welfare (Joyce et al 2012). Although the revenues raised from the carbon tax do not allow a major reduction in labour taxes, they do help to prevent (further) increases in labour taxes (Convery 2012). In terms of future developments, given pressures on exchequer finances, the government may be faced with the possibility of increasing tax and/or reducing social welfare benefits. It is therefore possible that future, additional revenue generated through a carbon tax might be used to offset or part offset planned future rises in income tax and/or reductions in social welfare payments (NESC 2012). Accompanying measures introduced to improve, amongst other things, energy efficiency in low-income houses included: • €50m of carbon tax yield was set aside to part-fund the sustainable energy management programmes including a Warmer Home Scheme (€12m) and a Home Energy Savings Scheme (€28m); • Fuel allowances which had previously been provided to help with the cost of home heating for people dependent on long-term social welfare and who are unable to provide for

	their own heating needs were increased from €18-20 per week following introduction of tax. Furthermore the duration of payment of the scheme was extended by 2 weeks to 32 weeks, although this was subsequently reduced to 26 weeks (the reason being the 200% increase in costs for the NFA and spending of €250m) (Joyce et al 2012 and Convery 2012).
Future developments in ETR	When the tax was introduced it was envisaged to increase to EUR30 by 2014. Although both Government party manifestos refer to a carbon tax rate of EUR25 per tonne, the Programme for Government does not contain any reference to a specific increase (Gargan 2012).
Interactions with other policies	
Compatibility with EU ETS	The carbon tax covers non-ETS sectors however the price of carbon in the non-ETS sector and in the ETS sector is an issue which needs to be resolved in the future – the wide gap between the carbon tax rate and the European Union Allowance price (EUA) creates an incentive for consumers to 'favour' electricity over other sources and as such is economically inefficient (Convery 2012).
Revised EU Energy Tax Directive 2003/96/EC	The revised rates in the proposed Energy Tax Directive s likely to result in setting minimum rates likely to be well below the rates already applying in Ireland, but could bring peat and coal into the net (Convery 2012).
County context	
GDP	178.0 billion USD current PPPs (2010) (OECD 2012)
Total primary energy supply	14.9 million tonnes of oil equivalent (Mtoe) (2010) (OECD 2012)
Energy intensity (TPES per unit of GDP)	0.11 Toe per '000 USD (2010 figures) (OECD 2012)
Electricity generation by fuel (per cent of total)	2010 figures Electricity generation from coal and peat: 22.45 per cent Electricity generation from oil: 2.13 per cent Electricity generation from natural gas: 62.3 per cent Electricity generation from nuclear energy: - Electricity generation from hydro energy: 2.11 per cent Electricity generation from other sources*: 11.01 * Includes geothermal, solar, biofuels, waste, tide, wave, ocean, wind and other fuel sources (IEA 2012)
Economic structure	Real value added of industry (0.5 per cent in 2009); agriculture, forestry, fishing (8.4 per cent in 2009); services (-1.7 per cent in 2009) (OECD 2012)
Demand elasticities	Conniffe and Scott (1990) examine the price and income elasticities for energy products, in particular gas, electricity, coal, peat, oil and LPG in Ireland. They find that GDP elasticities for various types of fuel, which they show to be quite similar to the associated income elasticities, range from 0.2 to 0.58 while the own-price elasticity for

	aggregate energy was found to be –0.21. Another study by Lyons et al. (2007) estimates the average expenditure elasticity for fuel and power to be 1.219 in the long run, while average long-run own-price elasticities, Ireland-only model is -0.227 for fuel and power.
Key environmental impacts	**Description**
Nature and degree of impacts on the environment	Under the Kyoto Protocol Ireland was committed to limiting average GHG in the period 2008-2012 to 13 per cent above 1990 levels. As noted in a 2011 review of Ireland's climate policy, Ireland is on course to meet this target through domestic emission reductions supplemented by carbon units (allowances or credits) and helped by the economic downturn which led to a significant drop in emissions in 2009. The carbon tax introduced in 2010 was anticipated to contribute to an average reduction of 0.15 Mt CO2e each year over the Kyoto period (Department of Environment, Community and Local Government 2011). Between 2008 and 2011, the consumption of petrol fell by 21 per cent, while the consumption of auto-diesel fell by 13 per cent over the same period. Whilst some of this may have been as a result of the carbon tax, a drop in consumption was already underway in 2008-2009 before the introduction of the carbon tax and reflects wider economic factors and the general downturn in the economy. Moreover, complementary measure have also played a role in this decline, for example the Vehicle Registration Tax (VRT) and annual motor tax were re-calibrated from July 2008 to be based on open market selling price and CO2 rating and have had a significant impact on the composition of the new car fleet (Convery 2012). Other environmental effects are expected in the buildings sector (given the price increase of between 8-12 per cent) and through a reduction in fuel tourism (Convery 2012). Data is however not yet available for such an assessment although some ex ante assessments provide an indication of possible impacts. For example, Tol et al 2008 estimate that the carbon tax would reduce fuel tourism and associated carbon emissions by around 0.5 per cent (although this would be offset by increases in emissions elsewhere). FitzGerald, et al (2008) conclude that while a carbon tax equal to the price of CO2 emission permits would be cost-effective and fair, it would not be high enough to induce substantial changes in emissions in the medium term from transport, households, or industry not covered by the ETS (because the tax is not high enough or because there are no practical alternatives or existing infrastructure precludes a change in behaviour). Carbon tax rates in the region of €180 per CO2 tonne are estimated to be required for Ireland to reach its 2020 emission targets. However such high rates, in a short to medium timeframe to 2020 at least, are generally considered both politically and economically unrealistic. (NESC 2012).

The time series currently available is too short to establish a link between emission reductions achieved and the carbon tax (especially since the recession started in at the same time as application of the carbon tax). Thus more data and research required (Joyce et al 2012).

Figure 1: Development of fuel costs since the introduction of the carbon tax

Budgetary Excise Changes on Motor Fuels (VAT inclusive) since 2007		
Budget	**Petrol**	**Auto-diesel**
2007	no change	no change
2008	no change	no change
2009 (emergency and supplementary)	increased by 8 cents (Oct. 08)	increased by 5 cents (Apr. 09)
2010 (**via carbon tax**)	Increased by 4.2 cents	Increased by 4.9 cents
2011	Increased by 4 cents	Increased by 2 cents
2012 (**via carbon tax**)	Increase by just under 1.5 cents	Increase by just over 1.5 cents
Total increase per litre	17.7 cents	13.4 cents

Source: Joyce et al 2012

Key social impacts

Impacts on income distribution

Data on real time equity and regressive impacts yet to be analysed (Joyce et al 2012). As noted above, some efforts have been made by the government to ameliorate the impact of the tax increase on certain groups, however according to Social Justice Ireland (2012), the combination of the decrease in Fuel Allowance (the length of the fuel season in the Fuel Allowance was decreased from 32 weeks to 26 weeks) and the increase in the carbon tax will increase fuel poverty in 2012 (Social Justice Ireland 2012). Furthermore, the extension of the carbon tax to coal and commercial peat from 2013 is likely to raise further concerns about impacts on low income households who tend to more extensively use fuels such as coal and turf (Tax Strategy Group 2011).

A 2012 report by the NESC cites a number of studies which found that a carbon tax, which applies to solid fuels has been found to be 'mildly regressive', a carbon tax weighs somewhat more heavily on rural households compared to urban households due to higher energy use for home and transport, although the absolute difference is estimated to be small, and the spatial incidence of a carbon tax in Ireland suggests that long-distance commuters are impacted the most. Tax incidence is shown to be the lowest in city centres, increases in the commuter belt and falls again in the rural

	countryside (NESC 2012). Data on the actual impacts of the tax is limited. Some ex ante assessments show that the carbon tax has regressive impacts (Callan et al 2008). A study on the distributional implications of a EUR20/tCO2 tax concluded that the overall impact of the carbon tax is markedly regressive, as the average burden is an estimated 2.1 per cent of disposable income for the first decile, 1.2 per cent for the second decile and 0.3 per cent for the tenth decile. However, the impact distribution is strongly skewed within the first decile (implying that the burden would be smaller for most households in the decile and higher for others), some observations with highest impacts are found to have spurious income values and the tax would probably be less regressive if compared to consumption rather than disposable income (Verde and Tol 2009). Regressive effects have most impact for heating and transport fuels where substitutes are not available and where domestic heat efficiency is low (Joyce et al 2012).
Unintended social impacts	No information found
Key economic impacts	
Administrative cost	No information found
Impacts on competition, employment, growth, innovation	Actual data is limited given the recent introduction of the tax. Ex ante assessments of a EUR20/tonne CO2 in 2010 rising to EUR38/tonne CO2 in 2020 with revenues recycled through a reduction in income taxes leads to GNP in 2020 which is 1.1 per cent higher than it would have been without the carbon tax. Employment is also expected to increase due to the lower income tax (Tol et al 2008). Another study concludes that the combined effect of the carbon tax (beginning at EUR20/tonne in 2010 with revenues recycled through lower labour taxes) and reduction in labour taxes would raise the level of GNP in 2020 by 1¼ per cent, with very little further impact thereafter, while total employment would increase by almost the same amount (Fitz Gerald, et al 2008). Another ex-ante simulation of a carbon tax of EUR20/tonne of CO2 introduced in 2005 (which is held at that level for 15 years) finds that where the revenue from a carbon tax is used to cut income taxes, GNP is estimated to grow 1.1 per cent faster than in the baseline (that assumes no tax reform) and employment to grow by 1.1 per cent. However if the revenue of a carbon tax is used simply to repay government debt on international markets a double dividend will not arise. In such a scenario the study finds that the volume of GDP at market prices would decrease by 0.21 per cent as a result of the carbon tax with just under half of the effect of the tax in terms of lost output arises in manufacturing and the remainder occurs in market services. Total employment is also found to fall by 0.07 percentage points (Conefrey et al, 2008). As noted in Joyce et al 2012, the carbon tax would have less of a dampening effect on the economy if labour taxes were

	simultaneously lowered. Fitzgerald et al (2008) for instance found that the economic stimulus of lower income taxes would be greater than the drag on the economy of higher energy prices.
Unintended economic impacts	A shown by Fitz Gerald, et al (2008) a small but rising carbon tax may not have much of an effect in the 2020 time frame, it does signal to industry that it is worthwhile to invest in carbon-saving technologies and R&D and is thus likely to have more of an impact in the long-term.

References

Callan, T., Lyons, S., Scott, S., Tol, R., Verde, S., (2008) The Distributional Implications of a Carbon Tax in Ireland, Working paper No. 250, July 2008, http://www.esri.ie/UserFiles/publications/20080723152521/WP250.pdf [accessed 12/3/2013]

Citizens Information Board (2012) Carbon tax – Introduction, http://www.citizensinformation.ie/en/money_and_tax/tax/motor_carbon_other_taxes/carbon_tax.html [accessed 7/3/2013]

Conefrey, T., FitzGearld, J., Malaguzzi Valeri, L., Tol, S.J., (2008), The impact of carbon tax on economic growth and carbon tax emissions in Ireland. Working paper no. 251, August 2008, http://www.esri.ie/UserFiles/publications/20080821092420/WP251.pdf [accessed 7/3/2013]

Conniffe, D., Scott, S., 1990. Energy Elasticities: Responsiveness of Demands for Fuels to Income and Price Changes. General Research Series, Economic and Social Research Institute, Paper no. 149.

Convery (forthcoming) Ireland's Carbon Tax and the Fiscal Crisis - Issues in Fiscal Adjustment, Environmental Effectiveness, Competitiveness, Leakage and Equity Implications – Forthcoming unpublished

Convery (2012) Budget 2013 – Three Cheers For The Carbon Tax, http://www.publicpolicy.ie/budget-2013-three-cheers-for-the-carbon-tax/ [accessed 6/3/2013]

Commission on Taxation (2009), Report 2009, http://www.commissionontaxation.ie/downloads/Commission%20on%20Taxation%20Report%202009.pdf [accessed 10/4/2013]

Department of Environment, Community and Local Government (n.d.) Irish water reform, http://www.environ.ie/en/Environment/Water/WaterSectorReform/ [accessed 13/3/2013]

Department of Environment, Community and Local Government (2011) National Climate Policy Review 2011, http://www.environ.ie/en/Publications/Environment/Atmosphere/FileDownLoad,28328,en.pdf [accessed 10/4/2013]

Department of the Taoiseach (2007), Programme for Government 2007-2012, http://www.taoiseach.ie/eng/Publications/Publications_Archive/Publications_2007/Eng_Prog_for_Gov.pdf [accessed 12/3/2013]

Department of the Taoiseach (2010), Building Ireland's Smart Economy - A Framework for

Sustainable Economic Renewal, Progress report March 2010, http://www.taoiseach.gov.ie/eng/Building_Ireland's_Smart_Economy/Smart_Economy_Progress_Report.pdf

Department of Finance (2010) The National Recovery Plan 2011-2014, http://www.budget.gov.ie/The per cent20National per cent20Recovery per cent20Plan per cent202011-2014.pdf [accessed 12/3/2013]

Eurostat (2013) Environmental tax revenue, http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do [accessed 18/4/2013]

Fitz Gerald, J., A. Bergin, T. Conefrey, S. Diffney, D. Duffy, I. Kearney, S. Lyons, L. Malaguzzi Valéry, K. Mayor, and R.S.J. Tol, 2008. *Medium-Term Review 2008-2015*, Economic and Social Research Institute, Dublin. http://www.esri.ie/UserFiles/publications/20080515155545/MTR11.pdf [accessed 7/3/2013]

Forfás (2011), Competitiveness Impacts of Increases in Carbon Tax, Dublin: Forfás

Gargan, E., (2012) Reflections on the implementation of the carbon tax in Ireland, Presentation to the UCD/ NESC Workshop: Climate Change Meeting Ireland's 2020 Obligations – 16 May 2012, Department of Finance, Ireland, http://www.nesc.ie/assets/files/downloads/project_climate per cent20change/ucd_workshop/ericgargan.pdf [accessed 6/3/2013]

Irish Statute Book (2010), FINANCE ACT 2010, Number 5 of 2010, http://www.irishstatutebook.ie/pdf/2010/en.act.2010.0005.PDF [accessed 12/3/2013]

Joyce, D., Convery, F., Dunne, L., (2012) Ireland's carbon tax: Equity and regressivity impacts, Presentation at Green Budget Europe + the Institute Sustainable Development and International Relations (IDDRI) Conference: Green taxation as a key for sustainable fiscal reform, PARIS 29-30 October, 2012, http://www.foes.de/pdf/20121107_GBE_IDDRI_Paris_3_Joyce.pdf [accessed 17/4/2013]

Lyons, S., Mayor, K., Tol, R., (2007) Convergence of Consumption Patterns During Macroeconomic Transition: A Model of Demand In Ireland and the OECD, Working Paper No. 205, http://www.esri.ie/UserFiles/publications/WP205.pdf [accessed 7/3/2013]

Ministry of Finance (2010) The National Recovery Plan 2011-2014. Published by the Stationary Office, Government Publications, http://www.budget.gov.ie/The%20National%20Recovery%20Plan%202011-2014.pdf [accessed 18/4/2013]

NESC Secretariat (2012) Towards a New National Climate Policy: Interim Report of the NESC Secretariat to the Department of Environment, Community and Local Government, June 2012, http://www.environ.ie/en/Publications/Environment/ClimateChange/FileDownLoad,31202,en.pdf [accessed 10/4/2013]

OECD (2013) Taxing Energy Use – A Graphical Analysis, OECD Publishing, 28 Jan 2013, DOI: 10.1787/9789264183933-en

Social Justice Ireland, 2012: "Fuel Poverty and Carbon Tax Increases" in Analysis of Budget 2012 Critique. http://www.socialjustice.ie/sites/default/files/file/Budget/2012/2011-12-07_per cent20-per cent20Budget per cent202012 per cent20Analysis per cent20and per cent20Critique.pdf. [accessed 7/3/2013]

Tax Strategy Group (2011) Energy and Environmental Taxes, TSG 11/17, http://taxpolicy.gov.ie/wp-content/uploads/2012/09/11.17-Energy-and-Environmental-Taxes.pdf [accessed 6/3/2013]

Tol, R., Callan, T., Conefrey, T., Fitz Gerald, J., Lyons, S., Malaguzzi, V., Scott, S., (2008) A Carbon tax for Ireland, Economic and Social Research Institute, Dublin, 23 May 2008

Verde, S., and Tol, R., (2009) The Distributional Impact of a Carbon Tax in Ireland, The Economic and Social Review, Vol. 40, No. 3, Autumn, 2009, pp. 317–338, http://www.esri.ie/UserFiles/publications/20090921160131/JACB200938.pdf [accessed 6/3/2013]

1.7 Environmental tax reform in the Netherlands

Summary
The Netherlands is commonly considered a progressive country with regard to energy and environmental taxation. ETR was implemented in the 1990s with the introduction of the Regulatory Energy Tax (RET) in 1996. The RET applies to small-scale consumers and aims to incentivise energy efficiency improvements in order to reduce GHG emissions. Revenues are recycled back to households and industry by reduced income and corporate tax rates, reduced social security contributions and in the past through limited earmarking for energy efficiency programmes. Derogations apply for large industrial energy consumers and tax free allowances and reductions apply to households. In 2004, the energy tax system was streamlined and the RET transformed into the energy tax. Notable elements of the Dutch ETR are that energy tax rates are indexed to inflation and the fact that most energy products with GHG impacts are subject to either direct or indirect taxation. Available evaluation studies suggest that the Dutch ETR has been successful in reducing residential energy demand, with reductions of 8 per cent for electricity and 4.4 per cent for natural gas. The regressive elements of the tax system are found to be nearly neutralised by exemptions applied. Recent changes in the area of environmental taxation focused on removing smaller taxes (on waste, groundwater and packaging) while increasing taxes especially on natural gas; abolishing the exemption for power plants from coal taxation; and abolishing the tax advantage on diesel used by non-road industrial vehicles.

Objectives and design	
Goals and objectives of the tax	Under the Kyoto Protocol the Dutch emission-reduction target is for 6% below the emissions level in the base year, for the period 2008-2012. For 2020, the target is to reduce GHG emissions, especially CO2, by 30% compared to the 1990 level. The Dutch Government has introduced four different taxes on the consumption of energy products since the 1980s (Speck and Jilkova, 2009): Fuel tax/tax on coal: Introduced in 1988 as a general fuel charge and revised into an environmental tax on fuels (i.e. excluding non-energy uses of energy products) in 1991. The purpose of the tax is revenue raising; all revenues go into the general budget. Since 2010 the fuel tax is largely integrated into the mineral oil excise duties, apart from a tax on coal, which since 2013 also covers coal use in electricity generation (Vollebergh, 2013, *personal communication*). (Regulatory) Energy Tax: Introduced in 1996, this tax applies to small-scale consumers and aims to incentivise energy efficiency improvements among those with the ultimate purpose of reducing GHG emissions. The scope of the tax covers mineral oil products for non-transport applications, natural gas and electricity. Revenues of this tax are recycled back to households and industry as part of the Dutch ETR; this and its objective to reduce emissions makes it the most interesting tax in this study's context. In 2004, the RET was renamed 'energy tax' (Energiebelasting) and took over some elements of the fuel tax. Mineral oil excise taxes on transport fuels and on mineral oils used for heating; Para-fiscal tax, a strategic stockpile fee, known as the COVA levy, on petrol, diesel, gas oil, LPG, and kerosene.

Wider ETR context	The most important element of Dutch efforts in the field of ETR is the (Regulatory) Energy Tax. ETR has been designed in the Netherlands to be revenue neutral with revenues recycled back to households and industry, as further explained below. As part of the wider ETR context, there are voluntary long-term agreements between the Dutch government and large energy consuming industries, whereby these industries commit themselves to energy efficiency improvements (until the end of 2012 this was under the 'Energy Efficiency Benchmarking Covenant') (Speck and Jilkova, 2009; Speck, 2008). In 2009, a Long-Term Agreement on Energy Efficiency (LEE) that covers sectors falling under the EU ETS was signed, as a parallel process to the Long-term agreements (LTA) concluded with non-ETS sectors (Bertoldi and Rezessy, 2010). The Covenant is no longer active (since 01/01/2013) but exemptions granted in return for efficiency improvements are still applied, as explained below (Hans Vos, 2013, *personal communication*). Recent developments are linked to political upheavals in 2012 and the risk of the Netherlands failing to meet the 3 per cent budget deficit limit under the EU Growth and Stability Pact. The subsequent budget negotiations included discussions on the green elements of the taxation system. As explained further below, certain energy taxes were increased in compensation for the termination of smaller environmental taxes. A nuclear phase out context is not of relevance: The Netherlands has one nuclear reactor generating just below four per cent of its electricity. It will remain in use until the end of 2033. The Dutch Government considers nuclear power an important transition technology towards a low-carbon energy supply and a new plant is being planned[13].
How the taxable base is defined	The **fuel tax** was designed as a 'upstream' type of tax, whose tax base includes all refined mineral oils, coal and coal products, and natural gas. Since 1992, the tax base is of a fully hybrid nature with fuels being taxed according to both energy and carbon content (50 per cent each) (Vollebergh, 2008; Speck and Jilkova, 2009). The tax has been subject to several modifications over time and some of its elements have been integrated into the energy tax and then the mineral oil excise duties. Since 2008, it is known as the tax on coal. The **(regulatory) energy tax** is a 'downstream' tax that applies to energy products used for heating and electricity generation by households and small businesses. Since its introduction in 1996 the tax base was broadened to include consumption by intermediate firms. With a change of the tax regime towards an 'output' tax style system in 2001, all fuels used to generate electricity were exempted from the fuel tax, while rates under the RET levied on electricity were raised. The rates are partly based on carbon content of the fuels (but have been raised in line with inflation since) (Vollebergh, 2008).
The tax rate applied	The **(regulatory) energy tax** has specific rates for electricity and natural gas. For both, the rate structure is regressive (with the level of consumption). Zero rates apply to very large commercial consumers (>10 million kWh/year), conditional upon the consumer having agreed to obligations for improving energy efficiency with the government (OECD, 2013). The **fuel tax** had specific rates for different fuels.

[13] Dutch government website: http://www.government.nl/issues/energy/nuclear-power

From 1999, tax rates for all energy taxes have been indexed according to inflation (Speck and Jilkova, 2009). An overview of rates for both fuel tax and RET (as well as the mineral oil excise) in 2002 is provided by Vollebergh (2008, p666). An overview of tax rates from the 1980s/90s up to 2005 is provided in Andersen *et al* (2007, p74). Recent tax rates as of 1 April 2012 are summarised in OECD (2013):

Table 1: Development of (regulatory) energy tax rates on natural gas over time (EUR cent per m^3)

	1998	2001	2006	2013	Excise ratio (2013)
0 - 800 m^3	0	13.06	15.07	18.85	0.66
800 - 5,000 m3	5.3	13.06	15.07	18.85	0.66
5,000 – 170,000 m3	5.3	6.65	12.38	18.85	0.56
170,000 – 1,000,000 m3		2.07	3.4	4.48	0.33
1,000,000 - 10,000,000 m3		1.03	1.16	1.63	0.25
> 10,000,000 m3 non-commercial		1.03	1.08	1.17	0.19
> 10,000,000 m3 commercial		0.68	0.77	0.83 *	n/a
Tax credit (€/year/connection)	0	142	197	319	

*Source: Vollebergh (2013) and Vollebergh et al (forthcoming) based on Dutch Ministry of Finance; *2012 value. The excise ratio is calculated as ratio of excise taxes out of the market price excluding VAT.*

Table 2: Development of (regulatory) energy tax rates on electricity over time (EUR cent per kWh)

	1998	2001	2006	2013	Excise ratio (2013)
0 - 800 kWh	0	5.83	7.05	11.8	0.66
800 - 10,000 kWh	1.34	5.83	7.05	11.8	0.66
10,000 – 50,000 kWh	1.34	1.94	3.43	4.4	0.49
50,000 – 10,000,000 kWh		0.59	0.94	1.2	0.25
> 10,000,000 kWh non-commercial			0.10	0.10	0.00
> 10,000,000 kWh commercial			0.05	0.05	0.00
Tax credit (€/year/connection)	0	142	197	319	

Source: Vollebergh (2013) and Vollebergh et al (forthcoming) based on Dutch Ministry of Finance. The excise ratio is calculated as ratio of excise taxes out of the market price excluding VAT.

Rates expressed in different units including EUR/kg CO2 are reproduced below, which shows the unequal tax rate structure when expressed in CO2 terms.

Table 3: Tax rates against different comparators

Energy product	Unit	EUR/unit	EUR/GJ	EUR/kg CO2
Mineral oils: transport fuels				
Unleaded petrol	Litre	0.755	22.91	0.32
Diesel/gas oil (sulphur free)	Litre	0.448	12.53	0.17
Mineral oils: other applications				
Diesel/gas oil	Litre	0.448	12.53	0.17
Heavy fuel oil (2012)	kg	0.035	0.86	0.01
LPG	kg	0.188	4.16	0.06
Coal				
coal	kg	0.014	0.52	0.01
Natural gas				
natural gas (0-5,000)	m3	0.189	5.96	0.11
natural gas (5,000-170,000)	m3	0.189	5.96	0.11
natural gas (170,000-1 mln)	m3	0.045	1.42	0.03
natural gas (1 mln-10 mln)	m3	0.016	0.52	0.01
natural gas (>10 mln)	m3	0.012	0.37	0.01
Electricity				
electricity (0-10,000)	kWh	0.118	32.67	0.85
electricity (10,000-50,000)	kWh	0.044	12.17	0.32
electricity (50,000-10 mln)	kWh	0.012	3.25	0.09
electricity (>10 mln non-commercial)	kWh	0.001	0.28	0.01
electricity (>10 mln commercial)	kWh	0.0005	0.14	0

Source: Vollebergh et al (forthcoming)

Implementation

Specific measures and/or derogations

Specificities of the Dutch system: Speck and Jilkova (2009) point out the detailed tax differentiations according to a range of consumption levels for natural gas and electricity, with tax rates determined in a non-linear, regressive way, which makes the Dutch scheme 'unique among EU Member States'. Vollebergh defines the international uniqueness of the Dutch energy system differently, pointing out that 'most energy products that contribute to climate change emissions are taxed either directly or indirectly' (2008, p667). The Netherlands is among the few countries in the EU where with an indexation to inflation of energy tax rates, benefits are to be expected in the form of stable real tax revenues and a stable impact of the tax on relative prices and thus behaviour (EC, 2012b).

Derogations: In order not to harm their international competitiveness, large industrial electricity consumers (>10 million kWh/year per electricity connection) are exempted from the (regulatory) energy tax if they have entered long-term agreements on energy efficiency with the Dutch Government (OECD, 2013).

	Horticulture (greenhouses) benefit from reduced natural gas tax rates again on the condition of participating in energy efficiency agreements; rebates exist for religious and non-profit organisations (OECD, 2012). The agricultural and horticultural sector contributes 4 per cent to Dutch CO_2 emissions and 66 per cent to total other GHG emissions (mostly CH_4 and N_2O)[14]. Measured on a CO_2-equivalent basis, the sector contributes around 8% of total Dutch GHG emissions (Eurostat 2010 data). Compensations for small-scale consumers in the form of tax-free allowances have changed over time. In 2001, the tax-free allowance for natural gas and electricity granted was abolished. Households now benefit from a tax credit per electricity connection of EUR 319 as of 2009 (see Tables 1 and 2). This tax credit represents a lump sum refund on the household's electricity bill. (Speck and Jilkova, 2009; Vollebergh, 2013, *personal communication*). Further rebates and subsidies exist for energy distribution firms for deployment of CHP, energy-saving technologies, and renewable electricity. Electricity from renewable sources used to be exempted from the RET giving it an additional regulatory purpose to promote the sourcing of renewable energy; since 2003 it benefits from a lower rate (Vollebergh, 2008). This change was triggered by significant increases of imported hydro and to a lesser extent wind power, for which the tax exemption had become an implicit subsidy that therefore failed to benefit the development of the Dutch domestic renewables sector. Decentralised (for own-use) solar and wind power continues to be exempted and since 2013 renewable power produced by (citizen) cooperatives for consumption within the same postal code area is exempted also (Vollebergh, 2013, *personal communication*). Rabobank (2012) calculated that in the case of solar PV for own use, the tax exemption adds 'an effective incentive of EUR 0.11 per KWh in 2012'.
Revenues from the taxes	As noted in a European Commission report (EC, 2012a), environmental taxes in the Netherlands are among the highest in the EU, second only to Denmark. Total revenues from environmental taxes equate to 4.0 per cent of GDP. This compares with total tax revenue of 38.8 per cent of GDP. Total energy tax revenue amounts to 2 per cent of GDP in 2010 (EC, 2012a, p128). A Dutch source specifies that the (regulatory) energy tax alone makes up over 20 per cent of total revenue from environmental taxes; its revenue increased from EUR 400 million when it was introduced to EUR 4.2 billion in 2010 (Vollebergh, 2013, *personal communication*). The figures from the EC (2012a) show that the tax revenue structure of environmental and energy taxes, as well as labour taxes has been fairly stable over 2000-2010. **Table 4: Tax revenue over time in the Netherlands**

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2010
	% of GDP									€ bn
Total tax revenue	37.7	37.4	37.5	37.6	39.0	38.7	39.2	38.3	38.8	228.1

[14] http://www.e-energymarket.com/news/single-news/article/agriculture-horticulture-sectors-supply-almost-half-of-all-dutch-sustainable-energy.html

Environmental taxes	3.7	3.7	3.9	3.9	4.0	3.8	3.9	4.0	4.0	23.5
of which energy tax	1.8	1.8	1.9	2.0	2.0	1.8	1.9	2.0	2.0	12
Transport fuel tax (out of energy)	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.3	1.3	

Source: EC (2012), p168

Going further back in time shows that the shifts brought about by ETR materialised earlier in the Netherlands; between 1990 and 2005, labour taxes decreased from 25.8 to 17.7 per cent of GDP whereas environmental taxes increased from 3.1 to 4 per cent of the same time frame (Speck and Jilkova, 2009, p26). Older figures from Vollebergh reproduced below show that the ETR plays an important role out of energy taxes, after mineral oil excise taxes (mostly for transport fuels as can be deduced from Table 3).

Table 5: Tax revenue from excises on specific energy products in the Netherlands in 1998, 1994 and 2002 (billion EUR)

	1988	1994	2002
Type of tax			
Mineral oil excise (MOE)	2.2	4.0	5.8
Fuel tax (FT)	0.1	0.3	0.6
Regulatory energy tax (RET)	0	0	2.4
Total	*2.3*	*4.3*	*8.8*
As a share of indirect taxes (including VAT) per cent	9.2	13.8	15.3
As a share of total tax receipts (per cent)	4.3	6.7	8.8
As a share of GDP (per cent)	1.1	1.6	2.0

Source: National Budget (Miljoenennota's) several years, cited in Vollebergh (2008, p661)

Use of tax revenues

As mentioned above, the ETR in the Netherlands was designed in a revenue neutral way. Recycling of revenues took effect in 1999 with compensation for both households and industry.

Households benefit from lower income tax rates and higher tax free allowances (especially for pensioners). Industry benefits from a reduction in the employers' social security contributions, an increase in tax free allowances for SMEs, and a reduction of corporate tax rates (Speck and Jilkova, 2009). This shows that revenues from energy taxes are offset by reductions in taxes somewhere in the fiscal system, not necessarily in the energy system (Vos, 2013, *personal communication*). Only until 2003, a smaller share of RET revenues (the most important source of revenues) of around 15 per cent used to be earmarked for an energy premium system rewarding the purchase of energy-efficient appliances (Duscha *et al*, 2005).

Recent and future developments

Towards the end of the 2000s, a renewed discussion on the role of the tax system in greening the economy and reducing GHG emissions emerged in the Netherlands. This culminated in the adoption of the 'Fiscal Plan 2012' by the

in ETR	Ministry of Finance at the end of 2011. The Plan proposes to abolish five environmental taxes including on water use, waste and packaging, amounting to a comparable small overall tax revenue (around EUR 700 million); taxes in the areas of energy and transport would remain, which, in terms of revenue, are the most important accounting for 90 per cent of revenue from all environmental taxes. These plans saw some changes in the midst of budgetary and political turbulences in spring 2012 leading to the stepping down of the coalition government and an eventual multi-party budget deal. As part of that deal, some of the smaller environmental taxes (on waste, groundwater and packaging) will be abolished. Among the other measures: taxes especially on natural gas will increase; the exemption for power plants from coal taxation will be abolished; and a tax advantage on diesel used by non-road industrial vehicles will be abolished. An important but also sensitive element of the original plans to abolish the income-tax exemption for commuter travel costs has been abandoned, hence, the income tax relief for commuter travel is still in place (Vos, 2012). With regards to future plans, Vos (2012) explains that the Dutch government would in principle welcome a move towards 'variabilisation' of transport taxation, i.e. a shift from fixed taxes such as registration charges and annual vehicle taxes towards increased fuel taxes. However, current lack of willingness by the German and Belgian governments to increase the fuel taxes in those countries, which are lower compared to the Netherlands, makes such a shift unlikely. The government of the Netherlands has proposed a (small) additional levy/surcharge on electricity to finance renewable energy subsidies (the Sustainable Energy Incentive Scheme, SDE+) that came into force on 1 January 2013 (OECD, 2013).
Interactions with other policies	
Compatibility with EU ETS	No conflicts with the EU ETS could be identified. In fact, the ETS is seen as the primary instrument to reduce emissions in energy intensive industries, which are exempted from energy and fuel taxation or only subject to very low rates due to competitiveness concerns and rather engaged in voluntary long-term agreements with the Dutch Government to improve energy efficiency (as explained above).
Revised EU Energy Tax Directive 2003/96/EC	Scenarios run by CE Delft show that adapting the Dutch tariffs to the changes in tariffs proposed in the Energy Tax Directive could produce significant changes in the tariffs applied to motor and heating fuels in the Netherlands. This is despite the fact that the Dutch have high tariffs already, mostly significantly above current EU minimum tariffs. The need for diesel and petrol taxation to better reflect energy and carbon content is highlighted as the only challenge in the area of environmental taxation in a report by the European Commission (EC, 2012b). With regard to the specific tariffs, the tariffs on petrol would decrease significantly, while diesel, kerosene and liquefied petroleum gas (LPG) tariffs would increase. Natural gas tariffs (apart from reductions in the lowest consumption bracket) would increase, as would the tariff on coal (CE Delft and Ecofys, 2011; cited in Vos, 2012).
Country context	

<table>
<tr><td>GDP</td><td>705.6 billion USD (current PPPs) in 2010 (OECD 2012)</td></tr>
<tr><td>Total primary energy supply</td><td>83.3 Mtoe in 2010 (OECD 2012)</td></tr>
<tr><td>Energy intensity (TPES per unit of GDP)</td><td>0.16 toe/'000 USD in 2010 (compared to 0.1 in Switzerland; mid-range out of the case study countries considered) (OECD 2012)</td></tr>
<tr><td>Electricity generation by fuel</td><td>Out of total electricity generation in 2010 (IEA, 2012):
Coal and peat: 21.8 per cent
Oil: 1.1 per cent
Natural gas: 62.8 per cent
Nuclear: 3.4 per cent
Hydro: 0.1 per cent
Renewable and other: 10.8 per cent
The data show an inherently different electricity generation structure than in Switzerland with a major reliance on natural gas (1.6 per cent in CH) and an important coal share (0 per cent in CH).</td></tr>
<tr><td>Economic structure</td><td>(Population: 16.53 million in 2009)
Real value added of industry (7.8 per cent in 2010); agriculture, forestry, fishing (1.1 per cent in 2010); services (2.2 per cent) (OECD 2012)
Peter et al (2007) note the similar economic structures of Switzerland and the Netherlands.</td></tr>
<tr><td>Demand elasticities</td><td>Table 5: Demand elasticities for different consumers
<table>
<tr><th>Consumer category</th><th colspan="2">Electricity</th><th colspan="2">Natural gas</th></tr>
<tr><td></td><td>short-term</td><td>long-term</td><td>short-term</td><td>long-term</td></tr>
<tr><td>Households</td><td>-0.15</td><td>-0.25</td><td>-0.1</td><td>-0.2</td></tr>
<tr><td>Utilities (HDO)</td><td>-0.13</td><td>-0.22</td><td>-0.12</td><td>-0.23</td></tr>
<tr><td>Industry, general</td><td>-0.05</td><td>-0.1</td><td>-0.05</td><td>-0.15</td></tr>
<tr><td>Industry, energy-intensive</td><td>-0.8</td><td>-1</td><td>-0.8</td><td>-1</td></tr>
<tr><td>Horticulture</td><td>-0.05</td><td>-0.1</td><td>-0.15</td><td>-0.23</td></tr>
<tr><td>Horticulture, greenhouses</td><td>-0.05</td><td>-0.1</td><td>-0.8</td><td>-1</td></tr>
</table>
Source: Own translation based on CE Delft (2012)</td></tr>
<tr><td colspan="2">Key environmental impacts</td></tr>
<tr><td>Nature and degree of impacts on the environment</td><td>An important evaluation study has been undertaken by Berkhout et al (2004). Their study based on household-level data provides strong evidence for that the RET has led to a reduction in residential use of natural gas and electricity. Specifically, it concludes that, in the short term, the energy tax led to a yearly average demand reduction of 8 per cent for electricity (over the years 1994-99) and 4.4 per cent for natural gas (over the years 1992-99).

Enevoldsen (2005) highlights energy intensity improvement in the Dutch industry over 1990 to 2000 of 10-15 per cent. Likewise Peter et al (2007) note the important improvement in the Netherlands, noting at the same time that the country started from a relatively high initial level of intensity.

As part of a more academic assessment, Vollebergh calls the Dutch energy tax structure ‘comprehensive but also incoherent’ (2008, p667). Comprehensiveness has been referred to above; incoherence stems from the fact upstream versus</td></tr>
</table>

	downstream taxation is not clear cut in the Dutch system. This leads to CO_2 emissions from the production of most final energy products being 'exempted either implicitly, as in the case of crude oil or [natural gas], or explicitly, as in the case of electricity production'. This is an inefficient outcome for CO_2 abatement as it results in low or zero energy taxes for those sectors with the cheapest abatement options (2008, p668).
Key social impacts	
Impacts on income distribution	While regressive tax rates have been introduced in the Netherlands with a higher burden on small consumers while large consumers are being sheltered due to competitiveness concerns, the assessment of the social impacts is positive. Peter *et al* (2007) compare net distributional effects of ETRs in various European countries including the Netherlands. It is found that in Netherlands, as in Sweden, the regressive design of the tax rates is nearly neutralised given the recycling measures and exemptions, for example in the form of tax free allowances, tax reductions and ceilings, as introduced above. The refund on electricity bills applied in the Netherlands are also put forward in an EU wide review of ETR by the EEA as good examples of policy options that avoid negative distributional effects of ETR on private households (EEA, 2011a).
Unintended social impacts	Unknown.
Key economic impacts	
Administrative cost	No detailed information on cost levels was found. It should be mentioned, however, that the recent reforms including the abolishment of lower-revenue environmental taxes on inter alia water and waste were motivated by the aim to reduce administrative costs.
Impacts on competition, employment, growth, innovation	Due consideration has been paid to competitiveness concerns as part of the design of ETR in the Netherlands. This has led to exemptions for large consumers and energy-intensive industries and alternative voluntary long-term agreements between these industries and the government. Competitiveness concerns also led to the stance that the ETS is the instrument of choice to reduce emissions in the energy-intensive industries. Given these measures, we are not aware of negative impacts on competitiveness. Peter *et al* (2007) note that ETR made investments in clean technologies more attractive. It is not clear whether this has led to measurably more innovative activities by Dutch firms that would give them a competitive advantage. Peter *et al* (2007) furthermore highlight that recycling of tax revenues to households and industry as part of the Dutch ETR has led to a small, positive employment impact of 9000 new jobs (or ~0.1 per cent of the Dutch workforce). The small impacts are not surprising given the low unemployment rate that has hardly exceeded 5.5 per cent since the late 1990s, according to Eurostat data.
Unintended economic impacts	Unknown.
References	
Andersen, M.S., Barker, T., Christie, E., Ekins, P., Gerald, J.F., Jilkova, J., Junankar, S., Landesmann, M., Pollitt, H., Salmons, R., Scott, S. and Speck, S. (eds.) (2007) *Competitiveness Effects of Environmental Tax Reforms (COMETR)*. Final report to the European Commission. National Environmental Research institute, University of Aarhus, http://www.dmu.dk/Pub/COMETR_Final_Report.pdf. Berkhout, P H G, Ferrer-i-Carbonell, A, Muskens, J C (2004). The ex-post impact of an energy tax on	

household energy demand. *Energy Economics* 26, 297–317.

Bertoldi, P. and Rezessy, S. (2010) *Voluntary agreements in the field of energy efficiency and emission reduction: Review and analysis of the experience in Member States of the European Union*. Report prepared by the Joint Research Centre of the European Commission, http://ec.europa.eu/energy/efficiency/studies/doc/2010_05_jrc_va_study.pdf.

CE Delft (2012) *Niet-fiscale prijsprikkels: Onderzoek naar het energiebesparingseffect van gedifferentieerde energieprijzen*. CE Delft: Delft.

CE Delft and Ecofys (2011) *Belastingen op energieproducten, elektriciteit en CO_2 Gevolgen van herziening van de Energiebelastingrichtlijn voor Nederland*. CE Delft: Delft.

Duscha, M., Seebach, D., Grießmann, B., Rath, U., Thomas, S. (2005) *Politikinstrumente zum Klimaschutz durch Effizienzsteigerung von Elektrogeräten und -anlagen in Privathaushalten, Büros und im Kleinverbrauch*, Endbericht im Auftrag des Umweltbundesamtes (FKZ 201 41 137). Institut für Energie- und Umweltforschung (IFEU): Heidelberg.

EEA (2011a) *Environmental tax reform in Europe: implications for income distribution*. EEA Technical Reports No 16/2011.

EEA (2011b) *Environmental tax reform in Europe: opportunities for eco-innovation*. EEA Technical Reports No 17/2011.

Enevoldsen, M K (2005) *The theory of environmental agreements and taxes* (Series eds Oates, W E and Folmer, H), Cheltenham: Edward Elgar.

European Commission [EC] (2012a) *Taxation Trends in the European Union: Data for the EU Member States, Iceland and Norway*. Eurostat Statistical Books, Luxembourg.

European Commission [EC] (2012b) *Tax reforms in EU Member States: Tax policy challenges for economic growth and fiscal sustainability*, 2012 Report. Taxation papers working paper series N34, DG TAXUD.

IEA (2012) *Energy balances of OECD countries*. OECD/IEA: Paris.

OECD (2012) Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels 2013, OECD Publishing, http://dx.doi.org/10.1787/9789264187610-en.

OECD (2013) *Taxing Energy Use: A Graphical Analysis*, OECD Publishing. http://dx.doi.org/10.1787/9789264183933-en.

Peter, M., Lückge, H., Iten, R., Trageser, J., Görlach, B., Blobel, D. and Kraemer, R. A. (2007) *Erfahrungen mit Energiesteuern in Europa — Lehren für die Schweiz*, Infras/Ecologic im Auftrag des Schweizerischen Bundesamtes für Energie (BFE).

Rabobank (2012) *An Outlook for Renewable Energy in The Netherlands*. Rabobank Industry Note # 320 (June 2012), http://www.energie-nederland.nl/wp-content/uploads/2012/06/An-Outlook-for-Renewable-Energy-in-The-Netherlands.pdf.

Speck, S (2008) The Design of Carbon and Broad-based Energy Taxes in European Countries.

Vermont Journal of Environmental Law 10(3), 31-59.

Vollebergh, H. R. J. (2008) Lessons from the polder: Energy tax design in The Netherlands from a climate change perspective. *Ecological Economics* 64, 660-672.

Vollebergh, H (2013) *De belasting op energieproducten, CO_2 en elektriciteit*. Presentation at the Dutch Ministry of Finance, Expertbijeenkomst belastingen op energie, on 16 April 2013.

Vollebergh, H, Drissen, E, Eerens, H and Geilenkirchen, G (forthcoming) *Milieubelastingen en Groene Groei Deel II: Verkenning ruimte voor verbetering van het energie en klimaatbeleid*. Forthcoming report by PBL.

Vos, H (2012) *Market-based instruments in environmental policy: the Dutch case*. Unpublished working paper.

1.8 Carbon taxes in Norway

Summary
Norway was among the first countries worldwide to introduce a carbon tax (in 1991). The key purpose of this tax was to reduce CO_2 emissions from the petroleum industry and hence to stimulate low carbon technologies in this sector. This resulted, for example, in the implementation and operation of a first large-scale carbon capture and storage project in the mid-1990s in Norway. The introduction of the tax was much less about providing a stimulus for *economy wide* low carbon innovation and jobs. This is also reflected in the fact that all processing industries are exempt from the CO_2 tax. In addition to the CO_2 tax, there is an energy, SO_2 and NO_x tax in place. Over the last decades, the tax rates, which are reviewed annually, have been changed and adapted on a regular basis. Most recently, the CO_2 tax for the petroleum sector was nearly doubled to further incentivise low carbon emission technologies in this sector. Many exemptions and derogations have been introduced to prevent carbon leakage, in particular for the energy intensive industries such as aluminium, pulp and paper etc. All CO_2 tax revenues from the petroleum industry are transferred to the Government Pension Fund Global which also supports the National Insurance Scheme's expenditure on pensions. Other revenues from the CO_2 and energy taxes go to the national budget. Norway is for several reasons a 'special case' - the country has been a net oil and gas exporter for several decades and tax revenues as well as the overall economy have strongly benefited from the national oil and gas industry. The Norwegian petroleum industry is a major target of the CO_2 tax and is still dominated by state ownership. Moreover, Norway's electricity system is almost carbon free due to the high share of hydropower (95 per cent).

Objectives and design	
Goals and objectives of the tax	Norway introduced a CO_2 tax in 1991 with the purpose of reducing GHG emissions in particular from the petroleum industry and hence to stimulate low carbon technologies in this sector. The CO_2 tax forms part of the Norwegian excise duty scheme on fossil fuels, which apart from the CO_2 tax includes an energy tax and a SO_2 tax. The different tax schemes have been subject to frequent changes over time including the abolishment and reintroduction of the energy tax as further explained below.
Wider ETR context	GHG mitigation potential in the electricity sector is limited due to the overwhelming share of hydropower in the electricity mix. Apart from the availability of this low-carbon electricity source, the emissions intensity of the industrial sector is rather high with the Norwegian offshore petroleum industry being an important source of emissions. The CO_2 tax therefore targets offshore oil and gas production to lower emissions and enhance efficiency. The introduction of the CO_2 tax is considered as a key driver behind the first carbon capture and storage projects in Norway. Climate mitigation is broadly supported in Norway and is reflected in Norway's pledge to cut global GHG emission by 30 per cent by 2020 compared to 1990 levels. Norway has also committed to the objective of becoming carbon-neutral by 2050. In 2008 the Norwegian Parliament backed by a cross-party majority adopted an 'Agreement on Climate Policy' to increase public spending on climate related action.
How the taxable base is defined	**Energy tax**: The energy tax on mineral oil was introduced in 1970. Rates were lowered in 1992 following the introduction of the CO_2 tax and subsequently the

	energy tax on mineral oil was abolished completely in 1993, thus shifting towards taxing fuels based on their CO_2 and sulphur content. In an attempt to discourage the use of heating oil following an increase in the electricity tax, the energy tax was reintroduced in 2000 as a basic levy on heating oil. **CO_2 tax**: In 1991, the government introduced a CO_2 tax on consumption of petrol, auto diesel oil, mineral oil and on the offshore petroleum sector. The instrument was designed to reduce CO_2 emissions from the petroleum industry which pays the CO_2 tax per litre of oil and natural gas liquids and per standard cubic metre of gas burnt off or flared on platforms, installations or facilities (IEA, 2013). The tax rate is not fixed per tonne of CO_2 but is set at specific rates per fuel (see below). In 1992, the CO_2 tax was extended to cover coal and coke but was abandoned and since January 2003 coal and coke are no longer subject to the CO_2 tax. The CO_2 taxes on mainland activities are generally levied on use (i.e. the purchase or import) of mineral oils and petrol (Bruvoll and Dalen, 2009). A CO_2 tax on natural gas and LPG was introduced on 1 September 2010 at a similar level as the CO_2 tax rate levied on mineral oil; the tax is mainly imposed on the fuels used for heating and in-land transport (OECD, 2013). **Sulphur (SO2) tax**: This tax is levied according to the sulphur content of different mineral oils and coal. The tax on coal and coke was abandoned at the end of 2001 and replaced with a voluntary SO_2 reduction scheme (Speck *et al*, 2006). **Electricity tax**: A tax is charged on electricity consumption. The removal of both the CO_2 and SO_2 tax on coal and coke means that since 2003 these fuels are no longer subject to any taxation (Speck *et al*, 2006).
The tax rate applied	The following table provides the applicable energy and CO_2 tax rates on energy products for 2010 (per litre unless otherwise indicated and in NOK): **Table 1: Energy and CO2 rates on energy products in 2010** **Petrol tax** Sulphur-free 4.54 Low-sulphur 4.58 **Auto diesel tax** Sulphur-free 3.56 Low-sulphur 3.61 Biodiesel 1.78 **Electricity consumption tax, per kWh** General rate 0.11 Reduced rate 0 **Basic tax on heating oil, etc.** Mineral oil 0.89 Mineral oil for wood processing, production of colourants/pigments 0.13 **Lubricant oil tax** 1.8 **Carbon dioxide tax** Petroleum activities, per litre or standard cubic metre 0.47 Mineral oil 0.58 Mineral oil for domestic aviation 0.68 Mineral oil for wood processing & fishing industry 0.3 Gasoline 0.86 Natural gas, per standard cubic metre 0.51 Liquefied petroleum gas, per kg 0.65 **Sulphur tax** 0.08 *Source: IEA, 2011*

	Tax rates are reviewed annually and have therefore been changed and adapted rather regularly since their introduction in 1991. They are usually set as the result of political negotiation, except in the vehicle sector (Janne Stene, 2013, *personal communication*). As of 1 January 2013, the CO_2 tax for the petroleum sector on the Norwegian continental shelf was increased by NOK 200 per ton (EUR27) which corresponds to an emissions charge of roughly NOK 410 per ton of CO_2 (EUR55) (Norwegian Ministry of the Environment, 2013)[15]. The intention is to encourage the petroleum offshore industry to use almost carbon free electricity generated on the mainland for their operations instead of using natural gas and petroleum for power generation offshore (Speck, 2013). In addition, the rebate on the CO_2 tax rate for the fishing and hunting industry was reduced as of 2013 leading to an effective CO_2 tax of around NOK 50 (EUR6.7) per ton (Royal Ministry of Finance, 2012). As mentioned above, CO_2 tax rates are not fixed per ton of CO_2. The CO_2 tax rates differ between energy products ranging from 101 NOK (EUR13.7) per tonne of CO_2 for heavy fuel oil to NOK 225 (EUR30.5) for natural gas, light heating oil and 384 NOK (EUR52.1) for petrol in 2012 (Speck, 2012). The CO_2 tax applies to about 68 per cent of all CO_2 emissions and about 52 per cent of all greenhouse gas emissions (IEA, 2013). **Summary of further tax rates**: • In 2008, a CO_2 tax of NOK 0.65 per litre of jet fuel consumed was introduced to domestic flights. In addition, a NO_x tax was introduced in 2007. • On 1 January 2003, taxes on other GHG emissions, i.e. HFC and PFC, were introduced at a rate of NOK 225 (EUR30.5) per ton of CO_2-eq (Speck, 2012). • Electricity consumption is not subject to the CO_2 tax given the low carbon nature of the electricity but only to (modest) excise duties. • The motor vehicle registration tax was restructured in 2007, resulting in a strong fall in CO_2 emissions from newly registered cars (Royal Ministry of Finance, 2012). • For road transport fuels a fuel tax (petrol tax or auto diesel tax) and a CO_2 tax applies. • All biofuels are exempted from the CO_2 tax. High-blend bioethanol is also exempted from the petrol tax. Biodiesel (both high and low blends) is subject to 50 per cent of the auto diesel tax since 2010 (IEA, 2011). • Recently the CO_2 and NO_x element in the non-recurring tax on car purchases have been increased (Norwegian Ministry of the Environment, 2013).
Implementation	
Specific measures and/or derogations	**Specific measures**: Indexation of tax rates to inflation **Derogations**: No CO_2 taxes are levied from industrial processes which made up about 18 per cent of total emissions in 2006 (Bruvoll and Dalen, 2009). Moreover foreign air and water-borne transport as well as fishing in distant waters are exempt from CO_2 taxes, while the wood processing industry and the herring meal and fishmeal industries benefit from a reduced tax level of 50 per cent. From 2013,

[15] Exchange rates from: http://www.oanda.com/currency/converter/.

	the rebate on the CO_2 tax for the fishing and hunting industry was reduced (see above) and the regulatory fee for the fishing fleet was abolished (Royal Ministry of Finance, 2012). Installations paying the CO_2 tax were exempt from the Norwegian emissions trading scheme (ETS) which ran from 2005-07. Installations such as pulp and paper and offshore oil and gas industries which were included in the EU ETS after Norway joined the EU ETS in 2008 were exempt from paying the CO_2 tax on heating oil from 1 January 2008. In addition the petroleum sector, after having been included in the EU ETS, benefited from substantial reductions in the CO_2 tax in 2008 (IEA, 2011). But the tax was increased again in January 2013 (see above). In addition, CO_2 taxes paid by the petroleum industry offshore is classified as a deductible operating cost associated with petroleum activities, which reduces the ordinary tax and special tax actually paid by oil companies (IEA, 2013). Natural gas and LPG used in the domestic shipping and the greenhouse sector are exempted from the CO_2 tax introduced in 2010, the manufacturing sector benefits from a lower rate on natural gas and a full tax exemption on LPG (OECD, no date). Different exemptions for certain energy-intensive industries from the electricity excise duty applied over time which were simplified in 1993 by stipulating that all industry would be subject to half the normal electricity tax. Since then, several industries have been exempt from the electricity tax (IEA, 2011).
Revenues from the taxes	In 2010, the CO_2 tax generated estimated revenues of NOK 2.5 billion (EUR 286 million) (IEA, 2011). According to estimates by the European Commission revenues from energy taxes in Norway amount to around EUR 3.8 billion in 2010 which corresponds to 1.2 per cent of GDP and 2.8 per cent of total tax revenues. The following table shows the historical development of tax revenues between 2000 and 2010.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	per cent of GDP										
Total tax revenue	42.6	42.9	43.1	42.3	43	43.2	43.5	42.9	42.1	42.4	42.9
Environmental taxes	3	3	3.1	3.1	3	2.8	2.8	2.8	2.4	2.6	2.6
of which energy tax	1.5	1.5	1.5	1.5	1.3	1.2	1.2	1.2	1.1	1.2	1.2
Transport fuel tax (out of energy)	*:*	*:*	*:*	*:*	*0.9*	*0.9*	*0.8*	*0.8*	*0.7*	*0.8*	*0.8*

Source: EC (2012), p168

	According to the Norwegian government environmental and energy related taxes have increased by around NOK 1.7 billion from 2005 to 2012 in total (Royal Ministry of Finance, 2012).
Use of tax	Revenues from the CO2 tax go to the general budget. Parts of the revenues have

revenues	been used to lower labour and capital income taxes and employers' non-wage labour costs (co-financed by increased revenues from VAT increase) (Peter *et al*, 2007). Income from the CO_2 tax on the petroleum sector is transferred to the 'Government Pension Fund Global'. The purpose of this fund is to 'support government savings to finance National Insurance Scheme's expenditure on pensions and support long term considerations in the use of petroleum revenues' (Norwegian Government, 2012). The increase in the CO_2 tax on petroleum activities as of January 2013 increases the transfer to the fund by NOK 370 million (Royal Ministry of Finance, 2012). However, the net transfer will in fact be lower because the petroleum industry can count their CO_2 tax expenditure towards their operational costs (see above), so that the increased CO_2 tax will lead to reduced income from taxes on petroleum extraction. With the increase of the CO_2 tax for the petroleum industry's offshore operations from January 2013, the Norwegian government decided to establish a new fund for climate change mitigation, renewable energy and energy conversation worth NOK 10 billion in 2013 on the basis of the Basic Fund for Renewable Energy and Energy Efficiency with a total capital of NOK 35 billion. At the same time the transfers to the Energy Fund with a total estimated income of NOK 1,836 million in 2013 will be increased from 2014. By developing and implementing new technologies the fund aims to reduce GHG emissions and reduce energy consumption[16].
Future developments in ETR	No information available.
Interactions with other policies	
Compatibility with EU ETS	After Norway joined the EU ETS in 2008, CO_2 tax rates were adjusted and some installations covered under the EU ETS exempted from the CO_2 tax. The recent increase of the CO_2 tax which took effect in 1 January 2013 was also justified by the low EU ETS allowances prices.
Revised EU Energy Tax Directive 2003/96/EC	No detailed information could be found on how the proposed revisions to the Directive may affect tax rates in Norway. With regard to the (lower-revenue) electricity tax, Speck et al (2006) note that the Norwegian rates were set at the EU minimum level as set out in the current Energy Tax Directive. It can be assumed that these rates will simply be changed to follow new proposed minimum rates.
Country context	
GDP	277.0 billion USD (current PPPs) in 2010 (OECD 2012)
Total primary energy supply	30.9 Mtoe in 2010 (OECD 2012)
Energy intensity (TPES per unit of GDP)	0.16 toe/'000 USD in 2010 (compared to 0.1 in Switzerland; mid-range out of the case study countries considered) (OECD 2012)
Electricity generation by	Out of total electricity generation in 2010 (IEA, 2012): • Hydro: 94.7 per cent

[16] Norwegian Ministry of the Environment: The Government is following up on the Climate Agreement, http://www.regjeringen.no/en/dep/md/press-centre/Press-releases/2012/the-government-is-following-up-on-the-cl.html?id=704137 [11/03/2013]

fuel	• Natural gas: 3.94 per cent • Coal and peat: 0.09 per cent • Oil: 0.02 per cent • Nuclear: - • Renewable (other than hydro) and other: 1.24 per cent The almost entire reliance on hydro is a striking feature of the Norwegian electricity mix and means that basically no further efforts are needed in Norway to shift towards renewable energy sources.
Economic structure	Population: 4.89 million in 2010 Real value added of industry (7.8 per cent in 2010); agriculture, forestry, fishing (1.1 per cent in 2010); services (2.2 per cent) (OECD 2012)
Demand elasticities	No information found.
Key environmental impacts	
Nature and degree of impacts on the environment	A modelling based approach on the effects of the Norwegian CO_2 tax analysing the period 1990–1999 concludes that despite the introduction of the CO_2 tax and other tax modifications the actual effect of the CO_2 tax on GHG emissions has been rather low, if compared to a scenario without a CO_2 tax place. Bruvoll and Larsen (2004) argue that the taxes contributed to a reduction in onshore emissions of only 1.5 per cent and in total emissions of only 2.3 per cent. Thus instead of a 21.1 per cent increase of total emissions in a counterfactual zero-tax situation, observed emissions rose by 18.7 per cent over the period 1990–1999. This rather limited effect is explained by the extensive tax exemptions and lack of demand elasticity in the sectors covered by the CO_2 tax. For example, the exemption of industrial processes from the CO_2 tax explains why virtually no reduction of CO_2 emissions was achieved in this sector. However an IEA comparison of the impact on GHG emissions of selected implemented or adopted policies and measures shows that the CO_2 tax on offshore activities makes by far the highest contribution (5.2 MtCO2 eq) to a total emission reduction of 10.8 to 14.2 $MtCO_2$ eq in 2010 (IEA, 2011, p31), By contrast, the CO_2 tax on onshore activities contributes 0.85 $MtCO_2$ eq only. However, energy intensity reduced by 7.2 per cent from 1990 to 1999 and contributed to a reduction of CO_2 emissions by 11 per cent. Among private households a 30 per cent reduction in energy intensity was reached, mainly due to a more efficient use of gasoline which may indeed reflect changes in consumers' vehicle choice as a result of higher fuel prices (Bruvoll/Larsen, 2004). Moreover a sectoral analysis points to positive effects of the CO_2 tax. For example, CO_2 emissions at statutory combustion plants decreased by 21 per cent between 1991 and 1995 (Duff/Hsu, 2010). Comparing the impacts of climate policies on the Dutch and Norwegian petroleum sectors during the 1990s, Christiansen and Skjaerseth (2005) conclude that the CO_2 tax in Norway was effective in reducing CO_2 emissions per unit of production which fell by around 22 per cent between 1990 and 2001.
Key social impacts	
Impacts on income distribution	No significant impacts on income distribution have been found in Norway. One study expresses a concern for regions where there is no public transportation available that would allow people to switch to public transport in response to

	increase fuel taxes (OECD, 2004).
Unintended social impacts	No information found
Key economic impacts	
Administrative cost	No information found.
Impacts on competition, employment, growth, innovation	No recent assessments could be found on economic impacts. Earlier work suggests that there have been some closures of firms in energy-intensive industries (metal, petroleum and chemical industries), while other evidence suggests positive innovative effects underpinned by higher turnover in companies subject to strict environmental regulation (Peter *et al,* 2007). Current insight from Norway suggests that there is no discussion about the impact of environmental taxes on jobs given the lack of human capital in the petroleum sector (Janne Stene, 2013, *personal communication*).
Unintended economic impacts	No additional information found.
References	

Bruvoll, A. and Dalen, H. M. (2009) Pricing of CO_2 emissions in Norway: Documentation of data and methods used in estimations of average CO_2 tax rates in Norwegian sectors in 2006. Statistics Norway/Climate and energy economics, http://www.ssb.no/a/english/publikasjoner/pdf/doc_200916_en/doc_200916_en.pdf [11/03/2013]

Bruvoll, A. and Larsen, B.M. (2004) Greenhouse gas emissions in Norway: do carbon taxes work? *Energy Policy* 32(4), 493–505.

Christiansen, A. C. and Skjaerseth, J. B. (2005) Climate change policies in Norway and the Netherlands: Different instruments, similar outcome? *Energy and Environment* 16(1), 1–25.

Duff, D.G. and Hsu, S.-L. (2010) Carbon taxation in theory and practice. In: Soares, C. D. *et al, Critical issues in environmental taxation*. Oxford University Press, 261-276.

EEA (2011) *Environmental tax reform in Europe: opportunities for eco-innovation*. EEA Technical Reports No 17/2011.

European Commission [EC] (2012) *Taxation Trends in the European Union: Data for the EU Member States, Iceland and Norway*. Eurostat Statistical Books, Luxembourg.

IEA (2011) *Energy policies of IEA countries 2011 review: Norway*. OECD/IEA: Paris.

IEA (2012) *Energy balances of OECD countries*. OECD/IEA: Paris.

IEA (2013) IEA Policies & Measures Databases, Norway CO_2 tax, http://www.iea.org/policiesandmeasures/ [11/03/2013]

Norwegian Government (2012) Provisions on the management of the Government Pension Fund as of 8 October 2012, http://www.regjeringen.no/pages/1719656/governmentPensionFundact.pdf [12/03/2013]

Norwegian Ministry of the Environment (2013). *The Government is following up on the Climate*

Agreement, http://www.regjeringen.no/en/dep/md/press-centre/Press-releases/2012/the-government-is-following-up-on-the-cl.html?id=704137 [11/03/2013]

OECD (2004) *Green Tax Reforms in OECD countries: an overview*. http://www.eclac.org/dmaah/noticias/discursos/3/14283/03_en.pdf [11/03/2013]

OECD (2013) N*orway: inventory of estimated budgetary support and tax expenditures for fossil fuels*, http://www.oecd.org/site/tadffss/48786631.pdf [11/03/2013]

OECD (2013) *Taxing Energy Use: A Graphical Analysis*, OECD Publishing. http://dx.doi.org/10.1787/9789264183933-en.

Peter, M., Lückge, H., Iten, R., Trageser, J., Görlach, B., Blobel, D. and Kraemer, R. A. (2007) *Erfahrungen mit Energiesteuern in Europa — Lehren für die Schweiz*, Infras/Ecologic im Auftrag des Schweizerischen Bundesamtes für Energie (BFE).

Royal Ministry of Finance (2012) Main features of the tax programme for 2013, Oslo, 8 October 2012, http://www.regjeringen.no/pages/38074274/skatt_eng.pdf [11/03/2013]

Speck, S., (2013) 'Carbon taxation – two decades of experience and future prospects', *Carbon Management*, April 2013 (forthcoming).

Speck, S., Andersen, M S, Nielsen, H Ø, Ryelund, A and Smith, C (2006) *The use of economic instruments in Nordic and Baltic Environmental Policy 2001-2005*. Nordic Council of Ministers: Copenhagen.

1.9 Carbon and energy tax reform in Sweden

Summary

In 1991, a CO2 tax was introduced which complemented the existing energy tax scheme. This was followed by a 10-year 'green tax-shifting programme' from 2001–2010. The programme was stopped by the new government in 2007, but the climate package adopted in 2008 included an increase in CO2 tax and other changes. The objective of the first phase was to reduce relatively high rates of personal income tax and offset some of the revenue losses caused by this reduction. The objective of the second phase was to lower taxes of low and medium wage earners and encourage the adjustment to an ecologically sustainable society, while at the same time safeguarding the competitiveness of Swedish industry (Speck and Jilhova 2009).

In December 2009, energy and CO_2 taxation were further reformed with a view to address the reduction of GHG emissions and the achievement of the 2020 targets for renewable energy and energy efficiency. The government aims to achieve energy savings of 9 per cent by 2016 from 2001-05 levels and to reduce the energy intensity by 20 per cent below 2008 levels by 2020. Sweden is on track to achieve and exceed its interim energy-saving target with an estimated share of 15 per cent by 2016, while achieving 20 per cent by 2020 is still challenging. Energy efficiency will be the driver of the decarbonisation agenda for 2020, 2030 and 2050, across the whole economy. On the basis of Government Bill 2009/10:41, the Parliament decided to gradually limit CO_2 tax exemptions for energy intensive industries and others outside the EU-ETS between 2011 and 2015. It abolished the special CO_2 tax break to some industrial installations outside the EU-ETS and reformed energy taxes on heating fuels to strictly reflect the energy content (International Energy Agency, 2013).

Sweden has developed and implemented a comprehensive mix of measures to promote energy efficiency, including legislative and fiscal measures, setting price signals through energy and CO_2 taxes and the EU-ETS in order to steer demand. Sweden complements these measures with a range of financial supports, information, training and dissemination tools to support voluntary energy efficiency measures. Sweden is considered to be a role model for the creation of municipal energy and climate advisory services provided to households and small businesses (International Energy Agency, 2013).Sweden has also taken steps to clarify the framework for nuclear energy, allowing for the replacement of nuclear reactors located at three existing sites, by the end of their operational life. The government will not however provide any direct or indirect subsidies, as it follows a market-based approach with taxation, EU-ETS and technology neutral support to renewable energies. In addition, Sweden has levied taxes on nuclear power since the late 1990s. In 2000, the nuclear tax shifted from a production tax to a tax on installed capacity and was increased in 2006 and again in 2008. (International Energy Agency, 2013).

Objectives and design	
Goals and objectives of the tax	The goals of the ETR have slightly shifted over time evolving from a tax-shifting exercise towards a more target focused approach for Sweden to meet its environmental targets, especially those linked to CO_2 emissions. In the beginning the tax reforms represented a broader tax-shifting operation that strengthened environmental taxes and reduced taxes on labour. With the introduction of the CO_2 tax, the focus moved more towards environmental protection, even though the principle of tax-shifting still applied. The latest reform in 2009, moved the focus even further towards environmental protection, removing a number of exemptions that were in place to protect the competitiveness of energy intensive industries. The main reason for this latest reform was the political commitment to meet the long-term aim of the Swedish Government of a sustainable energy supply that makes efficient use of resources and gives rise to

<table>
<tr><td></td><td>zero net emissions of greenhouse gases by 2050 (Government Bill 2008/09:162 and Skatteverket,2012) .

Both the energy and CO_2 taxes are levied on fossil fuels used for heating purposes. As the two taxes are levied on the same basis, they in practice function as one tax with two components. The provisions for collection, chargeability and control are identical and both taxes are presented together to taxpayers for the purposes of their tax returns. The CO_2 tax and the energy tax have an environmental steering effect on the consumption of fuels. Over the years, the Government has adjusted tax levels of either the energy tax or the CO_2 tax to achieve the desired steering effect. (Lannering et al, 2003).</td></tr>
<tr><td>Wider ETR context</td><td>In addition to traditional energy/excise taxes levied on energy products, the government introduced in the early 1990s CO2 taxes (1991), SO2 taxes (1991) and a NOX charges (1992). Since 1995 energy taxes have been indexed and linked to CPI in Sweden (Andersen et al 2007). Sweden currently has the world's highest CO_2 tax imposed on the non-trading (non EU-ETS) sectors and households/services. Certain tax breaks are granted to domestic industries (see below). High energy taxes on fuel and electricity as well as high CO_2 taxes on fossil fuels effectively steer demand through environmental signals, putting an implicit price on carbon, while at the same time providing a source of state revenue (International Energy Agency, 2013).

Since 2006, Sweden has applied a CO_2-based vehicle tax. Since 2011, light-duty vehicles, buses and motor caravans are covered by a CO_2 factor. Heavy-duty vehicles are not covered by the CO2 factor although they continue to be subject to the vehicle tax according to vehicle weight and exhaust levels. Heavy-duty vehicles and trailers have to pay an annual toll charge. There are also a number of motor vehicle tax breaks for so-called 'environment friendly new passenger vehicles' which, since 2009 are exempted from vehicle tax for the first five years (International Energy Agency, 2013).

In addition, Sweden has levied taxes on nuclear power since the late 1990s. In 2000, the nuclear tax shifted from a production tax to a tax on installed capacity and was increased in 2006 and again in 2008. Regulated in the Act on Excise Duties on Thermal Capacity on Nuclear Power Reactors, the tax is based on the thermal production capacity of the nuclear reactor. The duty rate applicable is SEK 10 200 (about EUR 1 100) per MW of the permitted thermal capacity, amounting to about EUR 0.005 per kWh electric, or roughly EUR 350 million per year (International Energy Agency, 2013).</td></tr>
<tr><td>How the taxable base is defined</td><td>The energy and/or CO2 tax are applied to fossil fuels for heating purposes, motor fuels and electricity use and based on an energy content component and a CO2 emissions component (OECD 2013), see Table 6 for an overview.

Table 6. Tax base
<table>
<tr><th>Tax base</th><th>2010</th><th>2011</th></tr>
<tr><td>Households and Services</td><td>100% energy tax – not based on energy content (EUR 0.001-0.008 per kWh)
100% CO2 tax</td><td>100% energy tax – based on energy content
(EUR 0.008 per kWh)
100% CO2 tax</td></tr>
<tr><td>Industry outside the</td><td>0% energy tax</td><td>30% energy tax = EUR</td></tr>
</table></td></tr>
</table>

	EU-ETS + agriculture	21% CO2 tax 0.8% rule – further tax reductions	0.0025 per kWh 30% CO2 tax (60% in 2015) 0.8% rule more strict (abolished in 2015)
	Installations within the EU-ETS	Industry + heat production in CHP (combined heat and power plants): 0% energy tax 15% CO2 tax Other heat plants: 100% energy tax; 94% CO2 tax	Industry: 30% energy tax = EUR 0.0025 per kWh 0% CO2 tax Heat production in CHP: 30% energy tax = EUR 0.0025 per kWh 7% CO2 tax. Proposed to be 0% in 2013. Other heat plants: 100% energy tax; 94% CO2 tax

Those who import electricity are considered to be a producer and therefore liable to the energy and CO2 tax. The tax is to be paid to the customs when the fuel is imported to Sweden. The tax applied is based on the same criteria as nationally. However, some minor changes came into force in January 2013, introducing exemptions from CO2 and energy taxes where the importer is an authorised storage keeper and the fuel is to be exported to another country. (Ernst and Young, 2012, Skatterverket, 2012).

The tax rate applied

The general energy and CO_2 taxes applied in Sweden are shown in **Error! Reference source not found.**.

Table 7. Energy and CO_2 taxes in Sweden for 1 January 2011 (excluding VAT)

	Energy tax	**CO_2 tax**
Fossil fuels for heating purposes		
Heating oil, EUR/m^3(SEK/m^3)	EUR 96 (SEK 797)	EUR 362 (SEK 3 017)
Heavy fuel oil, EUR/m^3 (SEK/m^3)	EUR 96 (SEK 797)	EUR 362 (SEK 3 017)
Coal, EUR/tonne (SEK/tonne)	EUR 73 (SEK 605)	EUR 315 (SEK 2 625)
Liquefied petroleum gas (LPG), EUR/tonne (SEK/tonne)	EUR 123 (SEK 1 024)	EUR 381 (SEK 3 174)
Natural gas, EUR/1000m^3 (SEK/1 000 m^3)	EUR 106 (SEK 880)	EUR 271 (SEK 2 259)
Crude tall oil, EUR/m^3 (SEK/m^3)	EUR 458 (SEK 3 814)	-
Motor fuels		
Petrol, unleaded, environmental class 1, EUR/L (SEK/L)	EUR 0.37 (SEK 3.06)	EUR 0.29 (SEK 2.44)
Diesel, environmental class 1, EUR/L (SEK/L)	EUR 0.18 (SEK 1.52)	EUR 0.36 (SEK 3.02)

Natural gas and methane, EUR/m^3 (SEK/m^3)	-	EUR 0.19 (SEK 1.58)
Electricity use		
Electricity, northern Sweden, pence/kWh (öre/kWh)	2.2 cents (18.7 öre)	-
Electricity, rest of Sweden, pence/kWh (öre/kWh)	3.4 cents (28.3 öre)	-
Industry		
Electricity use, industrial processes, pence/kWh (öre/kWh)	0,06 cents (0.5 öre)	-

Source: International Energy Agency, 2013

The tax rate applied has increased since its introduction in the early 1990s when it was set at a rate of SEK 25 (EUR 27) /t CO_2 to SEK 1080 (€118) /t CO_2 in 2012 (Speck 2013).

Implementation

Specific measures and/or derogations

In 2009, the Parliament adopted a reform of the tax system - Bill 2009/10:41 on energy and climate taxation for the years 2010, 2011, 2013 and 2015 which will see the gradual decrease and abolishment of carbon tax exemptions for energy-intensive industries and other cases outside the EU ETS between 2011 and 2015. Energy intensive basic industries could apply for a CO_2 tax reduction for the share of the taxes that exceed 0.8 per cent of the sales value. The decision to grant a reduction was taken individually for each case by the tax office and did not include any specific conditions. The reduction was allowed to an amount that does not exceed 24 per cent of the surplus tax of the fuel. This CO_2 tax reduction limit of 0.8 per cent was increased to 1.2 per cent in 2011 and it will be totally abolished in 2015 (International Energy Agency, 2013, Naturvardsverket, 2006 and Stigson, 2007)). In 2004, 750 industry applications were granted this exemption, with around 700 exemptions granted for greenhouses and the remaining for a mixture of other industries (Naturvardsverket, 2006)

The tax reform also included an increased CO_2 factor in the vehicle tax and a strong rise in CO_2 taxes on the non-ETS sectors (agriculture, forestry and some industries). It abolished the special CO_2 tax break to some industrial installations outside the EU-ETS and reformed energy taxes on heating fuels to strictly reflect the energy content (International Energy Agency, 2013, Naturvardsverket, 2006 and Stigson, 2007)). The main reason for these subsidies was to maintain the competitiveness of industry and avoid carbon leakage.

As set out in Table 3, following the 2009 reform, industry outside the EU ETS, including forestry, fisheries and agriculture, saw the introduction of a 30 per cent energy tax and an increase in the CO_2 tax by 30 per cent (and an increase by 60 per cent as of 2015) from 2011 onwards. Since 2011, industry within the EU-ETS faces a 30 per cent energy tax but a 0 per cent CO_2 tax. Heat production in CHP (within the EU ETS) saw the introduction of a 30 per cent energy tax and a 7 per cent CO2 tax, while other heat plants are subject to a 100 per cent energy tax and a 94 per cent CO_2 tax. In the 2013 Budget Bill the government proposed to abolish the CO_2 tax for CHP heat production (International Energy Agency, 2013).

Table 8: Reform of energy and CO2 taxes on fossil fuels in Sweden

(International Energy Agency, 2013)

Area of use	2010	2011
Households and Services	100 per cent energy tax – not based on energy content (EUR 0.001-0.008 per kWh) 100 per cent CO2 tax	100 per cent energy tax – not based on energy content (EUR 0.008 per kWh) 100 per cent CO2 tax
Industry outside the EU-ETS + agriculture	0 per cent energy tax 21 per cent CO2 tax 0.8 per cent rule – further tax reductions	30 per cent energy tax = EUR 0.0025 per kWh 30 per cent CO2 tax (60 per cent in 2015) 0.8 per cent rule more strict (to be abolished in 2015)
Installations within the EU-ETS	*Industry + heat production in CHP* (combined heat and power plants): 0 per cent energy tax 15 per cent CO2 tax *Other heat plants:* 100 per cent energy tax; 94 per cent CO2 tax	*Industry:* 30 per cent energy tax = EUR 0.0025 per kWh 0 per cent CO2 tax *Heat production in CHP:* 30 per cent energy tax = EUR 0.0025 per kWh 7 per cent CO2 tax. Proposed to be 0 per cent in 2013. *Other heat plants:* 100 per cent energy tax; 94 per cent CO2 tax

Revenues from the taxes

The revenue from energy and CO_2 taxes are shown in Table 4.

Table 9: Revenues from energy and CO_2 taxes in Sweden between 2006 and 2011, million EUR (SEK in brackets)

	2006	2007	2008	2009	2010	2011
Energy tax on fuels	2,313 (19,276)	2,335 (19,457)	2,351 (19,590)	2,427 (20,224)	2,418 (20,146)	2,450 (20,414)
Electricity taxes	2,328 (19,3396)	2,377 (19,812)	2,368 (19,732)	2,486 (20,720)	2,527 (21,061)	2,427 (20,227)
Nuclear power tax (capacity)	384 (3,198)	389 (3,238)	477 (3,976)	407 (3.395)	480 (3,997)	462 (3,852)
CO2 tax	2,969 (24,745)	3,015 (25,127)	3,092 (25,770)	3,130 (26,084)	3,280 (27,334)	3,044 (25,369)
Energy and CO_2 tax (total)	7,994 (66,615)	8,116 (67,634)	8,288 (69,068)	8,451 (70,423)	8,705 (72,538)	8,383 (69,862)
Per cent of GDP in Sweden[17]	2.2 per cent	2.1 per cent	2.1 per cent	2.4 per cent	2.2 per cent	2.0 per ce
CO_2 and energy tax revenues as a share of total revenues from taxes and social	4.7 per cent	4.6 per cent	4.6 per cent	4.9 per cent	4.8 per cent	Not y available

[17] Based on calculations from data in Statistics Sweden (Statistics Sweden, 2013)

	contributions[18] | | | | | | | | As can be seen from the table the tax revenues in relation to GDP and revenues from other taxes have stayed relatively constant over the years. It is not clear what action the Swedish government would take if these tax revenues would fall.
Use of tax revenues	Revenues from the energy and CO2 tax are not revenue neutral. Revenues are set aside to partly offset revenue losses caused by the reduction of income tax rates. For instance, the second ETR aimed to increase revenue generated from environmental taxes by up to SEK 30 million over the 10-year period to offset the shortfall in tax revenue from planned reductions in labour and capital taxes (Speck and Jilhova 2009). The tax changes are implemented stepwise so that households and companies have time to adapt. To date, tax increases for companies and households in the energy and environmental areas have been offset by tax reliefs in other areas, for example labour taxation (Government Bill 2008/09:162).
Future developments in ETR	In the 2013 Budget Bill the government presented a proposal to introduce from 2013 onwards an energy tax on biofuels used for low-blend purposes, at such a level that it is does not discourage the use of low-blends in the market. For 2014, the government is considering the introduction of a quota system aimed at 10 per cent and 7 per cent blending of biofuels in low-blended fossil fuels and diesel, as allowed by the EU Fuel Quality Directive. In the 2013 Budget Bill the government also presented stricter rules for motor vehicle tax exemptions where emission requirements also are related to the vehicle's weight (International Energy Agency, 2013).
Interactions with other policies	
Compatibility with EU ETS	The CO_2 fuel tax for industries that are part of the EU ETS was abolished in 2011 and instead the CO_2 tax will be increased for those sectors, such as agriculture, forestry and transport, that are not part of the EU ETS The energy tax for industry both within and outside the EU ETS has been increased in 2011 from 0.06 cents to 0.3 cents (Bahr et al, 2010). The IA of the proposal for the 2009 tax reform 2008/09:162 states that the tax will create new incentives to use non-fossil fuels for heating. At the same time the IA acknowledges that it is also likely that carbon leakage is likely to occur but that this will depend on the kind of instruments to reduce GHG emissions outside the ETS in place in other EU Member States.
Revised EU Energy Tax Directive 2003/96/EC	In its opinion to the EU Commission in August 2011 (SwEPA, 2011), the Swedish EPA expresses its concerns about the revision of the Energy Tax Directive. While it is positive towards the tax it expresses concern that the link between the tax and the price of carbon in the EU ETS leads to a very low carbon tax. Hence, the Swedish EPA wants Member States to be allowed to differentiate their own carbon tax. For instance to have a higher carbon tax for those sectors that are less sensitive to carbon leakage and a lower tax for those that are sensitive to carbon leakage. Another issue raised is that the proposal does not allow a

[18] Based on calculations from:
http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=ten00064&plugin=0

	carbon tax for non-industrial “heating installations” - Sweden has a carbon tax for such installations and feels that this should be maintained in order for Sweden to meet its renewable energy commitments by 2020. The Swedish EPA agrees that the link between the CO2 tax and CO2 price in ETS makes sense in theory, so that the impact on competitiveness between companies that are part of the EU ETS or those that are not is as small as possible. However it points out that this works in theory but not in practice as the ETS is not working optimally. Thus the Swedish EPA argues that by linking the carbon tax to the carbon price, the problems in the EU ETS are now expanded to also affect the non-ETS sector (SwEPA, 2011).
County context	
GDP	399.6 billion (European Central Bank, 2013)
Total primary energy supply	50.8 Mtonne in 2010 figures (OECD, 2013)
Energy intensity (TPES per unit of GDP)	0.17 kg/USD (TPES per unit of GDP at 2000 prices and PPPs for 2011) (OECD 2012)
Electricity generation by fuel	Electricity generation in 2010 figures (IEA, 2012): Coal and peat: 1.83 per cent Oil: 1.19 per cent Natural gas: 1.94 per cent Nuclear Power: 38.94 per cent Other*: 44.71 per cent * Includes geothermal, solar, biofuels, waste, tide, wave, ocean, wind and other fuel sources
Economic structure	Annual Growth: Real value added of industry (15.3 per cent in 2010); agriculture, forestry, fishing (-0.8 per cent in 2010); services (0.8 per cent)
Key environmental impacts	
Nature and degree of impacts on the environment	GHG emissions have gradually and steadily decreased for more than two decades, despite a steadily increased economic growth. Average GHG emissions in 2008-11 were 12.6 per cent lower than 1990 levels, well below the burden-sharing target of 4 per cent for the period 2008-12. In 2010, emissions of GHGs amounted to 66.2 Mt CO2-eq, which is 6.3 Mt CO2-eq less than in the 1990s. Projections indicate that Sweden is going to reach its Kyoto commitment by a considerable margin (International Energy agency, 2013). In 2009, new targets were adopted under the „integrated climate and energy policy” framework. They go beyond European Union and international obligations and require by 2020: i) the reduction of energy intensity by 20%; ii) a share of at least 50% renewable energy in gross final consumption and 10% in transport, and iii) a reduction of GHG emissions by 40%, two-thirds of which are to be implemented by domestic measures outside the EU Emissions Trading Scheme and the remainder by EU and international efforts. For the longer term, Sweden put forward two priorities: i) a fossil fuel-independent vehicle fleet by 2030, and ii) zero net greenhouse gas (GHG) emissions by 2050. (International Energy Agency, 2013). Sweden’s total final consumption (TFC) of energy has remained stable since the early 1970s as a result of improved energy efficiency across the economy, and

	the CO_2 and energy taxes in place. For example, consumption by industry has remained relatively constant, despite the fact that total industrial production steadily increased. The residential sector has reduced TFC over the same period, while commercial and other services have exhibited a constant increase in TFC. However, TFC in transport has increased by 54 per cent since 1973. In 2011, TFC was approximately 33.7 Mtonne, which is roughly the same as it was in 1990s, 1980s and in the 1970s. Of this total in 2011, industry accounted for 39.3 per cent, followed by 24.1 per cent for transport, 22.5 per cent for the residential sector and 14.1 per cent for other sectors (including commercial, public services, agriculture and fishing) (International Energy Agency, 2013). Sweden is committed to reduce energy intensity by 20% between 2008 and 2020 with the energy efficiency policy is guided by its National Energy Efficiency Action Plan (NEEAP). The plan sets an indicative energy savings target of 9% (or 33.2 TWh) by 2016, compared with average national TFC from 2001 to 2005. Sweden's 2011 NEEAP shows the country is likely to outperform this target by saving more than 53.8 TWh or 15% by 2016 (international Energy Agency, 2013).
Key social impacts	
Impacts on income distribution	The tax reform is likely to increase the outgoings of households regardless of their ability to pay and it is likely that low income households are proportionally more affected by the tax. Therefore the Swedish Government is said to be keeping the option open of using the increased tax revenues to potentially support low income households in the future (Government Bill 2008/09:162).
Key economic impacts	
Administrative cost	Administrative costs for the Swedish Tax Administration are 0.1 per cent of total revenues for energy and CO2 taxes (Ministry of finance, Sweden, 2011).
Impacts on competition, employment, growth, innovation	According to the results of the 6FP research work – COMETR (Andersen et al 2007), employment in Sweden was higher due to the ETR despite revenues being used to reduce income tax and not social security contributions. This is due to the increase in GDP resulting from the ETR which caused employment to increase slightly compared to the reference scenario. Investment in Sweden is also found to increase as a result of the ETR by nearly 1.5 per cent in 2006, although this falls after 2006. In the long run the study concludes that there may be an increase in GDP of something in the range of 0.5 per cent. A study by the Swedish think tank Fores argues that the losers of the CO_2 tax will be larger, carbon intensive companies (with more than 50 employees) while the winners are likely to be SMEs that can quickly adapt and innovate. However, the IA of the Proposal for the 2009 tax reform points out that larger companies do have the benefit of higher financial potential to invest into changes, in contrast to many SMEs (Bahr et al, 2010).
References	
Andersen, M.S., Barker, T., Christie, E., Ekins, P., Gerald, J.F., Jilkova, J., Junankar, S., Landesmann, M., Pollitt, H., Salmons, R., Scott, S. and Speck, S. (eds.) (2007): Competitiveness Effects of Environmental Tax Reforms (COMETR). Final report to the European Commission. National Environmental Research institute, University of Aarhus. 543 pp. - http://www.dmu.dk/Pub/COMETR_Final_Report.pdf Bahr, J., Andersson, M., Rutqvist, J. and Taxen, O. (2010) Vinnare och förlorare, FORES Studie 2010:1. European Central bank, 2013, Accessed 8.3.2013. http://sdw.ecb.europa.eu/quickview.do?SERIES_KEY=119.ESA.A.SE.N.0000.B1QG00.1000.TTTT.V.U.	

A

Ernst & Young (2012), Tax collection in the future billing regime, A common Nordic end-user market with combined billing, Stockholm, 11 May 2012, http://www.energimarknadsinspektionen.se/Documents/Publikationer/nordisk_slutkundsmarknad/NordREG_Tax_collection.pdf

IEA (2012), Energy balances of OECD countries, 2012 http://www.iea.org/w/bookshop/add.aspx?id=609

International Energy Agency (2013), Energy Policies of IEA Countries, Sweden, 2013 review
Lannering, J. and Renner-Loquenz, B. (2003, State aid and eco-taxes for state aid assessment, Competition Policy Newsletter, Number 3, Autumn 2003.

Ministry of Finance (2011), Swedish Energy and CO_2 taxes, National Design within an EU Framework, Presentation by Susanne Åkerfeldt, Conference on Environmentally Related Taxes and Fiscal Reform, Rome, December 15, 2011, Accessed 9.3.2013. http://www.dt.tesoro.it/export/sites/sitodt/modules/documenti_it/eventi/eventi/SESSION_I_-_SUSANNE_AKERFELDT_x6x.pdf,
OECD(2013b), Country statistical profile: Finland 2013, accessed 13.3.2013, http://www.oecd-ilibrary.org/docserver/download/191100071e1t004.pdf?expires=1363219366&id=id&accname=freeContent&checksum=5A833E3E169F5BE66D9E9BFA0CC727CB

Natuvardsverket, 2006, Ekonomiska styrmedel I miljöpolitiken, 2006, http://www.naturvardsverket.se/Documents/publikationer/620-5616-6.pdf

Skatteverket (2012), Handledning for punktskatter 2012, SKV 504 utgåva 15, Elanders Sverige, 2012, http://www.skatteverket.se/download/18.71004e4c133e23bf6db800065947/1332769481576/50415.pdf
Speck, S., and Jilkova, J., (2009), Design of Environmental Tax Reforms, COMETR, edited by Andersen-Ekins, Chapter 2, pp 24-52, 2009.
Statistics Sweden (2013), Accessed 5.3.2013
http://www.scb.se/Pages/TableAndChart____39451.aspx,

Speck, S., (2013) 'Carbon taxation – two decades of experience and future prospects', *Carbon Management*, April 2013 (forthcoming).

Stigson, L (2007), Reducing Swedish carbon dioxide emissions from the basic industry and energy utilities, Master Thesis, Mälardalen University, 2007.

SwEPA (2011*)* Europeiska kommissionens forslag till andring av Direktiv 2003/96/EG om omstrukturering av gemenskapsramen for beskattning av energiprodukter och elektricitet, m.m, Yttrande, 19.8.2011

1.10 The Climate Change Levy (CCL) in the United Kingdom

<table>
<tr><th colspan="2">Summary</th></tr>
<tr><td colspan="2">The UK introduced the climate change levy (CCL) in 2001. This levy only applies to energy products used by industries, business and the public sector. The underlying aim was to encourage business to reduce their CO2 emissions and to become more energy efficient.

Currently (and until April 2013) the full rates of the levy are 0.177p/kWh on natural gas, 0.509p/kWh on electricity, 1.137 p/kg LPG (Liquefied petroleum gas) and 1.387 on any other taxable commodity (HMRC, 2012). The tax is not applied to renewables (Fullerton, 2008).

The CCL is linked to Climate Change Agreements (CCA) under which energy intensive businesses are eligible to receive up to a 65 per cent discount from the CCL in return for meeting energy efficiency or carbon-saving targets. The discount for electricity increased to 90 per cent from April 2013.</td></tr>
<tr><th colspan="2">Objectives and design</th></tr>
<tr><td>Goals and objectives of the tax</td><td>The aim is to encourage business to reduce CO2 emissions and become more energy efficient. The Climate Change Levy (CCL) is an integral part of the UK climate change programme for meeting its Kyoto target and helping to achieve the government's domestic goal set in the 2008 Climate Change Act of at least 34 per cent in greenhouse gas emissions by 2020 and at least 80 per cent by 2050 (against the 1990 baseline) (EEA 2005).</td></tr>
<tr><td>Wider ETR context</td><td>The taxation of energy use in the UK comprises two different taxes: (1) fuel duty rates, which apply to oil products and biofuels; and (2) the climate change levy (CCL), which applies to the consumption of electricity, natural gas, liquefied petroleum gases and solid fuels (e.g. coal) by industry, business and the public sector (OECD, 2013).

In quantitative terms the most significant taxes levied on energy in the UK are the excise taxes on mineral oils, in particular motor fuels, which raise some £25 billion in revenue. Ultra low sulphur petrol and diesel are currently subject to an excise tax. Lower rates of duty are applied to some alternative fuels such as LPG and biofuels (Fullerton et al, 2008).

Domestic energy is subject to VAT at a rate of 5 per cent. Before 1994 domestic energy had been zero-rated (i.e. untaxed) in the UK’s VAT system. In 1993 the government proposed extending standard-rate VAT to domestic energy, primarily for revenue reasons, but also recognising the growing environmental concerns about fossil fuel use. The measure proved highly controversial, and the planned two-stage transition to the standard rate stalled at the first stage, with the rate at 8 per cent. This rate was subsequently reduced to 5 per cent in 1997. Compared with uniform taxation of all consumption at the standard VAT rate, the UK effectively subsidises domestic energy at 12.5 per cent, at an annual revenue cost of almost £3 billion (Fullerton et al., 2008).

In addition, some of the regulatory obligations placed on the power sector and the introduction of the EU ETS have some quasi-fiscal effects (Fullerton et al, 2008). Power generators are subject to a Renewables Obligation, obliging them to obtain a given proportion of their electricity from renewable sources. Compliance with these obligations is verified by Renewables Obligation Certificates (ROCs), which</td></tr>
</table>

<table>
<tr><td></td><td>are tradable, allowing flexibility in compliance.</td></tr>
<tr><td>How the taxable base is defined</td><td>The CCL is a tax on the taxable supply of specified energy products (taxable commodities) for use as fuels for lighting, heating and power, by business consumers which include:
Industry,
Commerce,
Agriculture,
Public administration, and
Other services
The CCL does not apply to taxable commodities supplied for use by domestic consumers nor to charities for non-business use.

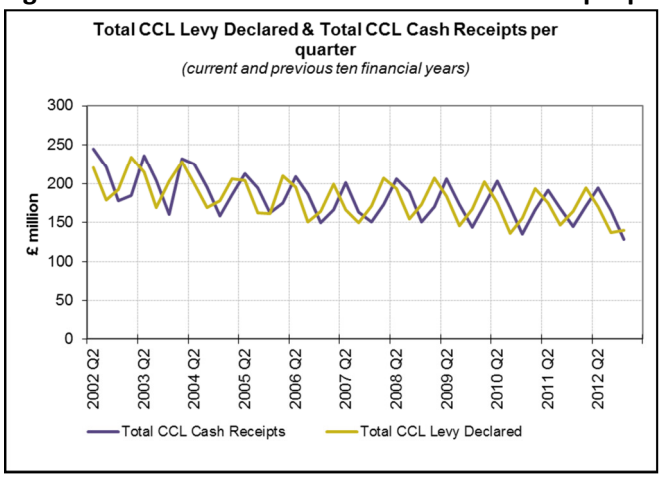
The four groups of taxable commodities are:
electricity
natural gas when supplied by a gas utility
liquid petroleum gas (LPG) and other gaseous hydrocarbons in a liquid state
coal and lignite; coke, and semi-coke of coal or lignite; and petroleum coke.</td></tr>
<tr><td>The tax rate applied</td><td>The CCL is charged at a specific rate per unit of energy. There is a separate rate for each of the four categories of taxable commodities (see above). The rates are based on the energy content of each commodity and are expressed in kilowatt-hours (kWh) for gas and electricity, and in kilograms for all other taxable commodities.

The table below shows how the CCL rates developed between their introduction in 2001 and 2012. The last two columns illustrate the CCL rates per tonne of CO2 revealing large differences between the energy products as well as showing that coal is subject to the lowest tax rate (Speck, 2012).

Table 1: Development of the climate change levy in the UK
<table>
<tr><th></th><th></th><th>2001</th><th>2012</th><th>2001</th><th>2012</th></tr>
<tr><td></td><td></td><td></td><td></td><td>EUR per tonne of CO2</td><td>EUR per tonne of CO2</td></tr>
<tr><td>Natural gas</td><td>Pence per kWh</td><td>0.15</td><td>0.18</td><td>10.2</td><td>12.0</td></tr>
<tr><td>Petroleum</td><td>Pence per kg</td><td>0.96</td><td>1.14</td><td>7.5</td><td>8.8</td></tr>
<tr><td>Coal</td><td>Pence per kg</td><td>1.17</td><td>1.30</td><td>5.4</td><td>6.4</td></tr>
</table>
Source: in Speck (2012), own calculations based on data

The CCL on natural gas, coal, LPG and electricity, rates remained constant (implying a slow decline in taxable commodities supplied) until April 2007 when they increased in line with inflation (Speck and Jilhova 2009). Since April 2007 the rates for CCL have increased each April (except in April 2012).</td></tr>
</table>

Figure 1: Total CCL declared and total cash receipts per quarter



Source: HMRC, 2013

The levy is based on the quantity of fuel supplied and does not reflect the carbon content of the different energy products (EEA, 2005). It has been criticised for its failure to tax fuels in proportion to their carbon content. To the extent that electricity is taxed at a single rate, regardless of the fuel mix in generation, the tax simply raises the cost of energy to users, and provides no incentive to switch the fuel mix in generation to lower-carbon inputs. Also, if the rates of the levy are expressed as an implicit tax per tonne of CO2, the tax on coal is considerably less (£4.30 per tonne of CO2) than on electricity and gas (both approx. £8.10 per tonne of CO2). The lower tax on coal appears to reflect a political decision to avoid adverse effects on the mining industry, but its unfortunate impact is to penalise switching from coal to lower-carbon fuels (Fullerton, 2008).

Implementation

Specific measures and/or derogations

The CCL applies to most energy users, with the notable exceptions of those in the domestic and transport sectors. Electricity generated from renewable sources (excluding large-scale hydro > 10 MW) and in combined heat and power plants (CHPs) are also exempt from the levy (EEA, 2005).

The CCL is combined with negotiated agreements for certain exemptions. As mentioned above, in order to make the Levy revenue neutral to the Government, employers' National Insurance Contributions were reduced by 0.3 percentage points when the Levy was introduced. Businesses do not benefit equally from this: energy intensive businesses often face a net tax increase because they incur a high Levy charge whereas businesses with large workforces (especially in the service sectors) may face a net tax decrease (NAO, 2007).

In recognition of this, Climate Change Agreements (CCAs), administered by Environment Agency from April 2013 onwards, set the terms under which eligible companies (energy-intensive businesses)[19] may claim the levy reduction. They

[19] Energy-intensive industries were defined initially as industries covered by Part A1 or A2, in Part 1 of Schedule 1 of the Pollution Prevention and Control (England and Wales) Regulations 2000 (as amended). This definition applies throughout the UK.

	allow eligible companies to receive a 65% discount from the CCL in return for meeting energy efficiency or carbon-saving targets. The discount for electricity will increase to 90% from April 2013. While the size of the discount changed over time it has been available since the Levy came into effect (NAO, 2007). CCAs cover a wide range of industry sectors, from major energy-intensive processes such as steel, chemicals and cement, to agricultural businesses, such as intensive pig- and poultry-rearing. Smaller sites that do not meet the size thresholds of the Pollution Prevention and Control (PPC) Regulations, but otherwise would qualify, are also eligible for a CCA. The exception to this is combustion plants with more than 50 MW capacity and the 3 MW limit for burning waste oil, recovered oil or fuel manufactured from or comprising waste. CCAs have a 2-tier structure: 1. Sector-level agreements, also known as 'umbrella' agreements, are negotiated between the Department of Energy and Climate Change (DECC) and the sector or trade association - these set out sector targets/targets allocated by the sectors to the operators in each sector, the sector and DECC's obligations, and the procedures for administering the agreements. 2. Individual agreements between DECC and the facility operator (known as underlying agreements) - these set out the targets the facility needs to meet, the operator and DECC's obligations, and the procedures for administering the agreements. All the major energy-intensive trade associations have signed such negotiated/voluntary agreements with the government (EEA, 2005). As of 2010, some 54 energy-intensive sectors had concluded CCAs with the government (Environment Agency, 2010). In 2011, the government announced that the CCA scheme, which was to end in 2013, would be extended to 2023 (HMRC, 2011). On April 2013 a new scheme started under which participants can start claiming their CCL discount at the revised rate of 90% for electricity and 65% for other fuels. All the sectors that were previously eligible to hold a CCA remained eligible, though a number of sectors have merged taking the total from 54 to 51. The new scheme applies to 51 sectors with umbrella agreements, with about 4,300 underlying agreements covering some 9,900 facilities (Environment Agency CCA website, April 2013). In practice, the scheme works as follows (Environment Agency, 2013):

In 2006, the qualifying criteria for sectors that could apply for a CCA was extended and the definition of 'energy intensity' expanded to include the one set out in the Energy Products Directive (which came into force on 1 January 2004). The extended criteria are as follows: (1) energy intensity (EI) must be 3% or more (i.e. energy costs must be 3% or more of the production value for the sector); (2) the industry import penetration ratio must be 50% or more - this ratio is calculated for the sector as a whole to determine its exposure to international competition (the import penetration ratio is the total value of sector imports, divided by the total value of UK sector sales, plus the total sales value of imports, minus the total value of sector exports)

Sectors that do not meet the international competitiveness criteria must have an EI of 10% or more. The eligibility test is based on the average energy cost and production values for 3 consecutive years. It is only applied at sector level and only at the beginning of the agreement so as not to disincentivise energy efficiency.

The Environment Agency (which administers the CCAs) has set up an IT system, the CCA register, through which the sector associations manage their sector agreements. Operators holding CCAs need to monitor and report their energy consumption against specified targets across four biennial target periods – each covering two calendar years – running from 2013 to 2020. After the end of each target period, operators meeting their targets are certified to continue to receive the CCL discount. Every fortnight the EA will publish a report on its website, known as the reduced rate certificate, listing operators and facilities certified in the scheme by sector.

Operators that do not meet their targets can continue to receive the CCL discount if they pay a 'buy-out' fee. This is set in legislation at £12 per tonne of CO2 by which the target has been missed. This replaces the need to purchase allowances from the now discontinued UK Emissions Trading Scheme that applied in the old CCA scheme. Operators that miss a target and do not pay the buy-out fee will be decertified from the scheme, making them ineligible for the CCL discount. They can re-enter the scheme at any time if they pay any buy-out fees and other outstanding penalties. There is also a new mechanism to allow operators to 'bank' surplus tonnes of CO2 where they have overachieved against their target, for use in subsequent target periods and which must be used where applicable.

Revenues from the taxes

The introduction of the climate change levy was initially designed to be revenue neutral. The table below provides an overview of total cash receipts from the CCL over the last ten years.

Table 2: Overview of total cash receipts from CCL

Financial year	Total Cash Receipts (£m)
2001/02	555
2002/03	829
2003/04	832
2004/05	764
2005/06	744
2006/07	712
2007/08	688
2008/09	716
2009/10	695
2010/11	674
2011/12	676

Source: HMRC (2013) Climate Change Levy (CCL) Bulletin – January 2013

HMRC collected £466.6 billion in taxes in 2011-2012. Thus, as a percentage of total revenue receipts the CCL represented about 0.15 per cent of total tax revenues in 2011/2012 (HMRC, 2013a).

Figure 2: Tax revenue from the climate change levy 2001-2011

Year	Annual tax revenue (millions)	Currency	Tax revenue as % of GDP	Tax revenue as % of total tax revenue

2011	678.00	GBP	0.04	0.12
2010	668.00	GBP	0.05	0.12
2009	704.00	GBP	0.05	0.14
2008	728.00	GBP	0.05	0.13
2007	687.00	GBP	0.05	0.13
2006	720.00	GBP	0.05	0.14
2005	733.00	GBP	0.06	0.16
2004	775.00	GBP	0.06	0.18
2003	822.00	GBP	0.07	0.20
2002	834.00	GBP	0.08	0.22
2001	529.00	GBP	0.05	0.14

Source: Eurostat (2013) "Taxes in Europe" database

Use of tax revenues

The CCL aimed to be revenue neutral and revenues raised were used to reduce employers' National Insurance Contributions (by ~0.3 per cent/year[20]). [21]). While revenue neutrality was the original intention, according to a report by the National Audit Office looking into the period 2001-2007, the CCL was actually revenue negative, meaning the revenue collected through the levy was less than reductions in national insurance contributions (National Audit Office, 2007). The table below shows that the Levy has consistently yielded less than the rebate on employer National Insurance Contributions.

Table 3: Levy yield and National Insurance Contribution rebate

[20] Businesses do not benefit equally from this: energy intensive businesses often face a net tax increase because they incur a high Levy charge whereas businesses with large workforces (especially in the service sectors) may face a net tax decrease (NAO, 2007).

[21] Businesses do not benefit equally from this: energy intensive businesses often face a net tax increase because they incur a high Levy charge whereas businesses with large workforces (especially in the service sectors) may face a net tax decrease (NAO, 2007).

	Levy Yield (£m)	Approximate employer National Insurance Contribution rebate (£m)
2001–02	555	1,035
2002–03	829	1,125
2003–04	832	1,185
2004–05	764	1,215
2005–06	744	1,275

Source: HMRC

NOTES

Rebate figures are based on actual receipts and assume that employer National Insurance Contributions would always have been 0.3 percentage points higher in the absence of the Levy, on top of other changes in the rate of employer National Insurance Contributions.

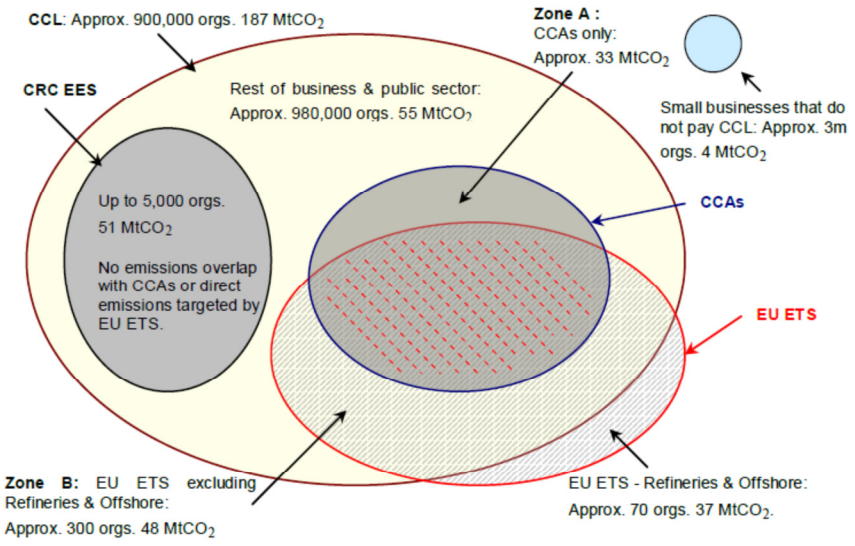
The yield in 2001-02 is significantly lower than later years; this is because there is a lag between when tax liability arises and when payment is received by HMRC.

Source: NAO, 2007

Some of the revenues collected via the levy are used to fund a number of energy efficiency initiatives via grants and loans from the Carbon Trust which was set up in 2001 to support investment in energy issues and research activities (Speck et al., 2009, NAO, 2007). As of 2007, a large proportion of the Carbon Trust's funding (at the time the Carbon Trust's budget was around £100 million/year) came from the Climate Change Levy. Today, the Carbon Trust receives funding from a number of government organisations (and devolved authorities) and therefore cannot be considered "funded by the CCL" (House of Commons, 2007-2008).

Future developments in ETR	The Government decided in the 2011 Budget to introduce a "carbon price floor" from 1 April 2013. The price floor will build on the EU ETS price and provide a clearer signal to investors about the long-term trajectory of the carbon price for the UK power sector (HM Treasury, 2011). The policy objective of the carbon floor price is to foster investment in low-carbon electricity generation technology by reducing the uncertainty about future carbon prices. This is done by fixing the carbon price for electricity generating companies for the period 2013 to 2020 (Bowen, 2011). Thus, the existing Climate Change Levy (CCL) exemption for supplies of fuel to electricity generators has therefore been replaced with a carbon price support rate of CCL. The carbon price support rates will apply to fossil fuels used to generate electricity and the rate will vary according to the carbon content of the fossil fuel.[22] It will not apply to recognised renewable fuel sources. See UK case study in Annex II on revisions to the CCL for more detail.

[22] http://www.ukbudget.com/UKBudget2012/business/indirect-tax/ukbudget2012-indirect-tax-climate-change-levy-carbon-price-floor.cfm
http://www.hm-treasury.gov.uk/d/carbon_price_floor.pdf

Interactions with other policies	
Compatibility with EU ETS	A natural extension of the CCAs is emissions trading and this arises if some participants over-achieve their targets and others under-achieve. In such circumstances, over-achievers could be given credits for the excess achievement and they could then sell them to the under-achievers. While not envisaged as part of the original CCL/CCA package, this trading option became available (with certain 'gateway restriction') when the UK developed its emissions trading scheme (ETS) which ran from 2002 and closed to new entrants in 2009 (OECD, 2005). When the EU ETS was launched in 2005 scholars argued that it appears to be incompatible with the (voluntary) UK ETS and with the CCL/CA systems (OECD, 2005, p.43, Sorrell, 2003). Today, the EU ETS runs in parallel to the CCL/CA systems. The co-existence of the EU ETS and the UK domestic climate change policies such as the CCL/CCAs means that carbon pricing is complex, with numerous overlapping instruments. In practice, effective carbon prices in the UK economy have been higher and more pervasive than the EU allowance price would suggest. For example, the CCL and the Carbon Reduction Commitment Energy Efficiency Scheme (CRC EES) in effect apply an additional carbon price (large businesses that consume a certain amount of energy must participate in the CRC EES which targets CO_2 emissions not already covered by CCAs and the EU ETS). Indeed, these policies overlap each other (Figure 2). **Figure 2: Climate policy overlap** **Figure 8. Climate policy overlap[1]**  1. Million tonnes of Carbon Dioxide ($MtCO_2$) *Source:* Based on a figure from Defra presented in CBI evidence to the House of Commons Environmental Audit Committee report, *The role of carbon markets in preventing dangerous climate change, Fourth Report of Session 2009-10.* Source: Bowen and Rydge, 2011 Firms not covered by a Climate Change Agreement (CCA) could be paying a form of carbon tax three times over: first, through higher payments for electricity

	produced by generators subject to the EU scheme and sold by suppliers subject to the Renewables Obligation; second, through the Levy; and, third, through the Energy Efficiency Scheme. That could result in an effective carbon price more than triple the EU price. In contrast, energy-intensive firms outside the EU scheme but covered by a Climate Change Agreement would have to pay only 20% of the Levy (35% from April 2011) and would not be affected by the implicit carbon tax in the electricity price if they used fossil fuels directly (although they would then be paying fuel duties) (Bowen and Rydge, 2011).
Revised EU Energy Tax Directive 2003/96/EC	In the UK, energy taxes are levied within the framework of the 2003 EU Energy Taxation Directive (OECD, 2013). The CCL satisfies the requirements under EU energy directive. How the proposed revision of the Energy Tax Directive to the CCL will be explored in the final version of this case study.
County context	
GDP	2 233.9 billion USD (2010) (OECD 2012)
Total primary energy supply	204.2 million tonnes of oil equivalent (Mtoe) (2010 figures) (OECD 2012)
Energy intensity (TPES per unit of GDP)	0.12 TPES per unit of GDP (2010) (OECD 2012)
Electricity generation by fuel	Electricity generation in 2010 figures (IEA, 2012): Coal and peat: 28.78 per cent Oil: 1.29 per cent Natural gas: 46.3 per cent Nuclear Power: 16.4 per cent Hydro: 0.95 per cent Other&: 6.24 per cent * Includes geothermal, solar, biofuels, waste, tide, wave, ocean, wind and other fuel sources
Economic structure	Real value added of industry (2.1 per cent in 2010); agriculture, forestry, fishing (-3.5 per cent in 2010); services (0.8 per cent)
Demand elasticities	
Key environmental impacts	
Nature and degree of impacts on the environment	The CCL and CCA are estimated to have reduced CO2 emissions by 3.5 and 1.9 MtC respectively in 2010, when compared with a business-as-usual scenario. Only the EU ETS has contributed to greater carbon savings, with the second phase of the EU ETS projected to have saved 8.0 MtC in 2010 (NAO, 2007). Initial projections suggested that the CCL may lead to a 2 per cent reduction of CO2 emissions compared with a reference scenario without the CCL (Cambridge Econometrics, in Infras and Ecologic, 2007). Under the Kyoto protocol the UK Government committed to reducing the levels of CO2 and five other GHGs by 12.5 per cent below 1990 levels between 2008 and 2012. These commitments have been surpassed and new targets set: Average 2008–2011 emissions in United Kingdom were 24.7 per cent lower than the base-year level, well below the burden-sharing target of -12.5 per cent for the period

2008–2012. In the sectors not covered by the EU ETS, emissions were significantly lower than their respective target, by an amount equivalent to 11.8 per cent of base-year emissions (EEA, 2011). The table below summarises the respective contributions (projected) of different components of UK's climate change policy to meeting this target.

Table: The five most significant policies in terms of expected carbon savings

Policy	Carbon saved in 2010 (MtC)
Second Phase of the EU Emissions Trading Scheme	8.0
Climate Change Levy	3.7 (since revised to 3.5)
Climate Change Agreements	2.9 (since revised to 1.9)
Renewables Obligation	2.5
Voluntary Agreements with car manufacturers package	2.3
Total	**19.4**

Source: HM Government (2006) in NAO, 2007

Research indicates the CCA generated additional emissions savings in terms of raising awareness among industry management in what has been labelled an "announcement effect". This effect is said to have a bigger impact on emissions reductions than those that a CCL alone might have generated (NAO, 2007).

In 2005, a report conducted by Cambridge Econometrics and the Policy Studies Institute attempted to evaluate the impact of the CCL by comparing actual energy use with a model predicting what would have happened in its absence (Cambridge Econometrics and PSI, 2005). It used a model of the economy, populated with data on energy use and intensity across different sectors, to build this alternative scenario. It found that annual carbon emissions were reduced by 3.1 MtC in 2002 and would have reduced further by 3.7 MtC in 2010. The report assumed the Levy would rise with inflation from 2005, rather than 2007 as has happened, so this estimate was slightly overstated, and the Government now uses a revised savings estimate of 3.5 MtC in 2010. It was from the Cambridge Econometrics work that HMRC generated a cost-effectiveness indicator for the Levy of £100 per tonne of carbon (NAO, 2007, HM Treasury, 2006).

The Climate Change Agreements have been controversial. One review claimed that there had been a substantial announcement effect from the introduction of the Climate Change Levy (Cambridge Econometrics, 2005) and that the agreements strengthened the effectiveness of the Levy (Ekins and Etheridge, 2006). Firms themselves have claimed that the Agreements were effective in winning managerial attention to energy efficiency (EAC, 2008). However, others have argued that they have not been very demanding, given the way in which targets were negotiated and the underlying trend in energy efficiency improvements. Martin and Wagner (2009a, 2009b), utilising more detailed micro-level data allowing better identification of the impact of the Agreements, have cast serious doubt on their efficacy; participation in an Agreement had a strong

	positive impact on both energy intensity and energy expenditures relative to firms having to pay the full Levy. The case for the Agreements on competitiveness grounds, protecting energy-intensive industries particularly vulnerable to foreign competition, is weak, as there was no sign of an impact of the full Levy on output, jobs or productivity. The studies also showed that the full Levy, but not the Agreement, was successful in promoting energy efficiency and innovation (Bowen and Rydge, 2011). Thus, research seems to show that the negotiated CCA targets were too lax because there has been wide success meeting the targets as well as some cases of "over compliance." (OECD, 2005) Sectors were allowed to choose their own baseline years. As a result, more than two thirds of the sectors chose baseline years of 1999 or earlier, meaning that any emissions reduction that had occurred before the policy was instituted could be applied to the CCA targets. In the first target period, 88 per cent of units met their targets. In the second and third periods, 98 per cent and 99 per cent of units, respectively, met their targets (OECD, 2010). In fact, 15 of 40 industrial sectors met their 2010 targets by 2002. On top of that, businesses missing their targets were able to use the UK ETS to purchase allowances and thus were not strongly motivated to transform industry processes towards more efficient energy use.
Key social impacts	
Impacts on income distribution	No evidence has been found of impacts of the climate change levy on income distribution. This is probably also because the climate change levy does not apply to households.
Unintended social impacts	No additional information found
Key economic impacts	
Administrative cost	The administrative costs of the levy have been small (NAO, 2007). The Levy is collected by energy suppliers at the point of sale in a similar way to VAT. The part of the total energy cost accounted for by the Levy is itemised on the energy bill to business customers. Other than that there is no difference from paying a normal bill so there is a minimal administrative burden on businesses subject to the Levy. There is a greater amount of administration required where businesses are claiming relief or exemptions (NAO, 2007). KPMG has estimated the annual administrative burden across the suppliers of energy (who are required to register and to pay to HMRC the levy that is due) to be a total of £13 million. This is equivalent to 0.26 per cent of the total burden placed on business by HMRC, or 1.7 per cent of Levy receipts. The burden includes (NAO, 2007): • the issuing of Climate Change Levy Accounting • Documents (itemised energy bills) to business customers; and • making quarterly Levy returns to HMRC. HMRC estimates the Levy is a cheap tax for it to collect. The estimated cost of collection is 0.4 per cent of revenue, with around 30 staff currently deployed on the Levy in HMRC (NAO, 2007).
Impacts on competition,	A 2007 paper on the macroeconomic effects of the CCA suggests that the energy efficiency improvements brought about by them have led to improvements in

employment, growth, innovation	international competitiveness for sectors subject to the Agreements (Barker et al, 2007). Ex-ante modelling had suggested that the combination of the CCL and the NIC reduction together has little effect on the main macro variables. By 2010, GDP is only 0.06% higher than without the CCL (Cambridge Econometrics, 2005). An audit by the UK National Audit office in 2007 concluded at the time that the impact of the CCL and CCA on international competitiveness was inconclusive. GDP and employment were slightly higher and average industrial costs were lower (due to national insurance reductions and the revenue negative aspect of the tax), although the balance of payments were slightly negative. Neither companies that paid the full CCL nor companies in CCAs seemed to be significantly affected by competitiveness impacts in terms of job losses, output or productivity. Thus, it appears that the CCL and CCA increased competitiveness because businesses were able to cost effectively reduce their energy use (NAO, 2007). A 2009 assessment of the impacts of the CCL did not find any statistically significant impacts of the tax on employment, gross output or total factor productivity. The authors also compare trends in outcomes between plants subject to the CCL and plants that were granted an 80 per cent discount on the levy under CCAs and conclude that, had the CCL been implemented at full rate for all businesses, further cuts in energy use of substantial magnitude could have been achieved without jeopardizing economic performance (Martin et al, 2009).
Unintended economic impacts	No additional information found

References

Barker, Ekins P. and Foxon (2007) Macroeconomic effects of efficiency policies for energy-intensive industries: The case of the UK Climate Change Agreements, 2000–2010, Energy Economics 29.

Bowen A. (2011) The case for carbon pricing. Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economic and Policy, Policy brief December 2011 (2011).

Bowen A. and Rydge J. (2011) Climate change policy in the United Kingdom, URL: http://www2.lse.ac.uk/GranthamInstitute/publications/Policy/docs/PP_climate-change-policy-uk.pdf

Cambridge Econometrics and Policy Studies Institute (2005) on behalf of HMRC, Modelling the Initial Effects of the Climate Change Levy, URL: http://www.enagri.info/gold/knowledge_base/reports_local/070115/Modelling+the+initial+effects+of+Climate+Change+Levy.pdf

EEA (2011) Greenhouse gas emission trends and projections in Europe 2012 – Tracking progress towards Kyoto and 2020 targets, URL: http://www.eea.europa.eu/publications/ghg-trends-and-projections-2012

EEA (2005) Market-based instruments for environmental policy in Europe

Environment Agency (2013) Climate Change Agreements Operations Manual (March 2013 version), URL: http://a0768b4a8a31e106d8b0-

50dc802554eb38a24458b98ff72d550b.r19.cf3.rackcdn.com/LIT_7911_6a1fc4.pdf

Environment Agency (2010) Guidance on the CRC Energy Efficiency Scheme EU Emissions Trading Systems (EU ETS) and Climate Change Agreements (CCAs), URL: http://cdn.environment-agency.gov.uk/geho0310brzg-e-e.pdf

Eurostat (2013) "Taxes in Europe" database, URL: http://ec.europa.eu/taxation_customs/tedb/taxSearch.html

Fullerton D., Leicester A., Smith S. (2008) Environmental Taxes – Paper prepared for the Report of a Commission on Reforming the Tax System for the "1st Century, Chaired by Sir James Mirrlees, URL: http://www.ifs.org.uk/mirrleesreview/reports/environment.pdf

HMRC (2011) Climate Change Levy: Reform of Climate Change Agreements, URL: http://www.hmrc.gov.uk/budget2011/tiin6125.pdf

HMRC (2011a) Carbon Price Floor, URL: http://www.hmrc.gov.uk/budget2011/tiin6111.pdf

HMRC (2013) Climate Change Levy (CCL) Bulletin – January 2013: https://www.uktradeinfo.com/Statistics/Pages/TaxAndDutybulletins.aspx

HMRC (2013a) HMRC Tax & NIC Receipts – Monthly and annual historical record, URL: http://www.hmrc.gov.uk/statistics/receipts/info-analysis.pdf

HM Treasury (2011) Carbon price floor consultation: the Government response, URL: http://www.hm-treasury.gov.uk/d/carbon_price_floor_consultation_govt_response.pdf

HM Treasury (2006) The climate change levy package, URL: www.hm-treasury.gov.uk/d/bud06_climate_169.pdf

House of Commons Environmental Audit Select Committee (2008) Reducing Carbon Emissions from UK Business: The role of the Climate Change Levy and Agreements, URL: http://www.publications.parliament.uk/pa/cm200708/cmselect/cmenvaud/354/35402.htm

House of Common Environmental Audit Committee (2007-2008) Reducing Carbon Emission from UK Business: The role of the Climate Change Levy and Agreements, Second Report of Session 2007-08

House of Commons Library (2009) Briefing paper on the Climate Change Levy.

Infras and Ecologic (2007) Erfahrungen mit Energiesteuern in Europa – Lehren fuer die Schweiz.

Martin R., de Preux L. B., Wagner U. J. (2009) The Impacts of the Climate Change Levy on Business : Evidence from Microdata, URL : http://www.cccep.ac.uk/Publications/Working-papers/Papers/1-9/Working_Paper7.pdf

NAO - National Audit Office (2007) United Kingdom of Great Britain and Northern Ireland, The Climate Change Levy and Climate Change Agreements
Available from www.nao.org.uk/publications/0607/the_climate_change_levy.aspx

OECD (2005) The United Kingdom Climate Change Levy – A study in political economy, URL: http://search.oecd.org/officialdocuments/displaydocumentpdf/?doclanguage=en&cote=com/env/e

poc/ctpa/cfa(2004)66/final

OECD (2010) Taxation, Innovation and the Environment. Paris.

OECD (2013) Taxation of energy in the United Kingdom on an energy content basis: United Kingdom, OECDiLibrary

Sorrell S. (2003) Back to the Drawing Board? – Implications of the EU Emissions Trading Directive for UK Climate Policy

Smith, S. (1992), "The distributional consequences of taxes on energy and the carbon content of fuels", European Economy, Special Edition No 1/1992 (The economics of limiting CO2 emissions), pp. 241–68.

Speck S. (2012 Forthcoming) Carbon taxation – two decades of experiences and future prospects

UK Government website: http://customs.hmrc.gov.uk/channelsPortalWebApp/channelsPortalWebApp.portal?_nfpb=true&_pageLabel=pageExcise_RatesCodesTools&propertyType=document&id=HMCE_PROD1_031183

UNESCAP (2012) Low Carbon Green Growth Roadmap for Asia and the Pacific CASE STUDY – Addressing Competitiveness in introducing ETR – United Kingdom's climate change levy, URL: http://www.unescap.org/esd/environment/lcgg/documents/roadmap/case_study_fact_sheets/Case per cent20Studies/CS-United-Kingdom-climate-change-levy.pdf

Annex 2: Cases of future plans for carbon taxes and failed reforms

2.1 ETR in the Czech Republic and proposals to introduce a new carbon tax

Brief description of plans	In 2007 an environmental tax reform was launched in the Czech Republic which is scheduled to take place in three stages until 2017 (Ministry of Environment of the Czech Republic, n.d.). The first stage transposed Directive 2003/96/EC on the taxation of energy products and electricity and led to the introduction of new taxes on natural gas (EUR1.1 per MWh), solid fuels (EUR0.3 per GJ) and electricity (EUR1 per MWh) with supplements to existing charges on mineral oils. Several exemptions were agreed including on household heating with natural gas, district heating, power and heat from renewable energy sources, methane, and hydrogen fuel cells. The second phase will take place between 2010 and 2013 and will introduce a new system of charges for air pollution. The third phase is to be implemented between 2014 and 2017 (Šauer et al, 2011). In April 2012 a package of measures to strengthen tax revenues were introduced as part of the Czech Convergence Programme. A carbon tax on mineral oil, solid fuels and natural gas was one of proposed measures in the package (Ministry of Finance of the Czech Republic, 2012a). In addition, excise tax exemptions on mineral oils for agricultural producers and natural gas used for household heating are also to be abolished (Ministry of Finance of the Czech Republic, 2012a).
Proposed design of new or revised tax	The carbon tax would apply to solid fuels, natural gas and heating oils (it would not be used for mineral oils used as a propellant) (Personal communication). The proposed carbon tax rate is to amount to EUR15 per ton of CO2 (Ministry of Finance of the Czech Republic, 2012a) released by the combustion of these energy products.
Specific measures and/or derogations planned	No information could be found on specific exemptions to the planned carbon tax.
Use of revenues	Under the consolidation package, the proposed carbon tax is expected to be the most significant revenue generating element and is estimated to raise about CZK6 billion for the government (Ministry of Finance of the Czech Republic, 2012a). The use of the revenues is not clear, but it is likely that it will be allocated mainly towards deficit reduction measures. Although the current economic situation might not be suitable for such measurements, the first phase of the ETR aimed to achieve revenue neutrality with the lowering of income taxation for both corporations and individuals (Šauer et al, 2011).
Proposed timeline for its introduction	It was initially envisaged that the proposed carbon tax would be implemented from 2014 (Ministry of Finance of the Czech Republic, 2012a). However, in March 2013, the Ministry of Finance asked the Czech government to postpone the proposal for implementation of the carbon tax until the proposed revision of the EU Energy Tax Directive 2003/96/EC is adopted. Thus, it is envisaged that the proposed carbon tax will be adopted in Czech law when the revision to the EU Energy Tax Directive is adopted (Personal communication, 2013).

Potential interactions with EU ETS and/or EU Energy Tax Directive where appropriate	It is proposed that subjects covered under the EU ETS would be exempted from the tax as their production of CO2 emissions will be effectively taxed from 2013 when they are obliged to buy CO2 emission allowances via auction under the EU ETS (Personal communication, 2013).

References

Bloomberg (2012) 'Czech Government Plans Spending Freeze to Meet 2012 Deficit' URL http://www.bloomberg.com/news/2012-02-27/czech-government-plans-spending-freeze-to-meet-2012-deficit-1-.html [Accessed:12/03/2013]

Green Budget Europe (2012) 'European Newsletter on Environment Fiscal Reform'. Green Budget News No. 30, 12/2012, URL http://www.foes.de/pdf/2012-12-GreenBudgetNews30.pdf [Accessed: 11/03/2013]

Ministry of Environment of the Czech Republic (n.d.) 'Environmental Tax Reform' URL http://www.mzp.cz/en/environmental_tax_reform [Accessed:11/03/2013]

Ministry of Finance of the Czech Republic (2012a) 'Convergence Programme of the Czech Republic' URL http://ec.europa.eu/europe2020/pdf/nrp/cp_czech_en.pdf [Accessed: 12/03/2013]

Ministry of Finance of the Czech Republic (2012b) 'Fiscal Outlook of the Czech Republic' URL http://www.mfcr.cz/cps/rde/xbcr/mfcr/FiscalOutlook_2012-11.pdf [Accessed:12/03/2013]

Personal communication with expert from Ministry of Finance, Czech Republic (April 2013)

Šauer, P., Vojacek, O., Klusak, J. & Zimmermannova, J. (2011) 'Chapter 6: Introducing Environmental Tax Reform - The case of the Czech Republic'. In: Ekins, P. & Speck, S., eds, 'Environmental Tax Reform (ETR): A Policy for Green Growth'. Oxford: Oxford University Press, pp. 131-147.

2.2 Abandoned French plans for a carbon tax in 2009

Brief description of plans	In autumn 2009, the French government put forward a proposal for a new carbon tax following a commitment in the first "Grenelle de l'environnement" law (2009), which had established that the creation of an eco-tax be examined further (Bureau 2012). The introduction of a carbon price was justified in the "Grenelle de l'environnement" for economic reasons (to minimise the cost of achieving emission reduction targets in sectors not covered by the EU ETS), ecological reasons, and for industrial reasons (as a tool to guide investment and innovation) (Bureau 2012). The proposal should have come into effect on 1 January 2010, but it was ruled unconstitutional by the Constitutional Court in December 2009 (Sénit, 2012).
Proposed design of new or revised tax	The tax was to apply to fossil fuels consumption (oil, gas and coal) by households and businesses, electricity was exempted (National Assembly, 2009). The tax was to start at EUR17 per tonne of CO_2 emitted from 2010, with a scheduled annual increase to reach EUR100 per tonne by 2030. A "Green Commission" dedicated to the new tax was to be set up to make recommendations on the extent of the yearly increases.
Specific measures and/or derogations planned	Industrial firms under the EU ETS were excluded from the proposed tax. Reduced tax rates were contemplated for energy-intensive and internationally-exposed sectors, such as agriculture and fisheries, which were to be charged at 25 per cent of the initial rate. Road transport and shipping were to be fully exempted (National Assembly, 2009 and Sénit, 2012).
Use of revenues	Two recycling mechanisms were contemplated. Firms were to be compensated with the suspension of the business tax ('taxe professionnelle') which was levied each year by local authorities. Households were to be provided financial compensation in the form of an income tax rebate or a 'green cheque' for non-taxpayers based on the households' composition and residential situation (urban vs. rural) (Sénit, 2012).
Proposed timeline for its introduction	The proposal was to be implemented on 1 January 2010 but was ruled unconstitutional by the Conseil d'Etat in December 2009 for two reasons. First, the proposed reduced rates, deferred taxation, partial and total exemptions resulted in the exclusion of 93 per cent of CO_2 emissions (mainly emissions already covered by the EU ETS) from the tax base. Second, the proposed compensation for households was considered to represent a breach of tax equality – which has been a principle of the constitution since 1973 (Senit, 2012). The French government under Nicolas Sarkozy shelved its plan to introduce such a tax on carbon emissions, claiming that the tax would put French companies at a competitive disadvantage to their European neighbours (New York Times, 2010). Following the election of Francois Hollande in 2012, a dedicated committee

	for environmental taxation was set up in December 2012 to study future possible developments in this area (French Government 2012). The committee issued its recommendations in March 2013 and called on the government to re-table a proposal for carbon tax by June 2013, taking into account the concerns expressed by the Conseil d'Etat on the previous proposal (Comité pour la fiscalité écologique 2013). The government also published a Feuille De Route Pour La Transition Ecologique (a green transition roadmap) in September 2012 which includes a section on environmental fiscal reforms (Green Budget Europe, 2012).
Potential interactions with EU ETS and/or EU Energy Tax Directive where appropriate	The proposed carbon tax excluded industrial firms which were already included in the ETS.

References

Assemblée nationale (2009) 'Projet de loi de finances pour 2010'. URL http://www.assemblee-nationale.fr/13/pdf/projets/pl1946.pdf [Accessed: 12/03/2013]

Bureau, D., (2012) The political economy of the 2009 French Carbon Tax project, Working Party on Integrating Environmental and Economic Policies, 19-20 November 2012 OECD Headquarters, Paris, http://www.chaireeconomieduclimat.org/wp-content/uploads/2013/01/The-political-economy-of-the-2009-French-Carbon-tax-project2.pdf [accessed 21/4/2013]

Green Budget Europe (2012) Newsletter on Environment Fiscal Reform, Green Budget News No. 30, 12/2012, URL http://www.foes.de/pdf/2012-12-GreenBudgetNews30.pdf [Accessed: 12/03/2013]

Ministère de l'écologie, de l'énergie, du développement durable (2009), 'Rapport de la conférence des experts et de la table ronde sur la contribution Climat et Énergie'. URL : http://www.developpement-durable.gouv.fr/IMG/pdf/01-18.pdf [Accessed: 12/03/2013]

Sénit, C. (2012) 'Taxation in France: preferences, institutions, and ideologies', Working Papers N°20/2012. Iddri, 2012. 26 p., http://www.iddri.org/Publications/The-politics-of-carbon-taxation-in-France-preferences,-institutions,-and-ideologies [accessed 21/4/2013]

Sénit, C. (2012) 'France's missed rendezvous with carbon-energy taxation', Working Papers N°04/2012. Iddri, 2012. 16 p., http://www.iddri.org/Publications/France-s-missed-rendezvous-with-carbon-energy-taxation [accessed 21/4/2013]

New York Times, (2010) 'France abandons Plan for Carbon Tax'. URL www.nytimes.com/2010/03/24/business/global/24iht-carbon.html?_r=0 [Accessed: 12/03/2013]

Ministère de l'écologie, de l'énergie, du développement durable (2012), Installation du Comité pour la fiscalité écologique URL : http://www.developpement-durable.gouv.fr/Installation-du-Comite-pour-la,30397.html [Accessed: 04/04/2013]

Comité pour la fiscalité écologique (2013) Avis N°1 du Comité pour la fiscalité écologique, 28 mars 2013, Introduction d'une assiette carbone dans la fiscalité française, http://www.developpement-durable.gouv.fr/IMG/pdf/Avis_assiette_carbone_28_mars_2013.pdf [accessed 21/4/2013]

2.3 Proposals to introduce a carbon tax in Italy

Brief description of plans	In 1999, a carbon tax was introduced to reduce Italy's emissions as stipulated by the Kyoto Protocol. The tax was foreseen to be phased-in over five years. It was to accrue additional revenues of EUR 1.1 billion in 1999 rising to EUR 5.4 billion by 2005. However it was suspended by the government in 2001 in response to rising global oil prices (EEA, 2005, Monetary Fund, 2012, Barde 2004). In a referendum in June 2011, Italians voted to abandon the use of nuclear in the country, striking a blow to the then Prime Minister Silvio Berlusconi who had intended to rekindle Italy's nuclear energy program in 2014. In April 2012, the Italian government approved a project on General Tax Reform, which included an explicit element of Green Fiscal Reform which proposes the introduction of new forms of fiscality (incentives and green taxes) which aim to conserve and guarantee environmental equilibrium. The introduction of a carbon tax on non-ETS sectors based on carbon content is the only measure explicitly mentioned (Ravazzi, 2012 and Ravazzi 2012a). The government expects with the introduction of this carbon tax to boost Italy's economy (Reuters, 2012). It is also worth noting that Art.4 on fiscal erosion opens the way to potential revision of environmentally harmful subsidies in form of fiscal expenditures (Ravazzi 2012a). The Monti Government also introduced other packages of reform to the fiscal system which have included environmentally-related measures including an increase in fuel excise taxes between 1.11.11 and 1.7.12 from €0, 61 to €0, and 72 per l/oil and from €0, 47 to €0, and 61 per l/diesel. Total consumption of petrol products in the period Jan-May 2012 (compared to the same period 2011) has decreased by 10 per cent (oil -11%, diesel -9%, others products 8%) (Ravazzi 2012a).
Proposed design of new or revised tax	The 1999 tax applied to a range of different fuels: leaded and unleaded petrol, diesel oil, natural gas, heavy fuel oils and liquefied petroleum gas (LPG). The tax was proportional to the tonnes of CO_2 emitted by the fossil fuel under consideration (Dias Soares, 2010). The 2012 proposal for a carbon tax proposes to impose excise duties on energy products depending on their carbon content (Reuters, 2012). The amount and modalities of the future carbon tax are still uncertain and details are yet to be defined (Ravazzi, 2012).
Specific measures and/or derogations planned	No information could be found on specific exemptions to be applied under the proposed new carbon tax on energy products.
Use of revenues	The revenues from the 1999 carbon tax were intended to support employment in the south of Italy, reduce employment charges and fund environmental improvements in sectors such as transport and

	heating (Martini, 2009, Barde, 2004, Dias Soares, 2010). The revenues from the proposed new carbon tax are expected to be earmarked to finance renewable energy, low-carbon technologies and interventions aimed at environment protection (Ravazzi, 2012 and Ravazzi 2012a).
Proposed timeline for its introduction	The fall of the Monti Government in December 2012 froze the project of General Tax Reform. Following the elections in February 2013 it is not yet clear what will happen to the tax reform process. If procedures are followed as set out in the original Government proposal from 2012, the Government would be required to prepare Legislative Decrees within eight months of Parliamentary approval, Parliamentary Commissions' are to be Consulted by the Government on the Legislative Decrees texts within one month with the official issuing of Legislative Decrees the responsibility of the Government (Ravazzi 2012a). Entry into force of the CO_2 tax is to be linked to the transposition date in other EU Member States of the "harmonized discipline established on the matter at European level" (Ravazzi 2012a).
Potential interactions with EU ETS and/or EU Energy Tax Directive where appropriate	The proposed new carbon tax would be only applied on non-ETS sectors (Ravazzi, 2012).

References

Barde, J-P. (2004) 'Green Tax Reforms in OECD Countries, a Review', OECD Environment Directorate, URL: http://www.eclac.org/dmaah/noticias/discursos/3/14283/03_en.pdf [Accessed:13/03/2013]

European Environment Agency (EEA) (2011) Environmental Fiscal Reform – Illustrative Potential in Italy, http://www.dt.tesoro.it/export/sites/sitodt/modules/documenti_it/eventi/eventi/EEA_Briefing_Note_for_ETR_Workshop_Rome_finaldraft.pdf

BBC (2011) Italy nuclear: Berlusconi accepts referendum blow, http://www.bbc.co.uk/news/world-europe-13741105 [accessed 13/3/2013]

Martini, C. (2010) 'The Distributive Effects of Carbon Taxation in Italy' in Dias Soares, C., E. Milne, J., Ashiabor, H., Kreiser, L., Deketelaere, K. (eds) (2010) 'Critical Issues in Environmental Taxation (volume III)', Oxford University Press

Martini, C. (2009) 'The distributive effects of carbon taxation in Italy' URL: http://host.uniroma3.it/dipartimenti/economia/pdf/WP103.pdf [Accessed:13/03/2013]

Monetary Fund (2012) 'The Delega Fiscale and the Strategic Orientation of Tax Reform' URL: http://www.mef.gov.it/primo-piano/documenti/Italy_-_TA_Report_on_the_Delega_Fiscale_and_Strategic_Orientation_of_Tax_Reform.pdf [Accessed:13/03/2013]

Ravazzi, A. (2012) 'The Italian response to reform commitments', Presentation at the workshop 'Reforming Environmentally Harmful Subsidies for a Resource Efficient Europe', Brussels, 26 June 2012

Ravazzi, A. (2012a), Up and Down: Environmental Fiscality Component of the Government Proposal for a General Tax Reform, Internal note for the Italian Ministry of Environment, Updated 17 December 2012

Aldo Ravazzi Douvan (2013),"Riforma fiscale ecologica in tempi di crisi economico-finanziaria" ["Ecological fiscal reform in times of economic-financial crisis"] in Rapporto Ambiente Italia 2013, "Oltre la crisi" ["Beyond the crisis"], Edizioni Ambiente.

Reuters (2012) 'Italy to introduce carbon tax to fund green energy' URL: http://uk.reuters.com/article/2012/04/17/italy-carbontax-idUKL6E8FHALR20120417 [Accessed:13/03/2013]

Full original text of the proposed bill available in Italian from the Government website: http://www.governo.it/Governo/Provvedimenti/testo_int.asp?d=67637

2.4 Introduction of a carbon tax in Japan

Brief description of plans	In October 2012, Japan introduced a new "Tax for Climate Change Mitigation" of JPY298 (approximately EUR 3)[23] per tonne of CO_2 on the use of all fossil fuels. The tax rate applied corresponds to the CO_2 emissions factor of each fossil fuel and is to be increased gradually over 3.5 years. The tax is expected to result in a -0.5 per cent to -2.2 per cent reduction of CO_2 emissions by 2020 compared to 1990. The tax aims to limit energy-related CO_2 emissions to help meet Japan's objectives to reduce GHG emissions by 80 per cent by 2050 and to reduce its reliance on nuclear power. Revenues from the tax are to be allocated to CO_2 emission reduction measures such as renewable energy and energy savings (Government of Japan Ministry of the Environment 2012). In terms of other measures in place, Japan is developing a bilateral offset credit mechanism with other interested countries which may produce carbon units for emissions trading schemes in Japan in the future. Emission trading schemes operate in the Tokyo and Saitama regions (Flannery, Beale and Hueston, 2012). Furthermore, the vehicle taxation system has been used to steer environmental behaviour, for example in 1999 tax incentives for the introduction of low-emission vehicles and for fuel-efficient vehicles were put in place (IEEP 2007).
Proposed design of new or revised tax	The tax rate corresponds to the CO_2 emission factor of each fossil fuel and is set at a rate of JPY 298 (approximately EUR 3) per tonne of CO_2. The tax rates applied will be progressively increased in three stages over 3.5 years (Government of Japan Ministry of Environment, 2012).
Specific measures and/or derogations planned	Tax exemptions and refunds from current petroleum and coal taxes and from the carbon tax are applied to imported and domestic oil used for petrochemical product production, imported coal (used for making steel, coal and cement), coal for generating electricity in Okinawa, imported and domestic heavy oil for agriculture, forestry and fishery, and domestic petroleum asphalt. Exemptions are also provided until March 2018 from the carbon tax for: imported coal used for home generation of electricity for caustic soda production and for salt production, heavy oil and light oil used for ships, light oil for railways, aviation fuel, light oil used for agriculture, forestry and fishery (Government of Japan Ministry of Environment, 2012 and Government of Japan Ministry of Environment 2011).
Use of revenues	Revenues from the carbon tax are estimated to be JPY39.1 billion for the first year and JPY262.3 billion for each year after 2016. Half the revenue from the taxes are to fund low-emissions technologies (Flannery, Beale and Hueston, 2012). More specifically, revenues are to promote energy-saving measures, the use of renewable energy and the clean and efficient use of fossil fuels such as the installation of energy-saving equipment by small and medium-sized

[23] Based on exchange rate from 1/10/2012-31/10/2012: EUR 1 = JPY 99,98, http://ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/inforeuro_en.cfm [accessed 13/3/2013]

	enterprises and the introduction of so-called "Green New Deal Funds" in accordance with local characteristics (Government of Japan Ministry of Environment, 2012).
Proposed timeline for its introduction	The carbon tax came to effect on 1 October 2012. Increases in the tax rate will take place in April 2014 and April 2016.
Potential interactions with EU ETS and/or EU Energy Tax Directive where appropriate	N/A – Although Japan is developing a bilateral offset credit mechanism with a range of interested countries which may produce carbon units for emissions trading schemes in Japan in the future. Emission trading schemes also operate in the Tokyo and Saitama regions (Flannery, Beale and Hueston, 2012).

References

Flannery, T., Beale, R. & Hueston, G. (2012) 'The Critical Decade: International Action on Climate Change'. Australia's Department of Climate Change and Energy Efficiency, URL http://climatecommission.gov.au/wp-content/uploads/climatecommission_internationalReport_20120821.pdf [Accessed: 02/03/2013]

Government of Japan Ministry of the Environment (2012) 'Details of the Carbon Tax – Tax for Climate Change Mitigation'. URL http://www.env.go.jp/en/policy/tax/env-tax/20121001a_dct.pdf [Accessed:11/03/2013]

Government of Japan Ministry of Environment (2011) FY 2012 – The result of taxation reform request by the Ministry of Environment – Introduction of carbon dioxide tax of climate mitigation, http://www.env.go.jp/en/policy/tax/tax-reform/fy2012_result.pdf [accessed 13/3/2013]

IEEP (2007) Environment and innovation in a global economy – Empirical analysis - Development of Country profiles – JAPAN, IEEP report to the OECD

Reuters (2012) Japan's new carbon tax to cost utilities $1 billion annually'. URL http://www.reuters.com/article/2012/10/10/us-energy-japan-tax-idUSBRE8990G520121010 [Accessed: 11/03/2013]

2.4 Proposed revisions to the Climate Change Levy in the UK

DISCLAIMER: *Note that given uncertainty in current political discussions in the UK on the changes to the CCL the information included in the case study below is subject to change and should not be considered final.*

<table>
<tr><th colspan="2">Title of case study</th></tr>
<tr><td>Brief description of plans</td><td>A carbon price floor (CPF) was introduced from 1 April 2013. The target floor price is at around £16 per tonne of carbon dioxide (tCO2) in 2013 rising to £30/tCO2 in 2020 (both in 2009 prices) (HM Treasury, 2011). The aim is to provide an incentive to invest in low-carbon power generation by providing greater support and certainty to the carbon price in the UK's electricity generation sector (HMRC, 2012). The CPF is expected to lead to an additional £6.1 billion of low-carbon electricity investment by 2030, according to government projections (GBE forthcoming).</td></tr>
<tr><td>Proposed design of new or revised tax</td><td>The existing Climate Change Levy (CCL) provides an exemption for the use of fuels to generate electricity (gas, coal, LPG and other fuels). The CPF will replace this exemption with a carbon price support (CPS) rate which electricity generators will be required to pay in addition to their obligations under the EU ETS (GBE forthcoming). The target CPF (CPS rate plus EU-ETS price) is of £16/tCO_2 in 2013, rising to £30/tCO_2 in 2020 (GBE forthcoming).

According to the UK treasury, the CPS rates in 2013-14 will be equivalent to £4.94/tCO2. Rates from 1 April 2015 will be equivalent to £18.08/t CO_2. The indicative rates for 2016-17 and 2017-18 are equivalent to £21.20 and £24.62/tCO_2 respectively (HMRC 2013b). The £30/tCO2 price floor in 2020 is planned to rise to £70/tCO2 in 2030 (HM Treasury, 2011).

The CPS rates will vary according to the carbon content of the fossil fuel. The rates of the CPS are different from the main CCL rates levied on consumers' use of these commodities (and electricity). The amount of fuel duty reclaimable on oil used in electricity generation would be adjusted to establish new CPS rates of fuel duty.

The Carbon Price Floor (CPF) rates in the period shown are as follows:

<table>
<tr><th>Carbon price support rate commodity</th><th>Gas</th><th>LPG</th><th>Coal and other solid fuels</th></tr>
<tr><td>Unit</td><td>£ per kilowatt hour (kWh)</td><td>£ per kilogram (kg)</td><td>£ per gigajoule (GJ) on gross calorific value (GCV)</td></tr>
<tr><td>1 April 2013 to 31 March 2014</td><td>0.00091</td><td>0.01460</td><td>0.44264</td></tr>
<tr><td>1 April 2014 to 31 March 2015</td><td>0.00175</td><td>0.02822</td><td>0.85489</td></tr>
</table>

Some additional legislative provisions will also be introduced with effect from 1 April 2013 (Deloitte, 2012):
• The previously announced carbon price support rate of CCL on solid</td></tr>
</table>

	fuels for 2013/14 will be amended. Rather than taxing all solid fuels used in electricity generation, only coal with a gross calorific value of more than 15 gigajoules (GJ) per tonne will be subject to the carbon price support rate. CCL for coal in 2013/14 will be £0.44264 per GJ and in 2014/15 £0.85489 per GJ. • Fossil fuels used to generate heat in good quality combined heat and power plants will not be liable to the carbon price support rates, subject to state aid approval. • Generators, and any connected persons, with a combined generation capacity of two megawatts or lower will not be liable to the carbon price support rates of CCL. • All generators will be required to self-account for carbon price support rates of CCL. If they are not already registered for CCL with HMRC they will be required to do so.
Specific measures and/or derogations planned	The CPS rates will not apply to recognised renewable fuel sources; small-scale generating stations other than CHP stations; small-scale generating stations that are CHP stations (fossil fuels to CHP stations would be exempt from the CPS rates where the fuel is used to generate good quality heat); stand-by generators; and oil generators (taxes under the fuel duty regimes) (HMRC 2013). Subject to the outcome of discussions with the European Commission over State aid, Northern Ireland will be exempt from the CPF (HMRC, 2012).
Use of revenues	Although the Treasury could be expected to have extra revenues from the CFP, this measure is expected to have a negligible impact on the Exchequer (HMRC, 2012). Any impact will be set out in Budget 2013. It seems that the government is likely to seek to make the overall impact of the CFP revenue neutral rather than as a money raising exercise. In 2011, the government announced that it would provide £100m support for businesses in compensation for the added indirect costs of the CFP (The Guardian 2012). The CPF is expected to lead to an additional £6.1 billion of low-carbon electricity investment by 2030, according to government projections (GBE forthcoming).
Proposed timeline for its introduction	The carbon price support (CPS) rates are to come into effect on or after 1 April 2013. The CPS rates of fuel duty will apply in relation to any claim for relief on oil used to generate electricity on or after 1 April 2013, irrespective of when that oil was supplied to the generator.
Potential interactions with EU ETS and/or EU Energy Tax Directive where appropriate	According to Speck (2012), the carbon floor price scheme can be portrayed as a policy tool which has some similarities to a CO2 tax as it increases the allowance price of the EU ETS to the carbon floor price set by the government in advance. However, this policy may lower the EU ETS price outside the UK electricity sector as it can be expected that it will reduce the demand for emission allowances (Speck 2012). Although the policy measure will provide clarity by reducing price volatility for electricity generating companies in the UK, the overall EU wide implications may be more disputed and an increase in the EU ETS price may also be achieved by strengthening the EU ETS cap.

	According to some commentators, the CFP would provide a modest boost to the price of carbon under the EU ETS. Others have argued that "a carbon price floor in the UK would merely work to subsidise coal-fired power generation in the rest of Europe, as a lower demand for carbon permits in the UK would mean more were available for companies on the continent, pushing down the prices for high-emitting power plants there" while others considered that the proposal could undermine the EU ETS (The Guardian, 2012, HM Treasury, 2011). According to the government, the UK needs to increase the rate of decarbonisation in the power sector above the level that can be delivered through the EU ETS carbon price alone. A carbon price floor complements the EU ETS by strengthening the carbon price signal in the UK enabling higher levels of investment in low-carbon infrastructure and therefore a faster rate of decarbonisation. As the price floor is limited to UK-based electricity generators, the impact will be no different to other Member States making changes to tax, regulation, or public spending that affects businesses in the EU ETS (HM Treasury, 2011).

References

Deloitte (2012) Climate Change levy – carbon price floor, URL: http://www.ukbudget.com/UKBudget2012/business/indirect-tax/ukbudget2012-indirect-tax-climate-change-levy-carbon-price-floor.cfm

GBE (forthcoming) Green Budget Europe – European Newsletter on Environmental Fiscal Reform, Green Budget News - forthcoming

HIS CERA (2013) New levels for the UK carbon tax, URL: http://www.ihs.com/products/cera/index.aspx

HMRC (2013) A draft guide to the Carbon Price Floor, URL: http://www.hmrc.gov.uk/climate-change-levy/cpf.pdf

HMRC (2013a) Calculating the carbon price support rates of Climate Change Levy and fuel duty, URL: http://www.hmrc.gov.uk/factsheets/chp-factsheet.pdf

HMRC (2013b) Overview of Tax Legislation and Rates, http://cdn.hm-treasury.gov.uk/fb2013_ootlar.pdf [accessed 21/4/2013]

HMRC (2012) Carbon price floor factsheet, URL: http://www.hm-treasury.gov.uk/d/carbon_price_floor.pdf

HM Treasury (2011) Carbon price floor consultation: the Government response, URL: http://www.hm-treasury.gov.uk/d/carbon_price_floor_consultation_govt_response.pdf

The Guardian (2012) 'Carbon floor price' plans dealt a blow by MPs, URL: http://www.guardian.co.uk/environment/2012/jan/26/carbon-floor-price-blow

2.6 Draft Bill for a carbon tax in the United States

Brief description of plans	In February 2013, two liberal Senators – Barbara Boxer (Independent from Vermont) and Bernie Sanders (Democrat from California) – proposed a draft bill to tax carbon dioxide emissions starting at USD20 per tonne of CO_2. The tax would target upstream emissions from 2,896 of the country's largest emitters, including coal mines, oil refineries and natural gas processing points (Reuters, 2013). The bill sets a goal to reduce carbon emissions by 80 per cent below 2005 levels by 2020. In addition to the proposed carbon tax, the Bill proposes the establishment of a Pollution Reduction Trust Fund, and a Sustainable Technologies Finance Programme to provide financial assistance for projects (Boxer and Sanders, 2013). There is currently no Federal action on carbon pricing in the US; however a number of states have taken forward initiatives in this area. For example carbon taxes have been introduced in Boulder (Colorado), the San Francisco Bay area (California) and in the county of Montgomery (Maryland).
Proposed design of new or revised tax	The Bill proposes a tax starting at USD 20 per ton of CO_2 emitted, and rising by 5.6 per cent annually over a 10-year period to reach USD33 per ton. The tax is to apply to the largest fossil fuel producers in the country. The tax rate applied will be assessed per ton of CO_2 content (including CO_2 equivalent content of methane) of the carbon polluting substance (Boxer and Sanders, 2013).
Specific measures and/or derogations planned	Power plants will not be covered by the tax, but will remain regulated under the Environmental Protection Agency (Reuters, 2013). It is also proposed that the tax apply to foreign companies who export fuels to the US and whose home countries do not have equivalent measures (Boxer and Sanders, 2013).
Use of revenues	Overall the carbon tax is expected to raise USD 1.2 trillion over 10 years (Reuters, 2013). The bill proposes that 60 per cent of revenues from the tax be allocated directly to a residential environment rebate programme, under which households would receive monthly rebate payments. 25 per cent of the revenues are to be allocated to deficit reduction measures and the remaining 15 per cent to weatherization of US homes, green energy and infrastructure investments (Boxer and Sanders, 2013).
Proposed timeline for its introduction	Senator Boxer has indicated that she plans to bring the bill to her Committee for a vote in spring 2013 and expects to bring the proposed measure to the Senate by summer 2013 (Reuters, 2013). The proposed bill faces significant opposition particularly from Republicans who argue among other things that it will raise the cost of living and stifle economic recovery, thus it is unclear whether it will be adopted.
Potential interactions with EU ETS and/or EU Energy Tax Directive where appropriate	Although there is currently no Federal action, some states have been taking forward initiatives on emissions trading. For example California has implemented a GHG emission trading scheme which came into effect in 2013 for energy intensive manufacturing companies. Other sectors, such as transport fuels and natural gas use by residential and commercial sectors will have to comply in 2015.
References	
Boxer, B. and Sanders, J. (2013) 'A bill to address climate disruptions, reduce carbon pollutions, enhance the use of clean energy, and promote resilience in the infrastructure of the United States, and for other purposes'. 113th Congress, URL http://www.sanders.senate.gov/imo/media/doc/0121413-ClimateProtectionAct.pdf [Accessed: 08/03/2013]	

Carbon Tax Centre (2013) 'Sanders-Boxer set "Gold Standard" but write off fiscal potential of carbon tax', 15/02/2013, URL http://www.carbontax.org/blogarchives/2013/02/15/sanders-boxer-set-gold-standard-but-write-off-fiscal-potential-of-carbon-tax/ [Accessed: 08/03/2013]

Reuters (2013) 'US Senator propose long-shot carbon tax for big polluters', 14/02/2013, URL http://www.reuters.com/article/2013/02/14/usa-climate-legislation-idUSL1N0BE7ZP20130214 [Accessed: 08/03/2013]

Annex 3: Overview of carbon and energy tax rates in selected OECD countries

Tax Base	Energy Tax (latest; generally 2012)						Carbon Tax (current/latest)				Notes
	Actual energy tax rate	Amount	Currency and units	Exchange rate to EUR	Energy tax rate in EUR	Unit	Actual carbon tax in national currency		Carbon tax in EUR		
Australia			AUSD	0.81	EUR		Summary: AUSD 23 (EUR 18.6)/t CO2 on 1/7/2012				
Fuel for Transport (petrol)	Excise tax: AUD 0.3814 per litre	0.381	AUSD/litre	0.81	0.308	(EUR/l)					
Fuel for Transport (diesel)	Excise tax: AUD 0.3814 per litre	0.382	AUSD/litre	0.81	0.309	(EUR/l)					
Heating fuel (fuel oil, LPG)	Diesel, gasoline & liquid petroleum products	0.381	AUSD/litre	0.81	0.308	(EUR/l)					
Natural Gas	Industry	0.000	AUSD/MWh GCV	0.81	0.000	(EUR/m3)	23	AUSD	18.6	EUR/t CO2	on combustion emissions GCV: 9 506 kcal/m3 (11.055 kWh/m3)
	Households	0.000	AUSD/MWh GCV	0.81	0.000	(EUR/m3)					
Electricity	Industry	0.000	AUSD//MWh	0.81	0.000	(EUR/Kwh)	23	AUSD	18.6	EUR/t CO2	on combustion emissions
	Households	0.000	AUSD//MWh	0.81	0.000	(EUR/Kwh)					
British Columbia	**Canada average**		CAD	0.78	EUR		Summary in BC: CAD 30 (EUR 23.3)/t CO2 on 1/7/2012				
Fuel for Transport (petrol)	Canada ave: Excise Tax (Q3 2012) RON 97	0.352	CAD/litre	0.78	0.273	(EUR/l)	0.067	CAN$/litre			
Fuel for Transport (diesel)	Canada ave: Excise Tax (Q3 2012) RON 97	0.252	CAD/litre	0.78	0.196	(EUR/l)	0.0767	CAN$/litre			
Heating fuel (fuel oil, LPG)	Light fuel oil for households: Excise tax (Q3 2012) +VAT	0.115	CAD/litre	0.78	0.089	(EUR/l)	0.0767	CAN$/litre			
Natural Gas	for industry (Q3 2012): Excise	0.000	CAD/MWh GCV	0.78	0.000	(EUR/m3)	0.057	CAN$/m3	23.3 EUR/t CO2		GCV: 8 892 kcal/m3 (10.341 kWh/m3)
	for households (Q2 2012): GST only	1.660	CAD/MWh GCV	0.78	0.013	(EUR/m3)	0.057	CAN$/m3			
Electricity	for industry (Q3 2012)	0.000	CAD/MWh	0.78	0.000	(EUR/Kwh)	no tax on final consumption via fuel inputs				Tax on fuel inputs
	for households (Q3 2012)	0.000	CAD/MWh	0.78	0.000	(EUR/Kwh)					Tax on fuel inputs
Denmark			DKK	0.142	EUR		Summary: 150 DKK (EUR 21.3)/t CO2 in 2012				
Fuel for Transport (petrol)	Premium unleaded (RON 98) Excise tax + Env tax	4.416	DKK/litre	0.142	0.627	(EUR/l)	155DKK/t CO2		21.3 EUR/t CO2		
Fuel for Transport (diesel)	Diesel excise tax for commercial/non commercial (Q3 2012	2.965	DKK/litre	0.142	0.421	(EUR/l)					

Heating fuel (fuel oil, LPG)	Light fuel oil for households: Excise tax (Q3 2012) +VAT	4.846	DKK/litre	0.142	0.688	(EUR/l)				GCV: 10 509 kcal/m3 (12.222 kWh/m3) and 173.5 MWH 2.12 m3
Natural Gas	Natural gas for households (Q3 2012) + VAT	364.900	DKK/MWh GCV	0.142	0.633	(EUR/m3)				
	Natural gas for industry	214.300	DKK/MWh GCV	0.142	0.372	(EUR/m3)				
Electricity	for households (Q3 2012)	806.000	DKK/MWh	0.142	0.114	(EUR/Kwh)				
	for industry (Q3 2012)	30.000	DKK/MWh	0.142	0.004	(EUR/Kwh)				
Finland							Summary: Average: EUR 60/t CO_2 (transport fuels); EUR 30/t CO2 (fuels for heating) on 1/1/2012			CO2 for heating: coal more highly taxed than gas hence average higher
Fuel for Transport (petrol)	Excise tax (Q3 2012) RON 98	0.651	EUR/Litre	1	0.651	(EUR/l)	64.51	64.51	EUR/t CO2	
Fuel for Transport (diesel)	Excise tax (Q3 2012)	0.470	EUR/Litre	1	0.470	(EUR/l)	34.45	34.45	EUR/t CO2	
Heating fuel (fuel oil, LPG)	Light fuel oil for households: Excise tax (Q3 2012) +VAT	0.055	EUR/Litre	1	0.055	(EUR/l)	6.79	6.79	EUR/t CO2	
Natural Gas	for industry (Q3 2012)	8.130	EUR/MWh GCV	1	0.099	(EUR/m3)	3.66	3.66	EUR/t CO2	GCV: 10 476 kcal/m3 (12.184 kWh/m3)
Natural Gas	for households (Q3 2012)	8.130	EUR/MWh GCV	1	0.099	(EUR/m3)	3.66	3.66	EUR/t CO2	
Electricity	for industry (Q3 2012)	7.000	EUR/MWh	1	0.007	(EUR/Kwh)	0	0	EUR/t CO2	
Electricity	for households (Q3 2012)	17.000	EUR/MWh	1	0.017	(EUR/Kwh)	0	0	EUR/t CO2	
Germany										
Fuel for Transport (petrol)	Excise tax (Q3 2012) RON 98	0.655	EUR/Litre	1	0.655	(EUR/l)				
Fuel for Transport (diesel)	Excise tax (Q3 2012)	0.470	EUR/Litre	1	0.470	(EUR/l)				
Heating fuel (fuel oil, LPG)	Light fuel oil for households: Excise tax (Q3 2012) +VAT	0.204	EUR/Litre	1	0.204	(EUR/l)				
Natural Gas	for industry (Q2 2012)	4.030	EUR/MWh GCV	1	0.039	(EUR/m3)				GCV: 8 400 kcal/m3 (9.769 kWh/m3)
	for households (Q4 2012)+VAT	16.790	EUR/MWh GCV	1	0.164	(EUR/m3)	N/A – energy tax			
Electricity	for industry (Q2 2012)	33.500	EUR/MWh	1	0.034	(EUR/Kwh)				
	for households (Q4 2012)+VAT	115.400	EUR/MWh	1	0.115	(EUR/Kwh)				Based on IEA statistics. Note electricity tax rate is EUR 20.50/MWh according to Stromsteuergesetz (5/12/2012)
Ireland							Summary: EUR 20/t CO_2 (petrol, auto-diesel, kerosene, marked gas oil, LPG, fuel oil, natural gas) in 2012; EUR10/t CO_2 (solid fuels) from 05/2013			

Fuel for Transport (petrol)	Excise tax (Q3 2012) RON 95	0.588	EUR/Litre	1	0.588	(EUR/l)	20.37	EUR/t CO2	20.37	EUR/t CO2	
Fuel for Transport (diesel)	Excise tax (Q3 2012)	0.479	EUR/Litre	1	0.479	(EUR/l)	19.91	EUR/t CO2	19.91	EUR/t CO2	
Heating fuel (fuel oil, LPG)	Light fuel oil for households: Excise tax (Q3 2012) +VAT	0.222	EUR/Litre	1	0.222	(EUR/l)	14.86	EUR/t CO2	14.86	EUR/t CO2	
Natural Gas	for industry (Q3 2012)	3.700	EUR/MWh GCV	1	0.041	(EUR/m3)	20.32	EUR/t CO2	20.32	EUR/t CO2	
	for households (Q3 2012)+VAT	12.990	EUR/MWh GCV	1	0.143	(EUR/m3)	20.32	EUR/t CO2	20.32	EUR/t CO2	GCV: 9 444 kcal/m3 (10.983 kWh/m3)
Electricity	for industry (Q3 2012)	0.000	EUR/MWh	1	0.000	(EUR/Kwh)	0	EUR/t CO2	0	EUR/t CO2	
	for households (Q3 2012): VAT (no excise tax)	25.700	EUR/MWh	1	0.026	(EUR/Kwh)	0	EUR/t CO2	0	EUR/t CO2	
Netherlands											
Fuel for Transport (petrol)	Excise tax (Q3 2012) RON 95	0.736	EUR/Litre	1	0.736	(EUR/l)					
Fuel for Transport (diesel)	Excise tax (Q3 2012) RON 95	0.437	EUR/Litre	1	0.437	(EUR/l)					
Heating fuel (fuel oil, LPG)	Light fuel oil for households: Excise tax (2009) +VAT	0.361	EUR/Litre	1	0.361	(EUR/l)					
Natural Gas	for industry (Q2 2012)	2.700	EUR/MWh GCV	1	0.026	(EUR/m3)					GCV: 8 406 kcal/m3 (9.776 kWh/m3)
	for households (Q4 2012)+VAT	29.600	EUR/MWh GCV	1	0.289	(EUR/m3)	*N/A - energy tax with a carbon component*				For excise tax: actual banding across consumption levels
Electricity	for industry (Q2 2012)	12.800	EUR/MWh	1	0.013	(EUR/Kwh)					For energy tax: has a banded eco-tax
	for large-scale industrial use (2013)	0.500	EUR/MWh		0.001	(EUR/Kwh)					
	for households, consumption <10,000 kWh (2012)		EUR/MWh	1	0.114	(EUR/Kwh)					Household tax rate taken from sources in Dutch case study (see Annex 1)
Norway			NOK	0.14	EUR		No fixed rate per tCO2, depend on energy product				
Fuel for Transport (petrol)	Excise tax (Q3 2012)	5.580	NOK/litre	0.14	0.757	(EUR/l)	394.04	NOK/t CO2	53.45	EUR/t CO2	
Fuel for Transport (diesel)	Excise tax (Q3 2012)	4.280	NOK/litre	0.14	0.581	(EUR/l)	225.43	NOK/t CO2	30.58	EUR/t CO2	
Heating fuel (fuel oil, LPG)	Light fuel oil for households (Q3 2012) Excise tax + VAT	3.623	NOK/litre	0.14	0.491	(EUR/l)	226.69	NOK/t CO2	30.75	EUR/t CO2	
Natural Gas	for industry	n/a	NOK/MWh GCV	0.14	n/a	(EUR/m3)	22.28	NOK/t CO2	3.02	EUR/t CO2	CO2 tax for natural gas (and LPG) in road is 202.61NOK/tCO2
	for households	n/a	NOK/MWh GCV	0.14	n/a	(EUR/m3)	22.28	NOK/t CO2	3.02	EUR/t CO2	
Electricity	for industry (Q3 2012)	0.000	NOK/MWh	0.14	0.000	(EUR/Kwh)	0	NOK/t CO2	0.00	EUR/t CO2	

	for households (Q3 2012)+VAT	258.200	NOK/MWh	0.14	0.035	(EUR/Kwh)	0	NOK/t CO2	0.00	EUR/t CO2	
Sweden			SEK	0.11	EUR		Summary: SEK 1080 (EUR 118)/t CO_2 in 2012				
Fuel for Transport (petrol)	Excise tax (Q3 2012) RON 98	5.650	SEK/litre	0.11	0.617	(EUR/l)	1050	SEK/t CO2	114.72	EUR/t CO2	
Fuel for Transport (diesel)	Excise tax (Q3 2012)	4.433	SEK/litre	0.11	0.484	(EUR/l)	1050	SEK/t CO2	114.72	EUR/t CO2	
Heating fuel (fuel oil, LPG)	Light fuel oil for households (Q3 2012) Excise tax + VAT	6.658	SEK/litre	0.11	0.727	(EUR/l)	220	SEK/t CO2	24.04	EUR/t CO2	
Natural Gas	for industry (Q2 2012)	79.600	SEK/MWh GCV	0.11	0.106	(EUR/m3)	220	SEK/t CO2	24.04	EUR/t CO2	Using Finnish GCV: 10 476 kcal/m3 (12.184 kWh/m3)
	for households (Q2 2012)+VAT	473.900	SEK/MWh GCV	0.11	0.631	(EUR/m3)	220	SEK/t CO2	24.04	EUR/t CO2	Using Finnish GCV: 10 476 kcal/m3 (12.184 kWh/m3)
Electricity	for industry (Q2 2012)	5.000	SEK/MWh	0.11	0.001	(EUR/Kwh)	0	SEK/t CO2	0.00	EUR/t CO2	
	for households (Q3 2012)+VAT	576.000	SEK/MWh	0.11	0.063	(EUR/Kwh)	0	SEK/t CO2	0.00	EUR/t CO2	
United Kingdom	*Ave exchange rate for 2012*		GBP	1.233	EUR		Summary: CCL equivalent to EUR 12.0/t CO_2 (natural gas), EUR 8.8/t CO_2 (petroleum), EUR 6.4/t CO_2 (coal)				*Note that for coal EUR 6.4/t CO2*
Fuel for Transport (petrol)	Excise tax (Q3 2012) RON 97	0.580	GBP/litre	1.233	0.715	(EUR/l)				EUR/t CO2	
Fuel for Transport (diesel)	Excise tax (Q3 2012)	0.580	GBP/litre	1.233	0.715	(EUR/l)				EUR/t CO2	
Heating fuel (fuel oil, LPG)	Light fuel oil for households (Q3 2012) Excise tax + VAT	0.145	GBP/litre	1.233	0.179	(EUR/l)	4.46	GBP/t CO2	5.50	EUR/t CO2	Carbon tax: heavy fuel oil GBP 4.46/t CO2. Note petroleum EUR 8.8/t CO2
Natural Gas	for industry (Q2 2012) Excise tax	0.720	GBP/MWh GCV	1.233	0.009	(EUR/m3)	8.76	GBP/t CO2	10.80	EUR/t CO2	GCV: 8 400 kcal/m3 (9.769 kWh/m3)
	for households (Q4 2012)VAT only	2.190	GBP/MWh GCV	1.233	0.026	(EUR/m3)	0	GBP/t CO2	0	EUR/t CO2	GCV: 8 400 kcal/m3 (9.769 kWh/m3)
Electricity	for industry (Q2 2012) Excise tax	2.800	GBP/MWh	1.233	0.003	(EUR/Kwh)	10.42	GBP/t CO2	12.85	EUR/t CO2	
	for households (Q3 2012)VAT only	6.600	GBP/MWh	1.233	0.008	(EUR/Kwh)	0	GBP/t CO2	0	EUR/t CO2	

Sources:

Energy taxes from IEA (2013), Energy prices and taxes - Quarterly statistics, Fourth Quarter 2012.

For carbon taxes see sources in Annex 1 of Withana et al 2013 and OECD 2013 Taxing Energy Use – A Graphical Analysis, OECD Publishing, 28 Jan 2013