Modelling of Milestones for achieving Resource Efficiency: Phasing out Environmentally Harmful Subsidies

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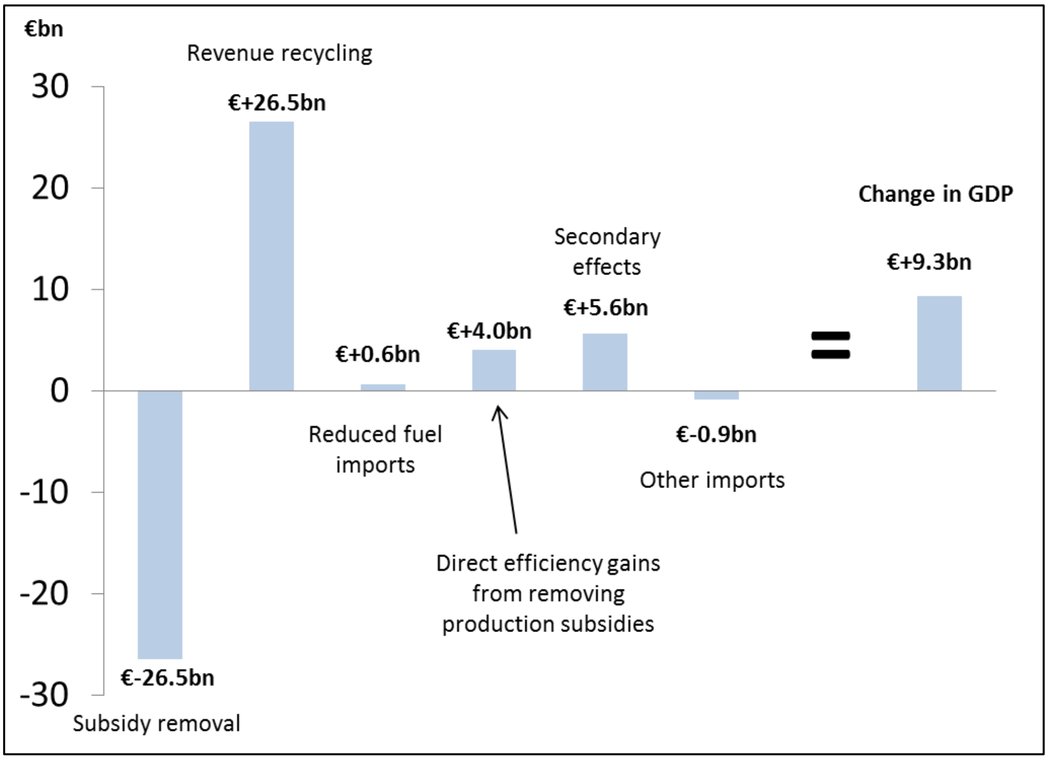
Executive Summary

- This modelling exercise focuses on the macroeconomic effects of phasing out fossil fuel subsidies in Europe's Member States by 2020. In particular, it considers the trade-off of between having higher general taxes and reduced fossil fuel costs for particular social and industrial groups.
- It is often not clear what should and should not be counted as a fossil fuel subsidy. In this report we generally follow the definitions used by the OECD in its *Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels 2013* report, although it should be noted that there are fossil fuel subsidies that this report does not include (and subsidies for electricity are excluded altogether). The subsidies are translated into inputs to the E3ME macroeconomic model. In order to maintain revenue neutrality, income tax rates are adjusted to balance the reduced spending on subsidies.
- Figure 0.1 shows that the combined effect of removing all fossil fuel subsidies in Europe will be a small increase in GDP. This is due primarily to reductions in inefficient production subsidies and a reduction in fossil fuel imports. Overall there is a net increase in GDP of €9.3bn (in 2005 prices). This finding, of a small but positive impact, is consistent with the results from previous analysis.
- Removing the subsidies leads to a modest reduction in primary energy consumption and CO_2 emissions. The exact size of these reductions is dependent on the behavioural responses of the major firms affected. Our estimate is that it will be in the region of 0.5% by 2020.

Figure 0.1: Summary of GDP Impacts in 2020, EU27



- Fossil fuel subsidies are often introduced for social reasons so it is important to consider the social implications of subsidy removal. This is not an issue that can be addressed very well by macroeconomic modelling and so it is instead addressed in a series of detailed case studies. In particular, subsidies in the UK, Belgium and Italy are found to be justified on social grounds. In most cases it would be quite difficult to design an instrument that achieves the same distributional outcome. This could make it difficult politically to phase out the subsidies.
- The UK case study identifies a hierarchy of options for alternative measures. These are:
    - measures to increase energy efficiency and reduce energy consumption
    - social transfers that are not linked to energy consumption
    - subsidies that will increase energy consumption

  However, it is also noted that local and national institutional frameworks are important for ensuring successful implementation of any programme of efficiency improvements.
- The case studies identify a series of additional obstacles that need to be overcome if fossil fuel subsidies are to be phased out. In some cases these draw on previous (both successful and unsuccessful) attempts at removing subsidies. The barriers may be economic, political or legal in nature; examples include the influence of particular lobby groups, public perception and interaction with other legislation.
- The recent recession provides grounds for both continuing and phasing out fossil fuel subsidies. On the one hand a reduction in real household incomes provides justification for support to particular social groups. On the other hand, this analysis shows that, at the macroeconomic level, phasing out the subsidies would have a small benefit to the economies of most of the EU’s Member States.

1 Introduction

1.1 Background and objectives

Overview

The background to this report is the EU's *Roadmap to a Resource Efficient Europe*[1]. In the roadmap, the EU has set a series of objectives that cover a range of different resource types. The document presents a long-term vision and a set of milestones for steps to achieving this vision. It also provides suggestions for policies that would contribute towards meeting the targets.

The EHS milestone

This report focuses on one particular milestone within the roadmap, which is Environmentally Harmful Subsidies (EHS). In Section 3.4.1, the roadmap states that:

By 2020 EHS will be phased out, with due regard to the impact on people in need.

The milestone makes a clear reference to the fact that many of the existing subsidies are in place for social or economic reasons, and that these must be taken into account when considering possible phasing out. It is important also to note that the 2020 time horizon gives only a limited period of time for businesses and households to adjust to higher energy prices.

The general purpose of subsidies is to increase social and economic welfare for a particular group. Their justification is based on their ability to counteract undesirable features of the market, in particular as they affect vulnerable social groups and economic sectors. However, it has been recognised that some subsidies are inefficiently targeted at activities associated with negative externalities for the environment, rather than the vulnerable groups.

Assessment of the OECD subsidies

EHS can come in many different forms[2] and so there has been much debate about where the boundaries of EHS should be drawn. In this report we use the OECD report *Inventory of Estimated Budgetary Support and Tax Expenditures for Fossil Fuels 2013* as the basis for the analysis and, as far as possible, we use the OECD's definition of subsidies and so our assessment includes only the subsidies that are covered in that report. One consequence that should be noted is that we therefore consider only subsidies on fossil fuels[3]. While it is noted, that the definition is by no means perfect, and can be inconsistent across countries the aim is to focus on the modelling results rather than the debate about what does and does not constitute a subsidy.

For the non-OECD European countries[4] data were taken from the European Commission working document, *Budgetary support and tax expenditures for fossil fuels.* Apart from this difference in the primary data sources, the assessment approach is identical for the OECD and non-OECD countries.

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[1] http://ec.europa.eu/environment/resource_efficiency/pdf/com2011_571.pdf

[2] From governments via direct fincial aid, preferential treatment, income support, forgo revenue, direct provision or conduct incomplete pricing.

[3] And that the definition is *direct* subsidies on fossil fuels, so subsidies relating to electricity consumption are also excluded.

[4] The European countries covered in our analysis are the 27 EU Member States, the four candidate countries, Norway and Switzerland.

Model-based quantitative analysis

Our assessment approach combines quantitative and qualitative analysis. The quantitative approach is primarily a model-based one. In particular, we use the E3ME macroeconomic model[5] that is maintained and developed by Cambridge Econometrics. The model was used to assess a large set of scenarios (one per subsidy), providing an estimate of the possible impacts of removing the subsidy by 2020. Although the modelling covers the whole economy, the results focus on the following key indicators:

- energy consumption
- CO2 emissions
- GDP
- employment

Our focus is in the main on subsidies that provide an incentive to consume increased volumes of fossil fuels. Where appropriate, we also provide an assessment of 'lump sum' subsidies for producers that may lead to increased supply[6]; however, the impacts of these are subject to a much higher degree of uncertainty so they are often excluded from the national totals. In total there are around 150 policy scenarios covering 26 Member States (no subsidies were found for Malta), plus several other sensitivity tests that were carried out. The modelling scenarios cover roughly more than 70% of the total value of the subsidies, as defined by the OECD report. The results are presented in Chapters 3 and 4.

The case studies

In addition to the modelling exercise, we have carried out a more in-depth qualitative assessment of five subsidies, or sets of subsidies, in Europe. These case studies focus on the policy context in which the subsidies were introduced, are maintained and on the possible barriers to phasing out the subsidies. The case studies build on the modelling results, but also consider some of the distributional and institutional aspects that the modelling cannot cover in detail. Each case study was chosen for a particular purpose, as shown in Table 1.1. The case studies are presented in Chapter 3.

Table 1.1: Overview of Case Studies

Countries	Subsidies	Particular Focus
Belgium and Italy	Household heating fuels	Social and distributional aspects of the subsidies
Germany	Industrial energy use	A large range of subsidies maintained for reasons of competitiveness
France	Various energy uses	A variety of different types of subsidy with sectoral and geographical focus
Sweden and Finland	CO_2 exemptions	Exemptions have been reduced in recent years
UK	VAT reduction on heating fuels	Very large subsidy. Other Member States also have reduced VAT rates

[5] See Section 2.2 or www.e3me.com for further details.

[6] These are subsidies that are independent of the level of fossil fuel consumption by the entity receiving the subsidy. For example the assistance that Germany provides to its coal mining industry is classified as a lump sum subsidy, although it relates to the production, rather than the consumption, of fuel.

1.2 Structure of this report

The overall assessment was divided into the following main tasks:

- interrogate the OECD inventory for Member States' EHS
- obtain similar information for the non-OECD countries' EHS
- formulate an analytical approaches for all EHS
- apply the approach to all countries
- identify barriers to phasing out EHS in the countries discussed in the case studies
- draw conclusions about common barriers

The outcomes of these tasks are presented in this report.

In Chapter 2 we present the modelling approach that was used, including a short description of the model, the baseline case and the inputs that were used in the scenarios. Chapters 3 and 4 contain the results of the analysis. In chapter 5 considers the results from a European perspective and presents our conclusions from the whole exercise.

Appendix A lists around 150 policies individually; these and their results as shown by E3ME were modelled on a policy-by-policy basis.

Appendix B provides an overview of the E3ME model.

2 Analytical Approach

2.1 Introduction

This chapter outlines the methodology that was used to estimate the impacts of removing the fossil fuel subsidies in each Member State. Section 2.2 provides a short overview of the E3ME model (a more detailed description can be found in Appendix B: Description of E3ME). Sections 2.3 and 2.4 describe the design and implementation of the scenarios that were used in the modelling exercise.

In Section 2.5 we provide details of how the most common types of subsidy were assessed, along with an account of the types of subsidy that it is not possible or desirable to model, because of the high degree of uncertainty surrounding their possible impacts.

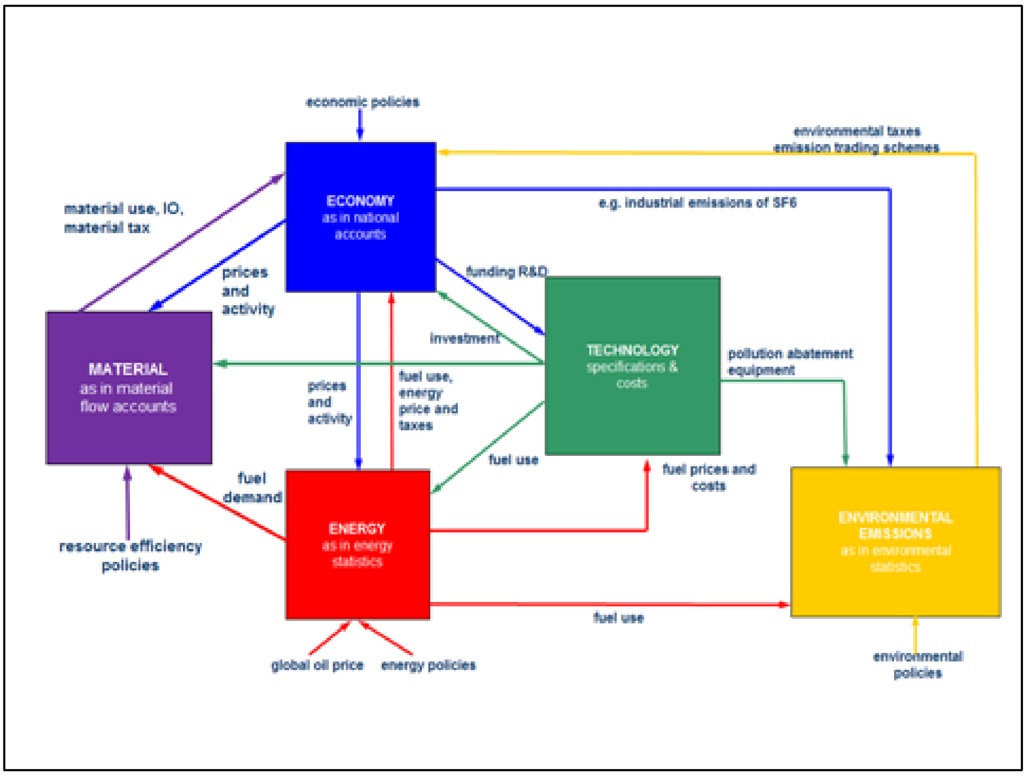
This section also describes the necessary assumptions we had to make. In view of the fact that the quantitative analysis on its own is not sufficient to provide a comprehensive assessment of the effects of subsidy removal, we have carried out case studies for seven Member States. In Section 2.5 there is a list of the main policy areas on which the case studies are focussed.

2.2 The E3ME model

E3ME is a computer-based model of Europe’s economies, energy systems, and the environment (hence the three Es); more recently it has been expanded to also include demand for physical materials. E3ME was originally developed through the European Commission’s research framework programmes and is now widely used in Europe for policy assessment, forecasting and research purposes.

Figure 2.1 provides an overview of the model structure.

Figure 2.1: Overview of the E3ME Model



The economic structure of E3ME is based on the system of national accounts, as defined by ESA95 (European Commission 1996), with further linkages to energy demand and environmental emissions. The economic model includes a full set of macroeconomic feedbacks at the sectoral level that capture supply chain impacts and multiplier effects. The model contains a total of 33 sets of econometrically estimated equations, covering the individual components of GDP (consumption, investment, and international trade), prices, the labour market, energy demand and materials demand. Each equation set is disaggregated by country and by sector.

Model dimensions

The main dimensions of the version of the model used for this analysis are:

- 33 countries (EU27 member states, Norway, Switzerland and four candidate countries)
- 69 economic sectors (2-digit NACE rev2 level), including a disaggregation of the energy sectors and 38 service sectors
- 43 categories of household expenditure
- 21 different users of 12 fuel types
- 14 types of air-borne emissions including the six greenhouse gases monitored under the Kyoto protocol.
- 13 types of household, including income quintiles and specific socio-economic groups

Comparison to CGE approaches

E3ME is similar in many ways to a Computable General Equilibrium (CGE) model and produces a similar set of outputs. However, E3ME does not impose the assumptions about the nature of the economy that are typically incorporated in CGE models. Instead, E3ME follows a more empirical approach, with behavioural parameters estimated using historical data sets rather than imposed or calibrated to conform to neoclassical economic theory. Consequently, the model's empirical validity does not depend on the validity of the assumptions common to CGE models, such as perfect competition or rational expectations, but it does mean that the model's validity depends on the quality of the data that are used to estimate the parameters.

The econometric specification also allows for an assessment of short-term impacts, which is important when considering the period up to 2020.

Key characteristics

The key characteristics of E3ME for this exercise are thus:

- its coverage of the EU at Member State level
- its two-way linkages between the economy and energy systems
- its econometric specification, allowing for analysis of both short and long-term impacts
- its sectoral disaggregation, allowing a relatively detailed representation of fossil fuel subsidies

The reader is referred to Appendix B for a more detailed description of the E3ME model.

2.3 Modelling baseline

Overview of the baseline

A forward-looking, *ex ante*, assessment requires a baseline forecast with which to compare the different policy scenarios. This is not necessarily presented as a forecast of future developments, but rather as a neutral viewpoint for the purposes of comparison, since many of the model-based results are presented as (percentage) difference from baseline. Nevertheless, the values in the baseline are important in themselves, since they provide, for example, an indication of prices and energy requirements over the next decade. It is therefore important that a robust and credible baseline should be established.

The baseline that was chosen for this study is the current policy initiatives (CPI) scenario from the Energy Roadmap. This is the result of a simulation made using the PRIMES energy model with inputs from the GEM-E3 economic model. The baseline includes the existing EHS in their current form. We have adjusted the baseline to take into account subsidies that are expected to be phased out. The modelling results always present the difference between a subsidy being maintained at present levels, and it being removed completely.

Table 2.1 summarises the baseline.

Table 2.1: Summary of Modelling Baseline

	2010	2020	% pa growth
Population (000s)	502,010	516,501	0.3
GDP (€bn2005)	11,549	13,296	1.4
Employment (m)	224,777	231,199	0.3
Final energy demand (mtoe)	1,072	1,104	0.3
CO_2 emissions (energy, $mtCO_2$)	3,733	3,662	-0.2

Sources: Cambridge Econometrics, based on PRIMES model outputs.

Additional processing

Many of the outputs from the PRIMES simulations are incorporated into the E3ME solution. This includes the sectoral economic projections, energy and ETS prices, projections of energy demand by sector and by fuel, and sectoral CO2 emissions. E3ME's Energy Technology sub-model of electricity capacity and generation also makes use of some of the more detailed outputs.

However, in order to meet E3ME's data requirements, it was necessary to carry out some additional expansion and processing.

- Classifications were converted – as E3ME and GEM-E3/PRIMES use similar data sources, the classifications also tend to be quite similar. There are, however, some differences. For example, E3ME has more disaggregation of service sectors.
- Point estimates for occasional years were converted to annual time series – a simple interpolation method is used; short-term forecasts from the AMECO database are also used to take into account more recent data from the recession.
- Additional social and economic variables were estimated – only a small set of economic variables (GDP and the ones that are direct drivers of energy demand) are given in the PRIMES outputs. E3ME requires a complete specification of the national accounts so other variables must be estimated. The procedure followed to achieve this is described below (*proxies for other economic indicators*).

These additional steps were carried out using software algorithms based in the Ox programming language (Doornik, 2007). The result of this exercise is a set of baseline projections that is both consistent with the published figures and the integrated economy-energy-environment structure of E3ME.

Energy demand

The PRIMES figures include a comprehensive set of projections for Europe's energy systems and the resulting emissions. Economic activity is provided as a driver of energy demand, but the figures tend to be provided only at an aggregate level (e.g. GDP, household spending or value added for some energy-intensive sectors). As the E3ME model is built around the complete structure of the national accounts, this means that the projections for other economic variables must be estimated.

Proxies for other economic indicators

This process was carried out using a methodology that is as consistent as possible between the economic variables, for example ensuring that the components of GDP sum to the correct total, and that similar indicators, such as gross and net output, follow the same patterns of growth. A set of software algorithms was used to carry out this exercise, written in the Ox software package.

The PRIMES datasets provide economic projections for GDP, gross value added (GVA) and household incomes in constant prices. It was necessary to estimate values for other variables. E3ME's projections of GDP and GVA are set to match the published figures. Economic output (which is gross, defined as intermediate demand plus GVA) was set to grow at the same rate as GVA.

E3ME's total consumer spending was set to grow at the same rate as the household income figures, following the standard economic assumption that, in the long run, all income is spent. Detailed consumer spending by spending categories was set to grow using historical trends and was then constrained to the total.

Other components of output (at sectoral level), mainly investment and trade, were also set to grow based on historical rolling averages and then constrained to the total output that was based on the GVA projections.

Prices for energy-related industries were set to be consistent with the PRIMES energy price assumptions. Prices for other industries were projected using historical trends.

2.4 Policy scenarios for modelling

Introduction to the scenarios

We modelled the phasing-out of EHS in two stages, using two different sets of scenarios:

- Initially, the removal of each individual subsidy was modelled as a separate scenario, and results were compared to the baseline in each case.
- Subsidies in each Member State were then grouped together to construct scenarios representing the removal of all EHS in a particular country. The results for this analysis can be found in Chapters 3 and 4.

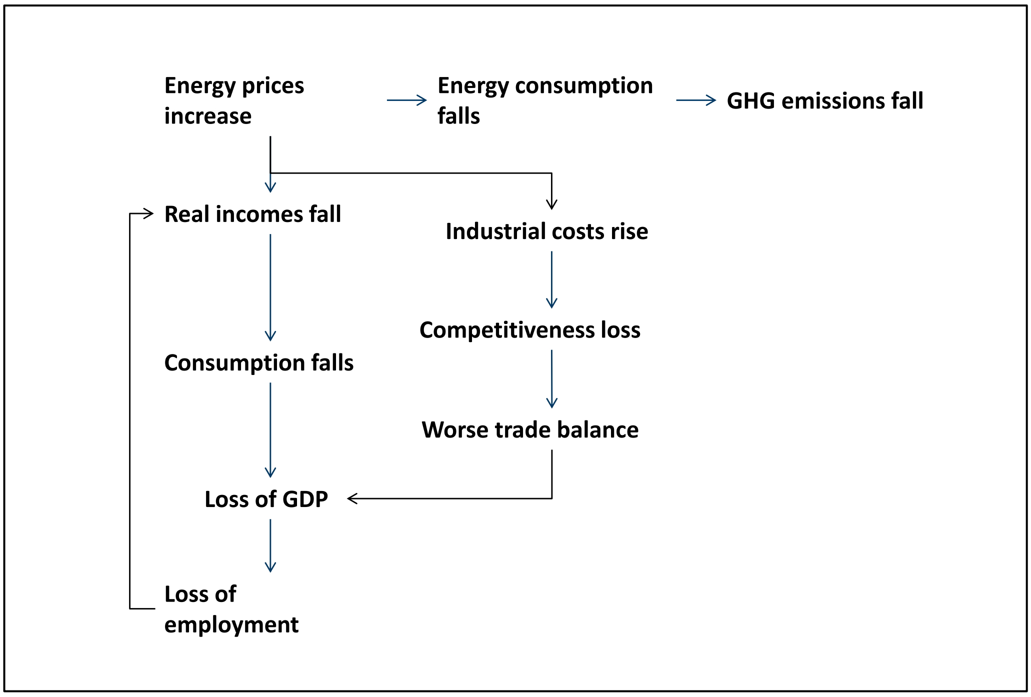
A possible final stage would be to construct a single scenario for the EU that represented the removal of all European fossil fuel subsidies. Although this is technically quite straight forward to do (in light of our scenarios), we have not carried out this exercise, since the definitions of the subsidies are not consistent across countries.

Nevertheless, a rough estimate of impacts at the European level could be derived from summing the results for each Member State.

Overview of impacts

Figure 2.2 summarises the economic impacts that could be expected from increasing fuel prices by removing fossil fuel subsidies, either to households (left-hand side) or businesses (right-hand side). It should be noted, however, that the figure does not include the impacts of revenue recycling (see below), which would cause real incomes to rise and reverse the negative impacts that are shown.

Figure 2.2: Summary of Economic Interactions



Forming the model inputs

Each subsidy was classified using the following dimensions:

- type of subsidy
- sector
- fuel type
- phasing out

Types of subsidy

The subsidies were classified as either being granted to energy producers or energy consumers, and were then sub-divided into four categories:

- subsidies on energy consumption
- exemptions or reduced rates of carbon taxation
- lump sum subsidies
- reduced rates of VAT

The energy subsidy and carbon subsidy categories represent compensation in the form of €/toe[7] and €/tCO_2 respectively. Lump sum subsidies refer to payments that are independent of fuel consumption and the VAT subsidies represent subsidies in the form of exemptions or reductions in the percentage of consumption tax that households pay on energy.

[7] tonne of oil equivalent.

These distinctions are important, because they determine the way in which the phasing-out of the subsidies was modelled. This is discussed in detail in the next section.

Sector and fuel type All of the subsidies are applied either to households or particular economic sectors. The level of sectoral disaggregation in E3ME allowed us to model the subsidies by economic sector at the 2-digit level. While this is sufficient for many of the subsidies, there are some specific cases where it was necessary to assume that the subsidy was applied to a wider sector than it is in reality. For example, one of the subsidies in Finland relates to the use of mobile machinery in agriculture, but we shared the value of the subsidy across all agricultural use of light fuels.

The sectoral dimension is very important to the analysis. Price elasticities[8] vary between different sectors (and countries), reflecting the technological options that are available and other possible substitutes for energy. Different sectors also face varying degrees of international competition and so the economic results may be largely determined by the sectoral coverage of each subsidy.

A similar approach is applied to identifying the fuel types (or carbon emissions) that a subsidy applies to. E3ME includes twelve energy carriers and each subsidy was allocated to one or more of these.

A list of sectors and fuel types is provided in Appendix B: Description of E3ME.

In many cases, the subsidies cover a range of sectors and it is not clear from the input data how the different sectors are covered. In the absence of further information, our approach is to take the total cost of the subsidy (in millions of euros) and to share this out across the sectors in relation to fuel consumption. This means that implicitly all the sectors covered by the subsidy receive the same rates of reduction.

Phasing out Some of the subsidies are due to be phased out in the period up to 2020, meaning that their removal is already included in the baseline. As described in the previous section, we adjusted the modelling baseline for this study so that the scenarios always show the difference between maintaining the subsidy at its current level and removing it altogether.

In the baseline, it is assumed that the value of the subsidies is maintained in real terms. The standard approach in the scenarios is to phase out the subsidies gradually, with an equal percentage point decrease each year, so that they are removed completely in 2020.

Subnational coverage There is one further dimension that is not covered explicitly in the modelling. A small number of the subsidies were restricted to cover certain parts of the Member States, notably overseas regions. As the E3ME model operates at a national level, it was not able to take this into account explicitly. The value of the subsidy was therefore shared across the whole country, in effect producing a lower rate of subsidy applied to a larger group. As the results are also presented at national level, this assumption does not have a major impact on the results.

Revenue recycling

The modelling scenarios have been designed to be revenue-neutral, with the result that they provide a representation of subsidy reform rather than a change in the total tax received. A compensating measure has therefore been added to the scenarios in the

[8] The magnitude of the response in demand to a change in price.

form of reductions in the standard rate of income tax. By removing the subsidies, national governments are able to reduce their expenditure, and this is balanced by reduced receipts from income taxation.

In reality, of course, there are many different forms that the revenue recycling could take, each one of which would have somewhat different economic impacts. Alternative possibilities for offsetting taxes would be standard VAT rates, taxes on capital or social security contributions. Other government expenditure (e.g. transfer payments, or health and education budgets) could also be adjusted. In the current economic climate, national governments may also choose to use available funds for deficit reduction.

The reason for choosing income tax rates for revenue recycling is that they contribute the largest share to tax receipts in Europe and therefore revenue recycling through income tax has a quite neutral impact. In any case, the aim of this analysis is to evaluate the phasing-out of fossil fuel subsidies in a revenue-neutral manner, rather than the impacts of any particular type of revenue recycling measure.

Fuel and ETS prices

International energy price are given as exogenous in the E3ME model and there is no feedback in the scenarios to prices. This seems a reasonable assumption given the scale of the changes involved.

As the analysis has been carried out at national level, the EU ETS price has also been set as exogenous (around €17/tCO2 in 2020) to make it more straightforward to interpret the results. In reality, however, reduced emissions in ETS sectors would lead to a very small reduction in the allowance price and an increase in emissions in other European countries.

2.5 Defining the model inputs

As described in the previous section, four main types of subsidy were assessed:

- subsidies on energy consumption
- exemptions or reduced rates of carbon taxation
- lump sum subsidies
- reduced rates of VAT

In a few cases a detailed approach specific to a single country is followed; this is described in Chapters 3 and 4 under the relevant country headings. However, to avoid excessive repetition the general approach to each type of subsidy is described below.

Subsidies for energy consumption

Energy prices in the E3ME model are derived from the IEA database. A price is estimated for each of the twelve energy carriers in the model, including taxes, with differentiated prices for industry, households and the power sector[9].

Taxes are modelled as an increase in price (per unit of energy consumption) and are assumed to have the same effect as an increase in price for any other reason. A subsidy is treated as a negative tax.

Phasing out a subsidy will therefore increase the price of one particular fuel type. This will reduce the consumption of that fuel type, although it may be replaced with

[9] However, the available data do not allow for ‘sector-specific’ pricing, and so in the model all industrial sectors pay the same for energy inputs.

consumption of a different fuel type (i.e. fuel switching). The economic interactions are largely as given in Figure 2.2.

Exemptions from carbon taxation

The procedure for modelling subsidies relating to carbon taxes is similar. Carbon taxes are entered to the model as rates in euros per tonne of CO_2. The model then converts these rates into effective increases in energy prices, depending on the coefficients of emissions per unit of fuel consumption.

As in the case above, these changes in energy prices are treated in the same way as any other changes in energy prices.

Lump sum subsidies

Lump sum subsidies stimulate a behavioural response different from that to energy and carbon price subsidies, because they are not dependent on the quantity of energy consumed, and therefore cannot be modelled as a price change. In many cases the modelling cannot on its own provide an estimate of the impacts of these subsidies.

Subsidies to industry or the energy sector

Instead, it is necessary to make assumptions about what the response to a subsidy might be. For example, there are several subsidies that relate to operations at mines. Removing these subsidies could:

- have very little impact – the mine keeps producing as before and the subsidy boosts the profits of the mining company
- make the mine no longer profitable and so it closes and ends production

Clearly, the economic consequences are quite different in these two outcomes, and it is usually not possible to determine which one is more likely to occur. There is therefore a very large range of uncertainty around results from these scenarios, and for this reason these scenario results are not typically included in the Member State results discussed in chapters 3 and 4.

Subsidies to households

In the case of households, the lump sum subsidies are added into income and have the same effect on consumption as any other changes in income (including wages, benefits and dividends). We do not assume that they have any particular influence on rates of energy consumption, even though they are classified as energy subsidies.

When modelling the lump sum subsidies to households, removing the subsidies subtracts from household income. However, the revenue recycling ads back into household income, with the result that there is only a small difference overall[10]. The main impact is therefore a shift in incomes between households rather than a change in overall household income. Unfortunately, due to the available data, this shift lies beyond the scope of the modelling.

The household lump sum scenarios are therefore described more qualitatively in the analysis. The case study on Belgium and Italy covers this type of subsidy in more detail (see Section 3.4).

Reduced VAT rates

The final set of scenarios considers differentiation in VAT rates for different product groups. Several countries in Europe have lower VAT rates for heating fuels. The scenarios in which these subsidies are phased out essentially bring VAT rates for fossil fuels in line with the standard rate for other products.

[10] There are some differences due to changes in incentives (lower income taxes increase the incentive to work) but these are very small when compared to the distributional effects.

The effect of increasing VAT rates is similar to that for removing energy subsidies to households: an increase in energy prices for households. However, there is one difference between scenarios. For the scenarios removing energy subsidies, we divide the value of the subsidy by energy consumption and increase energy prices to match. For the VAT scenarios, we adjust the rate of VAT directly and then estimate the revenues. This means that we may get estimates of potential revenues that differ from the figures published by the OECD[11].

2.6 Additional analysis in the case studies

The case studies presented in Chapter 3 include the full set of modelling results, but also consider some of the aspects that cannot be addressed very well in the modelling. The case studies go into much more detail than the modelling exercise and focus on the following issues:

- political background
  - reasons for introduction
  - interaction with other instruments
- barriers to phasing out
  - political barriers
  - legal barriers
- effects of phasing out
  - possible technological and behavioural responses
  - sectoral impacts (including SMEs)
  - distributional and social impacts

[11] The most likely reason for differences is that the OECD uses IEA energy balances to estimate revenues while we use National Accounts economic data in the VAT calculations. It would be possible to scale scenario inputs to obtain consistent revenues (and in some cases we have done this); the results from the scenarios are changed by a similar amount.

3 Assessment of Member State Case Studies

3.1 Introduction

Overview This chapter presents the findings from sub-task 3.2 of the project, which examines the extent of EHS in selected EU Member States, and discusses in detail the possible impacts of phasing out the subsidies. A group of EHS from the EU Member States was agreed with DG Environment for closer inspection. These are analysed in Sections 3.4, 3.5, 3.6, 3.6 and 3.8. Chapter 4 provides a brief overview of the measures from the other Member States.

The information on EHS in this chapter relies upon the OECD definition and identification of subsidies. This definition and identification vary between countries as the OECD uses the classification provided by each national government. There is considerable variation between the Member States on the question of whether similar features of their systems do or do not count as a subsidy.

Data for the non-OECD countries were supplied by DG Environment[12] in a draft version of a report made available to CE. The report extended the same guidelines as was that was used in the OECD Inventory report. .

Gaps in the analysis are often indications of missing data (for example, 2012 data were not available for all countries at the time of writing). For any subsidies still in effect, but for which data were not available in the Inventory report, we made an assumption after discussion with the OECD. Any ‘0’ values represent no subsidy in that given year even though the subsidy has not formally ended.

3.2 EHS measures from selected EU Member States

The five case studies focus on specific subsidies in Member States:

- Belgium / Italy
- Germany
- France
- Sweden / Finland
- UK

The country choices were agreed with DG Environment and selected on the basis of a consideration of their importance for the respective EU Member State, size of the inputs, capabilities of the E3ME model and coverage of a broad range of types of EHS, so that lessons could be learnt from comparisons between countries.

3.3 Structure of case studies

Each case study contains a discussion of the definition of the EHS, the background, potential barriers to removal and the expected impacts of removal. The information about definition and background is drawn mainly from the OECD report. The discussion of the potential barriers to removal started from a literature review covering general reports of policy barriers which any country might expect to face. Research

[12] (European Commission - DG Environment, 21 November 2012).

then moved on to identify which of those barriers identified might apply in each of the countries discussed. In addition to the general barriers, we also discuss other issues regarded as important to each country. Finally, we combine the quantitative outputs from the E3ME model with the qualitative interpretation to develop a comprehensive picture of the possible impacts for each country.

Barriers to removal

Among the barriers to phasing out subsidies there are two types of particular importance: namely, political and legal barriers. Indeed, the OECD states that "there is a general agreement that the main barrier to more rational energy subsidy policies is not economics, but politics."[13] Even though the economic analysis can demonstrate the benefits of phasing out EHS in terms of environmental protection, employment, economic growth and energy security, the barriers remain hard to remove. This is partly because the modelling does not capture the full distributional costs and benefits. Therefore the reality of the political logic and current macroeconomic situation must be fully grasped. A lack of political capability and/or will, as well as the shields provided by national and EU legislation, can entrench EHS even if demand is limited or not justified.

Interaction of mechanisms

The interaction with other energy and environmental policies is often complex. For example, the UK case study identifies a range of policies aimed at reducing residential energy demand, improving energy efficiency, and stimulating the use of renewable energy. It is important to recognise the presence of these policies because the projections are based upon a baseline case which includes these mechanisms. Furthermore, the removal of EHS might make some of these other measures redundant or at least less effective. There is a case for future analysis of such interactions in the light of any changes made to EHS in the period to 2020.

[13] http://www.oecd.org/env/outreach/EAP(2012)2_NP_Subsidies%20report_ENG.pdf

3.4 Belgium and Italy

In this case study the discussion of Belgium appears first at each stage, followed by Italy. The appropriate country name is displayed in the left margin.

Detailed definition Both Belgium and Italy provide energy subsidies to disadvantaged populations to assist with heating homes.

Belgium Belgium provides a comprehensive range of subsidies to disadvantaged households to assist them with heating their homes. The Fonds Social Mazout (FSM) provides grants to low-income (those with an annual income below €16,632.81), disabled and indebted households to pay for bulk heating oil, kerosene and propane used in furnaces or boilers. A fixed amount of financial support is given per litre of heating oil. The grant given to each household varies with the rise or fall in the price of oil. It is financed from both government and industry (from the sale of all heating oil products).

When it was first established in 2005, the FSM reduced the price of purchasing heating oil by around 18% for more than one million families. The eligibility thresholds have changed since these subsidies were first introduced. In 2008, the threshold for the FSM was raised but so was the amount of support. This may suggest that the government is trying to target the subsidies more effectively. It is also aiming to harmonise the beneficiaries and subsidies related to gas, electricity and heating oil, possibly in a bid to reduce the administrative complexity of the existing system. This would help to clarify the interactions between systems and also make it less costly to phase out the subsidy, since fewer legislative changes would be needed. The Special Heating Grant provides a lump sum discount (of up to €105 in a year) for poor households on their heating bills from all sources (including electricity, heating oil and natural gas), provided that they are not receiving support from the FSM or are paying a social tariff.

The social tariff for natural gas[14] is targeted at disadvantaged households (elderly, disabled and those on welfare programmes). It is set every six months on the basis of the lowest commercial tariff in the country. The government will compensate natural gas suppliers for the difference between this social tariff and the market rate.

According to the OECD definitions, the FSM and Special Heating Grant represent direct transfers of funds. The social tariff for natural gas can be thought of more as an induced transfer as it represents price regulation.

Italy In Italy, the subsidy under review is a reduction on the excise tax for petroleum products (domestic fuel and liquid petroleum gas – LPG) for disadvantaged households for heating in poor, remote areas.

The reduction in excise duty in Italy represents a tax expenditure subsidy

[14] There is also a social tariff for electricity.

Country	BE, IT		
Subsidy	Fonds Social Mazout, OECD code BEL_dt_01 Special heating grant, OECD code BEL_dt_03 Social tariff for gas, OECD code BEL_dt_02 Tax relief for users living in disadvantaged areas, OECD code ITA_te_08		
Brief description	**BEL_dt_01** Data from 2007. All year round grant for low income and heavily indebted households to pay for heating (oil). Funded by industry and government, value reported pertains to government only. **BEL_dt_03** Data from 2010. Applied from 2009. Lump sum discount on heating bills of €105 a year for poor households, irrespective of energy source. Counter rising energy prices. Must not be benefiting from Fonds or Social Tariff. Natural gas & Heating oil. **BEL_dt_02** Applied from 2004. Payments made to suppliers to compensate them for the difference between market price and reduced tariff. Reduced tariff applied to those on welfare programmes and to disabled or elderly persons. **ITA_te_08** Data from 2005. Concession on excise tax on petroleum products. For LPG and diesel fuel.		
Reference in E3ME	BE / IT	**Support type**	Consumer
Subsidy value in 2011 (OECD)		**Expiry date (if applicable)**	none
crude oil, middle distillates & heavy fuel oil	€33.4m / €231m	**Expiry date (if applicable)**	none
natural gas	€71.39m / €0m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
BEL_dt_02			
Energy demand	-0.07%	CO_2 emission	-0.12%
GDP	+0.00%	Employment	+0.00%
ITA_te_08			
Energy demand	-0.03%	CO_2 emission	-0.02%
GDP	+0.00%	Employment	+0.01%

Note(s): Figures shown are % difference from baseline.
Source(s): OECD, 2013; Cambridge Econometrics, E3ME.

Background

Belgium

In 1988, Belgium became a Federal state with delegation of a number of administrative responsibilities to the newly formed three regions: Wallonia (French and German speaking community), Brussels (French and Flemish speaking community) and Flanders (Flemish speaking community). Each community and region has its own parliament and government and exercises its own power. There are ten provinces and 589 towns.

The right to decent housing is enshrined in the Belgian constitution. A right to a warm home can be seen as an extension of this, emphasising the importance Belgium places on assisting disadvantaged populations with heating their homes. Housing policy since the post-war period has broadly speaking been designed to encourage construction and home-ownership.

Belgian energy policy is complex due to the small size of the country compared to the number of institutions and initiatives being introduced at the federal, regional and community level. The IEA (2010) notes that fragmentation and duplication of measures is simply ‘unavoidable’. It suggests that the impact is reduced rationality and cost-effectiveness of policy measures, which may discourage energy sector investment.

Liberalisation of the Belgian energy market began in 2003 and was completed in 2007. GDF Suez is still the largest market participant but its dominance has declined following liberalisation. Competition continues to erode its dominant position, particularly amongst residential and commercial customers. Belgium is heavily dependent on imports for its energy. Oil and gas represent around two-thirds of primary energy supply. Oil is the main fuel demanded, representing around 50% of the total.

In Belgium, coal as a share of fuel demand has fallen since the 1980s from 6% to just 2.5%, possibly in response to falling indigenous supplies. Energy consumption in the residential sector represents around 25% of total final Belgium energy consumption and efficiency improvements are lower than in other sectors.

In order to attain a clear understanding of where the barriers to reform might be found, it is important to be aware of the statutory bodies that provide energy advice and implement energy policies. In broad terms, the federal government focuses on energy tariffs and social policy and provides a coordinating role among the regional regulatory bodies. The national regulator, the Regulatory Commission for Electricity and Natural Gas (CREG), monitors both the gas and electricity markets. It advises governments on their operation and ensures industry compliance. It is also responsible for approving transmission and distribution tariffs as well as administering the special heating grant and social tariff. At the Federal level, the Public Social Welfare Centre (CPAS) is responsible for providing advice, information, financial support and intervention in relation to energy supplies for disadvantaged households[15].

The regions are responsible for local energy distribution and use. Each region has its own energy regulator. The regions also administer initiatives to improve energy

[15] An equivalent fund was created in November 2002 for the electricity market.

efficiency in households and encourage 'rational use'. In terms of regional social policy, funds administered by the CPAS are distributed based on the number of social aid beneficiaries living in each region. However, each region has discretion over the way these funds are allocated.

Italy The government usually applies an excise tax and VAT at a rate of 21% for petroleum products. The Italian government applied to the European Commission for a reduced rate of excise duties for disadvantaged households in 1999 and renewed this request in 2000. As of January 2013, the excise duty for gas oil (LPG) heating in non-business buildings was approximately €190 per thousand litres[16]; the reduced VAT rate is 10% but it is planned to increase to 11% from July 1, 2013.[17]

Like Belgium, Italy is also very dependent on energy imports; in 2008 92.8% of Italy's energy requirements were met by imports. Italy's fuel mix is relatively less diversified than other European countries. Oil and gas represent around 80% of total primary energy supply[18]. Privatisation of the Italian energy market began in the 1990s and eroded the market dominance of state-owned oil and gas company Eni, although it still represents around half of Italy's total energy capacity. Enel is the largest distribution network operator, representing around 86% of the market.

In Italy, energy production, infrastructure, distribution and transportation are subject to legislation from the regions and the state. Unlike Belgium, there is only one market regulator, the Autorità Garante Della Concorrenza e del Mercato (AGCM).

Reasons for introduction and whether they are still applicable

Belgium

- rising consumption, costs and shift to renewable fuels
- fuel poverty
- poor energy efficiency of housing stock
- living in rented accommodation

Rising consumption, costs and shifts to renewable fuels Higher energy consumption rates, energy prices, transmission costs and a changing fuel mix (e.g. decommissioning nuclear and increasing the percentage of renewables as per national and EU commitments) all put pressure on lower income households to spend a higher proportion of their budget on energy. Gas and oil are the main fuel types used in the residential sector for heating in Belgium and oil is the main fuel type used in Italy. This may be the reason why the subsidies under assessment were designed to target specific fuel types.

Fuel poverty The UK Department for Energy and Climate Change (DECC) suggests that a household is in fuel poverty when it needs to spend more than 10% of its income on fuel for adequate heating. In 2008, the average household expenditure on energy in Belgium as a percentage of total expenditure was 9.5%, compared with an EU27

[16] European Commission (2013), Excise duty tables – Part II, Energy Products and Electricity.

[17] http://www.kpmg.com/global/en/issuesandinsights/articlespublications/taxnewsflash/pages/italy-vat-rate-increases-proposed-for-july-2013.aspx

[18] IEA (2009) Italy.

average of around 7-8%[19]. While there is no information available on the division between expenditure on heat and electricity, it can be assumed for reasons discussed in this section that a large proportion of this energy consumption is on heat. For example, in Wallonia, Belgium, heat production represents around 80% of the total energy consumption in a household.

Poor energy efficiency of housing stock

A study by McKinsey (2009) suggests that Belgian energy per square metre consumption (both heat and electricity) in residential buildings is more than 70% higher than the EU average and it has a relatively poor performance in terms of energy efficiency. The study identifies three principal reasons for the high amount of energy usage by households. Firstly, because there is a low rate of demolition of older buildings, the average age of buildings is higher than in other European countries (e.g. in Wallonia only 16% of homes were built after 1981). Second, there is a higher percentage of single-family houses, which results in the need to heat a larger surface area compared to other European countries (per unit of population). Third, there is a lower penetration of energy efficiency features (e.g. double glazing). Desmedt et al. (2009) also argue that the Belgian tradition of designing and building their own homes, along with weak enforcement of building regulation and supervision by authorities have led to a multitude of construction techniques, often to lower professional standards and thus to lower energy efficiency. Thermal efficiency regulations were introduced in the Belgian regions between 1984 and 1999 while neighbouring European countries introduced them as early as 1965. In Belgium, Brussels was the last region to introduce legislation in 1999 and 97% of the housing stock was built before that time[20]. The combination of these factors may explain why, on average, more energy will be required to heat a Belgian home than in neighbouring European countries. Energy tends to represent a higher proportion of expenditure in poorer households so the factors identified may be particularly pronounced in the Belgian case.

Rented accommodation

It is also worth noting that the level of home ownership will also affect the incentive to improve the energy efficiency of buildings in Belgium. Those families receiving support for heating are more likely to be in rented accommodation and/or have less disposable income to invest in measures to improve the efficiency of heating over the longer term. A 2006 study by European Fuel Poverty and Energy Efficiency (EPEE) identified an increase of around 15-20% in rent prices for lower categories of housing between 1996 and 2001, suggesting a significant fall in disposable income and few alternative accommodation options for disadvantaged members of the population.

Italy

- buffer for unforeseen weather conditions
- fuel poverty
- poor energy efficiency of housing stock
- living in rented accommodation

Buffer for variable weather conditions

Given the respective definitions of poverty and energy expenditure, it can be suggested that a large proportion of the population may be at risk of even if it is not yet in fuel poverty. Total demand for oil in the residential sector has been declining since the 1970s and is forecast to level off between 2005 and 2030 at around 5Mtoe

[19] Maarten Noeninckx (2011).

[20] http://www.fuel-poverty.org/files/WP2_D5_final.pdf

per annum[21]. However, the amount consumed will vary significantly on a yearly basis depending on climatic conditions. I.e. milder winters will mean lower heating fuel requirement.

Poverty implies a risk of 'fuel poverty'

Although we do not have data on the percentage of the population likely to be in fuel poverty, a proxy may be found in ISTAT data showing that around one-quarter of Italians were living in or close to poverty in 2011 (18% at risk of poverty and 7% experiencing severe material deprivation)[22]. On the other hand, in 2008, the average percentage of household consumption spent on energy was only just above the EU 27 average[23] at 8.2%. The apparent contradiction may be resolved by observing that there are likely to be substantial differences between different parts of the country within this aggregated figure, since the south has a warmer climate than the north, but is also much poorer. In 2006 the mean income of the population living in the south was 62% of that in the north[24].

Housing stock quality

As in Belgium, the amount of fuel required for heating homes varies considerably, depending on the characteristics of the building. On the one hand, Italy introduced thermal efficiency standards in 1973, suggesting the thermal efficiency of the Italian building stock may be relatively higher since only 60% of the total housing stock was built before the standard was introduced. Moreover, the average age of the building stock is also less in Italy than in Belgium. On the other hand, post-war buildings (pre-thermal standard) were generally built to a low quality, leading to heat loss, humidity from condensation, mould growth, infiltration of water from coverings and terraces, draughts and water infiltration from window and door frames[25].

Rented accommodation

The European Fuel Poverty and Energy Efficiency (EPEE) study identified a 100% increase in rental prices in Italy between 1999 and 2006, suggesting that, just as in Belgium, there will be less disposable income available for any capital spending on energy efficiency improvements. In 2004, around 40% of the total rental market in Italy was occupied by low income families[26]. The implication is that a large proportion of the low income households have an additional barrier to surmount before they can reduce their fuel costs. They need to request and persuade their landlords to make improvements to increase the energy efficiency of their property. Schemes that provide low income households with extra funds to support their energy consumption reduce the incentive to request and/or make improvements.

Interaction with other instruments

Belgium

In Belgium several additional policies have been introduced to assist disadvantaged households with heating their homes[27], and these may interact with these subsidies. Most are legislated at the federal level but the regions have autonomy over the way that the policies are introduced.

- Pre-payment metering
- Minimum energy efficiency standards

[21] IEA (2010), Italy.

[22] http://www.ictu.ie/download/pdf/italieen.pdf

[23] Presentation given by Maarten Noeninckx (2011).

[24] http://www.sis-statistica.it/files/pdf/atti/Atti%20pubblicati%20da%20Cleup_55-77.pdf

[25] http://www.fuel-poverty.org/files/WP2_D5_final.pdf

[26] ISTAT.

[27] A number of these policies are also relevant for the provision of electricity but the focus here is on heating.

- Regional measures
- Cuts in energy saving tax allowances
- Home energy efficiency upgrade
- Macroeconomic context
- CO_2 emissions targets

Pre-payment metering

There is pre-payment metering for gas and electricity in Belgium. The political motivations of this approach are to control consumption, limit debt and avoid energy cut-offs in households (Bartiaux et al (2011). Pre-payment meters are installed in households that have failed to pay their gas bills. These households are then obliged to purchase gas by using a magnetic card which the user tops up with credit beforehand. This replicates the way in which fuel oil is bought at pumps before being stored in household tanks. Each region has its own approach to installing pre-payment meters, including the timeframe for installation and decisions about who should bear the cost of installation. Most utilities install meters very quickly after a household stops payment (e.g. in Wallonia, installation is permissible after the second reminder of an unpaid bill and is charged to the customer). Bartiaux et al (2011), note that the increased use of prepayment meters makes it harder to identify the risk of energy poverty and the need for associated support measures, because the use of these meters conceals the cases where consumers are 'self-rationing' because they cannot afford to pay for energy. For example, where there is insufficient credit to heat a house, the occupants may simply remain cold, but there is no way of recording causality[28]. Another 'hidden' impact of pre-payment meters on poorer households is that their weekly heating budgets may well fluctuate more than those of wealthier households, since they have less disposable income to smooth their consumption patterns in the short run..

Minimum energy efficiency standards aimed to improve housing stock

A second policy interaction is with minimum energy standards, which were introduced in response to the EU Directive 2006/32/EC on energy end-user efficiency and energy services[29], for new and existing buildings subject to major renovations. The standards differ across regions and apply to a number of different building elements including: double glazing, thermal characteristics of buildings, heating installation and ventilation. These standards aim to increase the energy efficiency of the relatively old building stock in Belgium.

Regional support for home energy efficiency measures

A number of support measures are available in different regions to meet these standards depending on the renovation taking place. For example, a 40% tax reduction set by the federal government is offered on replacement and maintenance of old boilers, high efficiency glazing and insulation. The support measures are capped at €2,770. However, we can assume that in order to take full advantage of these favourable rates, an individual would have to invest around €7,000 of their own money. Putting this in the context of the eligibility criteria for some of the subsidies listed, this represents almost half the annual income for low income households eligible for support under the Social Mazout Fund. Some regional policies offer grants targeted to low income families. These include the Ménages à Bas Revenus grant in Wallonia to lowest income families for renovations to improve insulation, and grants

[28] The inability to identify the reason for using less fuel is not limited to this particular method of payment.

[29] This has since been superseded by the 2012 Energy Efficiency Directive (2012/27/EU).

in Flanders for poorest households who are unable to take advantage of the 40% federal tax reductions.

Cuts in energy saving tax allowances

As part of budgetary reforms to reduce the size of the government deficit in Belgium, the tax allowances for energy-saving expenditure in the home will be cut as of 2013, thus reducing the support available for household initiatives. However, a number of different financial stimuli are offered by different sources at both the federal and regional level in Belgium for investment in household energy efficiency measures. As a result, the amount of government support is still potentially very large[30], especially if barriers to access by disadvantaged households could be fully overcome.

Home energy efficiency upgrade

A study by Bartiaux (2011) which looked at home owners and energy-related renovations in Belgium suggested that most retrofitting programmes are carried out by richer members of the population, and cited lack of information, administrative and calculation competencies and lack of disposable income as the main barriers discouraging poorer households from taking advantage of favourable tariffs. In addition, there is likely to be less home ownership among disadvantaged members of the population who may be able to afford only rented property. This gives rise to the principal-agent problem whereby energy efficiency measures are undertaken and paid for by the landlord but the benefits of reduced energy consumption accrue to the tenant in the form of lower energy bills. This dampens the incentive for a landlord to assume these additional investment costs as the returns are limited to the change in the value of the property.

All of the Belgian heating subsidies will operate until 2020 and, depending on whether additional support measures are introduced, the phase-out may encourage disadvantaged households to review the energy efficiency of their homes. Studies suggest that the technical efficiency potential of Belgian houses is very large, between 30-40% on average [31]

Despite the support for renovations, projections on medium-term macroeconomic factors by the Belgian Federal Planning Bureau indicate that within gross fixed capital formation, investment in housing[32] has been declining and is forecast to decline further between now and 2015.

In addition to energy standards, other regional policies may also aim to change household energy consumption. For example, Wallonia in Belgium has a grant system to support investments in biomass boilers. The existence of the heating subsidies will affect consumer choice when looking to renovate or build heating systems in households.

CO_2 emissions targets

A number of these policies are driven by EU directives which aim to create a competitive internal energy market, offer security of supply and low energy prices for end consumers, and increase energy efficiency and the proliferation of renewables in the fuel mix[33]. Belgium has set emissions targets of 15% below 2005 levels by 2020

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[30] DeSmet (2011).

[31] Study on the Energy Savings Potentials in EU Member States, Candidate Countries and EEA Countries, Final Report for the European Commission Directorate-General Energy and Transport, 2009.

[32] Likely to include both renovation and construction, both of these activities are very pro-cyclical.

[33] For further information, please see Directives 2009/72/EC, 2009/73/EC, 2004/67/EC, 2005/89/EC, 2009/119/EC, 2012/27/EU, 2009/28/EC and 2009/29/EC.

and also aims to increase the share of renewable energy in consumption from 2.2% to 13% by 2020. This commitment to renewables is particularly ambitious for Belgium and will probably require government support from a decreasing public budget.

Potential barriers to removal

Several barriers have been identified to the phasing-out of EHS.

- communication: fear of the subsequent effects of a change
- communication: fragmented information
- government structure: federal structure
- entitlement: culture of entitlement
- distributional: distributional impacts of removal
- MS legislation: constitutional legal barriers

We discuss these in relation to the specific features of Belgium and Italy.

Fear of the effect of change

Belgium

The OECD notes that 'fear of change' might be one barrier to removing subsidies. From a political perspective, removing energy subsidies for disadvantaged populations is a very visible action and may also risk raising inflation in Belgium, which is still higher than pre-recession levels: 3.5% compared to around 2%[34]. Belgian inflation rates may be more sensitive to fluctuations in the price of energy than those of neighbouring countries, partly because energy consumption per household is higher in Belgium than in neighbouring countries, particularly in disadvantaged households. The 2012-2015 Belgian Stability Plan, as reported to the European Commission, identified the surge in energy prices as the main driver of inflation in 2011

Fragmented information

The OECD study also indicated that having large numbers of stakeholders at the national and subnational levels may also create barriers to the removal of environmentally harmful subsidies. The reason is that fragmented and dispersed sources of information hinder a comprehensive understanding of the operation, interaction and impact of different support schemes. In the Belgian case, there is the additional complexity of three official languages (Flemish, French, and, albeit only for a very small number, German), in addition to the use of English in many international institutions and corporations based in Brussels.

Federal structure

In addition to the complex federal structure and division of responsibilities between the federal state, the autonomous regions and the communities, there are also several other third parties involved in administering the various funds and monitoring the energy markets. The IEA (2010) notes that, although a certain fragmentation of energy policy and duplication of some measures are unavoidable, there is the opportunity for better harmonisation. The authority of the regions in Belgium in determining the use of funds for energy efficiency may also provide a barrier to reform, because they will strongly resist the removal of powers from their jurisdiction.

Culture of entitlement

An additional barrier identified by the OECD is a so-called 'culture of entitlement'. A right to decent housing is enshrined in the Belgian constitution, and so citizens may see it as a fundamental right. However, the converse might equally be true as a study by EPEE suggests that various factors make it difficult for citizens to identify their so called entitlement to energy. These include, but are not limited to, low levels of

[34] Eurostat.

education among those most at risk of poverty; poor coordination between healthcare, housing and welfare professionals; poor provision of information from energy suppliers; and the complex system of different actors involved in calculating bills and administering support. The recent 2008 reforms to the FSM show some movement towards alleviating some of these obstacles. Moving to a better-targeted, but higher, level of support can be seen as a measure to direct scarce resources to those who truly need assistance, while moving others away from a system of state support.

Distributional impacts of removal

The fact that the Belgian and Italian subsidies predominantly target the poorest members of society provides a significant barrier to reform, especially at present with rising unemployment and declining real incomes. The subsidies were introduced because of concerns about fuel poverty and the poor quality of housing stock; and these problems have been exacerbated by the current economic situation. Rising fuel prices, coupled with little scope for investment in widespread housing improvements, are likely to have increased the number of households under stress. Thus, politically and socially, removing the subsidies that target disadvantaged households is a significant challenge. However, fears regarding the need to reduce budget deficits may encourage people to take the opportunity of targeting the subsidies better and removing any that are regressive.

Legal barriers

Removing the subsidies to help poorer households heat their homes may well be incompatible with the constitutional right to decent housing, unless alternative measures can be provided in the short run given the long-term nature of housing retrofits. The strength of this potential legal barrier cannot be known without a legal test of the applicability of the constitutional right in light of the level of support that the current subsidy provides provision of this right.

Italy

Before the recession, Italy increased spending on benefits for the poor[35], partly as an effort to narrow the growing gap between rich and poor. However, income inequality is still very high in Italy and there may be political reluctance to increase income inequality further. There is a fear that precisely this would be the result of removing the subsidy for heating.

Expected impacts of removal

Model results Belgium

The lump sum subsidies in Belgium were not modelled, as these effectively transfer income from one group of households to another, but all households are treated as identical within the E3ME modelling framework. This is one of the main reasons for selecting these subsidies for the case study. A micro simulation model may be able to give an assessment of the distributional impacts, although not the macroeconomic impacts.

The model results for the other two subsidies in Belgium (for heating oil and reduced tariffs) suggest that the macroeconomic impacts of removing these subsidies would be small, mainly because the subsidies themselves are quite small in value. The results show an increase in GDP at the third decimal place for each of the scenarios. Impacts on employment levels are even less.

[35] OECD (2008), Growing Unequal? : Income Distribution and Poverty in OECD Countries.

As the subsidies are applied to households, there are also very few specific sectoral impacts. Only the sectors that supply energy may lose out, although the amounts involved will again be modest.

The expected impacts of phasing out these subsidies on energy consumption and CO_2 emissions are larger but still quite small in size. In Belgium the impact on both is around 0.1%, roughly double the possible impact of phasing out the fuel oil subsidy in Italy.

Possible behavioural responses

FSM has recently been phased out in the Netherlands, largely due to the supply of cheap gas and strict regulations governing storing oil in tanks in the ground. Should the FSM subsidy be removed in Belgium, complementary policies and the relative prices of different fuel types will likely influence the Belgian choice of substitute fuels. For example, energy supply in Belgium currently has a VAT charge of 21% for all fuels except steam coal used in households, which is charged at 12%. The amount of household fuel switching in the short term would, however, be limited to the existing infrastructure, e.g. heating tanks that require liquid fuel.

The behavioural response of consumers may also depend on the way in which they are currently receiving the energy subsidy. In the case of the Fonds Social Mazout, the fund is either paid into bank accounts, as a cash repayment or, in the case of debtors, is paid directly to the fuel deliverer. It may take some time for households to adjust to the absence of this payment, thus potentially risking increased defaulting on energy bills, particularly if there is a history of debt in the household. This may lead to the introduction of more pre-payment metering.

In the longer term, it can be expected that higher heating bills would create the incentive to lower energy consumption, through decreased consumption rates and/or by increasing the energy efficiency of the building stock. However, there is a risk that, if energy prices rise in line with forecasts[36], low income households might be trapped in an energy poverty cycle whereby any efficiency improvements are negated by increased energy prices and the proportion of income spent on energy remains constant or, in the worst case scenario, increases.

In the case of the Social Tariff, payment is given directly to energy suppliers. If the social tariff is removed, there may also be increased defaulting on bills. Although the pre-payment metering partly addresses this risk by requiring households to pay in advance for their energy consumption, any policy which increases the risk of non-payment may be strongly opposed by energy suppliers.

Distributional impacts

The particular fuels subsidised are natural gas and heating oil. The demand for these fuels is not constant between socio-economic groups, quintiles or locality.

BE_S2 and BE_S3 are lump sum subsidies while BE_S4 is a price related subsidy to suppliers of natural gas. The lump sums to households give them the freedom to purchase their preferred fuel source, given their own circumstances and subject to availability, rather than artificially increasing demand for the designated fuel, in this case natural gas. Direct payments may be more effective at targeting low income

[36] As an example, the Federal Planning Bureau forecasts oil prices to increase by almost 8% between 2010 and 2014 in Belgium.

households because they can allocate expenditure efficiently. Therefore the greatest utility gain for low income households may come from a reallocation of expenditure.[37]

In Belgium, generally speaking, rural households are more likely to use fossil fuels and wood-based fuels for heating, while in cities, heating oil and natural gas are more likely to be used[38]. This suggests removal of Fonds Social Mazout and the Social Tariff for LNG might disproportionately affect urban households. The implication of this may be two-fold; it may erode political will for reform among urban constituents, and it may also increase any current discrepancies between the urban and rural poor.

Although no data were found on fuel poverty in the different regions, a study by EPEE, identified that poverty risk (as a proxy for fuel poverty risk), varied significantly between the regions.[39] In 2005, it was 11% for Flanders, 18% for Wallonia and 27% for Brussels. This confirms the broad assertion about the particular vulnerability of urban dwellers.

Italy In Italy the fuels subsidised are LPG and diesel. The top quintile by wealth uses a higher proportion of these fuels than the lowest quintile; this implies that these schemes are not progressive as they implicitly benefit wealthier household's more than low income households[40].

Impacts on public balance It is estimated by the OECD that in 2011 the expenditure on heating subsidies under consideration in Belgium was €105m. In Italy it was €231m. The value of the subsidy is negligible relative to total government expenditure[41]. However, there will small secondary impacts on the public balance due to behavioural responses of households adjusting to higher prices. As there is almost no impact on GDP and employment, there would very little further impact on the public balance.

Belgium Belgium is also following recommendations by the European Council to reduce the structural deficit, which it is currently on track to do. This means that, however small, any reduction in expenditure will assist in attaining a nominally balanced budget by 2015 and in reducing the debt to GDP ratio.

Italy In spite of recent fiscal consolidation, Italy has one of the biggest debt to GDP ratios in Europe, estimated at 126.4% in 2012[42]. Reducing deficits is therefore also a priority in Italy.

Conclusions The Belgian and Italian case study has highlighted the importance of the subsidies to low income households. These countries both have complex regional and federal structures which hide the exact location of many of the barriers to reform. Some have been picked out from the literature but it should be recognised that for this reason the complex structure itself forms a significant barrier. Another aspect which has been a significant barrier to reform is the quality of the housing stock and the limited ability of vulnerable groups to mitigate their fuel costs. These points flag up areas for

[37] See http://siteresources.worldbank.org/EXTESC/Resources/Subsidy_background_paper.pdf for a greater discussion on the impacts of subsidy design on their implications

[38] Pellcert (2011).

[39] http://www.fuel-poverty.org/files/WP2_D6_en.pdf#page=1&zoom=auto,0,849

[40] http://siteresources.worldbank.org/EXTESC/Resources/Subsidy_background_paper.pdf p 10.

[41] Both represent far less than half a percent of total government expenditures in 2011 based on Eurostat data.

[42] Reuters (2012), "Italy's debt tops 2 trillion euros in new headache for Monti".

governments to further assess and devise suitable programmes to alleviate these concerns.

Another interesting lesson to take from this case study is the relative importance of political barriers. It would appear that effective communication and a clear full presentation of the distributional gain of policies are necessary to allay fears and gain public support for EHS removal. Moreover, the designers of policy in the future should be aware of the risks of creating entitlement effects.

3.5 Germany

Detailed definition

This section looks at Germany's three different forms of subsidies[43] to 'heavy-industry' users. The three subsidies are energy-tax breaks for manufacturing; the peak equalisation scheme; and tax relief for energy-intensive processes. The heavy-industry users are

- iron & steel
- non-ferrous metals
- chemicals
- non-metallic metals
- ore-extraction (non-energy)
- paper & pulp
- other industry

The estimated total value of subsidies to these users in 2011 was just under €0.95bn[44]. In the scenarios constructed, DE_S4, DE_S5 & DE_S6, the three subsidies are forms of tax revenues forgone by the German government.

[43] These three were chosen as those which focus on heavy industry and energy- intensive sectors on the basis of http://www.boell.org/downloads/HBF_GreeningTheBudget-6.pdf p19.

[44] This value was calculated by identifying the proportion of each of these subsidies that was allocated to each of the heavy industry users listed above and adding together the relevant amounts.

Country	DE		
Subsidy	Energy subsidies to industry, OECD code DEU_te_01, 02, 05		
Brief description	**DEU_te_01** Energy-tax breaks for agriculture and manufacturing. Data/applied from 1999. To give a lower rate of tax on heating oil, diesel, natural gas and LPG. **DEU_te_02** Peak equalisation scheme. Data from 2001. Given to compensate firms for higher taxes paid on energy inputs. Because firms already receive a reduction in their pensions contribution, this subsidy is only to be applied to companies for which the pension contribution reduction was not sufficient to offset the energy tax burden on natural gas, diesel oil and LPG. **DEU_te_05** Tax relief for energy- intensive processes. Data/Applied from 2006. Concession from energy tax. To maintain the competitiveness of the steel and chemical sectors. For all fuel types, but mostly natural gas and coal.		
Reference in E3ME	DE_S4, DE_S5, DE_S6	**Support type**	Consumer
Subsidy value in 2011 (OECD)		**Expiry date (if applicable)**	none
hard coal & other coal	€217.76m		
crude oil, middle distillates & heavy fuel oil	€188.88m	**Expiry date (if applicable)**	none
natural gas	€545.7m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
DEU_te_01			
Energy demand	-0.02%	CO_2 emission	-0.03%
GDP	+0.00%	Employment	+0.00%
DEU_te_02			
Energy demand	-0.02%	CO_2 emission	-0.04%
GDP	+0.01%	Employment	+0.00%
DEU_te_05			
Energy demand	-0.06%	CO_2 emission	-0.04%
GDP	+0.02%	Employment	+0.01%

Note(s): Figures shown are % difference from baseline.
Source(s): OECD, 2013; Cambridge Econometrics, E3ME.

Background

In 1999 Germany implemented several eco-taxes. These are defined as "taxes which are levied on products, practices, or activities which are considered to be harmful to the environment"[45]. The burden fell largely on households, as various subsidies were given to industries; policies DE_S4 and DE_S5, (the latter known as "Spitzenausgleich" i.e. "peak equalisation") were introduced in this wave. These measures gave eligible businesses considerable exemptions. The peak equalisation scheme partly compensates for increases in the energy tax rates for manufacturing[46.] However, the range of firms covered is not identical under these two schemes, and some have borne the full increase in the reduced rate in 2003, while others have been able to mitigate their burden. There has since been a move towards reducing the subsidies: in 2003 the reduced rates were raised[47]. However, this was followed by the introduction of new exemptions for energy-intensive processes, DE_S6. This reduction of subsidies is portrayed as revenue-neutral, since energy taxes increased but at the same time payroll taxes (employer contributions) decreased.

The peak equalisation scheme (DE_S5) has recently been renewed for a further ten-year period from 1/1/2013 up to the end of 2022, provided that certain energy demand reduction conditions are met by energy intensive industries.[48] When the exemptions were first introduced, the European Commission permitted them, but subject to the condition that CO_2 targets were met. This condition acts as a filter to mitigate some of the effects of increased energy consumption which would result from the unconditional subsidy and to encourage energy efficiency. There is a distributional consideration in this condition as small and medium-sized businesses (SMEs) are allowed to implement size-appropriate measures. Further, it was established that these exemptions did not constitute 'state aid'.

Although these subsidies have been reduced since 1999[49], there has been no full EHS reform. The possibility was raised in 2004, but the idea was dropped due to political pressure from opposing parties.

Reasons for introduction and whether they are still applicable

The exemptions were given because of concerns about:

- competitiveness in world markets
- businesses going 'off-shore'
- interaction with the EU-ETS
- high energy prices

The competitiveness of industry was, and remains, the main concern. The argument for retaining the subsidies is that, because there are differences in energy taxation levels across the world, the removal of these subsidises would put German industry at a disadvantage in its domestic market. There would be more imports by energy-intensive industries as fuel costs rose and the exchange rate appreciated. Clearly this impact would be largest in energy-intensive industries. The implicit premise in this

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45 http://oxforddictionaries.com/definition/english/eco-tax

46 The scheme applies only to the energy tax increases introduced from 1999 onwards.

47 DE_S5 – the reduced rate was increased to 60% from 20% of the standard rate.

48 http://www.germanenergyblog.de/?p=11306#more-11306,

http://www.publications.pwc.com/DisplayFile.aspx?Attachmentid=6395&Mailinstanceid=26762

49 DE_S4 had a lower tax cap of 20%, now 60%. DE_S5 was providing up to 95% reduction, it not provides 90%.

argument is that Germany would be removing the subsidy unilaterally. However, the gradual shift towards uniformity in taxation rates across countries undermines to some extent the reasoning for continuing the subsidies. Nevertheless, there is still not enough international cooperation in environmental taxation rates, and so the argument for retaining the subsidies still has some force.

The fossil fuels subsidies are part of a larger set of exemptions for energy-intensive industries, including the exemption from surcharges for renewable power under the Renewable Energy Act in 2000, and feed-in tariff exemptions. Invariably these subsidies have been justified at some level, by the fear that firms would otherwise go 'offshore' since the high costs would reduce their relative competiveness. The conclusion of the argument was that these industries required 'temporary relief' from environmental taxes.

The extension of the programme to 2022 has been supported on the grounds that these industries could lose their current advantages if the scheme were not continued. However, there are questions about whether the scheme's coverage has been expanded too far, since in the extended time period the scheme now includes illegitimate firms that are not competing on the international market.

Interaction with other instruments

These instruments interact with many other policies including:

- Renewable energy act (EEG [Erneuerbare-Energien-Gesetz])
- EU ETS
- Combined Heat and Power Act (KWKG [Kraft- Wärme- Kopplungsgesetz])

Renewable energy act (EEG)

The aim of the Renewable Energy Act is to encourage the uptake of electricity from renewable sources. Network providers are obliged to purchase this electricity at a fixed price known as the 'feed-in tariff' (FIT). This can then be passed on to consumers, such as heavy industry. Standard consumers were charged 35.3€/MWh in 2011 while manufacturing companies benefit from a considerably lower rate of 0.5€/MWh[50]. This obligation affects the price of electricity directly and of energy indirectly.

There are currently debates about how to distribute the cost of funding a shift towards increased use of renewable energy products, during the planned phase-out of nuclear power. The larger part of the 'green' subsidy burden is at present borne by households[51] and small businesses (due to the way the calculation is done), while heavy manufacturing has been granted exemptions, posing a distributional debate for Germany.

In fact the drive for renewable energy has already reduced the wholesale costs for firms. In 2012 it was reduced by 10% according to a study conducted by the German Institute for Future Energy Systems (Institut für Zukünftige Energiesystemen)[52]. Further, there is the added advantage that the push for increased use of renewable energy drives increased demand for products that German industry could provide (and gain a first mover advantage by remaining in the country). The anticipation of even lower energy costs and subsequent faster creation of new markets in the near future

[50] There is a threshold above which this rate is applicable, that is 10MWh.

[51] Estimates are between *0.75 to 1 Eurocent per kWh.*

[52] This study was conducted on behalf of the German Solar Industry Association (Bundesverband Solarwirtschaft).

would be the indirect benefit for industry from reducing the subsidies and suffering higher input costs in the short term.

EU ETS The interaction with the EU ETS is important. When two policy instruments are used, there is the possibility of double taxation or of double avoidance; or it is possible that the policies will combine neatly. In principle, 'energy conversion processes in manufacturing' in Germany are liable to German eco-taxes and to the EU ETS cap-and-trade programme. Policy DE_S4 (energy-tax breaks for agriculture and manufacturing) aims to prevent this double taxation by providing an exemption to industry on the eco-taxes. Similarly, DE_S6 (tax relief for energy-intensive processes) prevents an overlap which would lead to double taxation of energy intensive sectors. DE_S5 (the peak equalisation scheme) is both a tax cap and a subsidy for peak adjustments. Its main beneficiaries seem to be energy-intensive firms that employ relatively small numbers of people and so do not benefit sufficiently from the reduction in non-wage labour compensation.

Some have argued that the EU ETS alone is not an adequate regulatory instrument, because certain plants are missed by the ETS and German eco-taxes and, as a result, are not subject to any form of environmental policy. A study published in 2010 by the Heinrich Böll Foundation[53] argues that the current arrangement compensates for the failings of both policies when used alone.[54]

In April 2013 the European Parliament voted in against a 'backloading plan' by the EC to reduce some of the overcapacity in the market by taking 900m tonnes of carbon allowances off the market and thus raise the price of carbon. Industry within Germany was generally against the plan, although some of the big electricity generating companies, such as E.ON, was in fact in favour of higher carbon prices[55].The political parties were split as there is an impending election and increasing pressure from industry to resist higher carbon prices[56]. It is worth noting, however, that the environment minister was in favour of this change. Meanwhile, the price of carbon continues to fall and is currently at less than €5 per tonne. This is only the first stage towards raising the price as the debate surrounding how to prop up the carbon price continues.

Combined Heat and Power Act (KWKG) The KWKG is an obligation for network operators to purchase CHP electricity from suppliers at the market price. In addition to this, a premium is levied on purchases. The premium has an indirect influence on the energy price, because it can be passed onto end users, including heavy industry. Companies with a high ratio of electricity costs to turnover[57] pay the levy at a reduced rate. In 2011 the levy was 0.30€/MWh for standard users, but 0.25€/MWh for qualifying manufacturing companies. Because of the small difference between the levy rates, the interaction effect and the consequent impact on prices are limited.

[53] Ludewig D., B. Meyer and K. Schegelmilch, 'Greening the Budget: Pricing Carbon and Cutting Energy Subsidies to Reduce the Financial Deficit in Germany', Heinrich Böll Stiftung, Washington D.C. 2010.

[54] Greening the Budget p20.

[55] http://www.reuters.com/article/2013/02/13/eu-ets-idUSL5N0BC3M820130213

[56] http://www.reuters.com/article/2013/02/13/eu-ets-idUSL5N0BC3M820130213

[57] Impact of Reductions and Exemptions in Energy Taxes and Levies on German Industry, CPI Brief.

Potential barriers to removal

There are many political barriers to removal of the subsidies. The order in which we discuss them does not indicate their relative strength.

- interest groups: relationships with employer organisations
- politically sensitive issues: perception of a competitive location
- governmental structure: federal system and sectoral thinking
- rising fuel prices and high subsequent prices: rising energy costs
- rising fuel prices and high subsequent prices: high final prices for consumers
- distributional: distribution of recycled revenue
- macroeconomic health: competing public concerns
- MS legislation: recent extension of DE_S5 (peak equalisation scheme) for ten years to 2022

Relationships with employer organisations

The Federation of German Industry (BDI) represents heavy industry and other interest groups. It has consistently opposed any legislation which might impose a competitive disadvantage against other European manufacturers. Indeed, it was partly in response to pressure from the BDI that the initial exemptions under DE_S4 and DE_S5 were given in exchange for voluntary agreements. The BDI argues that energy efficiency has increased through the voluntary arrangements and that the subsidy agreements encourage such behaviour.

This is one example of the influence of lobbyists on German energy and environment policy (see the study by Brandt and Svensen[58]), in particular for sectors with a highly inelastic energy use.

Similar concerns about competitiveness have also been expressed by Germany's federation of chambers of commerce (DIHK). In the words of Heinrich Driftmann, the president of DIHK: "We must not endanger the competitiveness of the energy-intensive companies."[59]

The established industries have previously used their collective power to resist change, and there appears to be a close and long-lasting relationship with the relevant ministries. However there is evidence that the voluntary arrangement system has increased energy efficiency and thus the subsidy agreement has been successful in incentivising this behaviour.

Perception of competitive location

Germany is perceived internationally as a place where energy-intensive businesses will be able to work in partnership with the government to achieve a competitive position. Indeed even environmental groups such as 'Friends of the Earth' and BUND have long accepted that there should be tax reductions for energy-intensive firms on a temporary basis to compensate for the absence of uniform tax treatment. This highlights the widespread recognition of competition concerns.[60]

This perception is valuable to Germany as it encourages new and existing businesses to locate in Germany. It could be at risk if the government engaged in heated disputes with industry about raising tax rates. Moreover, the perception of Germany as a

[58] Brandt, U.S.; Svendsen, G.T. *The Political Economy of Climate Change Policy in the EU: Auction and Grandfathering*; Department of Environmental and Business Economics, University of Southern Denmark: Esbjerg, Denmark, 2003.

[59] http://www.spiegel.de/international/germany/german-environment-ministry-plans-to-cap-subsidies-for-renewables-a-880301.html

[60] http://www.2eco.nl/EEB%20(2004)%20NGO%20Guidelines%20Environmental%20Harmful%20Subsidies.pdf p24.

competitive location is also supported by the visibility of the measures that help industry to reduce its direct costs. If help were focused instead on indirect costs, this positive image of Germany might be lost, even if total costs to industry did not rise. The conclusion of this type of reasoning is that moving from a paradigm of demand-based subsidies would bring heavy costs through the changed image of the country conveyed to foreign companies.

Another, linked and significant, barrier to removing subsidies is the possibility of first-mover disadvantage.[61] The admission that there are such extensive fossil fuel subsidies will become a focus of media attention and will arouse criticism from various interest groups. The political cost of this would be a powerful disincentive to taking action. Policy makers may well be more influenced by this short-term loss than by the possibility of long-term gains.

The criticism that could be provoked by the acknowledgement of subsidies might well become more intense in view of the fact that the exemptions and reductions for eco-taxes amount to more than half of the total subsidies available to industry. Other exemptions include exemptions from feed-in tariffs to support electricity generated from renewable sources funded by taxes; and exemptions from charges for combined heat and power networks.[62]

Federal system and sectoral thinking

Another factor in the political reluctance to reduce subsidies is found in Germany's vertical federal system; the implication of this is a high level of independence between ministries, leading to sectoral thinking[63]. This was evident in the criticisms that the Ministry of Finance made of the eco-taxes when the reductions were first introduced[64]. Sectoral thinking reduces the political will to act, as the ministries o have a greater concern with supporting their immediate domain rather than taking action which might be part of a more coordinated and coherent approach.

Rising energy costs

During the past eleven years energy costs have been rising, and Germany is known to have higher electricity costs than its neighbours. Raising the costs of production would worsen the position further. This presents a very significant barrier, because high energy costs are frequently cited as one of the justifications for introducing such reductions and exemptions in the first place.

Passing the tax burden to consumers

The exemptions for heavy industry have received some support from the public because of concerns that, without these measures the higher energy taxes might be passed on to consumers as higher prices[65]. Even though the threat from international competition would restrict the ability of industry to pass the burden, nevertheless, at present up to 95%[66] of the extra costs are passed on by manufacturers in one way or

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[61] Koplow 2010.

[62] http://www.publications.parliament.uk/pa/cm201213/cmselect/cmenvaud/writev/669/669.pdf

[63] Tilmann Rave, 'Contextualising And Conceptualising The Reform Of Environmentally Harmful Subsidies In Germany', *Journal Of Environmental Assessment Policy And Management* Vol. 7, No. 4 (December 2005) pp. 619–650 (p 622).

[64] http://www.2eco.nl/EEB%20(2004)%20NGO%20Guidelines%20Environmental%20Harmful%20Subsidies.pdf p24

[65] 'Greening the Budget: Pricing Carbon and Cutting Energy Subsidies to Reduce the Financial Deficit in Germany' p22.

[66] Ibid.

another. If the industry was less subsidised it is feared that more costs would be shifted to the consumer.

Distribution of recycled revenue

In order to gain widespread acceptance of the eco-taxes when they were first introduced in 1999, the revenue raised was used to reduce labour costs, by reducing employees' and employers' social security contributions[67]. Thus this type of recycling, undertaken for political rather than purely fiscal reasons, created 'winners' among employees and employers. Any future increase of government revenues from removal or reduction of subsidies would probably come under intense scrutiny to see who benefits or loses from any recycling of the revenue. In 1999 the recycling won public acceptance of the eco-taxes and strengthened the government's hand against interest groups who would have preferred no change in the tax system. Interest groups might be able to cooperate to strengthen their opposition to any future change in the subsidies.

Competing public concerns

Any attempt to win public support for changes to subsidies and thus for imposing higher eco-taxes on industry would come up against conflicting pressures. On the one hand, it has been observed that when public participation has been restricted in debates and decisions, proposals to strengthen environmental policy have tended to be defeated. It is also difficult to strengthen support for environmental policy without public participation.[68] On the other hand, environmental concerns and policies to mitigate climate change are just one among the top three concerns most often cited by the German public in response to surveys. The other two concerns are the state of the labour market and the fiscal situation[69]. The two latter concerns weigh heavily in public attitudes to the imposition of higher eco-taxes on industry. In the past debates about tax reform were largely driven by fiscal considerations (particularly about the effectiveness of the taxes) and considerations of efficiency/inefficiency[70], linked, of course, with questions about whether the tax burden is shared equitably[71].

In short, there may be public pressure for reform of the subsidies and eco-taxes, but at present this is overshadowed by other more pressing issues.

Extension of DE_S5

The agreement to continue DE_S5 (the peak equalisation scheme) until 2022 was reached in 2012. The argument for any immediate reform of this policy would need to explain what has changed so much in so short a period to justify a sudden change in the policy framework. Moreover, such a sudden change would create an unstable and unpredictable policy environment and send unhelpful messages to the industries concerned. In effect, the German government would be reneging on agreements with industry. This would be costly both in political and financial terms.

Expected impacts of removal

Three scenarios were set up in the E3ME model to cover the subsidies. Each one was defined as a price-based subsidy on energy consumption, and modelled as described in Chapter 2. The sectors affected include agriculture but principally focus on manufacturing and industry.

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[67] See 'Carbon-Energy Taxation: Lessons from Europe', in Andersen Michael and Paul Ekins (eds), *Energy-Intensive Industries: Approaches to Mitigation and Compensation*, (on p 11).

[68] Lenschow Andrea, *Environmental policy integration: Greening Sectoral Policies in Europe* (p 65)

[69] UBA, 2010a

[70] http://www.2eco.nl/EEB%20(2004)%20NGO%20Guidelines%20Environmental%20Harmful%20Subsidies.pdf p21

[71] Households currently shoulder a higher burden of the eco taxes than industries.

Model results The model results show that, at macroeconomic level, removing each of the subsidies would result in a very small increase in GDP (up to 0.03% for all three subsides combined) compared to the baseline. This is too small to be viewed as much of a benefit of phasing out subsidies, but it does show that the impacts of removing the subsidies (including competitiveness effects) do not have a negative impact at the macroeconomic level.

The impacts on employment are similar to those on GDP.

Energy / Environment results The model results suggest that, if the subsidies were phased out, there would be a fall in energy consumption and CO_2 emissions of around 0.1%. The reductions are spread fairly evenly between the three different scenarios.

More detailed sectoral impacts When considering the impacts of phasing out these subsidies, the sectoral impacts are also important, as the sectors that at present receive the subsidies stand out as clear potential losers.

The two sectors that are targeted by the largest subsidy are the metals and chemicals industries. The model results show that removing the subsidies would result in cost increases of around 0.2% in each sector (at the 2-digit level) by 2020, which might then be passed on as higher prices. The model results also suggest that the higher prices might lead to some domestic production being replaced with goods produced elsewhere, but only to a small extent (less than 0.2%). As these sectors account for only around 3% of total production in Germany, the effects become small very quickly.

As always when considering competitiveness impacts, it is important to note that the level of detail in the modelling is quite limited due to the available data. There may be sub-sectors and firms that are particularly affected in the scenarios. However, in the case of the metals sector, the subsidy is largely given to steel, which is a large part of the total; we can therefore infer that impacts should not be particularly large. In the chemicals sector the subsidy is applied to a wider range of production processes, and so there may be a broader range of outcomes.

Finally, it should also be noted that the energy sectors will see a loss of output due to lower demand for their products. The model results suggest losses of up to 0.2% of total production.

Distributional impacts Currently there is evidence that the subsidies in place benefit firms which have a higher energy usage, as on average they pay less per unit of energy than smaller companies. SMEs therefore are not the main beneficiaries of the current system of subsidies; in fact studies show that the subsidies tend to be concentrated among a few large energy-intensive firms which benefit not only from the particular subsidies analysed in this case study but probably also from other schemes.[72] If the subsidies were removed, the distributional shift would not be to the benefit of big companies.

Impacts on public balance Given Germany's strong public balance, any impacts from fossil fuel subsidy removal are likely to be fairly small. Germany is not currently under pressure to reduce public spending.

[72] *Impact of Reductions and Exemptions in Energy Taxes and Levies on German Industry* CPI (2011) p. 18.

Conclusions

The exemptions that Germany grants from its energy taxes are primarily aimed to address concerns over international competitiveness in industrial sectors. This in part reflects the unique structure of the German economy, with its reliance on producing high-quality manufactured goods for export. This is likely to remain a powerful argument for maintaining existing subsidies, particularly if developing countries move up the value chain in terms of goods production (bringing them more into direct competition with Germany).

The exemptions must also be viewed in the context of Germany's ambitious renewables aims and feed-in tariffs, which have led to a large penetration of renewables, but in the future (although not at present) could increase electricity prices.

Nevertheless, it is important to note that some subsidies have been reduced previously, with the reductions being presented as a form of Environmental Tax Reform that is basically revenue-neutral. This is perhaps an approach that could be adopted in other countries.

Another point that is interesting to note from the German case study is the effect that the subsidies are having in separating industry and households. Although in the past the public has accepted that industry should pay lower costs, the different prices paid for energy appear to have more recently created a resentment in Germany that is not present in other European countries (even though the exemptions can have a similar effect, e.g. in Sweden); possibly this has been due to the visible rises in household energy bills due to high international energy prices. It will be interesting to see how this develops in future, as it has the potential to create political pressure for reforming the energy subsidies given to industries.

3.6 France

This case study assesses France's EHS for three groups:

- Agriculture: agriculture, forestry and fishing
- transport: road transport, aviation, rail transport, and shipping
- overseas territories: the French Overseas Departments and Territories (DOMs) and Corsica, a territorial collectivity

Detailed definition

Most of France's EHS consist of either exemptions or reduced rates of excise duties. The OECD calculates the subsidies as being the difference from the benchmark, which is acknowledged by France to be the default rate. Anything less than this is considered to be a subsidy. It was estimated that France subsidised fossil fuels by €2.75bn in 2011.

Currently there are several excise taxes on fossil energy products (*Taxes intérieures sur la consommation*, TIC). The most important tax for most of the subsidies examined in this case study is TICPE, "Taxe intérieure de consommation sur les produits énergétiques" (domestic consumption tax on energy products) formerly TIPP, "*Taxe intérieure sur les produits pétroliers*" (Domestic consumption tax on petroleum products). There is also an excise tax on natural gas (*Taxe intérieure sur la consommation de gaz naturel*, TICGN). The latter excise tax is only relevant for policy FR_S7[73]. The final type of tax which is relevant in this study is VAT (*Taxe sur la Valeur Ajoutée', or 'TVA'*). Two of the subsidies are VAT-based.

The OECD identified 20 subsidies in France. A sub-selection of these has been chosen for further analysis. The choice was based upon their relative importance to France, the number of similar policies for the same users and the size of the EHS. This filtering process led to 14 subsidies being further analysed and divided into the three categories shown in Table 3.1.
Table 3.1: Summary of French case study policies These categories are based upon the types of energy users.

The total subsidy value has been calculated for each category. However, this value does not necessarily equal the total amount by which the French government subsidises these activities. For instance FR_S14 is aimed at agriculture and **construction** and hence the actual amount estimated for agriculture is lower than a simple addition of all the listed policies would produce.

Similarly, the total value of the subsidies for transport is higher than the total of subsidies under the direct policies, as these do not include the FR_S1 policy which reduces LPG for all users and the French Overseas Departments and Territories (DOMs). The VAT reduction on gasoline, in_FR_S18, also reduces prices.

Table 3.1: Summary of French case study policies

Category	CE policy code	Total subsidy size of policies listed (millions)	% of total	Total subsidy size of all policies relevant to the fuel user	% of total

[73] Of the case study policies.

				category (millions)	
agriculture	FR_S6; FR_S12; FR_S14; FR_S15	€1,493.00	54.21	€1,176.49	42.72
transport	FR_S7, FR_S8, FR_S9, FR_S10 (all road based); FR_S11 (aviation); FR_S12; FR_17 (boats)	€358.00	13.00	€659.75	23.96
overseas territories	FR_S18; FR_S19; FR_20	€171.83	6.24	-	-

Background

There is some precedent for EHS removal and concerns with green growth in France. In 2007, subsidies for hard coal were ended after a period of gradual phase-out.

In August 2009 the Grenelle I Act instituted a review of the measures harmful to biodiversity with a view to proposing tools for implementing a gradual movement to a new, more environmentally appropriate, tax system. This was followed by the Grenelle II Act in July 2010 which targeted six major areas of national environmental concern.

More recently France has designed a 'National Sustainable Development Strategy' (NSDS). The NSDS is shorter, more instructive and more strategic than the obligations set out in the Grenelle acts. The strategy covers 2010-2013.
The main strategy for sustainable development within the European Union is the 'European Sustainable Development Strategy'. The NSDS considers specific circumstances for each single member.

Brief history

Agriculture, forestry and fishing

Agriculture, forestry and fishing are the biggest beneficiaries in France of the current EHS. France has a long history of subsidising these sectors. Indeed, policy FR_S12 has existed since 1928, while FR_S14 was introduced in 1970 and now has a rate of €56.60 per 1,000 litres. FR_S15 was introduced in 2004 and has to be reapproved annually; it has been renewed in every year since its creation. The rate for this measure is €72.00 per 1,000 litres. FR_S6 is a relatively new measure, dating from 2007. It is considerably smaller than the others for agriculture (and is shared with construction). These are all given as tax exemptions, reductions or refunds from the benchmark rate of TICPE and are a form of forgone government revenue[74].

Transport

The road transport subsidies cover a wide spectrum of freight, commercial, private, and public users. Also included in this grouping are transport subsidies for aviation (FR_S11) and boats (FR_S12 and FR_S17). These also come in the form of forgone government revenue via reduced rates of TICPE on diesel and jet kerosene.

Overseas territories

Measures FR_S18 and FR_S19 are both subsidies for the territorial collectivity[75] of Corsica. FR-S18 is a reduced rate of excise on the sale of petroleum goods, and

[74] Institute for European Environmental Policy, 'Study supporting the phasing out of environmentally harmful subsidies', Final Report, 2012, p 15.

[75] Corsica is considered to be part of an EU Member State.

amounts to only a very small subsidy. FR-S19 is a reduced rate of VAT on petroleum goods: 13%, compared to the standard rate for both Corsica and mainland France of 19.6% as of 14/1/2013[76].

Policy FR_S20 exempts the DOMs[77] from mainland French rates of VAT on sales of petroleum. Sales of petroleum are not subject to VAT. The four DOMs are Guadeloupe, French Guiana, Martinique, and La Réunion[78]. The DOMs are generally subject to the EU's VAT legislation, except for French Guiana which is fully exempt from all VAT legislation[79]. The DOMs have been exempt from the mainland French rate of VAT on petroleum products since 1951[80]. These subsidies are a form of forgone government revenue.

While the subsidies we are considering are all region-specific, they are aimed at very different types of socio-economic groups and for different regions. Their grouping reflects the focusing of the discussion at a regional level and the associated understanding of the specific dynamics that this entails.

Reasons for introduction and whether they are still applicable

The main reasons for introducing the subsidies in general are outlined and then discussed in detail.

General:

- competitiveness and other high tax rates

Agriculture:

- fluctuating revenue
- expensive practices

Transport:

- social provision

Overseas territories:

- offset higher costs due to geographical remoteness
- economically disadvantaged

Competitiveness and high tax rates

General - France has a much higher tax rate on petrol than many other European countries and there are varying rates within France. FR_S8 is a subsidy for taxi drivers; which offers a refund for the difference between the regional rate and the reduced rate. Subsidies are also given to compensate for adverse effects on (international) competitiveness. It should be noted that many of France's largest companies have links to the transport sector, either as providers of equipment or services, or as intensive users. Freight transport is given a reduction on diesel, FR_S9.

[76] http://ec.europa.eu/taxation_customs/resources/documents/taxation/vat/how_vat_works/rates/vat_rates_en.pdf

[77] The DOMs are not considered to be part of an EU Member State.

[78] In 2014 Mayotte is to become the 5th DOM, a new Outermost Region of EU. Previously it had the status of an overseas country and territory – (OCT). Currently 0% VAT is charged in Mayotte. If this continued, the size of the subsidy to French DOMs would increase after 2014.

[79] In the DOMs the standard VAT rate for goods and services is 8.5% and the reduced rate is 2.1%. These rates are lower than their equivalents in mainland France.

[80] Note that the rate of VAT in France is due to increase to 20% from 1/1/2014. This implies that if the lower rates in the DOMs do not rise at the same time then the projected size of the subsidy will increase.

Since 2000 a large reduction was given on the rate of excise duty paid by road hauliers.

For other taxes France has some of the highest rates of taxation in the EU and the highest total tax revenue at 44% of GDP. It is often argued that without sizable subsidies these tax rates would prevent France from being able to compete internationally. Indeed recent discussions about the health of France's economy have revolved around the loss of its competitiveness. Though discussions tend to point also to other structural issues, a removal of targeted EHS would not improve the situation and could make it harder for French companies to compete. Although the macroeconomic modelling that was carried out for this study suggests that removing subsidies would have small benefits overall, there could be losses within particular sectors.

Fluctuating revenues

Agriculture - One point of the argument for FR-S12 is based on the fluctuations of revenues from fishing and farming. More generally farming revenue is said to be decreasing and making farmers even more dependent on this subsidy[81]. This continues to be a problem though there are other stabilising mechanisms.

One subsidy that is often discussed is for irrigation. However, the area of land which needs to be irrigated has been decreasing. Nevertheless, the subsidy creates an incentive for irrigation that is inefficient, because it does not take into account the relationship between size of farm and value of subsidy given. An inefficient incentive is created and is also inconsistent with the 'polluter pays' principle. These considerations do not invalidate the case for smoothing fluctuating revenues by means of subsidies. However this smoothing ought not to be achieved by such a blunt and inefficient instrument which is insensitive to efficiency concerns.

Expensive practices

Agriculture - Many subsidies to agriculture are defended on the basis that the techniques and technology are old fashioned and use large amounts of fuel. This argument is advanced by the large commercial farms. However, the reality is that, while this may be true for the small-scale farms, it is generally not the case for large commercial farms. These, however are the main beneficiaries of the policies because there are minimum levels of size to qualify for reduced rates.

Social provision

Transport - FR_S10 is a subsidy that is aimed at supporting public transport. It produces positive externalities. Increased and improved provision of public transport is in keeping with the Grenelle I Act in some sense, though the strategy of reducing the price of fossil fuels contravenes the 'means' by which improvements in public transport should be achieved. Furthermore this type of subsidy reduces the incentive for investigation of alternative strategies.

Geographical remoteness

Overseas territories - FR_S18 is designed to reduce the higher costs that the people of Corsica would face because of the cost of supplying an island[82]. It was initially granted in 2007[83] until 2012[84] but has recently been extended until the end of 2018. This is a small measure and only reduces the TICPE rate by €1 per hectolitre of

[81] Public incentives that harm biodiversity, Summary, February 2012 p7.

[82] The reduced rate is permitted on the condition that the reduction does not go beyond offsetting the additional cost of transport, storage and distribution as compared with mainland France.

[83] Council Decision 2007/880/EC of 20 December 2007.

[84] European Commission 2013/0006/(NLE) 13 January 2013.

unleaded petrol. The argument for the recent extension is that the reduction compensates for the lack of petrol production on the island[85], a feature which is not likely to change.

Economically disadvantaged

Overseas territories - The justification for FR_S20 goes beyond the unfavourable geographical features of the DOMs, namely their remoteness and island status which raises the costs of acquiring petrol. The economies of these regions are also far less developed than those of the regions of mainland France. Their GDP per inhabitant ranges from 17% to 39% below the EU average, and 42-69% below the average for France.

Interaction with other instruments

The EHS interact with several other policies, both ones specific to the sectors involved and others that are more general in nature.

Agriculture:

- Common Agricultural Policy (CAP)
- La contribution au service public de l'électricité **(**CSPE**)**
- Taxes sur la Consommation Finale d'Électricité (TCFE)

Transport:

- Taxis: restricted number of licences
- Road hauliers: tax on heavy vehicles due to be introduced on 1st October 2013[86]
- Rail: la contribution au service public de l'électricité **(**CSPE**)**
- Rail: Taxes sur la Consommation Finale d'Électricité (TCFE)
- Rail: Contribution tarifaire d'acheminement (CTA)
- Rail: Imposition sur les Entreprises de Réseaux (IFER)
- Rail and aviation: VAT
- Aviation: EU ETS Exemption

Overseas Territories:

- VAT and reduced excise duty

Agriculture

CAP

In 2003 the CAP was reformed to remove a large part of its environmentally harmful subsidies. This was achieved by the decoupling of agricultural support from production levels which removed the incentives to increase production and thereby increase demand for fossil fuels. Nevertheless, EHS measures continued to exist within the CAP after 2003, although the Commission has taken steps to phase these out. For example the fisheries policy was reformed as part of a 'health check'[87] on the performance of the CAP.

As the largest CAP beneficiary, France receives around €11bn a year in agricultural support from the EU. In comparison, the environmentally harmful subsidies to French agriculture are estimated at around €1.5bn.

[85] There are no refineries on Corsica; the implication is that all petroleum has to be shipped from mainland Europe. This is much more expensive than using pipelines.

[86] http://www.tax-news.com/news/French_HGV_Tax_Enters_Into_Force_October_1____60020.html

[87] (European Commission, 2009a).

La contribution au service public de l'électricité

The CSPE is a contribution that is made by all electricity users; it is not restricted to agriculture. The objectives of this tax are to "offset the costs of the public service of electricity, which are supported by the incumbent suppliers, namely EDF Electricité de Mayotte (EDM) and local distribution companies (LDCs), and to finance the budget of the National Ombudsman of Energy[88]. This tax is linked to electricity consumption.

Taxes sur la Consommation Finale d'Électricité

TCFE was created at the start of 2011 to compensate for the removal of another instrument that taxed electricity (the TLE). Like the CSPE, it is applied to all users of electricity. The TCFE is levied on the final consumption of electricity. TCFE is broken down into three taxes; a tax on municipalities (TCCFE); a tax on departments (TDCFE); and a tax on inland consumption (TICFE). The TICFE is only applied to consumers who use over 250kVA[89]. The size of tax depends on the amount of electricity consumed. The municipalities and departments choose the rate of rate for their domain and the maximum possible rates were increased in January 2012. Municipalities can now select a multiplier coefficient for TCCFE between 0 and 8.28. Departments can now select a multiplier coefficient for TDCFE between 2 and 4.14.

Transport

Restricted number of licences

The policy to restrict the number of licences in France for taxi drivers prevents new entrants entering the market, in effect restricting the supply of taxis. The policy therefore to some extent caps the size of the subsidy.

Heavy vehicles tax

The taxation on heavy vehicles is to be based on the mileage travelled on all non-toll roads. Its aim is to compensate for the increased pressure on road infrastructure from heavy vehicles. It is also hoped it will encourage a transition from road hauliers to vessels and rail[90]. The tax increases the cost of operation for both hauliers and businesses which use haulage services. This initiative is in keeping with the Grenelle Acts

La contribution au service public de l'électricité

Rail transport and other downstream consumers can apply for an exemption on the tax rate. This applies to usage up to a threshold of 240 GWh per production site[91].

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[88] Interestingly this includes subsidising the higher production costs in areas such as the French overseas territories http://translate.googleusercontent.com/translate_c?depth=1&ei=GaBiUYG6F-iJ0AWIyoGQBg&hl=en&prev=/search%3Fq%3Dla%2Bcontribution%2Bau%2Bservice%2Bpublic%2Bde%2Bl%2527%25C3%25A9lectricit%25C3%25A9%26hl%3Den%26biw%3D1143%26bih%3D695&rurl=translate.google.co.uk&sl=fr&u=http://www.cre.fr/operateurs/service-public-de-l-electricite-cspe/mecanisme&usg=ALkJrhiEz0drCt_B114m6kY6hAmai1DR1A

[89] See document link for more information on the composition of TCFE http://www.edf.com/fichiers/fckeditor/Commun/Entreprises/pdf/Evolution%20des%20TLE.pdf

[90] OECD Economic Surveys: France 2011 p149.

[91] http://www.legifrance.gouv.fr/affichCodeArticle.do;jsessionid=0422546A3B6A2510D49459147FBCD533.tpdjo09v_1?idArticle=LEGIARTI000023985580&cidTexte=LEGITEXT000023983208&dateTexte=20120123

Taxes sur la Consommation Finale d'Électricité Electricity used by rail, metro, tram and trolleybus are exempt from paying TCFE when used to transport either goods or people[92].

Contribution tarifaire d'acheminement CTA is levied on transport and the distribution of electricity. The revenues raised are partly used to finance the pension system of those in the transport and distribution sectors. CTA consists of a fixed surcharge and a variable consumption aspect[93].

Imposition sur les Entreprises de Réseaux (IFER) One part of this tax is relevant to rail transport, namely the flat tax on rolling stock (for passenger trains and operations only) used on the national rail network[94]. The measure reduces the ability of rail to compete with other modes of transport. However, it is levied on both domestic and non-domestic train operating companies, with a slightly reduced scope for the latter[95].

VAT Aviation and rail is both exempt from paying VAT on cross border trips, though both are subject to a reduced rate of 7% on domestic transit[96].

EU ETS Exemption Aviation in France is subject to the EU ETS[97]. There have been discussions about making aviation exempt from this system on condition that the industry finds alternative ways of self-regulation. The current position is that the EU has created the text for the legislation which would 'stop the clock' for the aviation sector from the 30th of April 2013 for one year. DG CLIMA would be able to take account of progress made by the Assembly of the International Civil Aviation Organisation (ICAO) on this matter[98].

Overseas Territories

VAT and reduced excise duty In Corsica there is a reduced rate of VAT (13%) and a reduced rate of TICPE. Together these work to reduce the final price paid for petrol at the pump to a level below that of France and mainland Europe.

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[92] Other exemptions exist: see http://translate.googleusercontent.com/translate_c?depth=1&ei=TK1iUeKCH4nX0QX_joDgBw&hl=en&prev=/search%3Fq%3DTaxes%2Bsur%2Bla%2BConsommation%2BFinale%2Bd%2527%25C3%2589lectricit%25C3%25A9%2Btrain%26hl%3Den%26biw%3D1143%26bih%3D695&rurl=translate.google.co.uk&sl=fr&u=http://www.legifrance.gouv.fr/affichCodeArticle.do%3FidArticle%3DLEGIARTI000023216102%26cidTexte%3DLEGITEXT000006071570&usg=ALkJrhhvkx56-Yj9l0hKz2E-nFLTNVQ5Gw

[93] http://www.iaeeu2012.it/pdf/Camporealeppt.pdf

[94] http://translate.google.co.uk/translate?hl=en&sl=fr&u=http://www.impots.gouv.fr/portal/dgi/public/popup%3Bjsessionid%3DMJYIGRRE3EHQXQFIEIPSFFA%3FespId%3D2%26typePage%3Dcpr02%26docOid%3Ddocumentstandard_6067&prev=/search%3Fq%3DImposition%2Bsur%2Bles%2BEntreprises%2Bde%2BR%25C3%25A9seaux%2522,%2BIFER%26hl%3Den%26biw%3D1024%26bih%3D623&sa=X&ei=5HU0UairO-qw0AXUn4GICA&ved=0CDMQ7gEwAA

[95] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0144:FIN:EN:PDF

[96] http://ec.europa.eu/taxation_customs/resources/documents/taxation/vat/how_vat_works/rates/vat_rates_en.pdf

[97] http://ec.europa.eu/clima/policies/transport/aviation/index_en.htm

[98] http://ec.europa.eu/clima/news/articles/news_2013032501_en.htm

In the French DOMs TICPE does not apply. When combined with the VAT exemption, the absence of TICPE substantially reduces the final price paid by the consumers of these regions in comparison with mainland Europe.

Taxes sur la Consommation Finale d'Électricité

The French Overseas territories are also subject to the tax on final electricity consumption as described earlier in this section.[99]

Potential barriers to removal

The barriers in this section have been categorised in the same groupings and order as above.

General:

- entitlement effect
- timing & communication: timing and transparency of the removal of subsides
- communication: design and discussion of the policy
- rising fuel prices and high subsequent prices: rising fuel costs
- macroeconomic health

Agriculture:

- interest groups: employer organisations
- politically sensitive issues: political manifestos
- historical EHS: previous schemes to remove environmentally-harmful subsidies
- MS legislation: the constitution

Transport:

- politically sensitive issues: national interest
- competition and unilateral action: unilateral action
- competition and unilateral action: imbalance of other factors affecting competition
- interest groups: employer organisations
- MS legislation Grenelle I Act
- EU legislation: Energy Taxation Directive

French Territories:

- distributional: distributional concerns
- EU legislation: social provision legislation for overseas territories

General

Entitlement effect

Many of the subsidies in France have existed for many decades; moreover, because of the sheer number of subsidies, a sense of entitlement to some form of subsidy has become entrenched in certain sectors and economic groups.

Timing and transparency

Success in achieving agreement on the removal of coal subsidies was partly attributed to the widespread awareness of government action and the amount of warning that was given to those who have vested interests. The programme took over 40 years to complete. However, to meet the 2020 target it is necessary to agree a much more rapid

[99] http://www.allier.pref.gouv.fr/IMG/pdf/circ_2011_65_cle749429.pdf

phase-out schedule and far less advance warning would be given to vulnerable groups. Consequently they would have less time to adjust.

Design and discussion of the policy

The specific policy design has been shown to lead to lengthy debates about issues of inequality and fairness. Communication with the public in debate is often thought to raise the likelihood that the policy will be well received. However, the opposite seems to have occurred in some cases of environmental taxation. For example, the French Energy Act had a low level of acceptance because of the continued discussion that "eventually worsened the tax's social acceptability".[100] Moreover the design of policy must be in keeping with the country's own constitution. For instance the Energy Act was referred to the Conseil Constitutionnel, the French body responsible for upholding the 1958 constitution, on the grounds that two sections of the act were not in keeping with the constitution.

Rising fuel costs

At a time of high fuel costs, further rises may not be socially acceptable and thus may result in 'fuel revolts' thus reduces the political acceptability of any further increases in costs.[101]. For instance in 2000 there were blockades on the streets organised by the employer organisations in the agriculture sector and various transport groups[102]. More recently, the present government negotiated a reduction in the price of gasoline by €0.06[103] in 2013. Though this measure only gave a small relief to car users, it is indicative of the importance of rising fuel costs and was part of President Hollande's election campaign.[104]

Macroeconomic health

The most recent prediction for French GDP growth from the European Commission in 2013 has dropped to just 0.1%. The current poor prospects and weakness of the economy present a barrier as the public are more worried about additional tax rises during times of recession. This fear exists despite the consensus among economic organisations on the need to reduce labour taxes in France and to fund this reduction by a simultaneous rise in environmental taxes[105].

Agriculture

Employer organisations

Lobbying groups have considerable power in France to shape the political discussion. The beneficiaries of the agriculture and transport subsidies are clearly identifiable groups who have an easily identifiable common interest and are able to cooperate to exert direct political pressure. The membership of trade unions is significantly lower

[100] http://www.iddri.org/Publications/Collections/Idees-pour-le-debat/WP0412_CAS_france%20carbon-energy%20taxation_web.pdf

[101] Deroubaix J.S. Leveque F. (2006), The rise and fall of French Ecological Tax Reform: social acceptability versus political feasibility in the energy tax implementation process, *Energy Policy*, 34.

[102] http://www.tandfonline.com/doi/pdf/10.1080/714000664 p107

[103] http://www.ft.com/cms/s/d509fcea-f11e-11e1-a553-00144feabdc0,Authorised=false.html?_i_location=http%3A%2F%2Fwww.ft.com%2Fcms%2Fs%2F0%2Fd509fcea-f11e-11e1-a553-00144feabdc0.html&_i_referer=http%3A%2F%2Fworld.time.com%2F2012%2F08%2F31%2Ffrench-president-hollande-embarks-on-his-own-mission-impossible%2F#axzz2PraSpSzA

[104] http://world.time.com/2012/08/31/french-president-hollande-embarks-on-his-own-mission-impossible/

[105] OECD (2013), *OECD Economic Surveys: France 2013*, OECD Publishing.

than that of employer organizations; and so the latter have much more influence on government decisions.[106]

France's largest farmers union is FNSEA (the National Federation of Farmers' Unions[107]). It includes over 50% of farmers as members. Some publications have described the relationship between the FNSEA and government as almost exclusive of other influences and so the targets of policy have a big influence on the policy itself. Moreover, a secondary effect is the strong public support that farmers have been able to generate because of the "ideational constraints" in France[108].

The impact of agriculture on rural communities more generally is also important. 'Multiplier' effects of changes in agricultural policy vary across the regions and across agricultural activities and have been found to range from 1.04 to 2.3. Even so, it should be noted that less than 3% of the population are employed directly by the agriculture sector[109].

It is acknowledged that the government commission for agricultural issues created in France has increased the level of discussion in public forums. However, the public's increased awareness has not translated into a powerful counter force able to overcome the pressure of organised special interests.

Furthermore, the political cost to the different political parties varies as there is evidence to suggest that large farm owners tend to support right-aligned political parties while smaller farm owners support left -of centre parties. This implies that different parties would be more likely to oppose reforms depending on the source of the lobbying. With regard to the current socialist government, if many small farmers are exerting pressure, the government will find it more politically costly and may be less inclined to push through reforms[110].

Political manifestos

The current government included in its manifesto[111] a commitment to defend the agriculture and maritime sectors. Removal of the EHS could be seen as a direct contravention and interest groups would be likely to demand the manifesto statement be honoured.

Experience of other EHS removal programmes

France has already removed subsidies for hard coal mining. This process contains lessons for the government and also shows how the public may be made more aware of the potential impact of such schemes. France took a long-term view, identified potentially vulnerable groups early, and used the growth of the nuclear industry to ease structural adjustment. However, EHS removal took more than 40 years and the

[106] http://www.eurofound.europa.eu/eiro/country/france_3.htm

[107] Fédération nationale des syndicats d'exploitants agricoles.

[108] van der Vleuten, Anna, and Gerry Alons. "La Grande Nation and Agriculture: The Power of French Farmers Demystified." *West European Politics* 35.2 (2012): 266-285.

[109] OECD. 2009. The Role of Agriculture and Farm Household Diversification in the Rural Economy: Evidence and Initial Policy Implications. Paris OECD

[110] Rozelle, S., and J. F. M. Swinnen. 2010. "Agricultural Distortions in the Transition Economies of Asia and Europe." Chap. 8 in *The Political Economy of Agricultural Price Distortions*, edited by K. Anderson. Cambridge and New York: Cambridge University Press.

[111] "Je défendrai un budget européen ambitieux pour l'avenir de l'agriculture" and "J'assurerai la protection de notre économie maritime et redonnerai à la pêche les moyens de sa modernisation." From 'Élection Présidentielle 22 Avril 2012, Le Changement C'est Maintenant, Mes 60 Engagements Pour La France' p9.

policy still cost around 35 billion euros between 1971 and 2000[112][113]. The cost may present a barrier to public approval of any other similarly extensive schemes such as those in agriculture.

Constitution The Constitutional council of the French Republic has previously declared proposed environmental policies as unconstitutional; this includes the carbon tax in 2010[114]. The removal of environmentally harmful subsidies would have to be in keeping with the 1958 French Constitution.

Transport

National interest Aviation - The nature of the aviation sector means that there is a strong motivation for countries to protect it (both air transport services and equipment manufacturing) from competition, by using fiscal tools such as tax exemptions. Pressure on policy makers is likely to increase near to election time.

Unilateral action Aviation - If a single country decided to remove its exemption on petroleum products for aviation, this would encourage ‘tankering’, This is when carriers re-fuel on international/EU flights as much as possible to avoid having to buy so much fuel for domestic flights. The result is higher emissions[115]. Further, this would disadvantage any purely domestic aviation carriers or carriers with a high proportion of flights within France as they would be unable to avoid the rise in excise duty by ‘tankering’. This would decrease their ability to compete with other carriers and it would adversely affect outlying regions.

Imbalance of other factors affecting competition Multiple modes of transport - There are other factors relevant to competition between different modes of transport. Subsidies are just one factor; others include the presence of externalities, regulation and land use as well as infrastructure quality. Certain modes of transport may argue that, because of such other factors, they would be placed at an overall disadvantage against their competition if their subsidies were taken away[116].

Employer organisations Road haulage - Employer organizations have previously been successful in gaining reductions in the TICPE rates for road hauliers[117]. The presence of such representative organizations has been important in reaching the current reduced rates that apply today and so they are unlikely to relinquish their gains easily.

[112] Laan, T., C. Beaton and B. Presta (2010):’ Strategies for reforming fossil fuel subsidies: Practical lessons from Ghana, France and Senegal’, *The Global Subsidies Initiative; Untold billions: Fossil fuel subsidies, their impacts and the path to reform*, International Institute for Sustainable Development.

[113] TemaNord Series, Nordic Council of Ministers (2011) 'Reforming Environmentally Harmful Subsidies: How to Counteract Distributional Impacts' p 39.

[114] Marrani, David. "Case Note: How to End an Attempt to Institute a Carbon Tax: The Conseil Constitutionnel Declares that Article 7 of the 2010 Budget Instituting a Carbon Tax does not Conform to the Constitution of the French Republic." *Environmental Law Review* 13.1 (2011): 50-55.

[115] House of Commons Library, Taxing aviation fuel, Standard Note: SN00523, 2 October 2012, Antony Seely, Section Business & Transport Section, p1.

[116] For a visualisation of these matters see ‘Size, structure and distribution of transport subsidies in Europe’ EEA Technical report, No 3/2007 p23

[117] http://www.eurofound.europa.eu/eiro/2000/10/feature/fr0010197f.htm

Grenelle I Act Rail - The removal of subsidies to rail could be seen to contravene the objectives of the Grenelle I Act, one of which was to increase the modal shift towards non-road freight from 14% in 2006 to 25% by 2022. So far, a shift in the opposite direction has occurred.

EU legislation Aviation - In 2003 the EC agreed the "Community Framework for the Taxation of Energy Products"[118]. This legislation allows member states to tax aviation fuel for national use. This does not mandate that aviation should be taxed at some uniform minimum level.

Road haulage - Similarly, the EU's Energy Taxation Directive allows a reimbursement to road freight via a reduced tax rate on commercial diesel used by lorries over 7.5t.

These can be construed as barriers because they make it legitimate for governments to yield to public pressure to maintain support for domestic flights and road freight. Review of these items of EU legislation began in 2011, but no changes have yet been introduced.

Overseas Territories

Distributional concerns Levying VAT would be regressive for households and would make it harder for industry and agriculture to grow. The VAT exemption is applied to all petroleum goods; this includes kerosene which is more widely used by low-income households for cooking and lighting.

Social provision legislation for overseas territories The DOMs are known as Outermost Regions (OR) in European law; this group comes under the jurisdiction legislation, under which certain territories can be excluded for VAT for "reasons connected with their geographic, economic and social situation". This is part of a wider perception of the treatment that should be given to some locations to take account of their "structural social and economic situation, which is compounded by their remoteness, insularity, small size, difficult topography and climate, economic dependence vis-à-vis a few products, the permanence and combination of which severely restrain their development"[119]. These principles would make it harder to remove subsidies from ORs if no appropriate alternative alleviation were instituted[120].

Expected impacts of removal

Model results There are a large number of subsidies in France, all of which are quite small in scale. The model results for each individual subsidy are available in Appendix A; here we focus on the subsidies covered in this case study as a package.

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[118] 2003/96/EC.

[119] "(Article 349 TFEU).

[120] Council Directive 2006/112/EC of 28 November 2006 on the common system of value added tax (OJ L 347, 11.12.2006, p. 1) consolidated version created on 01.01.2013.

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2006L0112:20130101:EN:PDF

Taking the subsidies as a whole, the model results for the scenarios in which subsidies are phased out suggest that:

- GDP could increase by around 0.03%
- Employment could increase by around 0.03%
- Energy consumption could fall by around 0.3%
- CO_2 emissions could fall by around 0.4%

So, overall the impacts on energy consumption and emissions are non-zero but quite modest, even when all the subsidies are taken together.

The economic benefit is largely derived from reduced imports of fossil fuels, as the largest subsidies are applied to liquid fuels used by the transport sector. Employment increases by a similar amount to GDP.

More detailed sectoral impacts

The model results give only a limited insight into the possible sectoral impacts, given the 2-digit level of detail that the modelling can cover, and the size of the individual subsidies. Within the transport sector, where the largest subsidies are applied, there may be some larger impacts.

For example, the removal of the transport subsidies ought to shift demand from aviation towards cheaper (and possible more environmentally-friendly) rail travel. However, the phasing out of subsidies for public transport might encourage increased use of private vehicles, resulting in increased energy demand.

A dedicated transport model would be required to carry out a full investigation of the possible impacts of removing the subsidies. This is recommended if the French government plans to phase out the subsidies related to transport.

Possible behavioural responses

The removal of the large EHS subsidies only comprises one part of the many agriculture subsidies in France. Similarly to CAP reform, arguments for removing EHS in agriculture centre on the issue of food security and international competitiveness. According to the French government website[121], which has been set up to provide data on how much French farmers receive each year from the EU, most of the agriculture subsidies are paid to large industrial food processing businesses and charitable organisations rather than to small farmers. The removal of subsidies would lead to these firms facing higher cost of production. Initially agriculture firms may absorb these cost increases through reduction in their profits but in the long run they are likely to find ways to reduce costs elsewhere and improve their productivity. In the transport market it is expected that the cost increase would lead to a decrease in overall use of transport. The importance of the subsidies is related to their relative size and the degree to which the mode of transport depends upon the subsidy to remain competitive. For instance, the cross-elasticity effect would be mitigated to some extent by the more efficient uses of transport, e.g. in the UK freight responded to higher prices and competition by increasing the load per trip.

Further, the elasticities of the different modes of transport vary as road transport is more inelastic than air and rail. Therefore the impact of removal would be more significant in those markets. Also, studies on the elasticity differences across locations in France show that elasticities do not vary significantly between rural and urban locations.

[121] https://www3.telepac.agriculture.gouv.fr/telepac/auth/accueil.action

In the DOMs the demand for fuel from households will be much more sensitive to the price than in mainland France due to the lower wages in those overseas regions. By contrast, in Corsica, as the population has a wage and lifestyle which is much more comparable with mainland France, it is expected that the elasticity estimates and behavioural response will also be similar.

Distributional impacts

A key impact of removing subsidies from agriculture is the rise in food prices. However, scenario results for FR_14 where EHS to agriculture sector of €1bn euro is removed show a net positive result for GDP. The results show that reallocating French EHS funds to households can compensate for higher food and agriculture prices. In any case, the rise in prices does not equate to 100% of the increased costs because agriculture will absorb some of the cost increases in order to maintain its competitiveness.

The removal of freight and water transport subsidies will eventually lead to an increase in final product prices, thus affecting consumers' real income and leading to some reduction in consumption. However, as with agriculture subsidies, an effective reallocation of the fund to consumers can produce a net benefit. Aviation subsidies favour those with higher incomes who fly frequently and so the removal of this subsidy is expected to have limited impacts on lower-income households. In contrast, the removal of subsidies to public transport is expected to have greater impacts on lower-income households.

Impacts on public balance

Phasing out the subsidies would lead to a decrease in government expenditure in France. As the French government is currently looking for areas in which to cut spending as opposed to increasing taxes, in order to meet its target for reducing the budget deficit, this case study presents some relevant areas for consideration. In addition the result of the modelling suggests there would be some small secondary advantages from EHS removal.

Conclusions

The French case study has focused on three different types of EHS. It was apparent that there were some common barriers which would relate to all of the cases while others related to particular features of the subsidies that are in place. The common barriers that include concerns about the macroeconomic health of the country are not easily alleviated. This is especially true for of high fuel prices and a public sense of entitlement. These are largely beyond the government's direct control.

The analysis also shows that there may be different barriers to removing particular subsidies, even within the same country. The regional subsidies (e.g. to Corsica) stand out here as they are applied within a special set of economic and legal circumstances and would therefore need to be considered separately from the other subsidies.

More generally, it would appear that some of the most difficult barriers to overcome are the close relationships between special interest groups and the government. These interest groups include employer organisations and large companies and, to a lesser extent, trade unions. Many of the largest companies in France have an interest in the sectors that receive subsidies, either because they operate directly in the sector or are suppliers to it. They also have a strong international presence and can be subject to international competition. These companies and organisations therefore have an interest in using their influence to maintain the status quo.

3.7 Sweden and Finland

This case study assesses the CO_2 tax subsidies that are given in Sweden and Finland. In Sweden there are eleven different reductions and exemptions, but in Finland there is only one. In each section of this case study the information about Sweden is given first, followed by the information about Finland.

Detailed definition

In the 1990s (even before the signature of the Kyoto Protocol in 1997) the Scandinavian countries were the first in the world to introduce carbon taxation. Finland led the way, introducing the world's first carbon tax in 1990. Sweden followed in 1991[122]. The main aims of these taxes were to provide incentives to reduce carbon emissions from any sources in the economy, and to make use of the most cost-effective options for mitigation. However, for various political and social reasons as well as concerns about, economic and environmental effectiveness, several exemptions and reductions were introduced in several sectors. Sweden introduced the widest range of exemptions and reduction policies, and Finland offered the least. These exemptions and reductions can be treated as subsidies to the sectors concerned.

The exemptions and reductions that existed in 2012 have been divided into five groups (see Table 3.2). For a brief description of these measures, see Table 7.24 and Table 7.25.

Table 3.2: Summary of Swedish and Finish case study policies

Category	CE policy code	Total subsidy size of policies listed (millions)	% of total
Transport	SW_S8, SW_S9, SW_S11, SW_S17	€158	32
Agriculture and forestry	SW_S12, SW_S13, SW_S14	€179.5	37
Mining	SW_S18	€21.05	4
Industry	SW_S1, SW_S3, SW_S4	€129.62	27
CHP generation	FI_S8	€58.25	

Sweden

The OECD has calculated the size of the tax exemptions that operate as virtual subsidies, using the IEA's figures for residential flows of natural gas, heating oil (which includes kerosene etc.) and solid fuel (various forms of coal). On this basis, total fossil fuel subsidises in Sweden are €488.5 million.[123] The tax exemptions and reductions are off-budget subsidies to the industries and they constitute forgone government revenue. By value, 80% of the subsidy relates to the use of oil and oil products, with 11% for natural gas and 9% for coal.

Sweden operated a carbon tax levied at SEK1.08/kg of CO_2 in 2012, increasing from its original rate of SEK0.25/kg of CO_2 at its introduction in 1991.[124] However, there are a number of exemptions that offer a range of reductions from this rate for different sectors. The tax and its exemptions are legislated through the Swedish Energy Tax Act.

[122] Norway also introduced a carbon tax in 1991 and Denmark in 1992.

[123] OECD (2013) Belgium: Inventory of estimated budgetary support and tax expenditure for fossil fuels.

[124] Swedish National Audit Office (2012) *Climate-related taxes: Who pays?*, RIR 2012:1.

Since its introduction in 1991 the exemptions from the carbon tax have evolved and been reformed. Thus, Sweden provides an interesting case study of the potential barriers to subsidy reform and how they can be overcome.

Finland

Finland offers a 50% reduction in its CO_2 tax rate for combined heat and power (CHP) production fired by light fuel oil, biofuel oil, heavy fuel oil, coal and natural gas. In addition, fuels such as peat receive a complete exemption.[125] The CO_2 rate was €30/tonne CO_2, and so the reduction equates to an effective subsidy of €15 per tonne CO_2 for CHP production compared to other forms of carbon-intensive energy generation.[126]

The subsidy's value has been estimated at over €56 million in 2011, with CHP fired by coal accounting for just over half of this, natural gas for nearly all of the remainder and heavy fuel oil for around €1 million.

Background

Sweden

Brief history

Sweden introduced a carbon tax in 1991 to complement its existing energy taxes, which were reduced by 50% as a result. At its inception a preferential rate of 50% of the general level of the carbon tax was applied for fuels used in industry, and electricity generation was completely exempt. Energy-intensive industries were eligible for further reductions.

Tax exemptions for industry and agriculture in Sweden are not new. Energy-intensive industry and agriculture have enjoyed similar exemptions from energy taxes in Sweden since the 1950s – the CO_2 tax merely extended the exemptions to the new instrument.[127] The exemptions have, however, changed during the period of operation of the carbon tax, with notable changes for industry with the introduction of the EU ETS in 2005, and, most important, a change of policy in 2010 which introduced two changes to exemption rates for 2011, with a further change set for 2015.[128] Before the change of policy in 2010, industries subject to the EU ETS were exempt from the energy tax and had to pay only a part of the CO2 tax. From 2010 these industries are fully_exempt from the CO2 tax but, instead, subject to energy taxes. It is therefore important to recognise the relationship between the EU ETS system and the CO2 taxes work together as parts of a larger system.

Context for tax reform

Sweden's two periods of carbon tax reform, with reductions in the exemptions given, were driven by external policy events and Sweden's bold climate targets. The introduction of the EU ETS in 2005 brought with it the issue of double taxation of industries covered by the carbon tax. Those industries, although enjoying large exemptions, focused on the issue of double taxation and lobbied hard for further reductions in their carbon tax. Sweden revised the exemption downwards to a new rate

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[125] Eurostat (2003) *Energy Taxes in the Nordic Countries – Does the polluter pay?*

[126] There is now a differentiated carbon tax rate in Finland with a rate of €60 per tonne of CO_2 for traffic fuels and €30 per tonne of CO_2.

[127] Hammar, H. and Akerfeldt S. (2011) *CO_2 Taxation in Sweden – 20 Years of Experience and Looking Ahead*, Global Untmaning (Global Challenge), Stockholm.

[128] Govt. Bill 2009/10:41 *Certain excise duty issues in view of the budget bill for 2010*.

of 15%, before removing carbon taxation from EU ETS companies altogether in 2011. This removal was part of a wider tax reform initiated in 2009, carried out in the context of Sweden's ambitious climate change targets. These are:

- To generate at least 50% of power from renewables by 2020
- 10% of transport energy use from renewables by 2020
- to phase out all fossil-fuel driven motor cars by 2030
- reduction of 20% in energy intensity between 2008 and 2020
- emissions reduction of 40% by 2020 compared to 1990 for non-EU ETS sectors
- by 2050 no net emissions of GHG

These targets require strong action by Sweden and the moves by the Riksdag in 2009 to reform both the carbon tax and the associated energy and vehicle taxes are aimed at these goals. The moves also mean that Sweden has already taken important steps for compliance with the Revised Energy Taxation Directive.

Finland

Brief history

The Finnish carbon tax applies to gasoline, diesel, light fuel and heavy fuel oil, jet fuel, aviation gasoline, coal and natural gas, but not to electricity.[129] Its legal basis is the Act on Excise Duty on Liquid Fuels and the Act on Excise Duty on Electricity and Certain Fuels. The tax has fluctuated between a pure carbon and a carbon/energy-mix tax since its introduction. The revenues from the tax are paid directly to central government, and are not earmarked. The tax is levied as an additional excise duty on traffic and heating fuels. Under recent reforms, from January 1, 2011 excise duties on liquid fuels and coal take into account the energy and carbon content of fuels, and also factor in local environmental effects. The CO_2 component of the tax is based on a life-cycle approach to emissions rather than just on combustion emissions.

There are a number of exemptions including those for CHP, peat, commercial vessels and commercial air traffic, but total exemptions are markedly lower than for carbon taxes in the other Scandinavian countries.[130] Furthermore, there is no tax exemption or tax relief to industry.[131]

Finnish targets

Finland has set a long-term target to reduce its GHG emissions by at least 80% below 1990 levels by 2050. A roadmap to a low-carbon Finland is set out in its National Climate and Energy Strategy. The strategy commits Finland to the continuation of sourcing its electricity from a diversified system based on cogeneration of power and heat. Finland has a target of increasing the share of renewable energy to 38% by 2020. The tax exemption for CHP may challenge the long-term move to renewables away from fossil fuel-fired technologies, although the promotion of efficiency and CHP is crucial to Finland's long-term strategy.

[129] Sumner, Bird and Smith (2009) *Carbon Taxes: A Review of Experience and Policy Design Considerations*, NREL.

[130] Ministry of the Environment (2012), *Excise duty and strategic stockpile fee rates as of January 1, 2012*.

[131] Ekins, P. and Speck, S. (1999) 'Competitiveness and Exemptions from Environmental Taxes in Europe', *Environmental and Resource Economics*, 13(4) pp. 369-395.

Reasons for introduction and whether they are still applicable

Sweden

The Swedish carbon tax rate is the highest in the world, and this is one reason why lower rates for industry, agriculture and forestry have been described as prerequisites for the original introduction of the tax and the continuation of such a high rate of taxation.[132] Approximately 10% of total Swedish CO2 emissions are covered by the tax[133].

The exemptions and reductions have been defended by the general argument that it is necessary to strike a balance between fulfilling environmental objectives but also accounting for the risks of loss of competitiveness and of 'carbon leakage'[134].[135] The Swedish government has advanced a combination of particular justifications, largely based on the impact on economy and on restrictions under EU legislation.

The justification, relevance and importance of the exemptions vary between the sectors, and so they are examined in turn.

Transport

The main reasons that are given for introducing and keeping the subsidies for transport are that the subsidies:

- have limited emissions and revenue implications
- incentivise the use of less carbon-intensive fuels
- protect output and employment

Limited emissions and revenue implications

Removing them would not make much difference to emissions or to government revenue, because the subsidies affect only a very small share of the fuels used in transport and amount to a small financial total. It is true that transport in Sweden accounts for a larger share of the country's total emissions than in any other member of the EU[136]: 43% in 2010.[137] However, only a relatively minuscule share of transport fuel is covered by the subsidies. In the rail industry, which accounts for 2.6% of energy use in the transport sector as a whole, only 0.5% of energy input comes from oil products, whereas the remaining 99.5% comes from electricity.[138] Thus the use of diesel in Swedish transportation is negligible. Diesel is used only on remote lines and

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[132] Hammar, H. and Sjostrom, M. (2011) 'Accounting for behavioural effects of increases in the carbon dioxide (CO_2) tax in revenue estimation in Sweden', *Energy Policy* 39 pp. 6672-6676.

[133] Swedish National Audit Office (2012) *Climate-related taxes: Who pays?*, RIR 2012:1.

[134] "*Carbon leakage* is the term often used to describe the situation that may occur if, for reasons of costs related to climate policies, businesses were to transfer production to other countries which have laxer constraints on greenhouse gas emissions." http://ec.europa.eu/clima/policies/ets/cap/leakage/index_en.htm

[135] Hammar, H. and Akerfeldt S. (2011), *CO_2 Taxation in Sweden – 20 Years of Experience and Looking A*head, Global Untmaning (Global Challenge), Stockholm.

[136] Hammar, H. and Sjostrom, M. (2011), 'Accounting for behavioural effects of increases in the carbon dioxide (CO_2) tax in revenue estimation in Sweden', *Energy Policy* 39 6672-6676.

[137] IEA (2012), *$C0_2$ Emissions from Fuel Combustion*, ESDS International, University of Manchester.

[138] IEA (2012), *Energy Statistics of OECD Countries Database*, ESDS International, University of Manchester.

for specialist applications such as loading of trains on to ferries. The value of this subsidy is estimated at only €3.3 million, less than 1% of the total tax exemptions.[139]

The exemption for natural gas in transport is also relatively small, accounting for just 0.34% of all energy used in the sector, and just 0.37% of the road transport sector, and just 0.29% of all the emissions from the road transport sector.[140] The use of LPG is negligible.

Incentivise the use of less carbon-intensive fuels

The subsidy to support the use of natural gas in transport was introduced as an incentive for the use of less carbon-intensive fuels. However, it is now being phased out, with a reduction in the exemption planned for 2013, and complete phase-out by 2015. The total value of this subsidy is estimated at €4.43 million, not much higher than the €3.3 million for rail. Thus the consequences of its removal are relatively minor[141]

Protect output and employment

Water and air transport in Sweden provide around 1% of gross output, 0.5% of gross value added and 0.7% of the total compensation of employees.[142] They account for about 4% of total energy consumed in Sweden and contribute 2.2% of emissions.[143] Thus, exemptions and reductions for these sectors are slightly more important than those for natural gas and diesel trains. The estimated value of the total subsidy reflects this, with values of €55 million for domestic shipping and €95 million for domestic aviation.[144] Neither of these taxes was selected for reform in the 2009 reforms.

Agriculture and Forestry

The tax exemptions already enjoyed by agriculture and forestry were transferred to the carbon tax at the time of its introduction, for the following reasons:

- employment
- output
- reliance on oil
- high degree of CO2 efficiency
- to satisfy important political constituents

The exemptions correspond to a larger share of the total emissions of this sector than any other sector in Sweden. However, there are plans to reduce all three of the exemptions at different rates over the next ten years.

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139 OECD (2012) *Inventory of Estimated Budgetary Support and Tax Expenditure for Fossil Fuels 2013*, OECD Publishing.

140 IEA (2012), $C0_2$ Emissions from Fuel Combustion. ESDS International, University of Manchester, IEA (2012) Energy Statistics of OECD Countries Database. ESDS International, University of Manchester.

141 OECD (2012) *Inventory of Estimated Budgetary Support and Tax Expenditure for Fossil Fuels 2013*, OECD Publishing.

142 IMF (2012) World Economic Outlook, ESDS International, University of Manchester.

143 IEA (2012) $C0_2$ Emissions from Fuel Combustion. ESDS International, University of Manchester, IEA (2012) Energy Statistics of OECD Countries Database. ESDS International, University of Manchester.

144 OECD (2012) *Inventory of Estimated Budgetary Support and Tax Expenditure for Fossil Fuels 2013*, OECD Publishing.

Employment The agriculture and forestry industry is an important employer in Sweden (accounting for 1% of total compensation of employees[145]), and has enjoyed exemptions from energy taxes since the 1950s.[146]

Output This industry produces a greater share of Sweden's output and value-added than transport, with crop and animal production producing 0.8% of output and 0.5% of gross value-added, and forestry and logging contributing 0.7% of output and 1.2% of gross value-added.[147]

Reliance on oil Oil products generate 29% of total final energy consumption in the agriculture and forestry industry in Sweden (biofuels/waste generate the largest share at over 49%),[148] and so oil products produce by far the largest share of carbon emissions. The size of the sector and the industry's relative reliance on diesel and similar products mean that SW_S14 is one of the largest in terms of value of any of the CO_2 exemptions from carbon taxes available in Sweden. Its value has been estimated at €136 million.[149]

High degree of CO_2 efficiency The industry accounts for smaller shares of Sweden's total energy consumption (0.9% in 2010) and total emissions (1.4%) than its share of output (1.5%).[150]

Represents important political constituents The two parts of this industry represent important political constituents and are also regional employers in rural and remote areas. Agriculture is generally located in the more temperate south of the country, with forestry located more in northern regions. The south-western county of Västra Götaland has more agricultural enterprises than the six most northerly counties combined.[151]

Mining The mining industry enjoys a 70% concession on the CO_2 tax rate on all fossil fuels used for heating purposes. This will be reduced to 40% in 2015. The original reasons for this subsidy were:

- output
- regional economic benefits
- energy required for a variety of purposes
- EU ETS coverage

Output Mining is an important component of Sweden's economy, but more important for output than for labour income. It produces 0.7% of gross output and 1% of gross value -added, but provides just 0.3% of the compensation of employees.[152]

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[145] Hammar, H. and Akerfeldt S. (2011) CO_2 Taxation in Sweden – 20 Years of Experience and Looking Ahead, Global Untmaning (Global Challenge), Stockholm.

[146] Ibid.

[147] IMF (2012), *World Economic Outlook*, ESDS International, University of Manchester.

[148] IEA (2012), *Energy Statistics of OECD Countries Database*, ESDS International, University of Manchester.

[149] OECD (2012) *Inventory of Estimated Budgetary Support and Tax Expenditure for Fossil Fuels 2013*, OECD Publishing.

[150] IEA (2012), *$C0_2$ Emissions from Fuel Combustion*, ESDS International, University of Manchester, and IEA (2012), *Energy Statistics of OECD Countries Database*, ESDS International, University of Manchester.

[151] Statistics Sweden.

[152] IMF (2012) *World Economic Outlook*, ESDS International, University of Manchester.

Regional economic benefits Mining is concentrated in the two counties Norbotten and Västerbotten that constitute the most northerly region of Sweden, Övre Norrland. The industry is important for the economy of this remote region.[153]

Energy required for a variety of purposes The mining and quarrying sector consumes 1.2% of Sweden's total final energy consumption, and produces a similar share of its carbon emissions.[154] It should be noted however that the mining industry uses energy for a wide variety of purposes apart from heating, including transport and processing. The total estimated value of the mining carbon tax exemption is €21.05 million.[155]

EU ETS It should be noted that the most (87%) of the mining sector in Sweden is covered by the EU ETS and so its carbon emissions are covered by an alternative instrument to Sweden's carbon tax.[156]

Industry There are three types of CO_2 tax exemptions for industry in Sweden, (see Table 7.25 polices SW_S1, SW_S2, and SW_S4). The reasons for their introduction were:

- international competition
- entitlement
- EU ETS
- low reliance on fossil fuels
- to encourage the efficient use of district heat

International competition Carbon emissions from industry account for 19% of Sweden's total emissions.[157] Much of this industry is engaged in internationally traded sectors such as iron & steel and pulp & paper. These industries are exposed to competitive pressure international markets and moreover there is a potential risk of carbon leakage. There is a particularly high risk of carbon leakage in the pulp & paper industry, which contributes more than 7.5% of Sweden's total value-added in manufacturing. [158] Concerns about carbon leakage were the main reason why the carbon tax for the entire sector was reduced to 25% of the general level, with further exemptions for firms whose carbon tax liability was greater than 0.8% of their total sales, when specific exemptions were abolished in a reform of energy taxes in 1993.[159]

The decision to phase out SW_S4 is interesting because it represents a move away from specific support for industries thought to be at risk of carbon leakage and represents a wider move away from the '1.2%' rule[160] for both industry and agriculture. It could be seen as recognition that the threat of carbon leakage is not as great as previously thought, but must also be placed in context that the majority of

[153] Newman, H. (2012), *The Mineral Industry of Sweden*, USGS.

[154] IEA (2012), *$C0_2$ Emissions from Fuel Combustion*, ESDS International, University of Manchester, and IEA (2012), *Energy Statistics of OECD Countries Database*, ESDS International, University of Manchester.

[155] OECD (2012) *Inventory of Estimated Budgetary Support and Tax Expenditure for Fossil Fuels 2013*, OECD Publishing.

[156] Bohlin, L. (2010), *Climate Policy within an International Emissions Trading System – A Swedish case*, Örebro University.

[157] IEA (2012), *$C0_2$ Emissions from Fuel Combustion*, ESDS International, University of Manchester.

[158] Naess-Schmidt, S., Bo Hansen, M. and Kirk, J.S. (2012), *Carbon leakage from a Nordic perspective*, TemaNord.

[159] Swedish National Audit Office (2012), *Climate-related taxes: Who pays?*, RIR 2012:1.

[160] That reduction on CO2 tax rate is only given when the value of the tax in 2011 exceeds 1.2% of sale value.

industries such as pulp & paper that could be at threat from leakage are now covered by the EU ETS and are exempt from the carbon tax.

Entitlement

Before the introduction of the carbon tax, firms could apply for specific exemptions from existing energy taxes. This system had been in existence since the 1950s. When the carbon tax was introduced, these exemptions were extended to it.

EU ETS

The differentiated taxation system remained in place up until the EU ETS was introduced in 2005. Swedish industries were, in principle, subject to double taxation for their emissions, (although they were still entitled to reduced rates of carbon tax EU ETS allowances were also allocated for free). This remained the position until spring 2008 when the Riksdag, approved a reduction for installations at the rate of 15% for industries within the EU ETS, while those outside the ETS continued to be taxed at 21%.

Under a further set of reforms in 2009, from January 1, 2011 the carbon tax has been abolished for all firms within the EU ETS – thus bringing an end to the double taxation. The carbon tax remains in place only for industries outside the EU ETS. Bohlin (2010) estimates the share of industry covered by the EU ETS in Sweden, and emphasises that in the major emitters, pulp and paper and other energy-intensive manufacturing, the majority of industries fall within the EU ETS and thus are exempt from the carbon tax.

Table 3.3: ETS Share of industry in Sweden (Bohlin 2010)

Industry	ETS Share (2005)
A15 Manufacture of food, textiles and wearing apparel	23%
A20 Manufacture of wood and wood products, publishing	4%
A21 Manufacture of pulp, paper and paper products	83%
A23 Refineries	21%
A24 Other energy-intense manufacturing	56%
A30 Other manufacturing	14%

Low reliance on fossil fuels

The industrial emissions and energy profile of Sweden is quite different from that of the EU as a whole; it is relatively more electricity and biofuel-intensive than the EU average. This, along with the fact that the Swedish electricity system is dominated by nuclear and hydro-electricity generation, makes the carbon intensity of industry in Sweden lower than in other countries. Therefore, any exemptions offered in the sector in Sweden are less costly than similar exemptions offered in other countries.[161]

Encourage the efficient use of district heat

The use of district heat by industry is relatively small-scale – the Swedish Energy Agency estimates that it accounts for only 4% of total energy use in industry. Consequently, the total value of this subsidy has been estimated at only €3.32 million,

[161] Hammar, H. and Sjostrom, M. (2011), 'Accounting for behavioural effects of increases in the carbon dioxide (CO_2) tax in revenue estimation in Sweden', *Energy Policy* 39 pp. 6672-6676.

split relatively evenly between the three different types of fuel.[162] The main aim of the subsidy is to help promote the efficient use of district heat in Swedish industry, as part of the wider development of district heat and the use of waste heat across the economy.

Finland

The main reasons given for carbon tax exemptions in Finland were:

- to protect Finland's world-leading CHP industry
- knock on effects
- to achieve a high rate of reduction of carbon emissions

World-leading CHP industry

Finland is a world-leader in generation by combined heat and power (CHP) industry and there were fears that high carbon tax rates might damage the industry. So, a reduced rate of carbon tax was introduced.

Knock-on effects

In 2010, 75% of heat required for district heating in Finland was produced by CHP, along with 35% of the country's electricity supply.[163] CHP's share of electricity generated by thermal power is even higher, accounting for 65% in 2007.[164]

Finland has high levels of development in district heating, industrial CHP and the use of biofuels within these areas. The IEA estimates that CHP can yield an energy saving of 15-30% as against the separate production of heat and power – however government incentives are required to support the use of the technology.[165]

High carbon emissions

A third of CHP is fired by biofuels and waste, just under 30% by natural gas, 18% by coal and 18% by peat with just over 1% from oil. In 2010, 25% of Finland's total carbon emissions came from CHP production.

The promotion of CHP generally, and biofuel-fired CHP more specifically, is seen as a key success of Finland's carbon tax regime. The distinctive reliance on this level of CHP and the importance of heat and district heat in Finland's energy profile provide the main justifications for the tax exemption.

Interaction with other instruments

This section looks at the interaction with other instruments, first in Sweden and then in Finland.

Sweden

The instruments identified as relevant to Sweden are:

- EU ETS
- Sweden Energy tax
- Sweden Vehicle tax
- Sweden Energy Efficiency Improvement Programme

EU ETS

Sweden's carbon taxation has been heavily influenced by the evolution of the EU ETS. The majority of industries are included in the EU ETS, and without some subsidy the problem of double taxation arises.

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[162] OECD (2012) *Inventory of Estimated Budgetary Support and Tax Expenditure for Fossil Fuels 2013*, OECD Publishing.

[163] The International CHP/DHC Collaborative (2009) CHP/DHC Country Scorecard: Finland.

[164] Ibid.

[165] IEA (2010), *Combined Heat and Power, Energy Technology Systems Analysis Programme.*

In contrast, Finnish industries were entitled to a 50% reduction of the CO2 tax in 2012; but had to pay the full rate of energy tax. Although there has been some reduction in the CO2 tax to avoid double taxation, this affords only partial relief.

Sweden Energy tax

Sweden's carbon tax is designed to work in co-operation with the energy tax, as can be seen from the 50% reduction in the rate of energy tax when the carbon tax was introduced in 1991.

Sweden Vehicle tax

In harmony with the spirit of carbon taxation and the changes made to energy and carbon taxes in 2009, Sweden's vehicle taxes have been changed to a differentiated model where tax rates are based on the levels of carbon dioxide emitted.

Sweden Energy Efficiency Improvement Programme

Sweden is engaged in a five-year programme (running until 2014) to improve energy efficiency at the regional and local levels. [166] The changes to relative prices of fuels introduced by the carbon tax exemptions may affect the success of this programme.

Finland

The instrument identified as relevant to Finland is:

- the energy component of excise tax

Finland Energy component of excise tax

Finland's excise tax consists of both energy and carbon taxes, and recent reforms have shown the intrinsic links between them.

Potential barriers to removal

This section looks at the barriers to removal: first in Sweden and then in Finland.

Sweden

Sweden has reformed the exemption/subsidies related to its carbon tax twice in recent years. The first reform, in 2008, tackled the double taxation faced by industries covered by both the carbon tax and the EU ETS, and the second, wider reform in 2009 brought about a more general reduction of the tax exemptions and sought to convert the carbon tax into a more universal instrument. Thus, Sweden has already embarked on an important programme of subsidy reform.

Given the wide scope of recent reform there are likely to be powerful political barriers to removing the remaining subsidies in the short term. Nevertheless, the policy direction shown by the Riksdag in the 2009 reforms and the ambitious environmental targets set by Sweden show a desire to create, strong, robust, universal policy instruments to mitigate climate change. The political barriers that may arise are:

- interest groups: strength of special interest groups
- interest groups: weak lobbying power of households to oppose industrial interest groups
- politically sensitive issues: unpopularity of CO_2 instrument
- competitiveness: competitiveness and carbon leakage
- EU legislation: EU ETS

Strength of special interest groups

It is likely that interest groups will provide powerful support for keeping the remaining subsidies largely unchanged, especially in well-organised sectors such as

[166] Sweden Energy Agency (2010), *Energy in Sweden 2010.*

agriculture and industry that are strong in certain regions and have much political clout.

The difficulty (but not impossibility) of agricultural reform was very evident in the political opposition to the agricultural policy reforms of 1990.[167] The power of energy-intensive firms to lobby for exemptions from carbon policy constraints can be seen clearly in the evolution of the EU ETS and its instruments for avoiding carbon leakage.[168] The scale of the recent reforms has shown that this barrier can be overcome, but it also reveals clearly that the interaction with other instruments, namely the EU ETS, is important in achieving these changes.

Weak lobbying power of households to oppose industrial interest groups

Hammar and Sjostrom show that the exemptions that accompanied the introduction of the carbon tax facilitated the introduction of the tax, and especially the rate at which it was introduced. The exemptions calmed fears about carbon leakage, and competitiveness, and also allowed an ambitious and rising rate of carbon tax to be introduced. However, the consequence of the system of exemptions for industry is that the burden of the carbon tax has fallen heavily on households and, moreover, the implicit carbon tax rate is in fact far lower than the general level. The Swedish National Audit Office computes the implicit tax value at between SEK422 and SEK551 per tonne of carbon dioxide between 2003 and 2009, well below the headline level of SEK1,050.169 The implicit level also varied substantially between sectors. Eurostat estimated that in 2003 there was a total effective rate of €23/tonne CO_2 but households paid €43, agriculture and fishery €36, mining and quarrying €14 and transportation €15.170 The fact that the burden fell mostly on households, traditionally a sector with less lobbying power than industry, was probably important in allowing the government to introduce the carbon tax at such a high rate.

Unpopularity of CO_2 taxation

One factor that may hinder future reform of carbon tax exemptions in Sweden is the relative unpopularity of the tax. Jagers and Hammar (2009) highlight that consumer's rank the tax below other instruments aimed at reducing the emissions from private transport on a scale of preferred instruments. Although only one of the current exemptions relates to private transport, if the same preference ranking also holds for other industries, this might create a powerful barrier to further reform.

Competitiveness and carbon leakage

There remains a fear that industries outside the EU ETS could relocate abroad. There are similar worries about technologies that promote the efficient use of energy such as the use of district heat in industry. These worries are similar to the concerns that motivated the tax exemptions for CHP in Finland.

EU ETS

The high rate of the carbon tax also highlights an important issue related to subsidies and the use of carbon taxation alongside the EU ETS. Sweden's initial response to the EU ETS was not to remove the taxation on the industries covered by the scheme. Initially, there were moves to remove part of the tax levied on industry in 2008. However, only a limited part of the tax levied on industry was removed in 2008,

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[167] Rabinowicz (2003), 'Swedish Agricultural Policy Reforms', Workshop on Agricultural Policy Reform and Adjustment.

[168] Wettestad (2009), 'EU energy-intensive industries and emission trading: losers becoming winners?', *Environmental Policy and Governance* 19(5) pp. 309-320.

[169] Swedish National Audit Office (2012), *Climate-related taxes: Who pays?*, RIR 2012:1.

[170] Eurostat (2003), *Energy Taxes in the Nordic Countries – Does the polluter pay?*

because of uncertainty about the stringency of the ETS scheme. It was only after the scheme had been established for six years that the entire carbon tax was removed. Thus, for a period of time industries in Sweden were effectively accounting more than once for their emissions. This highlights the importance of coordinating national and European climate policy

Lessons learnt from the Swedish case

The Swedish example provides lessons for the rest of the EU about the use of carbon taxes alongside the EU ETS, and also about first introducing, using and then reforming exemptions in order to implement a policy but then to make the tax and exemptions a more efficient instrument. to serve the end of the policy.

The Swedish experience with carbon tax exemptions highlights the importance of concerns about competitiveness and distributional fairness as barriers to reform. The exemptions in Sweden cover industries potentially exposed to international competition and carbon leakage along with industries of particular importance to the economy of certain regions, such as agriculture and forestry. The Swedish experience shows that concerns about competitiveness and carbon leakage can be reduced over time as initial fears about the effects of tax changes become weaker, while assistance regionally important industries through tax exemptions create clients reluctant to give up the subsidies to which they have become accustomed.

Finland

The potential barriers that might hinder the removal of the CO_2 subsidy to CHP production are:

- entitlement effect
- importance of supply: importance of contribution to the energy mix
- rising fuel prices and high subsequent prices in a context of high demand for energy for heating

Entitlement effect

The Finnish carbon tax regime has been operating with an exemption for its CHP industry since its inception over 20 years ago. The main question now is for how long Finland should support the continued development of this technology through tax exemptions, instead of creating a level playing field for all energy technologies. Given that the aim of the subsidy was to help the industry grow, develop and become cost-competitive, it is difficult to judge when this aim has been achieved. This is one example of the wider problem of the optimal time for withdrawing support for renewables.[171] The danger is that a culture of entitlement is created within the industry, and that this persists long after the aim of the subsidy has been achieved, or after it is no longer cost-effective to continue the subsidy as it fails to achieve sustainable growth.

Importance of contribution to energy mix

CHP plays such a central role in Finland's energy mix that removal of the tax exemption may prove politically and socially difficult. It supplies 75% of locally-generated electricity, 35% of the country's total electricity and 65% of electricity generated by thermal power.

[171] See the work on this subject by Rutger-Jan Lange of the Electricity Policy Research Group at Cambridge University, in particular *The Problem of Alternatives*, available at: http://rutgerjanlange.files.wordpress.com/2012/04/the-problem-of-alternatives-v2.pdf

High energy demand

Because of the cold climate, Finnish households consume more than four times as much heat as the EU average and Finnish consume almost three times as much as their EU counterparts. This level of heat consumption has created a strong incentive for efficient cogeneration of power and heat. Under these circumstances, the prospect of a (possibly steep) rise in prices following the ending of subsidies can be expected to arouse strong opposition to the change.

Expected impacts of removal

The changes to the tax exemptions passed by the Swedish Riksdag in 2009, together with a set of other financial policy instruments, are expected to yield a total reduction of 2m tonnes of CO2e (Carbon Dioxide equivalent) by 2020.[172] Since these reforms target the largest of the remaining exemptions, any future reforms will probably provide more limited emissions benefits.

Model results

Taking all the Swedish subsidies together, the model results from the scenarios in which the subsidies are phased out suggest that:

- GDP could increase by around 0.07%
- employment could increase by around 0.03%
- energy consumption could fall by around 0.8%
- CO_2 emissions could fall by 1-2%

In summary, phasing out subsidies would lead to modest reductions in energy consumption and emissions, at no economic cost. If the consequent revenues are used in an efficient manner, then a small economic benefit might be possible, largely due to reduced imports of fossil fuels.

The case is quite similar for Finland, although in this scenario the results are much more dependent on modelling assumptions. We have assumed higher fuel costs for producers of CHP but have not adjusted the demand for heat from CHP plants, which could fall (and perhaps be replaced by gas) if prices rose. But, on the assumptions we have made, energy consumption could fall by around 0.2% by 2020 and emissions by 0.4%, with almost no economic impact.

More detailed sectoral impacts

The Swedish carbon tax exemptions cover a wide range of sectors and therefore the impacts of removing the subsidies are also dispersed (and small in economic terms for each sector). In general, there is little change in the industrial and manufacturing sectors, which face slightly higher costs, while services sectors typically increase output in line with the small increase in GDP.

Nevertheless, it should be noted that some sub-sectors and individual firms might be particularly affected by phasing out the subsidies, and thus would face impacts larger than predicted by the modelling.

The loss of output in the energy supply sectors is small, because of the share of imports in Swedish fossil fuels.

In Finland only the energy-supplying sectors are affected under our scenario assumptions, also by a small amount.

[172] Swedish National Audit Office (2012), *Climate-related taxes: Who pays?*, RIR 2012:1.

Possible behavioural responses

Hammar and Akerfeldt (2011)[173] have emphasised that the carbon tax base in Sweden has been inelastic with regard to petrol and diesel used for transport. Consequently, it is uncertain whether the removal of the diesel tax exemption for agriculture would have any effect on the choice of fuels. However, there does seem to have been a major impact from the CO_2 tax on the types of fuels used for heating, with major growth in biofuels and non-fossil fuel sources including waste products. Therefore, the removal of the remaining tax exemptions for heat could incentivise further growth in this area.

Distributional impacts

The restructuring of the carbon tax in 2009, along with changes to the energy tax and vehicle taxes, is estimated to have adversely affected mining & quarrying, manufacturing, and agriculture, forestry & fishing. Before these reforms, the highest implicit tax rates were faced by households, but the 2009 reforms shifted the burden towards agriculture, mining and industry not covered by the EU ETS; and any future changes can be expected to continue this shift. The removal of the carbon tax from industry covered by the EU ETS ended the possibility of double taxation, but it also brought about a fall in the direct costs borne by these industries, because emissions permits had been allocated for free in Sweden during Phase II of the EU ETS. The Swedish National Audit Office found that the 2009 restructuring did not have major effects on the income or carbon dioxide emissions of households. This suggests that any future reforms along the same lines would also make little difference to households in these respects.

Given the nature of the sectors covered by the carbon tax exemptions, predominantly agriculture and non-EU ETS industry, it would be reasonable to assume that the burden would fall more heavily on small and medium enterprises than on large ones. The agriculture sector tends to have lower levels of concentration than other sectors of the economy and the proportion of small and medium operators tends to be higher.[174] Since the largest industrial operators are included in the EU ETS, the companies currently covered by the carbon tax exemption are likely to be smaller, and thus the impact of phasing-out the exemptions will fall more heavily on small and medium-sized enterprises than on larger industrial concerns.

According to Eurostat's estimates of the implicit taxes faced by different sectors in Finland, the exemption for electricity production means that households paid an implicit energy tax rate eight times that of industry in 1999. The removal of the CHP exemption might affect households more than industry; because household heat consumption is four times greater than the EU average while industry's consumption is only three times higher.

Impacts on public balance

The CO_2 tax produced around 1.8% of total Swedish tax revenues in 2009 and the total subsidy covers less than 10% of the potential emissions covered by the instrument.[175] Thus, the revenue benefits in favour of keeping the exemptions or reforming them are relatively small.

[173] Hammar, H. and Akerfeldt S. (2011), *CO_2 taxation in Sweden: 20 years of experience and looking ahead*, Global Untmaning (Global Challenge), Stockholm.

[174] According to Eurostat data, the average size of an agricultural holding in Sweden in 2007 was 57 ha and the 72,600 holdings employed 57,100 full-time-equivalent workers.

[175] Hammar, H. and Sjostrom, M. (2011), 'Accounting for behavioural effects of increases in the carbon dioxide (CO_2) tax in revenue estimation in Sweden', *Energy Policy* 39 pp. 6672-6676.

The carbon tax component of the Finnish excise tax has been estimated at approximately €500 million in 2010, amounting to approximately half of 1% of the government's total revenues. This estimate is expected to be higher in 2012 as the Finnish energy taxation reform in 2012 raised the carbon tax rate considerably[176].

Conclusions

Finland and Sweden were among the first countries to implement carbon taxes. The exemptions that were granted at the outset contributed to the political acceptance of the taxes, and of the tax rates that were set. In the case of Sweden the rationale for the exemptions was based on concerns about competitiveness of the domestic industrial sectors and about carbon leakage. The same concerns had motivated similar exemptions from previous environmental taxes). In Finland the reason for the exemption was related to the development of the domestic CHP industry.

The carbon tax and its exemptions in Sweden have developed since the 1990s, but there is still a wide range of exemptions across a broad spectrum of sectors. The most notable change was the introduction of the EU ETS, which meant that competitor industries in other European countries were also paying a price on carbon; ETS sectors were eventually removed from the carbon tax altogether. The other industry sectors, however, lost their exemption from the carbon tax. However, in general these are not intensive users of energy.

The remaining exemptions cover sectors that have an important role in the economies of the regions and strong lobbying power (agriculture, forestry) or where there is an argument for promoting low-carbon fuels (transport). The result is that the carbon tax falls disproportionately on households; but this has not led to popular demand for reform.

The Swedish case, therefore, provides some important lessons for other countries that are considering domestic carbon taxation. The range of exemptions was helpful in establishing the carbon tax initially, but it has turned out to be difficult to remove. The most notable example of subsidy being removed (the exemption from carbon tax) was accompanied by a reform of the tax to exclude industrial sectors covered by the EU ETS.

In Finland, the justification for the exemption was to aid the development of a new, and relatively low-carbon, CHP sector. The key question is whether, 20 years later, this justification is still relevant. To answer this question requires a detailed analysis of the energy system in Finland, including the various technological options available, linked to the possible social effects of higher heating costs for homes.

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[176] http://www.environment.fi/download.asp?contentid=134385&lan=en

3.8 UK

Detailed definition

The UK government implicitly subsidises energy consumption (fossil fuels and electricity) by charging household consumers a reduced rate of VAT, 5% as opposed to the standard rate of 20%. The size of the subsidy (for fossil fuels, but not electricity) was calculated by the OECD using the IEA's data on residential consumption of natural gas, heating oil (which includes kerosene etc.) and solid fuel (various forms of coal), categorised by the OECD to three fossil fuel subsidies for coal, oil and natural gas (but not electricity). CE's estimate of the total value of the reduced VAT subsidy on power and energy, including electricity, is €5.5bn The OECD estimated the revenue foregone by the government was over €4.5 billion (nearly £4 billion) in 2011.

The VAT Act 1994[177] stipulates that electricity, gas, heating oil and solid fuel which are used by households[178], charities for non-business use, organisations who use less than 60% of the supply to a building which contains other 'approved users', and businesses whose supply is below a fixed low threshold are all charged at the 'reduced' VAT rate. The focus of this analysis is limited to the supply to UK households.

Table 3.4: UK's VAT Reduced Rate: Summary

Country	UK		
Subsidy	Reduced rate of VAT for fuel and power, OECD code GBR_te_06		
Brief description	Data from 1997. Applied from 1973 5% VAT paid on fuel and power by consumers for heating and general power. For fossil fuels like natural gas, kerosene, and coal.		
Reference in E3ME	UK_S4	**Support type**	Consumer
Subsidy value in 2011 (OECD)		**Expiry date (if applicable)**	none
hard coal & other coal	€93.72m		
crude oil, middle distillates & heavy fuel oil	€438.18m	**Expiry date (if applicable)**	none
natural gas	€4,044.49m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.55%	CO_2 emission	-0.54%
GDP	+0.00%	Employment	+0.01%

Note(s): Figures shown are % difference from baseline.
Source(s): OECD, 2013, p 6 of GBR; Cambridge Econometrics, E3ME.

Background

Domestic fuel and power have been subject to a reduced VAT rate since 1973, the year in which VAT was introduced in the UK to replace the purchase tax. Initially,

[177] c.23, schedule 7A, Part 2, Group 1 – Supplies of domestic fuel or power.

[178] deliveries of less than 2,300 litres (HMRC, 2012).

heating fuel and power were exempt from VAT, but in April 1994 the government imposed a VAT rate of 8%. This was lowered to 5% by the new Labour government in September 1997. At the time 5% was, and still is, the lowest possible VAT rate at which energy sales could be taxed under the European guidelines[179].

Subsidising heating fuel for domestic purposes is a long-standing feature of government policy. This subsidy exists in statute law in the UK and removal would require an amendment to be passed. Previous attempts to increase the VAT rate have faced strong public and political opposition[180], most notably in 1995 when the government was defeated in Parliament. The imposition of an 8% rate in 1994 was intended to be the first part of a two-stage programme. There was due to be a further increase to the then standard rate of 17.5% in April 1995 but this did not happen, because the government was defeated in a Budget Resolution vote in December 1994 (by 1994 the government had only a bare majority) and the 8% rate remained in place until 1997 when it was reduced to the current 5% rate. There is now little sense of urgency or political will to alter the VAT rate as the political cost seems (to any government) likely to outweigh the environmental gains.

It is useful to examine the reasons for the failure to raise the rate in 1995 as this failure might show which obstacles could arise in the future. The two principal concerns were that the higher rate might bring about an inequitable distribution of income and might lead more households into 'fuel poverty'[181]. Whether or not these fears were justified, the presence of such a perception, misguided or otherwise, these concerns presented a very real political barrier. In fact, there were plans for several alternative provisions of relief to address these concerns[182], but the rapid succession of proposed increases is thought to have led to more intense opposition because the public did not have enough time to prepare for the changes. Since 1995, the UK has further extended its provision of alternative mechanisms to meet the same concerns[183]. Very recent evidence suggests, however, that the public awareness of these programmes and consequent uptake have been rather limited.[184] These factors influence the context in which a rise in the VAT rate would be contemplated.

Reasons for introduction and whether they are still applicable

The government cited two main objectives as a justification for lowering the VAT rate on fuel from 8% to 5% in 1997:

- to improve distributional equity

[179] See VAT Directive 2006/112/EC.

[180] Boardman, B. (2010). *Fixing Fuel Poverty: Challenges and Solutions*. Earthscan.

[181] A household is considered to be in fuel poverty when it would need to spend 10% or more of its disposable income to achieve a defined level of warmth..

[182] The government planned to have compensatory social security increases in pensions and other income-related benefits. The proposed increased spending on the Home Energy Efficiency Scheme and Cold Weather Payments did take place. http://archive.treasury.gov.uk/budget/1994/statement/hmtstat1.txt

[183] See https://www.gov.uk/government/policies/helping-households-to-cut-their-energy-bills for a list of current initiatives to help reduce household bills.

[184]https://www.gov.uk/government/publications/public-attitudes-tracking-survey-wave-4 - The fourth wave of data was collected between 12 December 2012 and 2 January 2013 using face-to-face in-home interviews with a representative sample of 2,107 households in the UK.

- to reduce fuel poverty without jeopardising commitments to achieve reductions in CO_2 emissions

On the first point it was argued that a reduced rate would promote 'fairness'. This is a socio-economic reason commonly cited in the literature in support of VAT cuts on items that are considered to be necessities[185]. Low-income households typically spend a higher proportion of their income on essential items such as energy for heating and are therefore more sensitive to changes in price. In 2009, the lowest decile (bottom 10% of households) spent on average 7.7% of their budget on fuel, more than twice the 3.4% proportion spent by the highest income decile.[186] There was a particular concern that pensioners would suffer, even though the government prosed to compensate by raising the state pension. This increase was abandoned when the VAT rate did not rise [187].

The impact on CO2 emissions depends upon the elasticities for energy demand. Although estimates of these elasticities vary, it is generally thought that demand for heating fuels is highly inelastic. For example, if the long-run price elasticity is -0.2 (the figure used in the E3ME model), the reduction in the VAT rate from 8% to 5% would lead to an increase in energy demand of only around 0.6% in households. Therefore the reduced VAT rate was not seen as having had a substantial impact on CO2 emissions.

Are the justifications for the VAT subsidy still relevant?

The two objectives of the subsidy seem generally to be accepted as worthwhile. However, it is frequently argued that the VAT system is not the most efficient tool to achieve these goals and that; consequently, there may be better ways to achieve the same ends.

Alternative distributional equity mechanisms

In particular, there are good reasons for believing that, far from promoting a more equitable distribution of income, VAT systems benefit higher-income households more than lower-income ones in absolute terms.[188] Since 1995 new policies have been introduced to achieve greater fairness and to reduce fuel poverty, thus reducing the need to rely on the reduced VAT rate to aid low-income households. These mechanisms are often better targeted at the most vulnerable groups. Nevertheless, measures such as reduced VAT on energy-saving materials are still not of much use to low-income households because they may not have access to the necessary finance to install such materials. This is a 'price barrier' to making home improvements; there are also 'non-price barriers', such as living in privately rented accommodation or social housing.

Moreover, if the government targets GHG emissions through new taxes the interactions within the tax regime could become more complex. This leads to a risk that the system, as a whole, may fail to achieve the distributional objectives[189].

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[185] Seely, A., & Twigger, R. (1997). *VAT on fuel & power* - Research Paper 97/87. London: House of Commons Library, 9 July 1997, p. 8.

[186] Fuel price inflation and low income consumers, William Baker.

[187] Fouquet, R. (1995), ´The impact of VAT introduction on residential energy demand: an investigation using the co-integration approach´, *Energy Economics* 17(3) 237-47.

[188] *Value added tax and excises*, Mirrlees Review, Institute of Fiscal Studies, 2007.

[189] http://www.oecd.org/unitedkingdom/45642018.pdf p 24.

However, the main reason for the reduced effectiveness of the lower rate of VAT in combating fuel poverty is the very steep increase in wholesale fuel prices since 2005, and the consequent rise in household fuel bills, despite the various other policies to tackle fuel poverty. Consequently, the numbers of households in fuel poverty in the UK have increased as well. In 2012Q3 the RPI index for natural gas, the main component of household fossil fuel demand, reached 220.4 from a base of 100 in 2005[190]. Between 2001 and 2011 real prices for natural gas have risen by 111% and by 141% for heating oil.[191] The rising fuel prices accompanied by stagnating real incomes [192] have led to an increased burden for households, particularly low-income households. This is happening at a time of great uncertainty about the future path of the economy and the labour market.[193]

Interaction with other instruments

There are some important interactions with other policies in the UK that aim to help households reduce their fuel bills and/or their energy consumption or to achieve greater fairness. The effectiveness and efficiency of any scheme targeted at particular groups will depend on both the targeting method and administrative capacity. Low levels of administrative capacity can lead to programmes with significant identification errors that, unintentionally, exclude low-income households and include high-income households.[194]

The relevant policies and programmes include:

Housing energy efficiency programmes:

- Green Deal
- Energy Company Obligation (ECO)
- decent homes

Energy efficient products:

- energy efficiency labels and standards for appliances
- smart meters

Renewable energy promotion:

- Renewable Obligation
- feed-in tariffs
- renewable heat incentive

Energy related payments:

- winter fuel payments
- cold weather payment
- warm home discount

Reduced rates:

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[190] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65940/7341-quarterly-energy-prices-december-2012.pdf p15.

[191] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65898/5942-uk-energy-in-brief-2012.pdf p40.

[192] http://www.ons.gov.uk/ons/dcp171766_283109.pdf

[193] http://www.oecd.org/eco/surveys/UK_Overview_ENG.pdf

[194] *Subsidies in the Energy Sector: An Overview*, World Bank, July 2010 p 53.

- reduced VAT on ESM
- exemption from minimum excise duty rates

Green deal The Green Deal aims to reduce energy consumption by households by helping business and home owners to employ more green technologies in their properties.

The new green technology is installed into the property with no up-front costs and the loan is paid back through energy bills over a period of time. The loan repayments stay with the property, where the energy-savings are occurring, and not with the bill payer. The amount to be repaid for Green Deal improvements is based on what a typical household or business is expected to save on energy bills as a result of the greater efficiency.

Energy Company Obligation The ECO works with the Green Deal to create a legal obligation on energy suppliers to provide heating and insulation packages for vulnerable and low-income households, particularly in low-income communities and rural areas. This scheme targets households that are missed by the Green Deal, such as those with solid walls or insulation problems that are difficult to treat[195].

Decent Homes The Decent Homes programme was introduced in 2000 when there was a large backlog of repairs in local authority housing. The aim was to bring all social housing up to the decent homes standard by 2010. At the start of the programme it was acknowledged that, in addition to the backlog, other homes would also become non-decent as the programme progressed. In April 2001, there were 1.6 million 'non-decent' homes in the social sector, 39% of all social housing. The National Audit Office[196] calculated in 2010 that 86% of the social housing stock was 'decent' in April 2009, and the Department for Communities and Local Government forecast in 2009 that 100% decency would not be achieved until 2018-19.

The energy efficiency of the social housing stock has increased during the programme, and more rapidly than in the private sector, with the SAP rating for social housing increasing from 51.9 in 2001 to 57.8 in 2007, compared with a rise from 44.1 to 48.1 for private housing.

Energy efficiency labels and standards for appliances EU energy labelling gives information about the energy usage and efficiency of a product. This should help to reduce energy bills and CO2 emissions and also encourage producers to improve their designs. However, greater energy efficiency may lead to the heat replacement effect, a type of rebound effect. As more energy-efficient products generate less 'waste' heat, households may use their heating systems more (although the heating energy would come from a more efficient source).

Smart meters Smart meters are installed in houses free of charge by energy companies. The smart meters display the level of energy usage and communicate with their energy company. The aim is to inform the household about its level of usage and to encourage a decrease in energy consumption.

Energy companies will increase prices to pay for these one-off installations and eventually replacement costs. Higher-income households may benefit more from this measure than low-income households, because they have more scope to reduce or shift their consumption of energy.

[195] http://www.ofgem.gov.uk/Sustainability/Environment/ECO/Pages/index.aspx

[196] http://www.nao.org.uk/wp-content/uploads/2010/01/0910212.pdf

Renewables Obligation This legislation requires that electricity suppliers in the UK must purchase an increasing proportion of their electricity from renewable sources.

Feed In Tariffs Feed in Tariffs (FITs), introduced in 2010, replaced UK government grants as the main financial incentive to encourage uptake of renewable electricity-generating technologies, such as wind turbines and solar photovoltaic panels. Both domestic and non-domestic consumers are eligible.

There is a second element to this programme known as a ‘generation’ or ‘export’ tariff, which applies when the household sell unused electricity back to the energy supplier. The household is paid for the electricity generated by the equipment they have installed, even if all the electricity is used by the consumer; and they are paid also for any surplus electricity exported to the grid. Households will also make savings on their electricity bills. The tariffs are guaranteed to be available for the next 20 years.

The distributional impact of this policy is negative, for two reasons. Energy companies have to raise their prices to cover the cost of the tariffs and it is likely that only high-income households will be able to invest in the new equipment.

Renewable Heat Incentive The renewable heat incentive works on the same principle and in the same way as feed in tariffs. It provides grants for the acquisition and installation of renewable heat generation technology in non-domestic buildings. It is due to be extended to domestic residences. The subsidy will last for 20 years and its size will depend upon which renewable heat system is installed. Households will receive payments for the hot water and heat that they produce and consume.

Winter fuel payments The winter fuel payment is an annual payment to those aged over 60 of between £100 and £300 depending on the circumstances of the household. The payment is not means tested even though the aim is to assist households suffering from fuel poverty. This helps households with pensioners pay their bills, but is not related to the price of fuel.

Cold weather payment This is a payment of £25 per week paid to persons in receipt of some specified benefits[197] when the temperature was or was forecast to be average 0% Celsius or below. This reduces the burden on households in regions with bad weather, but it is not related to the price of fuel.

The winter fuel payments and cold weather allowances are tools which are used to target the most vulnerable households without specifying the energy source which they must use to heat their home. It is for this reason that the OECD does not regard them as EHS in its inventory.

Warm Home Discount This discount is given in the form of a rebate on bills for households that are vulnerable under certain criteria, i.e. those receiving the ‘Guarantee Credit’ element of the pension. The level of rebate for 2013/14 is £135[198].

Reduced VAT on ESM Energy saving materials and building work by contractors installing such materials are subject to a lower rate of VAT than normal. If the materials and equipment go into a new house at the time of construction, no VAT is charged; but a lower rate is charged when they are installed as part of a larger project such as building a new roof or an

[197] Pension Credit Income Support, income-based Jobseeker’s Allowance and income-related Employment and Support Allowance (ESA).

[198] https://www.gov.uk/the-warm-home-discount-scheme

extension, or installing a central heating system. The lower rate incentivises one-off projects to improve households' energy efficiency in an attempt to mitigate rising fuel costs.

Exemption from minimum excise duty rates

In the UK domestic consumption of certain fuels and power for heating purposes is also exempt from excise duty rates[199]. Combined with the reduced VAT rate this acts as a 'double subsidy'. The table below shows which fuels carry reduced VAT rates and which are exempt from excise duty.

Table 3.5: UK's fuel excise and VAT rates

Fuel	**Excise duty per 1000 litres for domestic users in the UK (GBP)**	**Excise duty per 1000 litres for domestic users in the UK (Euros)**	**VAT (%)**
Leaded Petrol	676.70	787.22	20,00
Unleaded Petrol	579.50	674.15	20,00
Gas Oil	111.40	129.59	20,00
Kerosene	0	0	20,00
Heavy fuel Oil	107.00	124.47	5,00
Liquid Petroleum Gas	0	0	5,00
Natural Gas	0	0	5,00
Coal & Coke	0	0	5,00
Electricity	0	0	5,00

Sources: (European Commission Director General Taxation and Tax administration, 1 July 2012).

Potential barriers to removal

There are a many obstacles to ending the lower rate of VAT. This section aims to identify the largest.

- distributional: distributional concerns and fuel poverty
- timing and macroeconomic health: timing of a VAT increase in the wider economic context
- interaction with other instruments: possible increases in VAT for energy-saving products
- communication: isolation effect and visibility of changes
- interest groups and communication: lobbying and the public perception
- administrative costs for alternatives
- previous failures to remove EHS: Country comparison
- EU legislation: EU VAT laws
- MS legislation: Warm Homes and Energy Conservation Act 2000 (WHECA)

Distributional concerns and fuel poverty

The issue of 'fuel poverty' remains the biggest single impediment to subsidy reform; it presents a strong political and legal case against increasing the VAT rate for fuel. The

[199] Note that the OECD does not consider the reduced/exempt excise duty rates to be a subsidy to fossil fuel consumption except for the reduced rate of excise paid on red diesel, for which OECD has no estimate of the revenue forgone.

problem of fuel poverty has been widely recognised within the UK. It is estimated that 6-7 million households are currently in fuel poverty in the UK[200].

Fuel poverty and distributional issues are often taken to be parts of the same issue, but it should be recognised that fuel poverty is distinct from distributional equity. Blurring of the issues can lead to a misdiagnosis of the relative importance of each of the barriers to reform and to the development of compensatory schemes which fail to target the heart of the public's concern. Indeed, a key concern seems to be how any compensation scheme might be designed to avoid exacerbating the benefit/poverty trap. The direct effect of higher fuel prices is that they lead to greater fuel poverty, while the indirect effect is to worsen the distributional imbalance.

It has been suggested that the undesirable consequences of higher environmental taxation in terms of income distribution are best dealt with separately in the tax and benefit system rather than through exemptions to the environmental tax because these can create the wrong consumption incentives. However, the alternative measures have their own flaws and coverage issues. These concerns clearly need to be addressed. They would also need to be communicated effectively to the general public and popular press. It should be noted that the current government is attempting to introduce comprehensive benefit reforms and changes in energy prices could be a complicating factor.

Timing of a VAT increase in the wider economic context

Since the financial crisis and subsequent recession, UK economic growth has stagnated. After the initial fiscal stimulus, the government has implemented a package of austerity measures in which the standard rate of VAT increased from 17.5% to 20% (following a temporary reduction to 15% immediately after the crisis).

In 2013, the economic recovery looks weak and there are calls for a reduction in the standard VAT rate. An increase in VAT that affected all households would therefore be politically challenging.

At the same time, inflation in the UK remains above the Bank of England's target. An increase in VAT rates would raise inflation further and make future reduction more difficult.

Given the current economic climate, any change in VAT rates for heating fuels would therefore need to take into account the possibility that it might undermine public support for climate change policies[201]. Survey evidence[202] indicates that 13% of citizens see inflation and rising prices as their top concern. Rising prices featured among the top three concerns for 15% of respondents. This worry is carried through to energy bills as 50% of respondents were either worried or very worried about their bills. Moreover, this sentiment has been growing. Indeed the share of energy bills relative to other household costs has been rising since early 2012, and bills are expected to increase further in the future. The same survey indicates that energy supply and climate change concerns combined are considered to be most the important issue facing Britain by only 5% of the sample.

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[200] (Department of Energy & Climate Change, 2012).

[201] Bowen & Rydge, (2011), *Climate change policy in the United Kingdom,* p. 22.

[202] https://www.gov.uk/government/publications/public-attitudes-tracking-survey-wave-4 - The fourth wave of data was collected between 12 December 2012 and 2 January 2013 using face-to-face in-home interviews with a representative sample of 2,107 households in the UK.

Previous attempts at reform

Previous failure to end the reduced rate VAT may well be an obstacle, because opponents can ask the question, 'what is different now?', and can point out that higher fuel prices are a further reason for supporting the status quo. A proposal that has not learnt from the lesson of the previous attempt would not be well received by the public[203]. Moreover, the previous attempt was followed by a series of poor results in by-elections. The opposition would be well aware this and the potential advantage of opposing the reform. A unified commitment by the major political parties would be the only way round this problem.

EU challenge against 5% VAT charged on ESM

Public and stakeholder support for this policy would also be affected by changes in legislation in other related aspects. At the time of writing in 2013 there is an on-going debate regarding the legitimacy of the UK's VAT rate for energy saving materials (ESM) as the European Commission[204] argues that the UK has breached the EU's VAT rules[205]. The UK government is challenging the EU on this matter and the case has reached the European Court of Justice. If the UK lost, this would make it even more unpopular to impose any further burdens on the energy costs of households.

However, if the VAT rate on ESM were raised, then the UK would be in breach of its own legal requirement that the taxation rates of ESM should not be higher than those on energy consumption. In order to comply with the UK legislation it would be necessary to raise the VAT rate on energy consumption to be at least as high as the new VAT rate on ESM. This might be seen as an aid rather than a barrier to EHS reform, but there would be a high risk of worsening public sentiment towards the EU.

Whether the UK wins or loses this battle, there would be different implications for the political casts and financial burdens. The political impact would be out of proportion to the actual level of demand that ESM represents.

Isolation effect and visibility

It has been suggested that tax increases which are presented to the public in isolation are not likely to be well received. This is because the taxes are not seen as part of a whole tax system and with distributional adjustments in the rest of the economy. An isolated presentation of the policy also contributes to the development of a false perception of the cost incurred both financially and environmentally, and thus strengthens support for the continuation of the current policy[206]. Moreover, isolated policy announcements are more likely to be subject to successful lobbying from opponents.

Another element is that policies which are highly visible tend to be more broadly understood by the public and removal of these types of policies is naturally harder. The reduced VAT rate would be an example of such a policy. This observation suggests the need to heighten the awareness and visibility of the policies targeted at compensating particular groups for the change in VAT rates.

Lobbying and the current public perception

There would be winners and losers if the government raised the VAT rate. If the government were to alter the distribution of benefits to increase the costs for the high-income households while concurrently reducing the costs for the low-income

[203] Golub, J. ed, (2003) *New Instruments for Environmental Policy in the EU* , p48.

[204] European Commission's Taxation and Customs Union Directorate-General.

[205] http://europa.eu/rapid/press-release_IP-13-139_en.htm?locale=en and See (VAT Directive 2006/112/EC).

[206] http://www.ifs.org.uk/mirrleesreview/pamphlet.pdf

households, there would be lobbying from the better-off households, and from trade unions.

The public can become used to subsidies, creating what has been referred to as an entitlement culture by recipients. This has occurred in the UK where some level of reduced VAT on domestic fuel and power has been a long-standing feature in the balance sheet (since 1973). This entrenchment makes it harder to change than other tax rates, where changes are more normal. This resistance could bell be stronger if those affected had to apply to gain compensation rather than being automatically eligible for the subsidy, as is the case with the lower VAT rate.

Administrative costs for alternatives

The shift from a blunt instrument to a targeted narrower mechanism would imply a higher administrative cost as currently the environmental subsidy makes use of the differentiated VAT system, which is easier to administer than more focused mechanisms. However, if the compensatory measure were applied via the income tax system, this would not be a costly change, as it would only involve varying the levels in another system. The compensatory mechanism would not be fully revenue-neutral from the perspective of each individual household. The result would be a distribution of winners and losers. For instance, households that spend a higher proportion of their income on fuel than the compensation they could expect to receive, based on their income group, would be disadvantaged.

Country comparison

There are reduced VAT rates on domestic fuel in Greece, Italy[207], France[208], Ireland[209] and Luxembourg, though the reduced rate in each of these countries is higher than in the UK. This presents a political barrier for the UK as questions will be raised as to why these other countries have not raised their rates[210]. However, it should also be noted that the VAT rate in most EU Member States is higher than 5%.

EU VAT laws

The UK government is taking advantage of a clause in EU law[211] that allows a reduced rate to be applied, but not below a minimum 5%. There is no legislation to harmonise EU VAT rates across Europe but rather a preference that rates progress towards uniformity. It has been argued that the freedom to choose reduced rates within constraints acts as a barrier to removal as it allows the subsidy to continue to exist legally and impedes the drive for reform[212]. However, this may change in the near future as the reduced VAT tax laws are currently under review. A report is due at the end of 2013.[213]

[207] 10% on sales of natural gas up to 480 cubic metres a year.

[208] 5 % on sales in Corsica only, the full rate of 20% is charged in the rest of mainland France. Only on standing charge

[209] 13.5% is the 'parking rate'. This is supposed to be a transition rate on the way to the standard rate though it has remained at this level for some time.

[210] However, the number of Member States with lower VAT rates on domestic fuel has come down from ten in 2005 to five in 2013.

http://ec.europa.eu/taxation_customs/resources/documents/taxation/vat/how_vat_works/rates/vat_rates_en.pdf The general shift could be used to weaken the force of the argument from the remaining few.

[211] 2006/112/EC, art. 98 and Annex III).

[212] *Tax reforms in EU Member States: Tax policy challenges for economic growth and fiscal sustainability*, 2012, WORKING PAPER N.34, Directorate General for Taxation and Customs Union Directorate General for Economic and Financial Affairs. p55.

[213] http://ec.europa.eu/taxation_customs/common/consultations/tax/2012_vat_rates_en.htm

Warm Homes and Energy Conservation Act 2000 (WHECA)

Under current UK legislation (WHECA), the target is that no household should be in fuel poverty, as far as is reasonably practicable, by 2016. A household is considered to be in fuel poverty if it would need to spend 10% or more of its disposable income to achieve a defined level of warmth.

One of the main factors that contribute to fuel poverty in the UK is the rise in fuel prices. An increase in the VAT rate for fuels would raise prices further and could therefore be seen as directly contravening the legislation against fuel poverty (WHECA). However, the counter argument is that a lower price of energy consumption is one factor deterring households from making capital investments that could reduce fuel poverty in the long run.

Expected impacts of removal

Model scenario

The E3ME model was used to assess a scenario in which VAT on all fuels was increased to the standard rate of 20%. The rate was gradually stepped up over time in a linear way, starting in 2013. The annual stepwise increase was modelled despite EU VAT law stating that only two rates of VAT are allowed: the full rate and the reduced rate. The gradual increase was chosen to make the policy more acceptable politically, since the public would see only small changes year-on-year.

It should be noted that our definition is different to that used by the OECD in that we also increase the VAT rate that is applied to electricity. This means that the total value of the subsidy is higher in the modelling than the estimate from the OECD; our estimate is €5.5bn in 2011 (taken from Eurostat expenditure data). The reason for modelling the subsidy this way was that the Eurostat household expenditure data do not disaggregate between different heating fuels. Moreover, the lower VAT on electricity is also an environmentally harmful subsidy.

The data in the E3ME database were updated to reflect the large reduction in real-terms expenditure on heating fuels in 2011. As with the other scenarios in this report, the additional revenues that are generated are offset by reductions in income tax rates.

Economic model results

The model results show that the net impacts are quite small at the macroeconomic and sectoral level. GDP is almost unchanged by 2020, with a very slight increase.

The initial impact of higher fuel prices for households pushes up the aggregate price level by 0.6%, meaning inflation would increase by up to 0.1 percentage points per annum up to 2020. This is largely a mathematical relationship; spending on heating fuels accounts for around 4% of total household consumption, so a near 15% increase in price cuts real incomes by 0.6%. However, this loss of real income is offset by the revenues that are recycled back to households through lower income tax rates. Therefore there is very little difference in real household incomes and, by implication, spending.

The very small benefit to GDP arises, therefore, largely from a reduction in energy imports. If household fuel consumption falls by 2-3% (see below) this has a value of around €1bn; although half of this value is retained domestically (e.g. retail margins), the rest is directly reflected in the UK’s net trade balance. However, much of the additional money that households have to spend on other things is also directed to imports, cancelling out the benefit.

Following the increase in GDP, and reflecting an increase in sales of more labour-intensive goods, there is a small increase in employment. The total number of jobs is around 4,000 higher by 2020 in the scenario, compared to base.

If the UK increased its excise duties on household purchases of gas and electricity this could reduce CO2 emissions by a further 0.15%. Results from E3ME show that this would have no additional impact on GDP and employment levels if the revenues are recycled

Energy and environment model results

Household energy prices increase by just under 15% in the scenario. With a long-run price elasticity of -0.2, this would be expected to lead to a reduction in energy demand of 3%. However, by 2020, not all long-run outcomes are realised and the fall in energy consumption is slightly less (2-3%). Nevertheless, it should be noted that further reductions in energy consumption would be expected after 2020.

Direct emissions from household energy consumption also fall by 2-3% in the scenario. This is not surprising, given that the increase in VAT is applied to all energy products.

There is also a small reduction in emissions from the power sector, due to the lower demand for electricity. Overall, energy emissions in the UK fall by around 0.5%.

More detailed sectoral impact

As the subsidy applies only to households, there are few direct sectoral effects. However, there are losses in the sectors that supply energy (i.e. electricity and gas distribution) as they lose demand from the household sector, for which their margins are usually wider.

However, as total household expenditure remains unchanged, this loss is compensated by higher spending on other goods and services. The main sectors that benefit are those that produce consumer goods and services, although, when spread across so many sectors, the effects are typically small for each sector.

Distributional impact

Equity concerns have been identified as the main barrier to removing the VAT subsidy. Indeed, this is an argument that has been applied to the VAT system as a whole. A higher proportion of the burden falls on the vulnerable groups in society. Groups with low incomes will spend a higher proportion of their disposable income on fuel and power than those in the higher quintiles. However, high-income households will benefit more from VAT subsidies in terms of absolute expenditure.

It has been found that the difference in energy consumption between the top decile and the bottom decile is greater for gas than electricity[214]. This suggests that, in absolute terms, high-income households benefit more from the reduced VAT rate on gas than electricity.

In addition to this, the IFS points out that different consumers may pay different prices per unit of energy. So it cannot be inferred that differences in the level of absolute spending are the same as differences in energy consumption[215]. This is not reflected at all in the modelling.

[214] http://www.ofgem.gov.uk/Sustainability/Cp/CF/Documents1/High%20use%20low%20income%20energy%20consumers_Final%20Report%20Nov%2010.pdf p7.

[215] http://www.ifs.org.uk/comms/comm119.pdf p 18.

According to the same IFS report, the lowest decile spent 7.7% of their income on fuel in 2010 while the top decile spent 3.4%. These figures may have increased since then as fuel prices have risen, although the latest Eurostat data also show a fall in actual energy consumption in 2011. However, each decile only represents an average outcome for a large and heterogeneous group in society, with different household and housing characteristics.

It is also important to note that high-income households have a wider range of options for avoiding higher heating costs, as they have funding available to purchase energy-efficient capital goods to mitigate the rising cost. This means, in effect, that they have a higher price elasticity of demand. However, due to data constraints, this is not reflected in the modelling.

The distribution of the tax burden and recycled revenue should be considered together in an examination of the net distortions of the distributional result and the deadweight loss. The literature on fuel poverty has highlighted for in-depth discussion groups that would be vulnerable to a price rise. These include:

- benefit-households (unemployed head of the household)[216]
- pensioners
- households with many dependents
- those living alone
- households with above-average consumption

The unemployed and pensioners typically have higher energy usage since they spend more time in their houses[217]. Their restricted income leaves them with little option but to limit their use of energy for heat or risk getting into debt with high bills. This factor is combined with a tendency to live in housing stock of a lower quality.

Houses with many dependents have a greater increase in heat and power demand than smaller households. Though some economies of scale are possible, the increase in the cost without an increase in the number of earning members makes them a vulnerable group. Moreover, households with many dependents tend to be located in larger housing which is often detached or semi-detached. Such houses have lower energy efficiency than smaller connected rows of houses such as terraces. This group is vulnerable for the combined reasons of less energy-efficient housing and increased numbers of dependents.

Single people living on their own are vulnerable because there is a certain minimum level of energy used in houses such as running a fridge, or heating one room. The numbers in this group have been increasing over time. Pensioners constitute a sub-section of this group. They have the combined problems of maintaining a minimum level of energy; increased time spent in their houses and restricted incomes.

Households with above-average consumption for whatever reason would be likely to suffer more from the VAT increase. This applies both absolutely and proportionately (subsidy per unit of fuel used). Alternative schemes which were not based on actual consumed values would provide this group with a lower compensatory package for their fuel usage than they were receiving when the subsidy (i.e. the lower VAT rate) was related to their consumption.

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[216] http://www.ifs.org.uk/comms/comm119.pdf p16.

[217] http://www.ifs.org.uk/comms/comm119.pdf

When considering distributional impacts, it is also important to take the revenue recycling methods into account. In the modelling exercise, the VAT revenues were used to reduce income taxes. This was an assumption that was made to reflect the current taxation structure, but it should be noted that it benefits those with incomes from working, but not (or much less) those that are unemployed, retired or economically inactive. However, because this is a modelling assumption rather than fixed policy, some of the revenues could be diverted to offset this effect. Possible options include fixed transfers (not related to energy consumption), changes in income tax bands or investment in household energy efficiency.

However a recent report has found that the use of carbon taxes should not be prevented due to distributional concerns as "With appropriately-designed packages, a progressive approach to carbon taxation is possible with most low-income households gaining". [218] The key message they have to governments is that taxation to reduce CO2 emissions can be implemented without fears for the impact on household income, providing that the appropriate compensation measures are put in place.

Impacts on public balance

It is estimated by the OECD that in 2011 the projected revenue foregone was €4.5bn. Using the latest Eurostat expenditure data (as opposed to IEA energy data) and including electricity, we derive a figure that is slightly larger. The modelling scenario assumes revenue neutrality by offsetting this against reductions in income tax rates; but in reality other supporting measures for vulnerable groups would be required.

Conclusions

The VAT exemption on heating fuels has existed since 1973 and, although increased to 8% in the 1990s, it was then reduced to 5%, the lowest rate allowed under EU law.

The main barrier to removal is the potential social distributional impacts of higher prices of heating fuels. Due to various factors, including income distribution, international energy prices and the UK housing stock, up to 6 million households may be in 'fuel poverty', a term which is used to describe households which would need to spend 10% or more of their disposable income to achieve a defined level of warmth.. It is clear that any attempt at subsidy removal would need to be accompanied by flanking measures to support low-income groups; even so, previous experience suggests it would be politically difficult.

Nevertheless, the OECD analysis (and our own modelling) suggests that substantial revenues could be raised by abolishing the reduced rate. These could be used to offset other taxes (or for spending cuts), possibly even for reducing the standard VAT rate itself. In view of the size of the additional revenues, there would also be scope for using some of the revenues to offset possible adverse distributional consequences, although it may remain difficult to reach the target groups. There are several examples of existing policies that have had varying degrees of effectiveness.

When comparing the present situation to previous attempts to reduce the subsidy, it is necessary now to take into account energy prices that are well above their historical norm. High and rising energy prices receive substantial coverage in the national media and have been shown to be a major concern for citizens. Ironically, the UK government would probably have met much less opposition during the time when

[218] Preston, I., White, V., Browne, J., Dresner, S., Ekins, P. Hamilton, I. (2013) Designing Carbon Taxation to Protect Low-Income Households, Summary, Joseph Rowntree Foundation, York. page1.

energy prices are low. Unfortunately, that time has passed and the policy can only be assessed in the contemporary context.

4 Phasing Out EHS in the EU

Overview This chapter provides a shorter assessment of the possible impacts of removing all EHS for fossil fuels in Europe. For each subsidy case there is a summary description of the policy and a brief set of background information.

Phasing out of the subsidies was modelled on a case-by-case basis (where modelling was appropriate, see previous chapter) and then for each Member State as a whole. Additional results on a policy-by-policy basis are presented in Appendix A.

As no subsidies were found for Malta, it is not covered in this chapter. There is a separate section for each other Member State.

Note that policy codes with the letter 'a' after e.g. BE_S1 indicates that the policy had a specific phase our pathway and that the result given presents the results as if the policy was to end in 2020 and has been reduced along the standard phase out pathway.

4.1 Belgium

Introduction

Belgium has five EHS of which three were modelled by E3ME. The focus of three of these subsidies is low-income households; these are discussed in more detail in Section 3.4. There is also one subsidy for industrial users (S1) and a large subsidy for certain professional users (S5). The full list is:

- €143.16m is the total revenue forgone because of a concession on excise tax on petroleum products for certain industrial uses. This includes some off-road vehicles and stationary engines. Primary users are the construction and civil engineering sectors. BE_S1
- €30m is the amount given by the government in an all-year-round direct subsidy to low-income households to pay for heating. BE_S2
- €7.73m is the amount given as a direct subsidy in a lump sum to reduce poor households heating bills irrespective of the energy source. BE_S3
- €67.06m is the amount paid to suppliers of natural gas to compensate them for the difference between the market price and reduced tariff. BE_S4
- €1,890.82m is the total revenue forgone because of a concession on excise tax on petroleum products for professional uses BE_S5

Assessment methodology

Two of the subsidies (S2 and S3) were not modelled as they are lump-sum payments given to low-income households, which are not well represented in the data used by the E3ME model (see Section 2.2). However, these are discussed in much more detail in the case study.

Phasing-out of the remaining subsidies was modelled as a change in energy prices using the basic methodology described in Chapter 2.

Summary of results

As Table 4.1 shows, the results from the modelling exercise suggest that phasing out the subsidies in Belgium could have the potential to stimulate reductions in energy consumption and CO_2 emissions without adverse impacts on GDP and employment. Energy consumption and CO2 emissions fall by around 1% in the scenario results.

By far the largest part of this reduction is the phasing-out of the subsidy for petroleum products used for professional purposes (S5). This is also the largest subsidy in terms of value, at almost €2bn, and the other subsidies are quite small in comparison.

There are some small economic benefits (for both GDP and employment) in the scenarios, again mainly from S5. This results primarily from a reduction in the imports of petroleum products.

Table 4.1 Belgium: Summary of results in 2020

BELGIUM, SUMMARY OF RESULTS

	GDP	Employment	Final energy demand	CO2 emissions
BE_S1	0.01	0.00	-0.10	-0.26
BE_S4	0.00	0.00	-0.07	-0.12
BE_S5	0.03	0.06	-0.62	-0.94
Belgium	0.04	0.06	-0.79	-1.31

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Conclusions from the Belgian package

Although three of the fossil fuel subsidies in Belgium are directed towards low-income households, by far the largest is provided to professional services for the use of petroleum products. It would therefore be advisable to focus initially on reforming this particular subsidy.

The modelling results suggest that the phasing-out of this subsidy could reduce energy consumption and CO_2 emissions in Belgium by between 0.5% and 1%. Provided that the revenues are recycled effectively, this is likely to have a small but positive impact on the Belgian economy.

The other fossil fuel subsidies are much smaller in scale but could also make a contribution to reducing energy consumption and CO_2 emissions in Belgium. The model results indicate that a complete phasing-out of these subsidies would reduce emissions by up to 0.4%.

4.2 Bulgaria

Introduction

Bulgaria had two fossil fuel subsidies in 2012. There was a very small subsidy for agriculture and a much larger one for households. The total subsidies to fossil fuel in 2012 were estimated to be €35.96m:

- €35.84m forgone in government revenue is given up to allow households to purchase energy with zero excise duty, BG_S1
- €0.12m of forgone government revenue is lost via the reduced excise rate on gas oil given to agriculture in the form of fuel vouchers, BG_S2

Assessment methodology

We modelled the phasing out of both subsidies, with each one classified as a price-based subsidy for energy consumption, as described in Chapter 2.

It should be noted that the agricultural subsidy was intended to exist for only two years, finishing at the end of 2013. The scenario was modelled by using non-inflated values for the two years for which it will be in existence; these fixed values were available from the state aid case raised by the EU219. However, in order to compare a baseline scenario, where this subsidy exists up to 2020, with a scenario in which the subsidy is gradually phased out, we added the value of this subsidy back into the baseline (see Section 2.1).

Summary of results

The results of the modelling exercise (see Table 4.2) suggest that the scope for a reduction in energy demand and CO2 emission through the removal of EHS in Bulgaria is quite limited, compared to most other European countries. The agricultural subsidy (which is due to be removed anyway) is too small to have more than a negligible impact.

A phasing out of the household subsidy would be expected to lead to a 0.2% reduction in energy consumption and CO2 emissions. This could also lead to a small boost in GDP and employment of around 0.05%. The reasons for this are a combination of the revenue recycling measures and reduced fuel imports.

Table 4.2 Bulgaria: Summary of results in 2020

BULGARIA, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
BG_S1	0.05	0.06	-0.24	-0.18
BG_S2	0.00	0.00	-0.00	-0.01
Bulgaria	0.05	0.06	-0.24	-0.18

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

[219] Aid No SA.32982 (2011/N).

Conclusions from the Bulgarian package

In February 2012 there were public protests over high electricity prices and fuel costs in Bulgaria. This contributed to the resignations of the finance minister and his entire cabinet[220]. Energy prices are therefore a sensitive topic in Bulgaria and tensions are still currently running high[221].

While households have the lowest energy costs in the EU, they also have the lowest wages. This is coupled with 22.3% of the population living below the poverty line. Clearly there are therefore considerable welfare barriers to subsidy reform in Bulgaria. If seems impossible that the energy subsidy could be removed without the introduction of an alternative support scheme for low income households. This would also need to be clearly communicated to the general public.

The smaller agricultural subsidy may also prove to be difficult to withdraw, even though this is planned for the end of 2013. There have already been threats of protests by farmers as their (non-energy) subsidy payments were due to be delayed until the EU transferred the funds to the Bulgarian government. However the decision was overturned and it was agreed the farmers would receive their subsidies (about €511m[222]).[223]

Whilst the impact of removal is estimated to be very small in terms of the cost to GDP and employment, it is evident that the current political atmosphere is not receptive to the removal of EHS schemes. The bigger challenge for Bulgaria is the political barrier which must be overcome.

[220] http://www.economist.com/news/europe/21572252-bulgarian-prime-minister-unexpectedly-resigns-power-protests?zid=307&ah=5e80419d1bc9821ebe173f4f0f060a07

[221] http://www.economist.com/blogs/easternapproaches/2013/02/bulgarias-electricity-prices?zid=307&ah=5e80419d1bc9821ebe173f4f0f060a07

[222] There are other subsidies to farmers in operation beyond the fuel vouchers scheme which has been identified.These include schemes which subsdise farmers based on the size of their land, subsidise grain producers and animal producers.

[223] http://www.economist.com/news/europe/21572252-bulgarian-prime-minister-unexpectedly-resigns-power-protests?zid=307&ah=5e80419d1bc9821ebe173f4f0f060a07

4.3 Czech Republic

Introduction

In the Czech Republic, four EHS for fossil fuels have been identified. All of them have been modelled using E3ME. The four subsidies cut across different fuel uses and, combined, relate to fossil fuel consumption by agriculture, buildings (heating), energy transformation, ore extraction, transport and other social uses. The full list of scenarios is:

- €74.27m is forgone government revenue from partially refunding the excise tax paid on diesel by the agriculture sector, CZ_S1
- €64.04m is forgone in government revenue via either a reduction or exemption on the excise tax rate for natural gas. This is applicable to a collection of different uses. An exemption is available for: households for heating, combined heat and electricity production when later supplied to households, non-recreational transport by boat, mineralogical and metallurgical processes. A reduced energy tax rate applies to: compressed natural gas and LNG when used as transport fuels. Also rebates for the energy tax on NG for diplomatic immunity, CZ_S2
- €37.60m is lost in forgone government revenue via an exemption on the excise duty levied on hard coal. Eligible activities include: households for heating, combined heat and electricity production when later supplied to households, non-recreational transport by boat, mineralogical and metallurgical processes, CZ_S3
- €23.52m is forgone in government revenue via a refund paid on the excise duty levied on light fuel oil when used for heating , CZ_S4

Assessment methodology

All four of the Czech subsidies have been modelled in the scenarios as an increase in energy prices for the respective sectors and fuels (as described in Chapter 2). It should be noted that two of the subsidies in the Czech Republic (CZ_S1 and CZ_S2) are due to be phased out by 2014 but we have added them back into the baseline so that the scenario results show the difference between maintaining the subsidies at current rates and complete withdrawal.

Summary of results

The modelling results, summarised in Table 4.3, show that the removal of fossil fuel subsidies in the Czech Republic has only a very limited potential to achieve a reduction in energy demand and CO_2 emissions. Even if all the subsidies were to be phased out, energy consumption and CO_2 emissions would only fall by 0.1%-0.2%.

It should also be noted that more than half of this possible reduction can be attributed to the subsidies that are due to be phased out anyway.

Given the small scale of the subsidies, it is not surprising that the potential economic impacts of withdrawal are also small. The model results suggest that a very small benefit is possible if the saved revenues are recycled effectively.

Table 4.3 Czech Republic: Summary of results in 2020

CZECH REPUBLIC, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
CZ_S1	0.02	0.01	-0.11	-0.02
CZ_S2	0.01	0.00	-0.07	-0.05
CZ_S3	0.02	0.02	-0.07	-0.03
CZ_S4	0.00	0.00	-0.01	-0.01
Czech Republic	0.06	0.04	-0.26	-0.10

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Conclusions from the Czech Republic's package

The OECD inventory has identified four fossil fuel subsidies in the Czech Republic. They are all small in scale and the two larger ones are due to end in 2014. The possibilities for further reducing energy consumption and CO2 emissions in the Czech Republic are therefore much smaller than in most other Member States.

The remaining subsidies relate mainly to energy from solid and liquid fuels that are used for heating, so their removal could have some quite important distributional effects, e.g. in rural communities. It is recommended that this is examined in more detail to assess the feasibility of removing the subsidies.

4.4 Denmark

Introduction

The OECD inventory has two fossil fuel subsidies for Denmark. There is one for heat produced by CHP (combined heat and power) generation and one for the consumption of diesel as a motor fuel:

- €264.70m is the total revenue forgone for heating when it is delivered from a CHP plant. DK_S1
- €717.58 m is the total revenue forgone via a concession on excise tax on diesel for road transport uses. DK_S2

Assessment methodology

DK_S1 acts as a competitive subsidy for CHP generation. It is not clear whether phasing out the subsidy would have an impact on the use of CHP (e.g. if heat output was replaced by gas-fired heating) or whether it would just end up as higher costs to households, without there being a behavioural response. Although a detailed energy systems model would be able to address this question, it is beyond the scope of the E3ME model; the scenario has therefore not been included in the results below.

DK_S2 is quite a lot larger in size. It was modelled as a price-based subsidy for the consumption of middle distillates, using the method outlined in Chapter 2. It should be noted that the current version of the E3ME model does not separate petrol and diesel, so it is assumed that withdrawal of the subsidy does not result in fuel switching.

Summary of results

As Table 4.4 shows, phasing out the subsidy for diesel could have quite a substantial effect on energy consumption and emissions in Denmark; both could fall by around 1%. This outcome is partly the result of the scale of the subsidy and also partly due to the higher long-run elasticity associated with the transport sector, as most motorists would be expected to replace their vehicles before 2020.

The reduction in fuel consumption could provide a modest boost to GDP, with output increasing by around 0.2%. Employment is expected to increase by 0.1%. Almost all economic sectors would benefit to some extent, with the exception of those in the fuel supply chain.

Table 4.4 Denmark: Summary of results in 2020

DENMARK, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
Denmark	0.19	0.12	-1.16	-1.00

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Conclusions from the Danish package

Denmark has a reasonably sized subsidy for heat that is generated from CHP production. Our analysis is inconclusive as to what the effects of removing the subsidy might be, both in economic and environmental outcomes; the situation is quite similar to that described in the Finnish case study (see Section 3.7). Because of the high level of uncertainty, we have not included the subsidy in our results.

Denmark has a much larger subsidy for the use of diesel in road transport. Our analysis shows that the possible phasing out of this subsidy represents a major opportunity for Denmark. On the assumption that there is no switching from diesel to petrol, phasing out the subsidy could result in a reduction in energy consumption and CO_2 emissions of 1% compared to the baseline case. If the revenues are recycled effectively, this could lead to small increases in GDP and employment.

The conclusion from this analysis is therefore that there may be quite strong grounds for reforming the subsidy that is given to the use of diesel for road transport. There may also be grounds for considering reform of the CHP subsidy but this needs further analysis within the Danish energy system.

4.5 Germany

Introduction

According to the OECD inventory, Germany has twelve fossil fuel subsidies. Not all of these were formally modelled (S1, S2, S3 and S12; see below) as the impacts of phasing out the subsidies are quite uncertain; these account for almost half of the total value of the subsidies. Three of the scenarios (S4, S5 and S6) are covered by the case study in Section 3.5.

The full list of subsidies is:

- €152.66m is forgone in government revenue due to a mining royalty exemption give to hard coal DE_S1.
- €344.67m is forgone in government revenue due 'manufacture privilege' which allows manufactures of energy to use fuels free of tax for production purposes. DE_S2
- €206.53m is forgone in government revenue due mining royalty granted exemption granted for lignite; the figure provided is the 2008 one (in real terms) as there is some uncertainty to the current value. DE_S3
- €150m is lost by the government in revenue forgone due to energy tax breaks for agriculture and manufacturing. DE_S4
- €195m is given as a direct subsidy to manufacturing firms to compensate them for the high taxes paid on energy inputs if the pension contribution was not sufficient to offset the energy tax burden. This is known as the peak equalisation scheme. DE_S5
- €607.34m is forgone in government revenue due to tax relief on energy tax on fuel when used by energy intensive firms in the steel and chemical sectors. DE_S6
- €70.14m is forgone in government revenue due to tax relief on energy tax charged on fuels when used by public transportation. DE_S7
- €210m is forgone in government revenue due to tax relief on energy tax on LPG and natural gas when used in engines for transport. DE_S8
- €680m is forgone in government revenue due to energy tax relief on fuels granted to commercial aviation. DE_S9
- €170m is forgone in government revenue due to energy tax relief on diesel granted to internal water transportation. DE_S10
- €395m is forgone in government revenue due to an energy tax refund for diesel when used by the agricultural and forestry sectors. DE_S11
- €1,778m is given in the form of annual direct payments to the hard coal industry to ease the continued gradual decline. DE_S12

Assessment methodology

DE_S1, DE_S2, DE_S3 and DE_S12 are producer subsidies granted to the coal mining sector in the form of energy consumption subsidies and lump sum payments. The largest of these subsidies (DE_S12) is already planned to be phased out by 2018.

Impact on the coal extraction sector

The removal of these producer subsidies could result in a number of possible outcomes: there could be a discontinuation of production in the coal mining sector; the coal mining industry might absorb the higher costs of production and continue production with lower profit margins, or, if the import price of coal is relatively high, the domestic coal mining industry may pass on higher prices to consumers of coal. It is not obvious which of these is most likely to occur if the subsidy was removed.

However, it is noted that the total value of these five subsidies was €2,473m in 2011, and gross operating surplus in this sector is estimated to be around €2,410m[224]. It therefore seems reasonable to assume that either the value of the subsidies is being passed on in the form of lower prices, or it is a requirement for coal to be produced in Germany.

Either way, it is not really possible to consider these subsidies in isolation as there is clearly a strong interaction between them. We did attempt to model a 'worst-case' scenario in Germany, where the subsidies that keep the coal sector operating are removed and output falls to zero. All the coal that is consumed is therefore imported. The model results suggested that GDP could fall by 0.6%, and there could also be some quite considerable localised impacts. However, there is a very wide range of uncertainty about this outcome, so it is not included in the national totals.

The other subsidies

All the other subsidies are modelled as changes in the prices of fossil fuels, following the procedure outlined in Chapter 2. DE_S4, DE_S5 and DE_S6 are case study subsidies and are discussed in more detail in the Section 3.5. These three subsidies are granted to heavy industry to compensate their expenditure on fossil fuels, and are modelled as an energy tax.

Summary of results

The results from the scenarios in which the price-based subsidies are phased out are shown in Table 4.5. The model outputs suggest that there some limited scope for reducing energy consumption and CO_2 emissions by phasing out the German subsidies; combined they only amount to a reduction of around 0.5%.

The economic impacts of phasing out the subsidies are small but the results indicate that GDP could increase by up to 0.1% by 2020. It should be noted that some German sectors may lose out in terms of competitiveness, but again the effects will be small and there is also the potential that other European countries will follow Germany's lead in phasing out subsidies (see Section 4.18).

Table 4.5 Germany: Summary of results in 2020

GERMANY, SUMMARY OF RESULTS

	GDP	Employment	Final energy demand	CO2 emissions
DE_S4	0.00	0.00	-0.02	-0.03
DE_S5	0.01	0.00	-0.02	-0.04
DE_S6	0.02	0.01	-0.06	-0.04
DE_S7	0.00	0.00	-0.02	-0.02
DE_S8	0.01	0.00	-0.07	-0.06
DE_S9	0.03	0.01	-0.23	-0.01
DE_S10	0.01	0.00	-0.01	-0.06
DE_S11	0.01	0.00	-0.04	-0.08
Germany	0.08	0.03	-0.46	-0.33

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

[224] According to Eurostat, gross operating surplus in the mining and quarrying sector was €2217m in 2006. Assuming this value grew in line with inflation, gross operating surplus in this sector in 2011 would be approximately €2410 m.

Conclusions from the German package

Around half of fossil fuel subsidies in Germany are in the form of lump sum payments to coal producers. These are granted primarily to ease the gradual decline in production on local communities. One would expect them to be phased out over time anyway (for economic reasons) and there is considerable uncertainty about what the economic and social impacts of speeding up their removal would be. Our modelling results of a worst case scenario suggest that the impact could be quite substantial, although this result is heavily dependent on the assumptions about behavioural responses that have been made.

The modelling is able to give a better estimate of the impacts of phasing out the other price-based subsidies that relate to fossil fuel consumption. The results from the exercise suggest that there could be a small environmental benefit from phasing out these subsidies, with almost no macroeconomic impact.

In conclusion, the case for phasing out fossil fuel subsidies in Germany is both an economic one (relating to coal production) and an environmental one (relating to fuel consumption). Our modelling results suggest that there is a case for considering phasing out these subsidies, which is addressed in further detail in the case study. In addition to this analysis, Germany’s role within Europe should also be taken into account, particularly relating to subsidies that are given to industrial sectors. If Germany was to reduce its subsidies, other European countries would be much more likely to follow suit.

4.6 Estonia

Introduction

Estonia has just two fossil fuel subsidies, both of which relate to fuel oil. The first of these is to the fishing industry and is very small. A larger subsidy is applied to a wider range of sectors, including transport:

- €1.3m is the amount of forgone government revenue to domestic commercial fishing via an exemption on the rate of excise duty paid on diesel and light oil. EN_S1
- €70.3m is forgone in government revenue via reduced rates on diesel and fuel oil. The reduction for diesel is applicable to all rail transport, water cargo, stationary engines, heating and combined production of heat and electricity. The reduction for marked light heating oil is no longer available for machinery used in forestry and construction as of 2012. Though the sum given reflects inclusion of these figures. There are potential plans to gradually abolish this subsidy though no details provided. EN_S2

Assessment methodology

In both cases modelling scenarios were set up in which the subsidies are phased out, following the basic methodology outlined in Chapter 2. The energy prices for middle distillates are adjusted for the affected sectors.

Summary of results

The scenario in which the subsidy to the fishing industry is removed has almost no impact at the macroeconomic level (see Table 4.6). In fact, a macroeconomic model is probably not an appropriate tool for this assessment as the impacts are all likely to be highly localised, both in terms of sector and geographical area. A bottom-up analysis of Estonia's fishing sector would be a better way of considering the impacts of this scenario.

Phasing out the larger subsidy on diesel use may have some impact on energy consumption and emissions in Estonia (-0.1% compared to baseline) but this is also quite small in nature, at both macroeconomic and sectoral level. There is almost no economic impact in this scenario.

Table 4.6 Estonia: Summary of results in 2020

ESTONIA, SUMMARY OF RESULTS

	GDP	Employment	Final energy demand	CO2 emissions
EN_S1	0.00	0.00	-0.01	-0.01
EN_S2	0.00	0.02	-0.12	-0.08
Estonia	0.00	0.02	-0.12	-0.08

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Conclusions from the Estonian package

Estonia has two fossil fuel subsidies, according to the OECD inventory. The first of these is very small in scale and is targeted specifically at the fishing industry. At macro level, phasing out this subsidy would have almost zero impact, but it should be stressed that there could be quite severe localised effects, for example in coastal towns. Any attempt at removing or reforming this subsidy would need to consider these effects carefully.

There could be slightly more substantial macroeconomic impacts from reforming the subsidy that is applied more widely to diesel. The model results suggest that this could result in a reduction in emissions of 0.1%. There would be no economic cost to doing this. According to the OECD inventory there are already plans to phase out this subsidy, although the details are not clear. This analysis provides some evidence to support the gradual phasing out.

4.7 Ireland

Introduction and assessment methodology

Ireland only has one EHS relating to fossil fuels. This was a producer subsidy to peat production.

- €78.2m is given in direct subsidy support to peat generated electricity power. This is funded through a levy on electricity purchases which is used to reduce the price of more expensive peat based electricity. IE_S1

The only environmentally harmful subsidy in Ireland is a producer subsidy that is granted to the power sector for their use of peat. The impact this would have on the power sector and the peat mining industry is quite uncertain, so we modelled an additional sensitivity case to give a range of outcomes (see below).

For this scenario, we assumed that the subsidy is paid at the margin, and therefore, if the subsidy was removed, electricity would no longer be produced using peat. We assume that peat electricity generation would be replaced by gas-fired power generation, which is the next cheapest fuel in Ireland, and we have used the relative efficiency of each of the fuels to calculate the extent to which the demand for gas would increase. As Ireland imports its gas, it is likely that this scenario would result in an increase in imports.

Three quarters of peat production in Ireland is used for energy purposes[225] so we also assumed that output in the peat mining sector would fall in this scenario. As with all of the scenarios, we modelled revenue from the subsidy as being recycled back into the economy through lower income taxes.

We assumed that peat power generation would gradually be replaced by gas generation, as the subsidy is gradually removed. This implies that in the short run, some power plants would stop using peat for electricity generation, and other plants would absorb the extra costs. By 2020, when the subsidy is completely removed, electricity produced using peat would cease to exist.

The results for this scenario are largely dependent on a number of assumptions, many of which are difficult to test. One uncertainty that is particularly important is the impact of removing the subsidies on the price of electricity. Our main scenario assumes that there is no change in the price of electricity. The sensitivity that was tested assumes that the full price differential is passed on to final consumers in the form of higher electricity prices.

Table 4.7 Ireland: Summary of results in 2020

IRELAND, SUMMARY OF RESULTS

	GDP	Employment	Final energy demand	CO2 emissions
Ireland	0.01	0.03	0.02	-2.35

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

[225] Our Energy Future: Resources, Alternatives and the Enviornment, C Niog, J Natowitz, 2012.

Summary of results

As Table 4.7 shows, removing the subsidy could have quite a large impact on CO2 emissions, reducing total emissions in Ireland by more than 2%. This is due to a shift from a relatively carbon-intensive fuel, peat, to natural gas.

In all other respects, the scenario is broadly neutral. Final energy demand is largely unchanged as the scenario represents fuel switching rather than an increase or decrease in total fuel consumption. Although there is an increase in imports of natural gas, which reduces GDP, the revenue recycling leads to an increase in household expenditure, so the overall economic impact is quite neutral. Employment increases slightly, mainly in the service sectors that benefit from the revenue recycling.

In the sensitivity test, where electricity prices are assumed to increase, the economic outcomes become negative, although only slightly. GDP falls by 0.02% and the increase in employment is reduced to 0.01%.

These two sets of results provide boundaries for the possible range or results; it is reasonable to conclude from this that the economic costs and benefits of phasing out the subsidy are going to be small at the macroeconomic level. The reduction in emissions occurs regardless of the assumption about electricity prices.

Conclusions from the Irish package

In conclusion, phasing out the subsidy represents a way in which Ireland could reduce its domestic CO2 emissions at little cost to the economy as a whole. However, there are some additional factors that the Irish government may wish to take into account, such as a slight increase in dependence on imported natural gas.

There are also some very important distributional factors that are missing from the modelling analysis. It is clear that producers of peat would lose out from removal of the subsidy and this could have important localised impacts in rural areas. It may be necessary for the Irish government to provide alternative compensation mechanisms to these communities. Although this would mean additional policy would be required, the macroeconomic effects are still likely to be quite small.

4.8 Greece

Introduction

Greece has six fossil fuel subsidies, of which one (to agriculture and forestry) accounts for more than 75% of the total value. The full list of subsidies is:

- €7m is paid in the form of a direct subsidy to suppliers of diesel fuel and motor gasoline which given to remote areas such as islands and border areas. EL_S1
- €2.99m of government revenue is forgone via the excise tax refund which is available for fuels used in the production of energy products which are subsequently to be used within the EU. The subsidy is allocated for crude oil, natural gas, lignite, and refinery feedstock. EL_S2
- €160m of government revenue is forgone via excise tax refunds for fuel oils and motor gasoline which is used in agriculture and forestry. EL_S3
- €13m of government revenue is forgone on excise tax refund in the domestic navigation and fishing sector. The refund in excise duty is for the use of fuel oils for domestic shipping which includes fishing boats. EL_S4
- €1.5m is the amount of government revenue forgone on excise tax for refunds of fuels used in tourist boats. This applies to the domestic navigation sector for fuel oils. EL_S5
- €23.5m is the total amount of government revenue forgone on an excise tax and other tax refunds for social purposes. The fuels for which are covered in the excise tax and other refunds are fuel oils, natural gas and LPG used by hospitals, social solidarity institutions and hotels. EL_S6

Assessment methodology

All of the subsidies in Greece are subsidies for energy consumption, with the exception of EL_S1, which is a lump sum subsidy to suppliers of fuel to remote areas. However, this subsidy was still modelled as a price increase, with the value of the subsidy assumed to be passed on to the final consumers of fuel.

The energy subsidies were therefore all modelled as energy taxes, using the method outlined in Chapter 2.

Summary of results

As Table 4.8 shows, the results for Greece are dominated by the impacts of phasing out the largest fuel subsidy to agriculture and forestry. This could result in a reduction in energy consumption and CO2 emissions of between 0.1% and 0.2%. There would also be a very small increase in GDP due to reduced imports of refined fuels.

The results from the other scenarios suggest that the impacts of phasing out the other fossil fuel subsidies in Greece would be small, accounting for less than 0.1% of emissions. There would be almost no economic impact at the macro level from phasing out the subsidies. However, there could be social implications, particularly relating to S5.

Conclusions from the Greek package

Greece has one medium sized fossil fuel subsidy which reduces the cost of transport fuels for the agriculture and forestry sectors. If this subsidy were phased out, there would be a modest reduction in emissions and a very small economic benefit. This would need to be weighed against the possible social and distributional impact in rural communities.

Any assessment of subsidy reform in Greece must be taken in the context of the wider economic and political situation. Although the government is being forced to improve its primary budget position, it is already in confrontation with many industry and social groups. Given that the scale of the fossil fuel subsidies is quite modest it may wish to avoid reform given the current circumstances. However, the analysis here shows that phasing out the subsidies may have a small economic benefit to Greece.

Table 4.8 Greece: Summary of results in 2020

GREECE, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
EL_S1	0.00	0.00	-0.01	0.00
EL_S2	0.00	0.00	0.00	0.00
EL_S3	0.04	0.01	-0.16	-0.13
EL_S4	0.01	0.00	-0.04	-0.03
EL_S5	0.00	0.00	-0.01	-0.01
EL_S6	0.01	0.00	-0.06	-0.03
Greece	0.06	0.02	-0.27	-0.19

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

4.9 Spain

Introduction

There are eight EHS for fossil fuels in Spain, although the first five are lump sum payments that are made to the mining sector (and two of these have been attributed values of zero). The other three subsidies are modelled explicitly using E3ME. The full list of subsidies is:

- €72.45m is given as a direct grant to a specific hard coal producer, HUNOSA, to cover operating costs. ES_S1
- €230.81m is given as a direct grant to coal producers for the difference between operating costs and price of output sold to the local power plants. ES_S2
- €0m is given as a direct grant to coal producers for the transport for coal within the basin. ES_S3
- €6m is given as a direct grant to coal producers to help cover the cost of decline of the coal mining sector. ES_S4
- €0m is given as a direct fund to coal stockpilers in order to ensure a defined level of power generation of 720 hours is possible at all times. ES_S5
- €393.86m is forgone in government revenue via an exemption on petroleum products when used by domestic aviation, navigation and railways. ES_S6
- €1,368m is forgone in government revenue due to a reduction in the excise tax charged on petroleum products when used by the agriculture and non-energy mining sectors. ES_S7
- €170.03m is forgone in government revenue via a partial refund of the excise tax paid on hydrocarbons for diesel fuel when used by the agricultural sector. ES_S8

Assessment methodology

The lump sum subsidies to the mining sector account for 14% of the total package. They are very similar in structure to the subsidies that are offered to mining operations in Germany (see Section 4.5). For the same reasons as Germany and Romania, we have not formally modelled these subsidies, or included the impact of their removal in the national totals.

However, it should also be noted that in Spain value added from the mining and quarrying sector accounts for a much smaller share of GDP (around 0.2%) so the effects of removing the subsidies would be smaller in Spain, even in a worst-case scenario where production ends altogether.

The other scenarios, which mainly relate to transport fuels, were modelled using the basic methodology for adjusting energy prices presented in Chapter 2.

Summary of modelling results

Table 4.9 presents the results from the scenarios. The outputs from the modelling suggest that phasing out these three subsidies could have a modest impact on energy consumption and CO_2 emissions, with reductions of around 0.2%. There could also be a small positive economic impact if the revenues are recycled efficiently.

At the sectoral level, impacts are to some extent quite spread out, as the subsidies affect transport costs that are paid by most sectors. However, if the subsidies were phased out there would clearly be higher costs for the agriculture sector, which it may be impossible to pass on through higher product prices. This may present a potential barrier to phasing out the subsidies and alternative support mechanisms may be required to assist rural communities.

Table 4.9 Spain: Summary of results in 2020

SPAIN, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
ES_S6	0.03	0.03	-0.09	-0.01
ES_S7	0.04	0.05	-0.13	-0.20
ES_S8	0.00	0.00	-0.01	-0.01
Spain	0.07	0.08	-0.23	-0.22

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Conclusions from the Spanish package

Although Spain has a relatively large (eight) number of fossil fuel subsidies, five of these are in the form of lump sum payments to the mining sector. These five subsidies only account for 14% of the total value.

The largest share of the subsidies is directed at agriculture, with some further support given to transport services. This means that there would be some quite important sectoral impacts from phasing out the subsidies with agriculture and rural communities likely to lose out, in the absence of alternative support mechanisms. This could present a strong potential barrier to phasing out the subsidies.

Nevertheless, the modelling exercise suggests that a successful withdrawal of the subsidies could lead to a small reduction in energy consumption and CO_2 emissions in Spain, with very small economic benefits.

4.10 France

Introduction

France has 20 EHS for fossil fuels of which the majority are quite small in scale, both in and absolute terms compared to other European countries. Fourteen of the subsidies are discussed in greater depth in the case study in Section 3.6. The full list is of subsidies is:

- €53m is forgone in government revenue due to a reduced rate of excise for LPG which is applicable to all users. In addition to a reduced rate of excise on liquefied butane and propane when used by specific off-road users. FR_S1.
- €105m is forgone in government revenue due to an exemption for oil refiners on the excise tax on fuel used for processing activities FR_S2
- €2m is forgone in tax revenue due to an exemption available for two natural gas producers when fuel is used for processing activities. FR_S3
- €10m is forgone in tax revenue due to an exemption from the excise tax normally applied to mineral oils and natural gas for co-generation plants. FR_S4
- €3m is forgone in government revenue to biomass producers due to an exemption in the excise tax normally applicable to bituminous coal. FR_S5
- €3m is forgone in government revenue to a reduced rate of excise in diesel fuel available for agricultural and construction users of stationary engines. FR_S6
- €4m is forgone in government revenue via a 100% reduction in the rate of excise tax charged on natural gas when used as a transport fuel. FR_S7
- €21m is forgone in government revenue due to a reduced rate of excise on fuel for taxi drivers. FR_S8
- €300m is forgone in government revenue via a refund paid to domestic and international road freight of the excise tax paid on diesel. FR_S9
- €30m is forgone in government revenue due to a refund paid to public transport providers of the excise tax paid on diesel. FR_S10
- €300.3m is forgone in government revenue due to an exemption given to flights made domestically by aviation on the sale of jet kerosene. FR_S11
- €350m is forgone in government revenue due to an exemption given to navigation boats, (mainly fishing boats) on the excise tax paid on petroleum products. FR_S12
- €253m is forgone in government revenue to households via an exemption on the excise tax normally charged on natural gas. FR_S13
- €1,000m is forgone in government revenue to the construction sector and agriculture due to a reduced rate of excise tax paid on diesel fuel when used in stationary engines. FR_S14
- €140m is forgone in government revenue to the agricultural sector to help with high fuel prices. This is via a refund made on the excise tax applicable to fuel oil. FR_S15
- €4.75m is directly given to aid gas stations with either upgrading infrastructure or ease a declining business. Implicitly this is a subsidy to gasoline and diesel FR_S16
- €3m is forgone in government revenue due to an exemption from the excise tax normally paid on diesel and light fuel oil when used for the transportation of freight on internal waterways. FR_S17
- €1m is forgone in government revenue via a reduced rate of excise tax charged on gasoline in the French territory of Corsica. FR_S18
- €14.19m is the amount of revenue forgone by the government due to a reduced rate of 13% VAT charged on petroleum products in the French territory of Corsica. FR_S19

- €156.64m is the amount forgone in revenue by the government via a an exemption of VAT on petroleum products when purchase in the French Departments Overseas (DOMs), these are geographically and economically disadvantaged FR_S20

Assessment methodology

We modelled 20 EHS in France. Of these, 17 subsidise energy consumption, two are reduced VAT rate subsidies and one is a lump sum subsidy to assist with upgrading infrastructure in petrol stations. For the case studies, we grouped together similar subsidies and modelled the impact of removing each of these groups of subsidies. One group consisted of subsidies that were provided to the transport sector, the second group were subsidies provided to agriculture and the final group were subsidies granted to consumers in specific regions of France. These are described in more detail in Section 3.6.

The 17 energy consumption subsidies were granted across a range of economic sectors, including agriculture, construction, transport and mining. The method used to model these scenarios is described in section 3.6.

To model the removal of the lump sum subsidy (FR_16) for investment in infrastructure in petrol stations, we assumed an exogenous reduction in investment in the wholesale motor vehicles sector, as petrol stations are classified under this sector in the NACE rev2 classification.

The two VAT subsidies (FR_19 and FR_20) are both applied to purchases of petroleum in specific regions of France: FR_19 applies to petroleum products in Corsica, whereas FR_20 is granted to consumers purchases in Guadeloupe, Martinique and La Reunion. As E3ME does not have a regional dimension, to model these subsidies, we took the total value of the subsidy from VAT revenues in the baseline and used this to calculate a new rate of VAT that was applied to petrol consumption across the whole of France in the scenario. See Chapter 2 for more details.

Summary of results

Table 4.10 presents the results from the French scenarios. It is immediately obvious that the impacts of phasing out the subsidies in France are small, which is not surprising given that the subsidies themselves are small.

The most notable impact is in Scenario FR_S13, which is a moderately sized subsidy that is given to households for heating purposes. This could lead to a reduction in energy consumption and emissions of between 0.1% and 0.2%. However, the macroeconomic impact is minimal.

The other large subsidy (€1bn) is FR_S14 which is described in the case study.

Conclusions from the French package

Although France has many subsidies for fossil fuel consumption, they are for the main part too small in scale to have a significant impact on fuel consumption and CO_2 emissions. If all the subsidies were phased out this would lead to a reduction in emissions of around 0.6%, the majority of which would be accounted for by just two of the subsidies (to households and agriculture/construction).

There is almost no economic impact from subsidy reform in France.

The case for phasing out fossil fuel subsidies in France is therefore quite modest; although there are reductions in emissions that can be made at no macroeconomic cost, overall savings are small. Further details about the barriers that might have to be overcome to achieve this small reduction in emissions are provided in Section 3.6.

Table 4.10 France: Summary of results in 2020

FRANCE, SUMMARY OF RESULTS

	GDP	Employment	Final energy demand	CO2 emissions
FR_S1	0.00	0.00	-0.01	-0.01
FR_S2	0.00	0.00	-0.02	-0.02
FR_S3	0.00	0.00	0.00	0.00
FR_S4	0.00	0.00	0.00	0.00
FR_S5	0.00	0.00	0.00	0.00
FR_S6	0.00	0.00	0.00	0.00
FR_S7	0.00	0.00	0.00	0.00
FR_S8	0.00	0.00	-0.01	-0.01
FR_S9	0.01	0.00	-0.07	-0.09
FR_S10	0.00	0.00	-0.01	-0.01
FR_S11	0.00	0.01	-0.09	-0.02
FR_S12	0.01	0.01	-0.03	-0.08
FR_S13	0.00	0.00	-0.12	-0.15
FR_S14	0.01	0.01	-0.09	-0.20
FR_S15	0.00	0.00	-0.01	-0.02
FR_S16	0.00	0.00	0.00	0.00
FR_S17	0.00	0.00	0.00	0.00
FR_S18	0.00	0.00	0.00	0.00
FR_S19	0.00	0.00	0.00	0.00
FR_S20	0.00	0.00	0.00	0.00
France	0.04	0.04	-0.44	-0.62

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

4.11 Italy

Introduction

According to the OECD inventory, Italy has eight EHS related to fossil fuels which were all directed at energy consumption. These were all modelled in E3ME, with one of them (S7) forming part of the case study on low income households. This can be found in section 3.4.

The full list of subsidies is:

- €60m is forgone in government revenue via a 60% tax relief which is granted to large industrial users of natural gas. IT_S1
- €2m is forgone in government revenue via an excise tax reduction on diesel granted for rail transport. IT_S2
- €5m is forgone in government revenue to ambulances due to an excise tax relief on diesel fuel. IT_S3
- €346m is forgone in government revenue due to a partial refund made to trucking companies on the excise tax charged on petroleum products IT_S4
- €547m is forgone in government revenue due to a fuel tax exemption on diesel and heavy fuel oil which is granted to goods navigation ships, passenger ships and fisheries. IT_S5
- €25m is forgone in government revenue via a tax relief granted to road and boat public transport on the excise tax for petroleum products. IT_S6
- €231m is forgone in government revenue via a tax relief on LPG and diesel granted to households in disadvantaged areas. IT_S7
- €908m is forgone in government revenue to agriculture via an energy tax break on diesel and gasoline. IT_S8

Assessment methodology

All eight environmentally harmful subsidies in Italy are price-based subsides on energy consumption. They were modelled using the method outlined under this heading in Chapter 2.

Table 4.11 Italy: Summary of results in 2020

ITALY, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
IT_S1	0.00	0.00	-0.01	-0.01
IT_S2	0.00	0.00	0.00	0.00
IT_S3	0.00	0.00	0.00	0.00
IT_S4	0.01	0.01	-0.10	-0.09
IT_S5	0.01	0.02	-0.01	-0.02
IT_S6	0.00	0.00	0.00	0.00
IT_S7	0.00	0.01	-0.03	-0.02
IT_S8	0.02	0.03	-0.05	-0.07
Italy	0.04	0.07	-0.20	-0.21

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Summary of results

As Table 4.11 shows, phasing out the subsidies has only a small macroeconomic and environmental impact in Italy.

The largest subsidy is provided to agriculture (S8, €900m). The modelling results suggest that phasing out this subsidy could reduce energy consumption by up to 0.1%, with a small economic benefit. However, this would have to be weighed against possible localised impacts in rural areas as it is unlikely that farmers could pass on higher costs through higher product prices. It may be that alternative instruments are required, at least in the short term.

The next two largest subsidies (S4 and S5) relate to transport, in particular to shipping and trucking. The impact of phasing these subsidies out is of a similar scale, both in environmental and in economic terms. These sectors have more scope to pass on cost increases to final consumers.

All the other scenarios have impacts that are close to zero at macroeconomic level.

Conclusions from the Italian package

Although Italy has a relatively long list of fossil fuel subsidies, there are only three that are at all important in macroeconomic terms. These subsidies reduce the prices of liquid fuels to the agriculture and transport sectors.

The results from the modelling suggest that phasing out these subsidies could have a modest impact on energy demand and CO_2 emissions, with almost no impact on economic outcomes. The main barrier to removing these subsidies (in particular the largest one relating to agriculture) is likely to be the possible social and distributional implications. As the case study in Section 3.4 has shown, Italy is already sensitive to these concerns.

4.12 Cyprus

Introduction

There is one EHS which has been modelled by E3ME to assist consumption by the agricultural sector:

- €20m is the total revenue forgone to agriculture through gas oil excise tax exemptions

Assessment methodology

The subsidy in Cyprus was modelled as an energy tax on motor fuels used by the agricultural sector. The scenario was defined using the basic methodology outlined in Chapter 2.

Summary of results

As Table 4.12 shows, the removal of the EHS on agricultural consumption has the potential to stimulate a moderate reduction in CO_2 emissions and final energy demand without any adverse impacts on economic activity at the aggregate level.

The removal of the policy measure is expected to lead to a modest reduction in final energy demand of up to 0.5% compared to baseline by 2020. The estimated reduction in CO_2 emissions is expected to be around 0.3%.

The impacts on GDP and employment at the macroeconomic level will be positive but close to zero. The positive effect is mainly derived from reduced imports of refined fuels to Cyprus.

The only sector that would be affected by subsidy withdrawal is the agricultural sector itself. It seems highly likely that agriculture in Cyprus would face some loss of profitability as it is unable to pass costs on to final consumers on international markets. This may have localised (rural) distributional impacts that may need further assessment (also in the context of the CAP) before the subsidy could be phased out.

Table 4.12 Cyprus: Summary of results in 2020

CYPRUS, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
Cyprus	0.04	0.00	-0.45	-0.32

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Conclusions from the Cypriot package

Cyprus has only one fossil fuel subsidy, which is applied to the consumption of gas oil by agriculture. The model results suggest that phasing out this subsidy could lead to a small reduction in energy demand and CO2 emissions (up to 0.5%) with a very small benefit to the economy. However, a more careful analysis of the impacts on agriculture and rural communities may be required before the subsidy can be removed, and alternative support schemes, at least in the short term, may be required.

Nevertheless, the analysis suggests that this could be a worthwhile exercise, and it would be in keeping with Cyprus's commitment to the removal of EHS made most recently in Rio in June 2012.

4.13 Latvia

Introduction Latvia has 10 EHS for fossil fuels, although several of them are very small in scale. The full list of subsidies is:

- €66.52m is given as a direct subsidy annually to one CHP plant. This is given to assist with the installed capacity of the plant. A second one is to be built in 2013 LV_S1
- €0.22 m is forgone in government revenue due to a full excise tax rebate granted on natural gas when used as a heating supply for greenhouses and industrial poultry rising. LV_S2
- €1.45m is forgone in government revenue due to an exemption in the excise tax normally charged on natural gas is granted for the industrial manufacturing and agricultural sector. LV_S3
- €3.07m is forgone in government revenue due to an exemption granted to natural gas when used for electricity produced in CHPs. LV_S4
- €6.01m is forgone in government revenue due to an exemption granted to domestic shipping on the excise tax normally levied on diesel. LV_S5
- €11.16m is forgone in government revenue to industrial consumers via two measures. An exemption on the excise tax for oil products and an excise reduction for petroleum, fuel oil and diesel when used for heating. LV_S6
- €1.74m is forgone in government revenue via an excise tax exemption on oil products when used in ‘special economic zones’. This includes: certain boats and electricity and CHP production. LV_S7
- €10.22m is forgone in government revenue via an excise tax exemption on diesel when used by agriculture for transport. LV_S8
- €0.08m is forgone in government revenue to electricity or CHP producers LV_S9
- €24.74m is forgone in government revenue to households which import oil products from non EU countries for their own personal consumption. LV_S10

Assessment methodology The lump sum subsidy to the CHP plant has not been included in the formal modelling exercise, as the E3ME model does not include the necessary detail on CHP. An energy systems model would be a better tool for this type of analysis. The key question is whether without the subsidy the CHP plant would continue to produce heat, what the price of the heat would be and whether final consumers substitute the heat with other fuels.

However, it should also be noted that the scope of the number of plants eligible to receive the lump sum subsidy is due to increase in 2013 as a second plant is to be built. The value of the subsidy may therefore increase as well, meaning that it becomes by far the largest subsidy in Latvia.

The other subsidies in Latvia were modelled as changes in energy prices, as described in Chapter 2. It should be noted that Scenario S8 was given as a 2012 value which was less than half of the 2011 value (form the OECD inventory). We have chosen to model the most up to date value wherever possible. As such the impact from removing this EHS had already begun in 2012. The high rate of reduction was not continued in our modelling and the standard phase-out rate which has been consistently applied to all other policies has been applied to the 2012 value.

Table 4.13 Latvia: Summary of results in 2020

LATVIA, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
LV_S2a	0.00	0.00	0.00	-0.01
LV_S3	0.00	0.00	-0.06	-0.09
LV_S4	0.00	0.00	-0.01	-0.02
LV_S5	0.00	0.00	0.00	0.00
LV_S6	0.03	0.02	-0.17	-0.28
LV_S7	0.00	0.00	0.00	0.00
LV_S8	0.03	0.01	-0.07	-0.15
LV_S9	0.00	0.00	0.00	0.00
LV_S10	0.09	-0.03	-0.26	-0.27
Latvia	0.15	0.01	-0.80	-0.80

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Summary of results

The results from the Latvian scenarios are shown in Table 4.13.

The two largest subsidies are on the use of liquid fuels for heating for industry (S6) and households (S10). The modelling results suggest that phasing out these two subsidies could reduce fuel consumption and CO2 emissions by between 0.5% and 1%. Removing these subsidies would also provide an incentive to invest in alternative forms of space heating, and the scenarios show a GDP impact of +0.1%.

These scenarios may also have quite important distributional implications. Raising the prices of the fuel used for heating by industry does not have major competitiveness impacts (at least at the level of detail seen by the model) but there could be (particularly short-term) costs to low income households. It may be that an alternative supporting mechanism would be required to provide assistance.

The model results show that phasing out the other subsidies, which are mostly very small in scale, could reduce energy consumption by a further 0.1%. There are no economic impacts from this.

Conclusions from the Latvian package

In Latvia there is quite a wide range of subsidies on fossil fuel consumption. However, most of these are very small in scale and are given to particular sub-sectors or firms. In many cases it seems possible they could be phased out or replaced through direct negotiations with the companies involved.

The two most important subsidies (S6 and S10) relate to the use of liquid fuels for heating purposes. Both companies and households receive subsidies to help with this. The modelling results suggest that there would be small economic and environmental benefits from phasing out these subsidies but there may be important distributional implications, particularly from the subsidies that are provided to households.

In summary, it appears that Latvia has the opportunity to reduce energy consumption and CO_2 emissions by around 0.5% through the phasing out of fossil fuel subsidies. Our analysis finds that this could have small economic benefits if the revenues that are saved are recycled effectively. It is therefore recommended that further analysis is carried out to consider how the existing structure of subsidies in Latvia could be reformed.

4.14 Lithuania

Introduction

Lithuania has two fossil fuel subsidies. There is a small subsidy that is granted for heating fuels and a larger VAT exemption for district heating:

- €5.3m is the total revenue forgone from the reduced rate of excise tax for heating. LT_S1
- €45.61m is forgone in government revenue via a reduced VAT rate charged on heat energy in the residential sector. The purpose was to mitigate the rising cost of fuels. This is only an implicit subsidy to fossil fuels. LT_S2

Assessment methodology

The first measure was assessed using the basic methodology for energy price subsidies that is presented in Chapter 2. Scenario 2 was modelled as an increase in VAT, also using the approach described in Chapter 2, but scaled so that the revenues are consistent with the IEA figures (as in the case of Hungary, the economic data do not distinguish district heating).

Also as in the analysis carried out for Hungary, it is assumed that there is no switching from district heating to other fuels (e.g. natural gas) although in reality this may occur. It is also not possible to estimate the change in CO2 emissions, without knowing the further details of fuels used in district heating (again beyond the scope of the economic model); but it is reasonable to assume it is relatively small in scale.

Table 4.14 Lithuania: Summary of results in 2020

LITHUANIA, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
LT_S1	0.01	0.00	-0.04	-0.04
LT_S2	0.00	0.00	-0.08	n/a
Lithuania	0.01	0.00	-0.11	n/a

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Summary of modelling results

The model results suggest that a gradual phase-out of the two fossil fuel subsidies in Lithuania would result in a small reduction in final energy demand (see Table 4.14). Although the modelling cannot give a precise estimate of the impact on emissions, it is likely to be of a similar magnitude.

The size of the subsidies is too small for their removal to have a meaningful impact at macroeconomic level.

Conclusions from the Lithuanian package

Lithuania has two subsidies for fossil fuel consumption. There is a very small subsidy that is applied to fuels used for heating and a larger implicit subsidy given through a reduced rate of VAT applied for district heating. The model results suggest that phasing out these subsidies would have only a small impact on energy consumption and virtually no economic impact.

The key concern in phasing out these subsidies is likely to be the impact on vulnerable social groups who will face higher heating costs. It may be necessary to create an alternative instrument to provide support to these households.

4.15 Luxembourg

Introduction

There is only one EHS from Luxembourg and it is very small in size. The beneficiaries of the policy include users of certain petroleum products in agriculture, horticulture and for heating purposes:.

- €4m is the total revenue forgone from the reduced rate of excise tax on petroleum products, diesel and LPG only. This policy covers the sectors of agriculture, horticulture and residential heating. LX_S1

Assessment methodology

Phasing out of the subsidy was modelled as a change in energy prices, as outlined in Chapter 2.

Table 4.15 Luxembourg: Summary of results in 2020

LUXEMBOURG, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
Luxembourg	0.00	0.00	-0.02	-0.01

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Summary of results

As Table 4.15 shows, the policy measures have only a very limited effect on energy consumption and emissions in Luxembourg. There is no discernible economic impact.

Conclusions from the Luxembourg package

The one fossil fuel subsidy in Luxembourg is very small in scale. It is likely to provide a small incentive for the agricultural sector to use more fuel, but the modelling results from the scenario in which it is phased out reflect the scale of the subsidy value.

4.16 Hungary

Introduction

There are five EHS for fossil fuels in Hungary, which combine support for both producers and consumers of fuel.

The full list of subsidies is:

- €25.14m is given in direct price support to coal producers. A levy is put on purchases of electricity and the revenue is used to finance the more expensive coal. HU_S1
- €17.24m is the total revenue forgone by governments via a refund paid to railways on the excise tax levied on diesel fuel. HU_S2
- €71.79m is the amount of direct support given to households in the form of a maintenance cost subsidy. The payment goes directly to the supplier which is then passed on to the consumer via lower prices for fossil fuels used in heating. HU_S3
- €103.37m is the amount of government revenue forgone to district heating. This is given via a reduced rate of VAT. This is only an implicit fossil fuel subsidy as heating is largely supplied by fossil fuels. HU_S4
- €84.52m is the total government revenue forgone to agriculture via a refund of up to 70% of the excise tax paid on petroleum products when diesel is used off road. HU_S5

Assessment methodology

The first subsidy was assessed in largely a qualitative manner and is not included in the national total. A modelling scenario was set up, however. In this scenario we assume that without the subsidy, electricity production from lignite would be replaced with generation from natural gas. There is thus a substitution between fuels used in the power mix.

The critical question is what would happen to electricity prices if the subsidy was phased out. This depends on the price differential between lignite and natural gas, compared to the value of the subsidy (and possibly whether power companies would be able to pass on higher costs). In the modelling exercise we have assumed that electricity prices would remain unchanged (meaning that the subsidy perfectly matches marginal generation costs for gas and lignite) but this is unlikely to be true in reality. The results from the modelling exercise, presented only in the text below, are likely to be overly positive.

Scenarios 2, 3 and 5 were modelled as increases in energy prices in the same manner as described in Chapter 2. Scenario 4 was modelled as an increase in VAT, also using the approach described in Chapter 2, but scaled so that the revenues are consistent with the IEA figures (the economic data do not distinguish district heating). It is assumed that there is no switching from district heating to other fuels (e.g. natural gas) although in reality this may occur.

Summary of results

The lump sum scenario (S1) in Hungary is relatively small in scale (€25m) so, even given the questionable assumptions; we would not expect to see large changes in macroeconomic outcomes. The modelling results suggest a maximum benefit of around 0.06% of GDP, mainly due to the revenue recycling measures and multiplier effects. Employment effects are positive but even smaller.

There are, however, possible reductions in emissions in this scenario from switching from a carbon-intensive fuel, lignite, to natural gas. In the absence of CCS technology, this would seem an obvious way for Hungary to reduce its CO2 emissions.

The three scenarios that result in increased energy prices could reduce energy consumption and CO2 emissions by up to 0.2% (see Table Table 4.16). Although this is quite a modest amount, there is a small economic gain (0.06% of GDP, 0.03% of employment) associated with the reductions. However, this must be taken in the context of possible distributional impacts on low income and rural households.

The VAT scenario results in a reduction of energy consumption of around 0.1%, although this is based on the assumption that consumption of heat is reduced and not replaced with other fuels.

Table 4.16 Hungary: Summary of results in 2020

HUNGARY, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
HU_S2	0.01	0.01	0.00	-0.01
HU_S3	0.01	0.00	-0.11	-0.11
HU_S5	0.04	0.02	-0.05	-0.06
Hungary	0.06	0.03	-0.17	-0.18

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Conclusions from the Hungarian package

Hungary has a range of fossil fuel subsidies that are given to both producers and consumers of fossil fuels. All the subsidies are quite modest in scale.

The subsidy to coal producers has not been modelled as the behavioural response to withdrawing the subsidy is unclear. Possible outcomes are described in Section 4.5 and the same factors are likely to apply for Hungary. However, the scale of the subsidy is much smaller in Hungary than it is in Germany.

The largest fossil fuel subsidy in Hungary is a reduced VAT rate for district heating. As district heating is not well defined in the E3ME model, the outcomes of phasing out this subsidy are quite uncertain; a detailed energy systems model would be a more appropriate tool. However, our results suggest a reduction in final energy consumption of around 0.1%, on the assumption that heat is not replaced directly with other fuel inputs. There would also be a very small increase in GDP and employment.

The other subsidies are smaller in scale and, when grouped together and phased out, could lead to a reduction in final energy demand of up to 0.1%. There may also be a very small economic benefit from this, particularly from reducing the agricultural subsidy (leading to reductions in fuel imports).

In conclusion there is quite a lot of uncertainty about the outcomes of subsidy reform in Hungary. Our recommendation is that further analysis is carried out for the VAT subsidy and the lump sum subsidy to coal producers. Together these account for 40% of the total fossil fuels subsidies in Hungary. An understanding of the regional and distributional effects of the other subsidies would be necessary to consider reform.

4.17 Netherlands

Introduction

The Netherlands is another country that only has one fossil fuel subsidy in the OECD inventory. This subsidy was first introduced in 1996 as a zero energy tax rate applied to the use of natural gas in the horticulture sector. The zero rate was later replaced by a tax reduction in 2000 that was set to increase by 10% in the years 2002 and 2005.

The value of the reduced tax-rate diminished over time to create a similar rate to those imposed upon energy-intensive industries. The beneficiaries are subject to conditions to enter voluntary agreements in order to improve their energy efficiency.

- €91m is the total revenue forgone from the reduced energy tax rates on natural gas used in the horticultural sector. NL_S1

Assessment methodology

The phasing out of the subsidy is treated as an increase in energy prices and follows the methodology described in Chapter 2.

Table 4.17 Netherlands: Summary of results in 2020

NETHERLANDS, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
The Netherlands	0.01	0.00	-0.05	-0.03

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Summary of results

The modelling results are shown in Table 4.17. For the given increase in energy prices to the agriculture sector, there is an overall fall in energy demand (for natural gas) of around 2% for agriculture as a whole and 0.05% for the whole economy. Dutch CO2 emissions fall by a slightly smaller amount. Unsurprisingly, given the scale of the changes, there is almost zero impact on GDP.

There are also few sectoral impacts from phasing out the subsidy. The agriculture sector is typically unable to pass on cost increases through higher prices and so must absorb the higher fuel prices. Alternative instruments may be considered to help with this.

Conclusions from the Dutch package

According to the OECD inventory, the Netherlands has only one fossil fuel subsidy and it is quite small in scale. If this subsidy were to be phased out, there would be a small reduction in energy consumption and CO_2 emissions.

Opposition to phasing out the subsidy is likely to come from the agricultural lobby as farmers would face a direct increase in costs that they may not be able to pass on through higher food prices.

4.18 Austria

Introduction

According to the OECD inventory, Austria had four fossil fuel subsidies in 2012. However, three of those were due to end by 12/12/2012, so only the one remaining policy was modelled using E3ME. This covered energy-intensive industries.

- €329.42m is the total revenue forgone from energy taxes to energy intensive businesses which invest in energy saving measures.

Austria's subsidy to energy-intensive firms is just over half the size of Germany's subsidy for the same final user. Similarly the refund in terms of euros per unit of energy for Austria is much smaller for energy-intensive firms than its neighbour. However, the OECD text warns users that great caution should be taken in drawing any cross-country comparisons (see Chapter 0). Moreover, a comparison of these two policies does not cover the full set of measures which are in place to subsidise energy-intensive firms in both countries.

Assessment methodology

Not all businesses are eligible for the same reduction in energy tax. Energy-intensive firms can get up to 100% of their energy tax bill refunded while other firms can only receive a maximum of a 50% reduction. The services sector, including transport, is not eligible.

In the modelling, the subsidy was split across the energy-intensive sectors on the basis of their energy demand, which is further split by fuel. The reduction in excise duties was modelled as a price-based subsidy on energy consumption following the methodology outlined in Chapter 2.

Summary of results

The results from the modelling exercise suggest that a quite substantial reduction in energy consumption and emissions could be made by phasing out the remaining fossil fuel subsidy in Austria. CO2 emissions fall by 1.4% in the scenario compared to baseline by 2020. The fall in energy consumption is less, reflecting the impact of higher industrial prices for coal in the scenario.

The modelling results also show that phasing out the subsidy could lead to an increase in GDP of 0.1% and an increase in total employment of 0.05%.

At sectoral level, the results indicate a possible small loss of output (less than 0.1%) in some of the industrial sectors that are subject to strong international competition, including production of metals and engineering. This loss of output is compensated by the positive effects of the revenue recycling, with overall benefits seen by most of the services sectors.

Table 4.18 Austria: Summary of results in 2020

AUSTRIA, SUMMARY OF RESULTS

	GDP	Employment	Final energy demand	CO2 emissions
Austria	0.11	0.05	-0.71	-1.4

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Conclusions for Austria

It is clear that any phasing out of the remaining subsidy in Austria would need to take into account the situation regarding subsidies in Germany (see case study in Section 3.5). It may be that the phasing out of the Austrian subsidy is impossible politically without there also being reform in Germany.

However, the modelling exercise suggests that there could be modest benefits to Austria from the phasing out of its subsidy, both in economic and environmental terms. Withdrawal of the subsidy could lead to a fall in Austrian CO2 emissions of over 1%. The economic results are dependent on the interaction with Germany; although our results suggest only a very small loss of production in the sectors that are currently covered by the subsidy; further specific analysis in this area may be advised.

4.19 Poland

Introduction

Poland had three fossil fuel subsidies in 2011, one of which was directed at electricity producers and two of which were aimed at consumers. The EHS cover agriculture, households (both supporting the consumer) and the coal sector (a support for the producer):

- €518m is the total amount of support given to coal-fired power plants which hold long-term power purchase agreements Power Purchase Agreements (PPAs) with network operators. This is a form of direct support as agreements for purchases to secure future production. The support has been conducted to improve the standards of the sector and to compensate the power plants for the termination of the PPAs which are due to expiry between 2025 and 2027. PL_S1
- €39.49m is the cost of the in-kind benefits granted to coal-mine workers in order to ease the closure of the coal mining industry. The measure includes the provision of free coal for heating and water-warming purposes. PL_S2
- €175.27m is the amount of government revenue forgone on the EHS for agriculture. The cost of diesel used for farming can be claimed back by the farmers twice a year but the amount cannot exceed 86 litres per hectare of utilised agricultural area. The rate of exemption is decided and agreed upon annually. PL_S3

Assessment methodology

The first subsidy, which is the largest by value, offers support to coal-fired power plants. As with the other subsidies of this type, it is not clear what the behavioural response of removing the subsidy would be. One possibility would be that electricity prices increase, another option is that power producers switch to using other fuels (possibly with knock-on effects to Polish coal producers).

Due to the considerable degree of uncertainty in this scenario, it has not been included in the formal modelling exercise and is excluded from national totals. However, given its size, it is suggested that the subsidy is looked at in further detail.

The second scenario is treated as a price subsidy for the consumption of coal. It is shared amongst all domestic users of coal although it is noted that it is only available to selected household groups (see the treatment of regional subsidies in Section 2.2).

The third scenario is modelled as an increase in middle distillate prices to the agriculture sector.

Table 4.19 Poland: Summary of results in 2020

POLAND, SUMMARY OF RESULTS

	GDP	Employment	Final energy demand	CO2 emissions
PL_S2	0.00	0.00	-0.02	-0.04
PL_S3	0.02	0.02	-0.09	-0.06
Poland	0.03	0.02	-0.11	-0.10

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Summary of results

As Table 4.19 shows, phasing out the two price-based subsidies would have only a modest impact on energy consumption and emissions. Both fall by around 0.1% if the scenarios are taken together. There is a very small increase in GDP.

At the sectoral level, it is the agricultural sector that stands to lose out; as in several other European countries, a phasing out of subsidised fuel would lead to higher operational costs that may not be possible to pass on through higher prices. It seems likely that an alternative instrument would need to be established if the subsidy was to be reformed.

It would also be necessary to consider the distributional effects of reforming the second subsidy as it is targeted at a very specific population. Again, an alternative support mechanism may be necessary.

Conclusions from the Poland package

The largest subsidy in Poland (valued at more than €500m) concerns the use of coal in the power sector. It is therefore natural that this instrument would be considered first if Poland was to phase out all fossil fuel subsidies. Unfortunately, the modelling on its own is unable to provide estimates of what the impacts of removing this subsidy would be, both on electricity prices and feedback to the coal sector. It is therefore recommended that this is assessed further.

The other fossil fuels subsidies in Poland are much smaller in scale and target specific groups (agriculture and mining communities). In both cases there is a strong social element to the subsidies which it seems would need to be replaced with alternative support if the fossil fuel subsidy was phased out. It should also be noted that the benefits of reducing these subsidies would be relatively small.

In conclusion, Poland is fairly limited in its options for phasing out fossil fuel subsidies but any subsidy reform would most likely have to be carried out in the context of reducing the country's dependence on coal.

4.20 Portugal

Introduction

Portugal has six EHS for fossil fuels. The largest subsidy relates to the consumption of fuel by agriculture, but the smaller measures cover a range of economic sectors. The full list of subsidies is:

- €19.7m of government revenue is forgone via the fuel-tax exemption for coastal and inland navigation. Specifically diesel and fuel oil are exempt from the fuel excise tax when used in coastal and inland water commercial navigation. PT_S1
- €7.1m of government revenue is forgone via the fuel-tax exemption on the excise duty on fuel for transport. The only eligible beneficiaries of this measure are the railway locomotives using diesel oil are exempt from the excise duty. PT_S2
- €66.8m is the amount of government revenue forgone via a fuel-tax reduction available for agriculture. Diesel fuel used in tractors and other farm machinery is subject to a reduced rate of tax. Specifically mentioned is the reduced rate for the use of coloured or marked diesel oils. The fuel-tax is mainly allocated to diesel rather than gasoline due to the relative amount used for this particular activity. PT_S3
- €29.5m of government revenue is forgone via the diesel fuel-tax reduction for fixed engines and heating. This mainly benefits engineering, construction and agriculture. PT_S4
- €5.2m of government revenue is forgone via the fuel-tax exemption for electricity generation. Electric utilities and CHP plants powered by coal, coke or fuel oil are exempt from the fuel excise tax. The same exemptions apply for the two outer most regions of Portugal (Azores and Madeira), but they are also eligible to purchase exempt excise rated diesel. PT_S5
- €15m of government revenue is forgone on a fuel-tax exemption for certain industrial processes. The industrial processes included are; electrolytic, metallurgical, and mineralogical. It is the use of petroleum products in these processes that is exempt from the fuel excise tax. Iron and steel and non-ferrous metals are sectors for which the exemption are carried out, provided the necessary licenses, emissions license scheme, and agreements, energy-efficiency agreement. PT_S6

Assessment methodology

All of the subsidies are treated as price-based subsidies on energy purchases by the relevant fuels and sectors. They are modelled using the approach presented in Chapter 2.

Summary of results

The results from the modelling scenarios are presented in Table 4.20. The table shows that phasing out the subsidies could have a quite modest effect on energy consumption and CO2 emissions in Portugal with a reduction of around 0.2% in each case. This small reduction is spread across the subsidies for agriculture and industry.

At macroeconomic level there is no economic impact but there could be some impact on particular sectors and sub-sectors (i.e. below the detail offered by the modelling). This is particularly relevant to the specific processes that are covered in S5.

Conclusions from the Portuguese package

Portugal has a set of subsidies that are quite modest in scale and cover a range of economic sectors. The largest ones relate to agriculture and particular industrial sectors. The modelling results suggest that phasing out these subsidies could lead to a small reduction in energy consumption and CO_2 emissions.

Although there is no obvious macroeconomic impact from removing the subsidies, this is partly because they are sometimes quite well targeted at specific industrial sectors and processes. These sectors are likely to lose out from the phasing out of the subsidies and are likely to provide opposition to reform. There may also be opposition from the agricultural sector.

Table 4.20 Portugal: Summary of results in 2020

PORTUGAL, SUMMARY OF RESULTS

	GDP	Employment	Final energy demand	CO2 emissions
PT_S1	0.00	0.00	-0.04	-0.01
PT_S2	0.00	0.00	0.00	0.00
PT_S3	0.00	0.00	-0.07	-0.07
PT_S4	0.00	0.00	-0.06	-0.06
PT_S5	0.00	0.00	0.00	0.00
PT_S6	0.00	0.00	-0.06	-0.04
Portugal	0.00	0.01	-0.23	-0.17

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

4.21 Romania

Introduction

According to European Commission analysis, Romania has three EHS for fossil fuels. There is a small agricultural subsidy and a larger producer subsidy for coal production. The value for the subsidy to railways is not known.

The list is therefore:

- €0.97m of government revenue forgone on subsidies to fund agricultural activities. Applications can be made to the Payment and Intervention Agency for Agriculture to claim allowances for fuel expenses. The funds made available are distributed nationally every year. RO_S1
- €37.42 is the total amount of government revenue forgone on the subsidy for the production of coal. The difference between the revenue the company makes and the cost of production is covered by the government i.e. is the size of the subsidy. The aid doesn't reduce the cost of coal below that of imported coal from other countries. It is only there to support the producer otherwise without it the coal-production plant wouldn't be able to run. RO_S2
- An unknown amount of revenue which the government pay out to SNCFR – the Romania national railway company. This company is heavily assisted by the government, through a variety of different ways which includes forgone revenue and direct support. There is little exact data on the size subsidy and composition of this subsidy. RO_S3

Assessment methodology

Of the three EHS in Romania, two are consumer subsidies and one is a producer subsidy granted to the coal mining industry. There were no data available for one of the consumer subsidies (RO_S3) and so we were not able to model the impact of its removal. The other consumer subsidy (RO_S1) was paid to the agriculture sector for their use of natural gas, and was modelled using the basic method outlined in Chapter 2.

The producer subsidy granted to the coal mining industry (RO_S2) is due to be phased out by 2018. The impact of removing the subsidy is not certain, but it is likely that either the price of coal in Romania would increase to reflect the increase in costs of production, or that the cost of coal extraction in Romania would increase to such an extent, that domestic coal production will become uncompetitive and be replaced with imports.

A report by Ecorys[226] suggests that coal mining in Romania would not exist without state support, which ensures that costs of production do not exceed total revenue in the industry. This implies that the subsidy is paid at the margin, to ensure that firms in the coal mining industry do not make a loss. Therefore, if the subsidy was removed, firms would close down production in the long run (although they may continue production in the short-run, to minimize losses). This subsidy is similar to the coal mining subsidies that were modelled for Germany, and it's likely that the increase in coal imports would have a negative impact on GDP, compared to the baseline.

According to Eurostat, value added in the mining and quarrying sector as a whole was €2.2bn in 2011 (about 1.7% of GDP), so the potential cost of removing the subsidy could be high. There would also likely be significant localised impacts.

[226] 'An Evaluation Of The Needs For State Aid To The Coal Industry Post 2010', Ecorys, 2009.

Table 4.21 Romania: Summary of results in 2020

ROMANIA, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
Romania	0.00	0.00	0.00	0.00

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Summary of modelling results

Table 4.21 does not include the potential impact of phasing out the coal production subsidies (which are due to be phased out anyway) as they are too uncertain to provide with any reasonable degree of confidence. The table also does not include the impact of phasing out the subsidy to railways, for which the value is not known.

This only leaves an analysis of one very small subsidy to agriculture. The scale of it means there is no impact at macroeconomic level.

Conclusions from the Romanian package

The key question in Romania is how to handle declining output from the coal mining sector. At present a subsidy of €37m per annum is provided, although this is due to be phased out by 2018. Analysis by Ecorys suggests that the sector as a whole would struggle to remain in operation without the subsidy.

It is difficult to draw any conclusions regarding the impacts of removing the other subsidies as their values are either unknown (railways) or very small (agriculture).

4.22 Slovenia

Introduction

There are eight EHS in Slovenia, covering a range of sectors. The first three are related to the power sector while the other five are based on final energy consumption. The full list of scenarios is:

- €7.3m is given to as an indirect form of support to the market price of coal producers which use a domestically produced coal in their production. Reimbursements are only given if additional costs are incurred. SI_S1
- €12.98m is the amount of direct support given in the form of a feed-in-tariff to CHP plants which use natural gas. SI_S2
- €32.5m is the amount of government revenue forgone via an exemptions to coal, diesel, oil, motor gasoline, kerosene and natural gas if it is used: by CHP plants, and further processing. SI_S3
- €0.07m is the total value revenue forgone by government through an exemption on excise duty on motor gasoline for fishing boats SI_S4
- €0.19m is the total revenue forgone by government for diplomatic missions as an exemption is given to the excise duty levied on diesel and petrol. SI_S5
- €12.78m is forgone in government revenue to the construction and civil engineering sectors through a partial refund on the excise duty paid on diesel when used by stationary working machinery e.g. for tools in railway transport in or cable cars. SI_S6
- €15.32m is forgone in government revenue to the agricultural and forestry sectors through a partial refund on the excise duty paid on motor fuel when used in machinery. SI_S7
- €45.63m is the total value of government revenue forgone via a refund on the excise duty paid on diesel fuel for commercial purposes. SI_S8

Assessment methodology

The impacts of phasing out the first three subsidies are quite uncertain and so they are not included in the national totals. However, an attempt was made to model them, by:

- For S1, assuming that the power mix is not changed, and the value of the subsidy is added on to electricity prices.
- For S2 and S3 assuming that the subsidy is required for existing CHP capacity to remain in operation and replacing consumption of heat with consumption of natural gas.

The other scenarios were modelled as changes in energy prices, using the approach outlined in Chapter 2.

Summary of results

If the first subsidy is phased out, resulting in higher electricity prices, the model results suggest a modest fall in energy demand (up to 0.05%). As this is probably an upper bound, it is reasonable to assume that the impacts on energy consumption are quite small. There may of course also be economic impacts on coal producers (although the subsidy is quite small), but it is difficult to estimate what these might be without further information.

The impacts of shifting from heat to natural gas are also very uncertain but could be slightly larger in scale. Heat accounts for a small but noticeable share of final energy demand in Slovenia (up to around 5%) so replacing this with gas could have a reasonable upward impact on emissions. Further analysis is recommended if this subsidy is going to be phased out.

The likely impacts from phasing out the other subsidies are more measurable, and are presented in Table 4.22. The figures suggest a potential reduction in energy consumption and emissions of up to 0.1%, with a very small economic benefit from the revenue recycling. This is split fairly evenly between the subsidy that is given to agriculture and the one for commercial use of diesel.

Table 4.22 Slovenia: Summary of results in 2020

SLOVENIA, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
SI_S4	0.00	0.00	0.00	0.00
SI_S5	0.00	0.00	0.00	0.00
SI_S6	0.02	0.01	-0.04	-0.06
SI_S7	0.02	0.02	-0.03	-0.03
SI_S8	0.04	0.03	-0.22	-0.14
Slovenia	0.08	0.06	-0.24	-0.19

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Conclusions from the Slovenian package

Slovenia's fossil fuel subsidies are split fairly evenly between those aimed at the energy sector (including coal and CHP) and those aimed at final users of energy.

As is the case with many of the other producer subsidies we have considered, there is a large range of uncertainty around the impacts of phasing out the subsidies in the energy sector. Our rough estimates suggest that the impacts of phasing out the market price support mechanism for coal are likely to be limited but there could be more substantial impacts from reducing support from CHP. In both cases further analysis is required if subsidy reform is to be considered.

The other subsidies mainly cover agricultural and commercial use of diesel. If these were phased out there could be small environmental and economic benefits, although possibly with knock-on effects within the agricultural sector.

4.23 Slovakia

Introduction

There are five EHS for fossil fuels in Slovakia. Although attempts have been made to model four of them, it is difficult to form model assumptions given their technical nature within the energy system and so there is a very high degree of uncertainty about the results. Because of this we do not formally present results for Slovakia, but describe some of our results to give an indication of the scale of possible impacts.

The full list of scenarios is:

- €4.71m is given in direct grants to one lignite producer in hornonitranske bane, prievidza. The purpose is to raise the accessibility of lignite reserves in a particular region of Slovakia. SK_S1
- €70.67m is the amount of revenue forgone by government to support lignite. As up to 15% of the total electricity generation can be subject to refund when lignite, which is more expensive than alternatives, was the fuel used as the energy source. This scheme only applies to one plant. SK_S2
- €39.05m is the amount of government revenue forgone via an exemption to coal if it is used: as a duel fuel, in mineralogical processes, CHP generation, coke and semi coke production, and finally operational and technological purposes in a mining and coal processes sing company. SK_S3
- €50.15m is the amount of government revenue forgone via an exemption on natural gas when used as a duel fuel, in mineralogical processes, in both CHP and electricity generation, by households, for operational and technological purposes in a gas undertaking, or in commercial use of railroads and water transportation. SK_S4
- €0.38m is the total value of the free provision of coal to be used for heating given to former miners and their widows. SK_S5

Assessment methodology and rough estimate of impacts

The first scenario represents a direct transfer from government to the lignite producer. As the value of the subsidy is small we have not attempted to evaluate the possible impacts of removing this subsidy, beyond noting they are also likely to be small.

The second subsidy is the largest in value. We modelled it as an increase in electricity prices when the government does not pay the subsidy, which implies that the subsidy itself has no behavioural impact. This means that our results are likely to provide an upper bound in terms of macroeconomic impacts, but do not take into account any possible impacts on lignite production. The model results suggested that there could be a small reduction in total final energy demand (0.2%), leading to some very small macroeconomic benefits (from the revenue recycling).

It is very difficult to identify what the impacts of phasing out the subsidy in S3 might be. A detailed energy systems model is probably a more appropriate tool for this purpose but one was not available for this study. We therefore modelled the scenario as a simple price increase within the energy sector, but this only had very small impacts (less than 0.05%) on all output indicators.

The same is true for S4, where the specific purpose that the subsidy is targeted at is well beyond the detail of the E3ME model. Again our approach was to apply a simple increase in price within the energy sector. The model results suggested that the impacts might be slightly larger in scale (up to 0.1%) than in S3 but still quite small overall.

The final Scenario S5 can be modelled as an increase in energy prices, as described in Chapter 2. However, it is too small to have any impacts beyond the narrow social group directly affected.

Conclusions from the Slovakian package

It is difficult to provide any clear conclusions on what the effects of phasing out the Slovakian may be. To do this would require considering the Slovakian energy system as a whole, and it may also be advisable to look at all the subsidies in a single package.

The outputs from this analysis (in terms of energy prices consumption) could then be fed into a macroeconomic model, such as E3ME, to estimate the economic impacts of subsidy removal. However, the indications that we have are the impacts are likely to be quite small.

4.24 Finland

Introduction

Finland has eleven fossil fuel subsidies of varying sizes. There are two large subsidies targeted at light fuel oil and diesel in transport, one fairly large one for energy-intensive industry and a range of smaller subsidies (less than €100m) for other fuels and sectors.

All of the subsidies are aimed at fossil fuel consumption (rather than production) and all are modelled using E3ME. This includes one CO_2 based tax subsidy (S8) which was discussed in the case study in section 3.6.

- €969m is forgone in government revenue via a reduction on the energy tax on diesel fuel used in transport. FI_S1.
- €470m is forgone in government revenue via a reduction on the energy tax rate for light fuel oil used in mobile machinery. FI_S2
- €75m is forgone in government revenue via a reduction in the energy tax rate for natural gas used in general heating. FI_S3
- €4.23m is forgone in government revenue via a reduction in the energy tax rate for heavy and light fuel oils when used heating greenhouses. FI_S4
- €8.5m (revised to €200m, see below) is forgone in government revenue via a refund made to energy intensive enterprise on the energy tax paid on coal, heavy fuel oil and natural gas. FI_S5
- €30.33m is forgone in government revenue via an energy tax rebate on light fuel oil made to the agricultural sector. FI_S6
- €126m is forgone in government revenue as there is a reduced energy tax rate on peat plants when used in heating and a complete exemption for small peat plants. FI_S7
- €56.46m is forgone in government revenue due to a 50% reduction in the rate of the CO2 tax rate for CHP production. FI_S8
- €10m is forgone in government revenue due to an exemption of the energy tax rate for LPG. FI_S9
- €42.61m is forgone in government revenue via an energy tax exemption on light and heavy fuels used in domestic, commercial, vessel traffic. FI_S10
- €0.16m is a direct subsidy given to peat producers to cover the costs of non-commercial stockpiling part of the peak harvested in a given year. This is paid monthly. FI_S11

Assessment methodology

The scenarios were modelled using the methodologies described in Chapter 2 for changes in energy prices and exemptions from carbon taxes. Scenario FI_S11 is modelled as a lump sum payment but is too small to have much impact.

It should be noted that the value of FI_S5 was expected to increase to €200 million in 2012; as such this was taken as proxy for the anticipated subsidy value. The same split between coal, oil and gas was scaled up and the results from the scenario reflect the higher value, with the subsidy being phased out from 2013.

In the analysis of scenarios where diesel subsidies are phased out, it should be noted that there is an assumption that there is no fuel switching from diesel to petrol.

Summary of results

The results from the scenarios are presented in Table 4.23.

The model results show that phasing out the two large subsidies for diesel use could have quite a large impact on energy consumption and CO2 emissions, with reductions in the range of 2%-3% of each for Finland as a whole. These quite large reductions reflect both the scale of the subsidies (combined around €1.45bn) and the potential for vehicle fleets to be upgraded in the period up to 2020.

The model results suggest that reform of these subsidies could also have a reasonable impact on the Finnish economy as a whole, if the revenues that are saved are recycled in an efficient manner; GDP and employment could increase by up to 0.3%-0.4% by 2020, in part due to reduced imports of liquid fuels. The increases in economic activity could be expected to benefit most sectors of the economy, with the only sectors that stand to lose out from this reform being the transport sectors and those that supply refined fuels.

Phasing out the subsidy that is given to energy-intensive sectors (here valued at €200m) could also provide quite a large reduction in energy consumption and, especially, emissions, due to the fact that it includes a subsidy for coal consumption. The result for emissions, however, is to some extent dependent on our assumption of the share of the subsidy that is allocated to coal. The economic impact of phasing out this subsidy is more limited, however, indicating that there may be some loss of competitiveness in the energy-intensive sectors (although this cost is still outweighed by the benefits of the revenue recycling).

The impacts of phasing out the other subsidies are smaller. In each scenario the impact on energy consumption and CO2 emissions is at most 0.1% (excluding the CHP subsidy, S8; see Section 3.6). Nevertheless, if the subsidies were reformed as a single package these reductions would add up, to a further 0.4% reduction in emissions. There is very little macroeconomic impact expected from phasing out these subsidies.

Table 4.23 Finland: Summary of results in 2020

FINLAND, SUMMARY OF RESULTS

	GDP	Employment	Final energy demand	CO2 emissions
FI_S1a	0.17	0.30	-1.86	-1.89
FI_S2	0.09	0.12	-0.97	-0.54
FI_S3a	0.02	0.02	-0.31	-0.10
FI_S4	0.00	0.00	0.00	-0.01
FI_S5	0.05	0.03	-0.77	-1.47
FI_S6	0.01	0.01	-0.02	-0.05
FI_S7	0.01	0.01	-0.09	-0.11
FI_S8	0.00	0.00	-0.18	-0.44
FI_S9	0.00	0.00	-0.04	-0.04
FI_S10	0.02	0.02	-0.03	-0.12
FI_S11	0.00	0.00	0.00	0.00
Finland	0.34	0.47	-3.42	-4.10

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Conclusions from the Finnish package

Finland has a wide range of subsidies of varying sizes, which possibly reflects the fact that environmental policy in Finland is otherwise fairly stringent (e.g. road fuel taxes are high, there is a carbon tax). The starting point for possible subsidy reform should be the large subsidies that are applied to the consumption of transport fuels. These are both the largest subsidies and their phasing out would have less competitiveness impacts than some of the others. Our analysis suggests that phasing out these two subsidies could reduce emissions by more than 2%. There would also be economic benefits of up to 0.3% of GDP, due to a reduction in fossil fuel imports and the saved revenues that are recycled to households.

Although the size of the subsidy that is granted to energy-intensive industry is not clear, phasing it out could result in a further reduction in emissions of 1% or more, because it encourages consumption of coal. This is therefore worth exploring further, even though there are some possible competitiveness impacts.

The other subsidies are all much smaller in scale but, when considered as a single package, could make a further contribution to emissions reductions if they were phased out. This would not have much macroeconomic impact.

In conclusion Finland has several options for phasing out subsidies that could result in quite large reductions in energy consumption and CO_2 emissions. The model results suggest that this could be achieved with a small boost to the Finnish economy resulting from a boost to household incomes and reduction in fuel imports.

4.25 Sweden

Introduction There are 19 EHS for fossil fuels in Sweden. They cover a wide range of fuel uses. Nine of the subsidies were analysed in more depth as part of a case study looking at CO2 taxes in section 3.6.

- €3.32m is forgone in government revenue to industry via a reduced rate of CO2 tax for district heating. SW_S1
- €106.36m is forgone in government revenue to industrial consumers via a reduced rate of energy tax on heating fuels. SW_S2
- €125.19m is forgone in government revenue to industrial consumers via a reduced rate of CO2 tax on all fossil fuels used for heating purposes SW_S3
- €1.11m is forgone in government revenue to energy intensive companies via a reduced CO2 tax rate. SW_S4
- €1,251.91m is forgone in government revenue to the transport sector via a reduced energy tax rate on diesel. SW_S5
- €25.48m is forgone in government revenue to the transport sector via a reduced energy tax rate for natural gas and LPG. SW_S6
- €3.32m is forgone in government revenue to the railway sector for diesel powered trains via an exemption from the energy tax rate on diesel. SW_S7
- €4.43m is forgone in government revenue to the transport sector via a reduced CO2 tax rate for natural gas and LPG. SW_S8
- €95.28m is forgone in government revenue to domestic aviation via a CO2 exemption on jet kerosene. SW_S9
- €103.03m is forgone in government revenue to domestic aviation via an exemption on the energy tax normally levied on jet kerosene. SW_S10
- €55.39m is forgone in government revenue to domestic shipping via a CO2 exemption on diesel and fuel oil. SW_S11
- €2.22m is forgone in government revenue to greenhouses and agriculture via a specifically reduced CO2 rate. This only applies when the rate of CO2 taxation exceeds 1.2% of their sales. SW_S12
- €40.99m is forgone in government revenue to greenhouse and agriculture via a generally reduced CO2 rate on all fossil fuels used for heating. SW_S13
- €136.27m is forgone in government revenue to the agricultural and forestry sectors when used for machinery. This is given via a CO2 reduced rate for diesel. SW_S14
- €11.08m is forgone in government revenue for heating fuels for used by greenhouses and agriculture. This is given via a reduced energy tax rate on heating fuels. SW_S15
- €47.64m is forgone in government revenue to CHP plants which are not covered the EU ETS system. This is given via a reduced energy tax rate for fuels used in CHP plants. SW_S16
- €3.32m is forgone in government revenue to the railway sector for diesel powered trains. This is given via a CO2 exemption. SW_S17
- €21.05m is forgone in government revenue to the mining industry via a reduction on the CO2 tax rate on all fossil fuels used for heating purposes. SW_S18
- €13.30m is forgone in government revenue to the mining industry via a reduction in the energy tax on diesel when used for fuelling stationary machines. SW_S19

Assessment methodology

A number of the policies above have specific phase out pathways and/or are planned to end before 2020. For a more detailed description of the phase out pathways already in current policy, see Section 3.7. Otherwise, the phasing out of the subsidies was modelled using the standard approaches for increases in energy prices and reduced exemptions from CO_2 taxes, as described in Chapter 2.

Table 4.24 Sweden: Summary of results in 2020

SWEDEN, SUMMARY OF RESULTS				
	GDP	**Employment**	**Final energy demand**	**CO2 emissions**
SW_S1a	0.00	0.00	0.00	-0.05
SW_S2	0.02	0.01	-0.16	-0.87
SW_S3a	0.02	0.01	-0.17	-1.36
SW_S4a	0.00	0.00	-0.01	-0.03
SW_S5a	0.05	0.05	-1.19	-2.23
SW_S6	0.00	0.00	-0.07	-0.13
SW_S7	0.00	0.00	0.00	0.00
SW_S8a	0.00	0.00	-0.03	-0.06
SW_S9	0.02	0.01	-0.13	-0.05
SW_S10	0.01	0.01	-0.09	-0.04
SW_S11	0.00	0.00	0.00	-0.01
SW_S12a	0.00	0.00	-0.01	-0.06
SW_S13a	0.01	0.00	-0.17	-0.49
SW_S14	0.02	0.01	-0.30	-0.56
SW_S15	0.00	0.00	-0.07	-0.31
SW_S16	0.01	0.00	-0.02	-0.02
SW_S17	0.00	0.00	0.00	0.00
SW_S18a	0.00	0.00	-0.02	-0.22
SW_S19a	0.00	0.00	-0.01	-0.11
Sweden	0.25	0.16	-3.33	-7.53

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

Summary of results

The results from the modelling scenarios are shown in Table 4.24. The table shows that, although many of the scenarios are very small in nature, there are a couple that stand out in terms of impacts.

The most obvious is the diesel subsidies that are phased out in S5. These are by far the largest subsidies by value in Sweden and this is reflected in the scale of the impacts from removing the subsidy. The model results suggest that a fall of 1%-2% in energy consumption and emissions is possible.

The other largest potential impact on CO2 emissions is in scenarios S2 and S3 (part of the case study), which cover some of the more carbon-intensive fuels used by industry. If this subsidy was phased out, Swedish emissions could fall by a further 2%.

The outcomes from the other scenarios are more modest; combined they could contribute another 1% reduction in energy consumption and emissions.

In all cases the economic impact is small. The modelling results suggest that GDP could increase by up to 0.2%, but only if all of the subsidies were phased out. The employment effects are smaller still.

Conclusions from the Sweden package

The reasons for the CO_2 tax exemptions are discussed in some depth in the Swedish case study. However, aside from these subsides, there is also the potential to reduce CO_2 emissions by phasing out the large diesel subsidy, which is currently worth over €1.2bn per annum. This could make quite a substantial contribution to reducing Swedish emissions on its own.

If all the Swedish subsidies were phased out, emissions could be reduced by 5% or more, with most of the reductions coming from transport and industry. This is a much larger figure than for other European countries, but in part reflects the high energy/carbon tax rates that these subsidies provide exemptions from.

However, the modelling results suggest that the subsidies could be phased out with no economic costs and possibly some very small benefits. The key issues of competitiveness and distributional impacts are discussed in the case study.

4.26 UK

Introduction

According to the OECD inventory there are four EHS in the UK for fossil fuels. Each one has been modelled in the scenarios described below, with one (S4) also being considered as the case study in Section 3.8. The other subsidies are provided to the energy sector itself and are much smaller in scale.

The full list of subsidies is:

- €0m was lost in forgone government revenue; though this measure does still exist there was no revenue lost in 2011. There is an agreement with British Gas to continue an exemption from revenue tax on petroleum (PRT). UK_S1
- €46.09m is the amount of revenue forgone by government to provide an allowance to oil and gas extraction companies to claim tariff receipts from taxable profits. UK_S2
- €275.56m is given in forgone government revenue to small and marginal oil fields as a form of relief against the petroleum revenue tax (PRT). UK_S3
- €4,576.39m (our estimate is higher, see below) is the amount of government revenue forgone via a reduced rate of VAT charged for domestic fuel and power consumption by households. This is the case study subsidy. UK_S4
- €1,179m (our estimate) is the amount of government revenue forgone via a reduced rate of energy tax charged (ETD) for domestic fuel and power consumption by households. UK_S5

Assessment methodology

The first three cases are subsidies that are granted to oil and gas companies as refunds or exemptions to the UK's Petroleum Revenue Tax (PRT). They were modelled as energy consumption subsidies using the method described in Chapter 2.

Scenario 4 was modelled by changing the VAT rate applied to gas, electricity and oil. The rate of VAT was increased on an annual basis so that by 2020, it was in line with the rate of VAT paid on other consumer products in the UK. In the scenario, we assumed that the VAT rate would increase incrementally from 5% in 2012 to 20% in 2020, to reflect our modelling assumption that the subsidy would be gradually phased out between the years 2013 and 2020. It is important to note that our definition of the subsidy departs from the OECD's definition as we also include the reduced rate of VAT for electricity consumption as a subsidy. This is discussed in more detail in the case study description.

Summary of results

As Table 4.25 shows, with the exception of the reduced VAT rate, phasing out the subsidies would have only a small impact (around 0.1%) on total UK energy consumption and CO_2 emissions. There is no discernible economic impact from phasing out these subsidies.

Conclusions from the British package

The priority for phasing out fossil fuel subsidies in the UK should clearly be the reduced rate of VAT, as the other subsidies are too small to have much influence on macroeconomic outcomes. This is discussed in detail in Section 3.8.

The other three subsidies should also be considered in the context of other special charges and taxes that are applied to the UK's oil and gas sector, as it is very much a special case in the UK economy. However, the existing structure could be reformed so as not to incentivise higher rates of fuel consumption.

Table 4.25: UK summary of results in 2020

UK, SUMMARY OF RESULTS

	GDP	Employment	Final energy demand	CO2 emissions
UK_S1	0.00	0.00	0.00	0.00
UK_S2	0.00	0.00	-0.01	-0.02
UK_S3	0.00	0.00	-0.03	-0.11
UK_S4	0.00	0.01	-0.63	-0.54
UK_S5	0.00	0.00	-0.15	-0.15
UK	0.00	0.01	-0.66	-0.67

Note(s): Figures shown are % difference from baseline.
Source(s): Cambridge Econometrics, E3ME.

5 Conclusions

5.1 The macroeconomic viewpoint and the modelling exercise

In the standard economic model, adding a subsidy to any product market will have a distorting effect. Those receiving the subsidy will increase their demand for the product, leading to a price increase and a fall in demand from other sectors of the economy. At the same time, taxes must be raised to pay for the subsidy. This will have a distortive effect elsewhere in the economy, for example by reducing the incentive to work, to invest or to hire labour. According to the theory, overall economic efficiency falls.

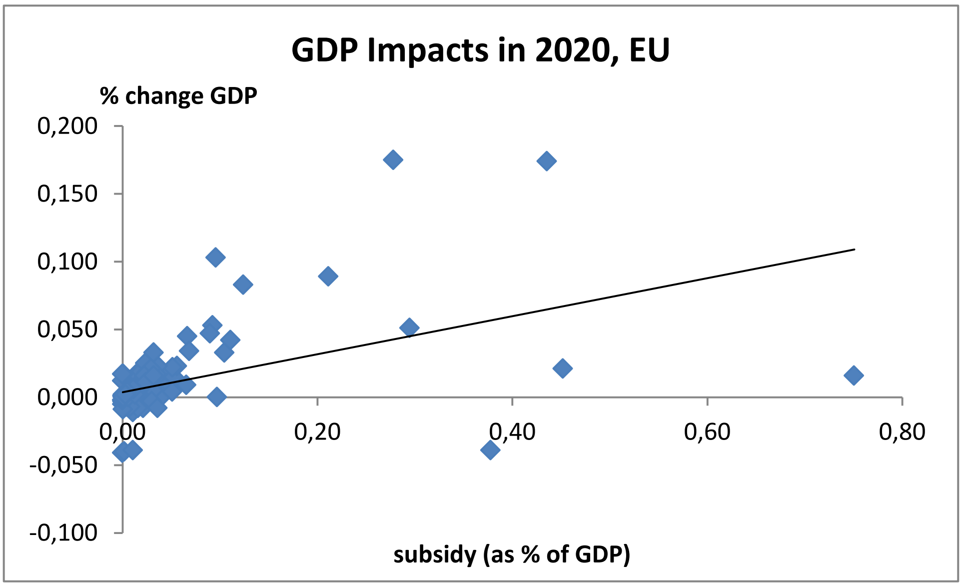
In the real world, however, there may be social or political justification for particular subsidies. For households in particular, fossil fuels provide one of the basic needs and there may therefore be social grounds for ensuring universal availability. Industry sectors may also justify benefiting from subsidies if they provide a good or services with social benefits, such as connecting rural areas or providing reasonably priced food.

This modelling exercise has focused on the macroeconomic effects of phasing out fossil fuel subsidies in Europe's Member States. In particular, it has considered the trade-off of raising taxes to pay for subsidies and reducing the cost of fossil fuels to particular social and industrial groups.

GDP impacts

The results from the modelling show that phasing out subsidies relating to energy consumption and CO_2 emissions (including reduced VAT rates) would have a positive but small effect on GDP in nearly all cases (see Figure 5.1, in which all the scenario results are presented compared to baseline). This is primarily due to reductions in fossil fuel imports to Europe and the beneficial effects of revenue recycling. However, as the figure shows, phasing out the subsidies very rarely results in impacts larger than 0.1% of GDP.

Figure 5.1: GDP Impacts (National Level)



The scenarios with the biggest (relative) impacts are often those that phase out subsidies for imported transport fuels. The ones that perform worse in terms of GDP outcome are ones where imports of fuels may increase (e.g. phasing out subsidies for CHP or district heating, see below).

Competitiveness effects and sectoral impacts

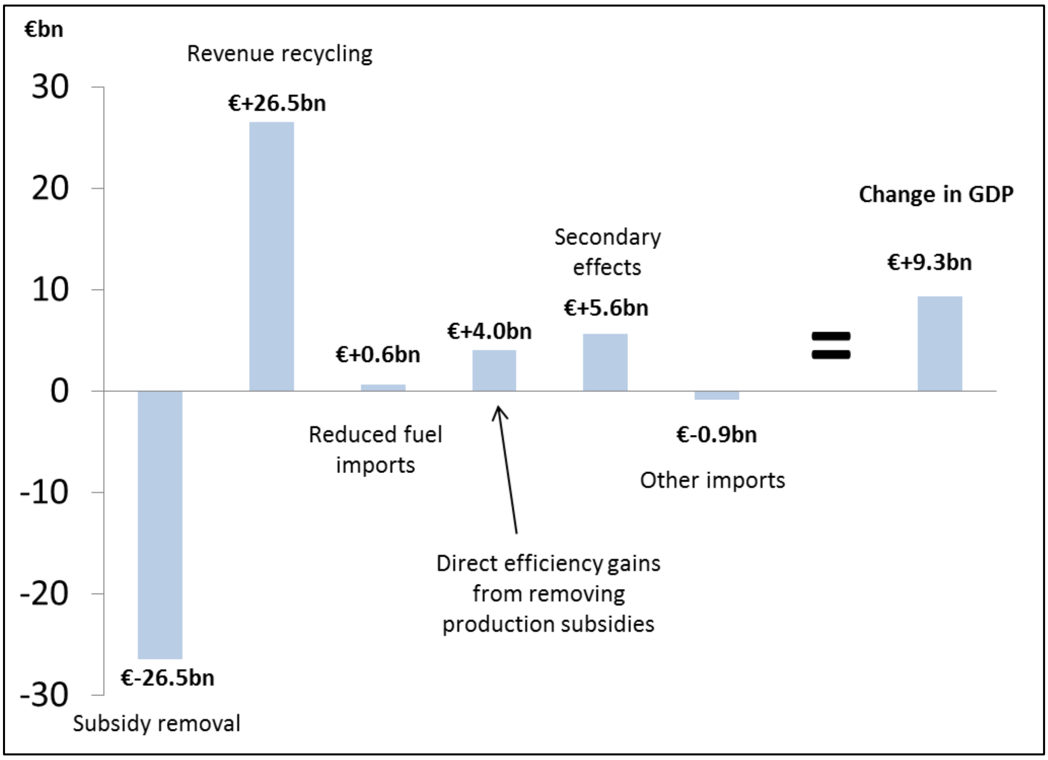
Many of the subsidies that were considered are at present offered to industry on the grounds of competitiveness. The modelling takes these effects into account at the NACE 2-digit level at which it operates. In almost all cases it does not find significant competitiveness effects although, as always, it should be noted that there might be much larger impacts for particular sub-sectors or individual firms.

It is also important to note that across Europe there can be similar subsidies offered to competing sectors, notably agriculture and particularly exposed energy-intensive sectors. If there was a coordinated effort to phase out subsidies, it may be more politically feasible.

The modelling has typically not focused on the sectoral impacts as they are usually quite clear, given the scenario definitions; phasing out the subsidy has a negative impact on the sectors directly affected, while other sectors benefit from alternative use of the revenues. However, we would also expect energy sectors such as manufactured fuels and gas distribution to lose out. If the subsides were extended to cover electricity use, the power sector would also lose out.

Figure 5.2 breaks down the changes in GDP at European level. It shows that the subsidy removal and revenue recycling balance out (by design) but there are benefits from removing inefficient subsidies given to producers (€4bn) and reducing fossil fuel imports from other countries (€0.6bn). There are also secondary multiplier effects (€5.6bn) although some of this benefit is spent on other imports from outside Europe (-€0.9bn). Once all these effects are taken into account, the net benefit of €9.3bn in 2020 is realised.

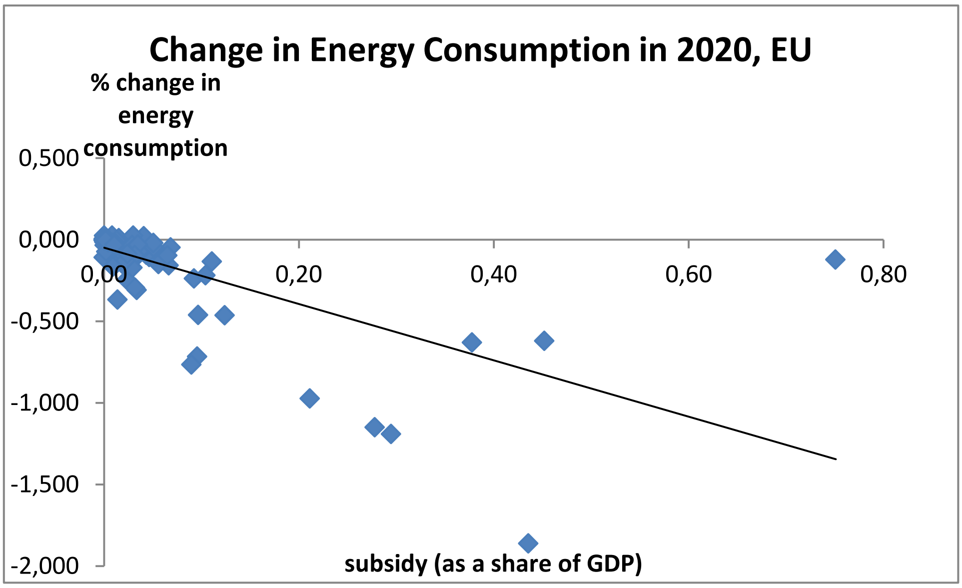
Figure 5.2: Annual Changes and Contributions to EU GDP, 2020 (Current Prices)



Environmental impacts There is a clearer environmental benefit from phasing out subsidies, as shown in Figure 5.3. In the chart, total national final energy demand is plotted against the value of the subsidy in that country. In almost all cases final energy consumption falls, by as much as 2% of the national total. The potential reduction in energy-related CO2 emissions is of a similar magnitude.

However, there are sometimes grounds for caution when subsidies are offered to make a relatively low-carbon energy carrier (notably heat from CHP) more attractive; on the chart, the subsidy for district heating stands out on the right hand side and some other countries have similar subsidies in place. A more careful analysis of the energy system is required in these cases, as the analysis in this report was based on some fairly basic assumptions.

Figure 5.3: Change in Energy Consumption



Social impacts The range of social impacts covered by the modelling framework is limited to employment, unemployment and incomes. The insight gathered from the case studies is important to provide further insight. Most of the scenarios lead to an increase in overall employment and a decrease in unemployment. However, the aggregate results indicate that there could be notable adverse impacts on vulnerable groups. This includes in particular groups in the population that spend a large share of income on heating fuels and lack the access to finance for energy efficiency improvements. This is a theme which is picked up in the case studies (see below) and represents a substantial barrier to subsidy removal.

Lump sum subsidies The results shown in Figure 5.1 and Figure 5.3 are for subsidies that act as pricing instruments. However, some of the largest subsidies are given as lump sum payments to producers, irrespective of their energy consumption. In total, these account for almost a quarter of the total subsidy value in Europe.

These subsidies are much more difficult to assess and need to be considered on a case-by-case basis. The behavioural responses to the removal of these subsidies are very unclear and could range from no change (in which case the subsidy boosts profits) to outright closure (in which case the subsidy could have a large impact on output and jobs). The environmental benefits are also not clear (or very positive either); energy consumption would only fall at the expense of a large loss of economic output.

The conclusions from the analysis are thus that there may be a very good economic reason for revisiting these subsidies, which are often given to industries that are in structural decline. However, in general there is not a strong environmental case for phasing out these subsidies.

There are also some examples of lump sum subsidies that are given to households in Europe, including in Belgium and Italy. These are generally quite small in scale and are granted for social reasons. Whereas they should not have an impact on energy consumption (according to economic theory) the contrary might be expected in some cases. In particular, a further example in the UK suggests effects; the Winter Fuel Payment is not linked to energy consumption (and is not classified as a fossil fuel subsidy by the OECD) but its name could encourage higher levels of energy consumption.

Comparison to other studies

There are very few recent studies that have attempted to quantify the impact of removing EHS. Those which have done so typically used the price-gap methodology to estimate subsidy size and have focused on a different selection of countries to those covered in this report. Therefore the results from these studies are not directly comparable to the results in this report.

The most relevant study for comparison is published in Burniaux et al (2009). This study used the OECD's linkage model, price-gap data, and modelled a number of scenarios covering broader world regions. The most similar scenario to our study was a multilateral gradual decrease of EHS by 2020. It was estimated that for the EU-27 and EFTA region this would result in a 3.1% reduction of CO_2 emissions, a GDP increase of 0.2% and a household equivalent real income gain of 0.4%, all relative to their baseline case (BAU).

The conclusion of Burniaux et al (2009) is that economic impacts will be small but positive; this is consistent with our findings.

5.2 Social impacts: Is it desirable to phase out fossil fuel subsidies?

The conclusions so far suggest that there are reasonable environmental benefits and small economic benefits to phasing out most of the fossil fuel subsidies that affect energy prices. There may also be an economic case for phasing out the lump sum subsidies that are given to industrial sectors.

However, the question of potential social impacts from removing fossil fuel subsidies remains unclear. This is of critical importance and, as outlined at the start of this report, is included explicitly in the Resource Efficiency Roadmap milestone:

By 2020 EHS will be phased out, with due regard to the impact on people in need.

To address this issue we must turn to the case studies.

The case studies for Germany and Sweden involved subsidies that were applied to industry only, meaning that households paid a higher price for energy than industry. The subsidies may protect jobs in particular industries but will have little impact on the wider community. In these cases there are indications that subsidy reform may now be gaining political traction.

In contrast, the main justification for the subsidies examined in the case studies for the UK, Belgium and Italy, is their social benefits, in the form of distributional effects in favour of low-income households. In all three cases it would be politically difficult to remove the subsidies without replacing them with alternative instruments. The case of the UK has shown that, even if alternative instruments do exist, it may be difficult to reach the vulnerable populations in an effective and efficient manner.

The UK case study provides the basis for a hierarchy of policy measures that could be used to address this issue. In summary, they are:

- measures to increase energy efficiency and reduce energy consumption
- social transfers that are not linked to energy consumption
- subsidies that will increase energy consumption

The first option has an initial cost, but longer-term economic, environmental and social benefits, particularly if the measures are targeted at low-income households. The second option has an economic cost but does not encourage higher rates of fuel consumption, while the final option may lead to energy use increasing.

However, local and national institutional frameworks will be important for ensuring successful implementation of efficiency improvements.

5.3 How to go about phasing out fossil-fuel subsidies?

The conclusion from this report is that there is a strong case for considering phasing out the subsidies, as long as the social costs of phasing out price-based fossil fuel subsidies are mitigated through alternative policies.

Previous examples

The OECD inventory of subsidies shows that there are currently several subsidies that are already due to be phased out in the period up to 2020, although in some cases these were only intended to be temporary measures when first introduced. The case study for Sweden also focused on carbon tax subsidies that have been reduced or removed, although at the expense of other revenue sources. On the other hand, the case study for the UK involved the failure of a previous attempt to reduce the VAT subsidy, which may now be an impediment to future change.

The barriers to removal

Table 5.1 summarises the barriers to removing the subsidies that were reported in the case studies. Each of these would have to be addressed if the subsidy was to be phased out successfully.

For subsidies to industrial sectors, offering short-term support for investment in more efficient equipment may help to smooth the transition to complete removal of the subsidy. However, it must also be noted that in some cases, such as agriculture, there may be only limited options for improving energy and resource efficiency. This would need to be considered on a case-by-case basis but the main opposition to removing the subsidy will be from the industry associations for the sectors involved; the wider public may offer support for reform, if government is able to offer support to displaced workers.

Timing the announcement

The case studies show that the timing of announcing plans to phase out subsidies is also important. With Europe’s economies stagnating and energy prices at current levels it would be difficult to announce a policy that would increase prices further.

However, in general either providing a long lead-time to removing the subsidy or implementing a gradual phasing out of the subsidy seems more likely to be successful, as this will give companies and individuals time to adapt, for example by investing in new equipment or vehicles. This could make the complete removal of environmentally-harmful subsidies by 2020 a challenge; 2030 may be a more realistic target.

Table 5.1: Summary of barriers to removal from case study countries

SUMMARY OF BARRIERS TO REMOVAL FROM CASE STUDY COUNTRIES

	Low income households	Low income households	Heavy industry	Agriculture	Transport	French territories	CO2 tax	CO2 tax	Household VAT
	BE	**IT**	**DE**	**FR**	**FR**	**FR**	**FI**	**SW**	**UK**
Economic									
timing				X	X	X		X	X
competition and unilateral action			X	X	X		X	X	
Rising/high fuel prices			X	X	X	X			
administrative cost of alternative policies									X
interaction with other instruments			X	X	X	X	X	X	X
macroeconomic health			X	X	X	X			
development						X			
Political									
communication[227]	X	X							X
politically sensitive issues[228]			X	X	X		X	X	X
historical EHS				X					X
interest groups			X	X	X			X	X
government structure	X	X	X						
entitlement	X	X	X	X	X	X	X	X	
distributional			X			X			
Legal									
EU legislation					X				X
MS legislation	X	X	X		X				X

[227] Communication barriers includes: public perception, fragmented information, isolation effect, fear of change, citing of bad examples

[228] Politically sensitive issues include: statements in manifestos, protection of sectors of national interest, sentiments towards the EU, value of competitive image

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7 Appendix A: Results by Policy

7.1 Belgium

Table 7.1: Belgium's EHSs

Country	Belgium		
Subsidy	Fuel-tax reduction for certain industrial uses, BEL_te_03		
Brief description	Data from 1997 Concession on excise tax on petroleum products. Off-road vehicles, stationary engines in construction and civil engineering. Diesel and Kerosene		
Reference in E3ME	BE_S1	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€143.16m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.101	CO2 emission	-0.258
GDP	0.012	Employment	0.001

Country	Belgium		
Subsidy	Fonds social mazout, BEL_dt_01		
Brief description	Data from 2007 All year round grant for low income and heavily indebted households to pay for heating (oil). Funded by industry and government, value reported pertains to government only.		
Reference in E3ME	BE_S2	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€30m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Belgium		
Subsidy	Special heating grant, BEL_dt_03		
Brief description	Data from 2010. Applied from 2009 Lump sum discount on heating bills of EUR 105 a year for poor households, irrespective of energy source. Counter rising energy prices. Must not be benefiting from Fonds or Social Tariff. Natural gas & Heating oil		
Reference in E3ME	BE_S3	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€3.4m	**Expiry date (if applicable)**	none
natural gas	€4.33m	**Expiry date (if applicable)**	
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Belgium		
Subsidy	Social tariff for NG, BEL_dt_02		
Brief description	Data/Applied from 2004 Payments made to suppliers to compensate them for the difference between market price and reduced tariff. Reduced tariff applied to those on welfare programmes/disabled persons/elderly.		
Reference in E3ME	BE_S4	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€67.06m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.071	CO2 emission	-0.119
GDP	0.001	Employment	0.001

Country	Belgium		
Subsidy	Fuel-tax reduction for certain professional uses, BEL_te_01		
Brief description	Data from 1997 Reduced rate on excise tax on petroleum. Eligible companies – those that consume large quantities of fuels and those which possess environmental permits. Applies mainly to diesel, smaller amounts to LPG and kerosene.		
Reference in E3ME	BE_S5	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€1890.82m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.620	CO2 emission	-0.937
GDP	0.027	Employment	0.055

7.2 Bulgaria

Table 7.2: Bulgaria's EHSs

Country	Bulgaria		
Subsidy	Reduced excise duty on gas oil in agriculture, BG_te_01		
Brief description	Data/Applied from 2012 Only to last for 2 years 2012-2013 but it isn't actually in any legislation. Plan is to provide agricultural producers with fuel vouchers.		
Reference in E3ME	BG_S1	**Support type**	Consumer
Subsidy value in 2012			
middle distillates	€35.8m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.238	CO2 emission	-0.178
GDP	0.053	Employment	0.056

Country	Bulgaria		
Subsidy	Zero excise duty on natural gas for household usage, BG_te_04		
Brief description	Data/Applied from 2012		
Reference in E3ME	BG_S2	**Support type**	Consumer
Subsidy value in 2012			
natural gas	€0.12m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.002	CO2 emission	-0.005
GDP	0.001	Employment	0.000

7.3 Czech Republic

Table 7.3: Czech Republic's EHSs

Country	Czech Republic		
Subsidy	Excise tax refund for diesel used in agriculture, CZE_te_01		
	Data from 2000		
Brief description	Partial refund of the excise tax on diesel when used by agriculture. Discussions about decreasing the tax refund in 2013 and completely abolishing it in 2014. Not law yet.		
Reference in E3ME	CZ_S1	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€74.3m	**Expiry date (if applicable)**	2014
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.108	CO2 emission	-0.016
GDP	0.020	Employment	0.012

Country	Czech Republic		
Subsidy	Energy-tax exemption for certain uses of natural gas, CZE_te_02		
Brief description	Data from 2008		
	Exemption on NG energy tax when used by: households for heating, combined heat and electricity production when later supplied to households, non-recreational transport by boat, mineralogical and metallurgical processes. Reduced energy tax rate applies to compressed natural gas and LNG used as transport fuels. Rebates for the energy tax on NG for diplomatic immunity.		
Reference in E3ME	CZ_S2	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€64.0m	**Expiry date (if applicable)**	2014
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.070	CO2 emission	-0.048
GDP	0.012	Employment	0.004

Country	Czech Republic		
Subsidy	Energy-Tax Exemption for Certain Uses of Solid Fuels, CZE_te_03		
Brief description	Data from 2008 Exemption on solid fuels energy tax when used by: households for heating, combined heat and electricity production when later supplied to households, non-recreational transport by boat, mineralogical and metallurgical processes. Brown coal.		
Reference in E3ME	CZ_S3	**Support type**	Consumer
Subsidy value in 2011			
hard coal	€37.6m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.066	CO2 emission	-0.030
GDP	0.021	Employment	0.023

Country	Czech Republic		
Subsidy	Energy-tax refund for (light fuel) oil used for heating, CZE_te_04		
Brief description	Data from 2008 Partial refund of their energy tax payments		
Reference in E3ME	CZ_S4	**Support type**	Consumer
Subsidy value in 2011			
crude oil	€23.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.010	CO2 emission	-0.006
GDP	0.004	Employment	0.002

7.4 Denmark

Table 7.4: Denmark's EHSs

Country	Denmark		
Subsidy	Reduced energy duty for CHP generation, DNK_te_03		
Brief description	Data from 1995 Reduced energy duty for heat delivered from combined generation of electricity and district heating plant. For diesel oil, other bituminous coal, refinery gas and heavy fuel oil		
Reference in E3ME	DK_S1	**Support type**	Consumer
Subsidy value in 2011			
hard coal	€246.4m	**Expiry date (if applicable)**	none
crude oil, middle distillates & heavy fuel oil	€18.3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Denmark		
Subsidy	Reduced energy duty for diesel, DNK_te_04		
Brief description	Data from 2001 Reduced excise duty on diesel used as motor fuel.		
Reference in E3ME	DK_S2	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€717.6m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-1.158	CO2 emission	-1.003
GDP	0.185	Employment	0.116

7.5 Germany

Table 7.5: Germany's EHSs

Country	Germany		
Subsidy	Subsidies to coal		
Brief description	DEU_te_06 Mining royalty exemption to hard coal Data from 1982. Due to end in 2018. Set at the federal level, OECD assumes a 10% average level (0-40% range across regions). Estimate on the low side – two reasons, see OECD text. DEU_te_07 Manufacturer privilege Data from 1991 When fuel products used by energy companies as process energy (not as feedstock) predominantly refinery gas and fuel oil DEU_te_14 Mining royalty exemption for lignite Data from 1982 The guideline royalty rate is 10% of the market value. Varies across regions between 0-40% DEU_dt_11 Combined Aids in North Rhine-Westphalia Data/Applied from 1998. Due to end in 2018 General support to the hard coal industry in order to ease gradual decline. Received as annual payments.		
References in E3ME	DE_S1, DE_S2, DE_S3, DE_S12	Support type	Producer
Combined subsidy value in 2011 (OECD)		Expiry date (if applicable)	none
hard coal & other coal	€2137.23m		
crude oil, middle distillates & heavy fuel oil	€303.4m	Expiry date (if applicable)	none
natural gas	€ 33.9m	Expiry date (if applicable)	none
Combined country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Germany		
Subsidy	Energy-tax breaks for agriculture and manufacturing, DEU_te_01		
Brief description	Data/applied from 1999 To give a lower rate of tax on heating oil, diesel, natural gas and LPG		
Reference in E3ME	DE_S4	**Support type**	Consumer
Subsidy value in2011			
crude oil & middle distillates	€16m	**Expiry date (if applicable)**	none
natural gas	€134m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.018	CO2 emission	-0.031
GDP	0.004	Employment	0.001

Country	Germany		
Subsidy	Peak equalisation scheme, DEU_te_02		
Brief description	Data from 2001 Given to compensate firms for higher taxes paid on energy inputs. Firms already got a pensions contribution reduction so this subsidy is only to be applied to companies for which the pension contribution reduction was not sufficient to offset the energy tax burden. To natural gas, diesel oil and LPG.		
Reference in E3ME	DE_S5	**Support type**	Consumer
Subsidy value in 2011			
crude oil	€20.8m	**Expiry date (if applicable)**	none
natural gas	€174.2m		
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.023	CO2 emission	-0.038
GDP	0.005	Employment	0.002

Country	Germany		
Subsidy	Tax-relief for energy intensive processes, DEU_te_05		
Brief description	Data/Applied from 2006 Concession from energy tax. To maintain the competitiveness of steel and chemical sectors. For all different fuels, these are mostly natural gas and coal.		
Reference in E3ME	DE_S6	**Support type**	Consumer
Subsidy value for in 2011			
hard coal & other coal	€217.8m	**Expiry date (if applicable)**	none
crude oil, middle distillates & heavy fuel oil	€152.1m	**Expiry date (if applicable)**	none
natural gas	€237.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.055	CO2 emission	-0.037
GDP	0.016	Employment	0.005

Country	Germany		
Subsidy	Energy tax-relief for public transportation, DEU_te_10		
Brief description	Data from 2000 Concession from fuel tax. For motor fuels, natural gas and LPG.		
Reference in E3ME	DE_S7	**Support type**	Consumer
Subsidy value in 2011			
crude oil & middle distillates	€70.1m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.021	CO2 emission	-0.018
GDP	0.000	Employment	0.000

Country	Germany		
Subsidy	Energy-tax relief for LPG and natural gas used in engines, DEU_te_11		
Brief description	Data from 1996 Concession from fuel tax. Applied to all transport sectors		
Reference in E3ME	DE_S8	**Support type**	Consumer
Subsidy value in 2011			
crude oil	€210m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.066	CO2 emission	-0.055
GDP	0.009	Employment	0.004

Country	Germany		
Subsidy	Fuel-Tax Exemption for fuels used in commercial aviation, DEU_te_08		
Brief description	Data from 1991. Applied since 1953 Concession from tax on mineral fuels. To be allocated to only domestic commercial aviation. mineral fuels		
Reference in E3ME	DE_S9	**Support type**	Consumer
Subsidy value in 2011			
crude oil, middle distillates & heavy fuel oil	€680m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.229	CO2 emission	-0.008
GDP	0.030	Employment	0.014

Country	Germany		
Subsidy	Energy-Tax Exemption for fuels used in internal water transportation, DEU_te_09		
Brief description	Data from 1991. Applied from 1962 To be allocated to internal water transportation only. Diesel.		
Reference in E3ME	DE_S10	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€170.0m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.009	CO2 emission	-0.062
GDP	0.007	Employment	0.002

Country	Germany		
Subsidy	Energy-tax refund for diesel used in agriculture and forestry, DEU_te_12		
Brief description	Data from 1991. Applied from 1951 Rebate on energy tax on diesel fuel for agriculture and forestry capped at 10,000 litres and max refund of EUR 350 per year.		
Reference in E3ME	DE_S11	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€395m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.040	CO2 emission	-0.082
GDP	0.012	Employment	0.004

7.6 Estonia

Table 7.6: Estonia's EHSs

Country	Estonia		
Subsidy	Excise-duty exemption for fuels used in domestic commercial fishing, EST_te_01		
Brief description	Data from 2007 Exemption on the excise duty on diesel and light heating oil used by domestic fishing boats. Maximum exemption limit based on the amount of fish caught or the boat's engine capacity.		
Reference in E3ME	EN_S1	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€13m	**Expiry date (if applicable)**	2013
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.014	CO2 emission	-0.009
GDP	0.001	Employment	0.001

Country	Estonia		
Subsidy	Excise-duty reduction for diesel fuel and light heating oil used for special purposes, EST_te_05		
Brief description	Data from 2005. Applied from 1997 Reduced rate of fuel excise duty applied to marked DIESEL when used by: all rail transport, water cargo, stationary engines, heating and combined production of heat and electricity. Marked light heating oil is not given a reduced rate for heating or the combined heating and electricity but is for machinery used in forestry and construction. However these are no longer eligible from 2012. Plans exist to gradually abolish this subsidy though no details provided.		
Reference in E3ME	EN_S2	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€70.30m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.122	CO2 emission	-0.077
GDP	0.000	Employment	0.016

7.7 Ireland

Table 7.7: Ireland's EHSs

Country	Ireland		
Subsidy	Public service obligation for peat, IRL_dt_01		
Brief description	Data from 2004 Price support to peat generated electricity power by plants (not renewable). A levy is paid on final purchases of electricity which is used to finance purchases of more expensive peat electricity which would exceed market price.		
Reference in E3ME	IE_S1	**Support type**	Producer
Subsidy value in 2011			
other coal	€78.2m	**Expiry date (if applicable)**	2020 (this is also the stated goal in the text)
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.021	CO2 emission	-2.349
GDP	0.008	Employment	0.031

7.8 Greece

Table 7.8: Greece's EHSs

Country	Greece		
Subsidy	Subsidy for suppliers of fuels to remote areas, GRC_dt_01		
Brief description	Data from 2004		
	Paid to oil companies that supply fuel to remote areas (islands, border areas, etc.) For diesel oil and motor gasoline.		
Reference in E3ME	EL_S1	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€7.0m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.007	CO2 emission	-0.004
GDP	0.001	Employment	0.001

Country	Greece		
Subsidy	Excise tax refund for fuels used in the production of energy products for intra-EU use, GRC_te_01		
Brief description	Data from 2004		
	Given mainly to energy products which are sold internally within the EU market. For crude oil, natural gas, lignite and refinery feedstocks.		
Reference in E3ME	EL_S2	**Support type**	Consumer
Subsidy value in 2011			
other coal	€0.8m	**Expiry date (if applicable)**	none
crude oil	€2.0m	**Expiry date (if applicable)**	none
natural gas	€0.2m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.001	CO2 emission	-0.003
GDP	0.000	Employment	0.000

Country	Greece		
Subsidy	Excise tax refund for fuels used in agriculture, GRC_te_03		
Brief description	Data from 2008. Applied from 1996		
	Partial refund which has to be approved each year from a special fund. For fuel oils and motor gasoline.		
Reference in E3ME	EL_S3	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€160m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.155	CO2 emission	-0.127
GDP	0.044	Employment	0.013

Country	Greece		
Subsidy	Excise tax refund for fuels used in domestic shipping including fishing, GRC_te_04		
Brief description	Data from 2004. Applied from 2001. For fuel oils.		
Reference in E3ME	EL_S4	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€13m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.039	CO2 emission	-0.026
GDP	0.009	Employment	0.001

Country	Greece		
Subsidy	Excise tax refund for fuels used in tourist boats, GRC_te_05		
Brief description	Data from 2004, Applied from 1976. For fuel oils.		
Reference in E3ME	EL_S5	**Support type**	Consumer
Subsidy value in 2011			
heavy fuel oil	€1.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.007	CO2 emission	-0.005
GDP	0.002	Employment	0.000

Country	Greece		
Subsidy	Excise tax and other tax refunds for fuel used by hospitals, social solidarity institutions and hotels, GRC_te_06		
Brief description	Data from 2004. Applied from 1996. A refund given for any fuel used for social purposes. For fuel oils, natural gas and LPG.		
Reference in E3ME	EL_S6	**Support type**	Consumer
Subsidy value in 2011			
crude oil & heavy fuel oil	€15.7m	**Expiry date (if applicable)**	none
natural gas	€7.8m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.059	CO2 emission	-0.029
GDP	0.006	Employment	0.002

7.9 Spain

Table 7.9: Spain's EHSs

Country	Spain		
Subsidy	Subsidies to coal		
Brief description	ESP_dt_01 Operating aid for HUNOSA Data from 2002. Applied from 1998 For one major state-owned producer of hard coal to cover its operating costs. ESP_dt_02 Operating aid to coal producers Data from 1998 Transfer payments to compensate domestic coal producers for difference between operating costs and price of output (sold to local power plants) For bituminous and sub-bituminous coal, lignite, and coking coal ESP_dt_04 Subsidy for the inter-basin transport of coal Data from 1998 Transfers to support transport of coal where supply conditions meet certain criteria. Maximum transfer ceiling exists subject to eligibility criteria. For bituminous and sub-bituminous coal, lignite, and coking coal ESP_dt_05 Adjustment aid to coal producers Data from 1998 Transfers to support the social cost associated with the decline of coal mining sector.) For bituminous and sub-bituminous coal, lignite, and coking coal ESP_dt_03 Funding for coal stockpiles Data from 1998 To support constitution of coal stockpiles so they are able to guarantee over 720 hours of power generation. For bituminous and sub-bituminous coal, lignite, and coking coal.		
References in E3ME	ES_S1, ES_S2, ES_S3, ES_S4, ES_S5	Support type	Producer Consumer
Combined subsidy value in 2011 (OECD) hard coal & other coal	€309.3m	Expiry date (if applicable)	none
Combined country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Spain		
Subsidy	Fuel-tax exemptions, ESP_te_01		
Brief description	Data from 1996 Exemption from excise tax on petroleum products for domestic aviation, navigation and railways		
Reference in E3ME	ES_S6	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€ 393.86m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.094	CO2 emission	-0.010
GDP	0.030	Employment	0.029

Country	Spain		
Subsidy	Fuel-tax reductions, ESP_te_02		
Brief description	Data from 1996 Concession on excise tax rate on petroleum products to agriculture and non-energy mining sectors.		
Reference in E3ME	ES_S7	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€1368m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.132	CO2 emission	-0.204
GDP	0.040	Employment	0.049

Country	Spain		
Subsidy	Fuel-tax partial refund, ESP_te_03		
Brief description	Data from 2011. Applied from 2006 Partial refund of the special tax on hydrocarbons for diesel fuel used in commercial activities such as farming and livestock. Diesel.		
Reference in E3ME	ES_S8	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€170.30m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.007	CO2 emission	-0.011
GDP	0.002	Employment	0.003

7.10 France

Table 7.10: France's remaining EHSs

Country	France		
Subsidy	Reduced rate of excise for LPG, FRA_te_16		
Brief description	Data from 1999. Applied from 1996 Concession on rate of excise tax on LPG. To promote use of LPG so all users. Concession on rate of excise tax for liquefied butane and propane used as fuels to certain specific off-road users. (Rates available in text).		
Reference in E3ME	FR_S1	**Support type**	Consumer
Subsidy value in 2011			
crude oil	€53m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.008	CO2 emission	-0.008
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Excise-tax exemption for refiners, FRA_te_24		
Brief description	Data from 1999. Applied from 1956 Concession on excise tax for fuel used for processing, not feedstock. Support for intermediate inputs. Described as a 'normal' part of France's tax code. For LPG, natural gas, petroleum coke, refinery gas, heavy fuel oil, and other non-specified oil products on		
Reference in E3ME	FR_S2	**Support type**	Producer
Subsidy value in 2011			
crude oil, middle distillates & heavy fuel oil	€100.18m	**Expiry date (if applicable)**	none
natural gas	€4.82m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.018	CO2 emission	-0.023
GDP	0.001	Employment	0.001

Country	France		
Subsidy	Excise-tax exemption for natural gas producers, FRA_te_11		
Brief description	Data from 2007. Concession on excise tax for fuel used for processing, not feedstock. Support for intermediate inputs. Only two recipients in 10, so big impact per recipient.		
Reference in E3ME	FR_S3	**Support type**	Producer
Subsidy value in 2011			
natural gas	€2m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Excise-tax exemption for co-generation, FRA_te_07		
Brief description	Data from 1999 Concession from excise tax on fuel consumption. Applies only to plans built before 31/12/07 and for no longer than 5 years. Mineral oils and Natural gas.		
Reference in E3ME	FR_S4	**Support type**	Consumer
Subsidy value in 2011			
crude oil, middle distillates & heavy fuel oil	€0.83m	**Expiry date (if applicable)**	none
natural gas	€9.17m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.001	CO2 emission	-0.002
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Excise-tax exemption for biomass producers, FRA_te_10		
Brief description	Data from 2007 Concession from excise tax on coal for biomass producers. Energy purchases must be 3% ≥ annual revenue. Bituminous coal.		
Reference in E3ME	FR_S5	**Support type**	Consumer
Subsidy value in 2011			
hard coal	€3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.001	CO2 emission	-0.001
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Reduced rate for stationary engines, FRA_te_17		
Brief description	Data from 2007 Concession from excise tax on diesel fuel for certain machines. Diesel fuel. Agriculture and construction.		
Reference in E3ME	FR_S6	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	-0.001
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Reduced rate for natural gas used as fuel, FRA_te_15		
Brief description	Data/Applied from 2007 100% reduction in the rate of excise tax on natural gas when used as a transport fuel		
Reference in E3ME	FR_S7	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€4m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.001	CO2 emission	-0.001
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Reduced rate of excise for taxi drivers, FRA_te_05		
Brief description	Data from 1999. Applied from 1982. Concession from excise tax on petroleum products. Annual capped refund based on fuel effectively consumed. Gasoline and diesel		
Reference in E3ME	FR_S8	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€21m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.005	CO2 emission	-0.007
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Refund for diesel used in road transport, FRA_te_20		
Brief description	Data/Applied from 1999 Concession on excise tax on diesel fuel. Freight only weighing over 7.5 tonnes. Other countries' freight is also eligible if vehicles comply and fuel purchased in France.		
Reference in E3ME	FR_S9	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€300m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.065	CO2 emission	-0.091
GDP	0.006	Employment	0.004

Country	France		
Subsidy	Refund for diesel used in public transport, FRA_te_21		
Brief description	Data/Applied from 2001 Concession from excise tax on diesel fuel.		
Reference in E3ME	FR_S10	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€30m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.007	CO2 emission	-0.009
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Excise-tax exemption for domestic aviation, FRA_te_25		
Brief description	Data from 2000. Applied from 1928 Exemption from excise tax on petroleum products. Not applied to private aircraft, international flights or flights to DOM. Kerosene-type jet fuel. Described as a 'normal' feature of France's tax code.		
Reference in E3ME	FR_S11	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€300.30m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.087	CO2 emission	-0.024
GDP	0.004	Employment	0.005

Country	France		
Subsidy	Excise-tax exemption for certain boats, FRA_te_23		
Brief description	Data from 1999. Applied from 1928 Exemption from excise tax applied to petroleum products (diesel) for navigation boats (mostly fishing boats, not private/leisure). Described as a 'normal' feature of France's tax code. For gasoline, heavy fuel oil, and diesel fuel		
Reference in E3ME	FR_S12	**Support type**	Consumer
Subsidy value in 2011			
middle distillates & heavy fuel oil	€350m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.033	CO2 emission	-0.083
GDP	0.007	Employment	0.005

Country	France		
Subsidy	Excise-tax exemption for households, FRA_te_12		
Brief description	Data/Applied from 2007 Exemption from paying excise on natural gas. To equalise price between households who receive natural gas directly and those who receive reticulated heat. Given to all households		
Reference in E3ME	FR_S13	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€253m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.118	CO2 emission	-0.154
GDP	0.003	Employment	0.004

Country	France		
Subsidy	Reduced rate for fuel oil used as diesel fuel, FRA_te_13		
Brief description	Data from 1999. Applied from 1970 Concession from excise tax on heating oil and diesel fuel when used by farmers & construction in diesel engines. Not to be used as a propellant (i.e. not for off road activities).		
Reference in E3ME	FR_S14	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€1000m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.091	CO2 emission	-0.195
GDP	0.012	Employment	0.013

Country	France		
Subsidy	Refund for fuel oil used in agriculture, FRA_te_22		
Brief description	Data from 2006. Applied from 2004 Concession on excise tax on fuel oil. Adds to previous measure for diesel fuel in agriculture to help cope with high energy prices.		
Reference in E3ME	FR_S15	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€140m	**Expiry date (if applicable)**	2020. This is discretionary and transitory but has been reapplied every year.
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.009	CO2 emission	-0.024
GDP	0.001	Employment	0.002

Country	France		
Subsidy	Aid to gas stations, FRA_dt_09		
Brief description	Data from 1999. Applied from 1991 For upgrading infrastructure and helping declining businesses. For gasoline and diesel fuel.		
Reference in E3ME	FR_S16	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€4.75m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Excise tax exemption for fluvial navigation, FRA_te_26		
Brief description	Data from 2011. Applied from 2011 Exempt from excise tax on petroleum products when used for the transportation of freight on internal waterways. For diesel fuel and light fuel oil.		
Reference in E3ME	FR_S17	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	-0.001
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Reduced Rate for Gasoline in Corsica, FRA_te_18		
Brief description	Data from 1999 Reduced excise tax rate for gasoline in Corsica, this applies on top of another arrangement which allows regional authorities to vary the excise within agreed limits, the latter aspect in itself not considered to be a subsidy to be consistent across countries.		
Reference in E3ME	FR_S18	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€1m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	France		
Subsidy	VAT Reduction for Petroleum Products in Corsica, FRA_te_04		
Brief description	Data 2007 13% VAT applies to petroleum products in Corsica. For gasoline, fuel oil, kerosene-type jet fuel, and diesel fuel.		
Reference in E3ME	FR_S19	**Support type**	Consumer
Subsidy value in 2011			
middle distillates & heavy fuel oil	€14.19m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	France		
Subsidy	Overseas VAT Exemption for Petroleum Products, FRA_te_03		
Brief description	Data from 1999. Applied from 1951 VAT exemption for petroleum products consumed in geographically and economically disadvantages, overseas, French departments. N.B that this measure actually applies to a few other products than just petroleum so might over estimate the size of the subsidy. For gasoline, fuel oil, kerosene-type jet fuel, and diesel fuel.		
Reference in E3ME	FR_S20	**Support type**	Consumer
Subsidy value in 2011			
middle distillates & heavy fuel oil	€156.6m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.003	CO2 emission	0.000
GDP	0.002	Employment	0.001

7.11 Italy

Table 7.11: Italy's EHSs

Country	Italy		
Subsidy	Tax relief for industrial users of natural gas, ITA_te_07		
Brief description	Data from 2005 60% Concession on excise on NG purchases. Eligible if consumption exceeds 1.2 million cubic metres per year. Large industrial users.		
Reference in E3ME	IT_S1	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€60m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.012	CO2 emission	-0.013
GDP	0.001	Employment	0.003

Country	Italy		
Subsidy	Fuel-tax reduction for rail transport, ITA_te_02		
Brief description	Data from 2005 70% concession on rate of excise tax on diesel fuel.		
Reference in E3ME	IT_S2	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€2m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	Italy		
Subsidy	Tax relief for ambulances, ITA_te_05		
Brief description	Data from 2005 Concession on rate of excise tax on petroleum products. For diesel fuel.		
Reference in E3ME	IT_S3	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.001	CO2 emission	-0.001
GDP	0.000	Employment	0.000

Country	Italy		
Subsidy	Tax relief for trucking companies, ITA_te_06		
Brief description	Data from 2005 Partial refund on excise tax on petroleum products. Usually a fixed amount of fuel. For diesel fuel.		
Reference in E3ME	IT_S4	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€346m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.095	CO2 emission	-0.089
GDP	0.005	Employment	0.011

Country	Italy		
Subsidy	Fuel-tax exemption for shipping, ITA_te_01		
Brief description	Data from 2005 Exempt from excise tax on petroleum products when used by navigation ships (goods and passengers within the EU) and fisheries. For diesel fuel and heavy fuel oil.		
Reference in E3ME	IT_S5	**Support type**	Consumer
Subsidy value in 2011			
middle distillates & heavy fuel oil	€547m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.013	CO2 emission	-0.024
GDP	0.007	Employment	0.018

Country	Italy		
Subsidy	Tax relief for public transport, ITA_te_04		
Brief description	Data from 2005 60% concession on rate of excise tax on petroleum products. Rail excluded, applies to road and some boats. Caps applied regionally and based on population density. For diesel fuel.		
Reference in E3ME	IT_S6	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€25m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.001	CO2 emission	-0.001
GDP	0.000	Employment	0.001

Country	Italy		
Subsidy	Tax relief for users living in disadvantaged areas, ITA_te_08		
Brief description	Data from 2005 Concession on excise tax on petroleum products. For LPG and diesel fuel.		
Reference in E3ME	IT_S7	**Support type**	Consumer
Subsidy value in 2011			
crude oil & middle distillates	€231m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.027	CO2 emission	-0.015
GDP	0.003	Employment	0.005

Country	Italy		
Subsidy	Energy Tax Breaks for Agriculture, ITA_te_03		
Brief description	Data from 2010 Concession in excise tax rate for diesel (78%) and gasoline (51%). Applied only to diesel.		
Reference in E3ME	IT_S8	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€908m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.051	CO2 emission	-0.066
GDP	0.018	Employment	0.032

7.12 Cyprus

Table 7.12: Cyprus's EHSs

Country	Cyprus		
Subsidy	Fuel-tax exemptions for the use of motor fuels in agriculture, CY_te_01		
Brief description	Data from 2011. For gas oil used as motor fuel		
Reference in E3ME	CY_S1	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€20m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.454	CO2 emission	-0.318
GDP	0.036	Employment	0.004

7.13 Latvia

Table 7.13: Latvia's EHSs

Country	Latvia		
Subsidy	Guaranteed payment (power component) for installed capacity of riga CHP1 and CHP2 using natural gas, LV_dt_01		
Brief description	Data from 2006		
	An annual guaranteed payment for installed capacity or power component for two CHP plants. Second plant only to be commissioned in 2013.		
Reference in E3ME	LV_S1	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€66.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Latvia		
Subsidy	Excise tax exemption for natural gas used in heat supply for greenhouses and industrial poultry rising, LV_te_01		
Brief description	Data from 2011		
	Full rebate for natural gas used for heating greenhouses and industrial poultry rising		
Reference in E3ME	LV_S2	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€0.2m	**Expiry date (if applicable)**	31/12/2013
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.002	CO2 emission	-0.005
GDP	0.001	Employment	0.000

Country	Latvia		
Subsidy	Excise tax exemption for natural gas for industrial consumers, LV_te_02		
Brief description	Data from 2011		
	Full exemption of excise tax for natural gas used for industrial manufacturing, agricultural raw materials including heating of those facilities.		
Reference in E3ME	LV_S3	**Support type**	Consumer
Subsidy value in 2011	€1.45m		
natural gas		**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.059	CO2 emission	-0.089
GDP	0.004	Employment	0.002

Country	Latvia		
Subsidy	Energy tax exemption for natural gas for electricity produced in CHPs, LV_te_04		
Brief description	Data from 2007 Exemption from energy tax on natural gas used by CHPs		
Reference in E3ME	LV_S4	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€3.07m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.014	CO2 emission	-0.022
GDP	0.004	Employment	0.003

Country	Latvia		
Subsidy	Excise tax exemption for oil products used for domestic shipping, LV_te_06		
Brief description	Data from 2005 Private leisure and entertainment are not exempt from the excise tax. For diesel.		
Reference in E3ME	LV_S5	**Support type**	Consumer
Subsidy value in 2011			
heavy fuel oil	€6.0m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	Latvia		
Subsidy	Excise tax exemption for oil products for industrial consumers and excise tax reduction for petroleum, fuel oil and diesel oil used for heating, LV_te_07		
Brief description	Data from 2005 Data for two tax exemptions has been combined here due the source reporting.		
Reference in E3ME	LV_S6	**Support type**	Consumer
Subsidy value in 2011			
middle distillate	€11.2m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.174	CO2 emission	-0.279
GDP	0.026	Employment	0.015

Country	Latvia		
Subsidy	Excise tax exemption for oil products used in special economic zones, LV_te_08		
Brief description	Data from 2005 Exemption for non-leisure/entertainment boats; ships used in construction, testing and maintenance, ships used in waterway dredging and expansion works, production of electricity and CHPs.		
Reference in E3ME	LV_S7	**Support type**	Consumer
Subsidy value in 2011			
heavy fuel oil	€1.74m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.001
GDP	0.000	Employment	0.000

Country	Latvia		
Subsidy	Excise tax exemption for diesel used in agricultural transport, LV_te_09		
Brief description	Data from 2005		
Reference in E3ME	LV_S8	**Support type**	Consumer
Subsidy value in 2012			
middle distillates	€10.2m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.069	CO2 emission	-0.147
GDP	0.025	Employment	0.014

Country	Latvia		
Subsidy	Excise tax exemption for oil products used for CHPs or electricity production, LV_te_10		
Brief description	Data from 2008		
Reference in E3ME	LV_S9	**Support type**	Consumer
Subsidy value in 2011			
heavy fuel oil	€0.08m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	Latvia		
Subsidy	Excise tax exemption for oil products imported from non-EU countries by individuals for their consumption, LV_te_11		
Brief description	Data from 2005 Exemption on the excise tax for oil products when for individual consumption when purchased and imported from non-EU countries. Maximum individual limit of 10 litres per vehicle but can now only claim once every 7 days (as of 1/1/12).		
Reference in E3ME	LV_S10	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€24.7m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.260	CO2 emission	-0.272
GDP	0.086	Employment	-0.026

7.14 Lithuania

Table 7.14: Lithuania's EHSs

Country	Lithuania		
Subsidy	Reduced rate of excise tax for heating, LTU_te_01		
Brief description	Data from 2002.		
Reference in E3ME	LT_S1	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€5.3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.035	CO2 emission	-0.034
GDP	0.005	Employment	0.002

Country	Lithuania		
Subsidy	Reduced VAT for heat energy in the residential sector, LUT_te_2		
Brief description	Data from 2002 To mitigate the impact of rising natural gas price as it provides 73.1% of fuel used for heating. 9% VAT reduction is applied for heat energy for households		
Reference in E3ME	LT_S2	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€45.6m	**Expiry date (if applicable)**	31/12/2012
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.078	CO2 emission	-0.234
GDP	0.001	Employment	-0.002

7.15 Luxembourg

Table 7.15: Luxembourg's EHSs

Country	Luxembourg		
Subsidy	Reduced rate of excise for certain uses of petroleum fuels, LUX_te_01		
Brief description	Data from 2007 Reduced rate of excise duty when used in agriculture, horticulture, or for heating purposes (so general heating purposes, therefore all users). For diesel fuel and LPG.		
Reference in E3ME	LX_S1	**Support type**	Consumer
Subsidy value in 2011			
crude oil & middle distillates	€4m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.019	CO2 emission	-0.014
GDP	0.004	Employment	0.000

7.16 Hungary

Table 7.16: Hungary's EHSs

Country	Hungary		
Subsidy	Coal pennies, HUN_dt_01		
Brief description	Data from 2004 Price support to coal producers from levies paid on final purchases of electricity which is used to finance purchases of more expensive coal (lignite). Subject to EU rules that the coal sector must be in connection with the production of electricity.		
Reference in E3ME	HU_S1	**Support type**	Producer
Subsidy value in 2011			
other coal	€25.1m	**Expiry date (if applicable)**	2018
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Hungary		
Subsidy	Fuel-tax refund for railways, HUN_te_01		
Brief description	Data from 2007 Refund on excise tax on diesel fuel.		
Reference in E3ME	HU_S2	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€17.2m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.002	CO2 emission	-0.006
GDP	0.009	Employment	0.005

Country	Hungary		
Subsidy	Household maintenance-cost subsidy, HUN_dt_02		
Brief description	Data from 2008. Applied from 2003 Support for heat only now since 2010. Payment is made to suppliers who pass this onto consumers. Estimate for the whole of 2011 is based on the period from January to August only. For coal, natural gas, fuel oil, etc.		
Reference in E3ME	HU_S3	**Support type**	Consumer
Subsidy value in 2011			
hard and other coal	€5.6m	**Expiry date (if applicable)**	none
crude oil, middle distillates & heavy fuel oil	€11.7m	**Expiry date (if applicable)**	none
natural gas	€54.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.108	CO2 emission	-0.108
GDP	0.012	Employment	0.003

Country	Hungary		
Subsidy	Reduced rate of VAT for district heating, HUN_te_03		
Brief description	Data from 2009. 98% of heat comes from fossil fuels therefore it's a subsidy. For coal, natural gas, fuel oil, etc.		
Reference in E3ME	HU_S4	**Support type**	Consumer
Subsidy value in 2011			
hard and other coal	€8.1m	**Expiry date (if applicable)**	none
crude oil, middle distillates & heavy fuel oil	€16.8m	**Expiry date (if applicable)**	none
natural gas	€78.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	N/A	CO2 emission	N/A
GDP	N/A	Employment	N/A

Country	Hungary		
Subsidy	Fuel-tax refund for agriculture, HUN_te_02		
Brief description	Data from 1990 Refund of up to 70% of the excise tax on petroleum products when used diesel is used off road.		
Reference in E3ME	HU_S5	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€84.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.047	CO2 emission	-0.060
GDP	0.035	Employment	0.019

7.17 Netherlands

Table 7.17: Netherlands' EHSs

Country	Netherlands		
Subsidy	Reduced energy-tax rate in horticulture, NLD_te_01		
Brief description	Data from 2001. Applied from 1996 Reduced energy-tax rates under the condition of voluntary agreement to improve energy efficiency. For natural gas only.		
Reference in E3ME	NL_S1	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€91m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.443	CO2 emission	-0.662
GDP	0.009	Employment	0.003

7.18 Austria

Table 7.18: Austria's EHSs

Country	Austria		
Subsidy	Energy-tax refund to energy intensive industries, AUT_te_04		
Brief description	Data/Applied from 1996. Fully or part refund on energy taxes paid by businesses that have invested in the rationalisation of energy use. Maximum refund of 100% for energy intensive businesses, 50% for other businesses (not the service sector). Solid fuels.		
Reference in E3ME	AT_S1	**Support type**	Consumer
Subsidy value in 2011			
Hard coal & other coal	€70.1m	**Expiry date (if applicable)**	none
crude oil, middle distillates & heavy fuel oil	€46.0m	**Expiry date (if applicable)**	none
natural gas	€213.3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Austria		
Subsidy	Energy-tax exemption for LPG used in public transport, AUT_te_01		
Brief description	Data from 1984. Applied from 1981 Exemption on energy tax payments for LPG used by public transport on routes not exceeding 25km		
Reference in E3ME	AT_S2	**Support type**	Consumer
Subsidy value in 2011			
crude oil	€4.0m	**Expiry date (if applicable)**	31/12/2012
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Austria		
Subsidy	Energy-tax relief for diesel used by trains of the Austrian Railways, AUT_te_02		
Brief description	Data from 1984. Applied from 1981 Partial refund on the diesel used by trains owned by the Austrian Railways.		
Reference in E3ME	AT_S3	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€10.0m	**Expiry date (if applicable)**	31/12/2012
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Austria		
Subsidy	Energy-tax rebates to diesel used in agriculture, AUT_te_03		
Brief description	Data/Applied from 2005 Rebate which is equal to the difference between the energy-tax levied on diesel and the energy tax rate levied on light heating oil for farmers and foresters. There is an annual cap on the funding source of EUR 50 million.		
Reference in E3ME	AT_S4	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€49.0m	**Expiry date (if applicable)**	31/12/2012
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

7.19 Poland

Table 7.19: Poland's EHSs

Country	Poland		
Subsidy	Stranded-costs compensation, POL_dt_13		
Brief description	Data from 2008. Applied from 2008 Provided price support to power plants that had PPAs (Power Purchase Agreements) with network operators. When these end (last one in 2027) the authorities have a stranded costs compensation to alleviate the effect, costs and risks until 2025. Implicitly for the coal sector.		
Reference in E3ME	PL_S1	**Support type**	Producer
Subsidy value in 2011			
hard coal & other coal	€518.0m	**Expiry date (if applicable)**	2025 OR 2027
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Poland		
Subsidy	Coal allowances in coal-mining sector, POL_dt_11		
Brief description	Data from 2006 In kind benefits for miners including free provision of coal for heating purposes. Being phased out and replaced with cash equivalents no but indication of when.		
Reference in E3ME	PL_S2	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€39.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.022	CO2 emission	-0.039
GDP	0.004	Employment	0.002

Country	Poland		
Subsidy	Rebates on diesel fuel tax in farming, POL_te_01		
Brief description	Data from 2006 Rebate value cannot exceed 86 litres per hectare of utilised agricultural area. Exemption rate decided on yearly basis, invoices submitted twice a year.		
Reference in E3ME	PL_S3	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€175.3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.088	CO2 emission	-0.057
GDP	0.021	Employment	0.017

7.20 Portugal

Table 7.20: Portugal's EHSs

Country	Portugal		
Subsidy	Fuel-tax exemption for coastal and inland navigation PRT_te_01		
Brief description	Data from 2001 Exemption from excise tax on motor fuels used in coastal and inland water commercial navigation. For diesel fuel and fuel oil.		
Reference in E3ME	PT_S1	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€19.7m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.036	CO2 emission	-0.014
GDP	-0.003	Employment	0.001

Country	Portugal		
Subsidy	Fuel-tax exemption for railway vehicles, PRT_te_02		
Brief description	Data from 2001 Exemption from excise tax on diesel fuel when used in rail transportation		
Reference in E3ME	PT_S2	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€7.1m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	Portugal		
Subsidy	Fuel-tax reduction for agriculture machinery, PRT_te_03		
Brief description	Data from 2001 Reduced rate of excise tax for coloured and marked diesel used by farm machinery		
Reference in E3ME	PT_S3	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€66.8m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.068	CO2 emission	-0.072
GDP	-0.001	Employment	0.003

Country	Portugal		
Subsidy	Fuel tax reduction for fixed engines and heating, PRT_te_04		
	Data from 2001		
Brief description	Reduced rate of excise tax for diesel used for heating purposes in power generating engines (e.g. small scale fixed generators, compressors, heating boilers)		
Reference in E3ME	PT_S4	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€29.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.064	CO2 emission	-0.057
GDP	0.000	Employment	0.001

Country	Portugal		
Subsidy	Fuel-tax exemption for electricity generators, PRT_te_05		
Brief description	Data from 2001 Exemption from excise tax on coke, coal and fuel oil used by electric utilities or CHP plants.		
Reference in E3ME	PT_S5	**Support type**	Consumer
Subsidy value in 2011			
hard coal, other coal	€4.38m	**Expiry date (if applicable)**	none
heavy fuel oil	€0.82m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.003	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	Portugal		
Subsidy	Fuel-tax exemption for certain industrial processes, PRT_te_06		
Brief description	Exemption from fuel excise tax on petroleum products as in industrial fuels in electrolytic, metallurgical and mineralogical processes. Installations must be under an emissions license scheme or energy efficiency agreement to be eligible. For diesel fuel, LPG, and fuel oil.		
Reference in E3ME	PT_S6	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€8.65m	**Expiry date (if applicable)**	none
crude oil & middle distillates	€6.35m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.064	CO2 emission	-0.036
GDP	0.000	Employment	-0.001

7.21 Romania

Table 7.21: Romania's EHSs

Country	Romania		
Subsidy	Fuel tax refund for agriculture, ROM_dt_02		
Brief description	Data/Applied from 2010 Individual applications have to be made		
Reference in E3ME	RO_S1	**Support type**	Consumer
Subsidy value in 2011			
middle distillates		**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.001	CO2 emission	-0.001
GDP	0.000	Employment	0.000

Country	Romania		
Subsidy	Direct budgetary support for hard coal production, ROM_dt_01		
Brief description	Data from 2006 According to the ministry of Economy and the Agency of Mineral Resources in Romania, no part of the coal production of the National Hard Coal Company can be viably produced without state aid (Ecorys, 2009). The subsidy is equal to the difference between the revenue and costs. Further this action must not reduce domestic coal prices to below that of imported coal, i.e. by subsiding more than the difference.		
Reference in E3ME	RO_S2	**Support type**	Producer
Subsidy value in 2012			
hard coal		**Expiry date (if applicable)**	2018
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Romania		
Subsidy	Fuel subsidies for railways, ROM_dt_03		
Brief description	Data from 2011. Applied from 1998. Data is imprecise as there are splitting of the different types of expenses, except in 2011for which there is a calculation of fuel expenses and fuel tax exemptions.		
Reference in E3ME	RO_S3	**Support type**	Consumer
Subsidy value in 2011			
middle distillates		**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

7.22 Slovenia

Table 7.22: Slovenia's EHSs

Country	Slovenia		
Subsidy	Market price support for domestic coal (producers), SVN_dt_01		
Brief description	Data 2001 To secure electricity supply domestic electricity producers are compelled to use a certain percentage of domestically produced coal in their production process (will not exceed 15% of total requirements of primary sector energy). If this obligation leads to the price of electricity being higher than the market price the producers will receive a reimbursement of the additional costs incurred.		
Reference in E3ME	SI_S1	**Support type**	Producer
Subsidy value in 2011			
hard coal & other coal	€7.3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Slovenia		
Subsidy	Feed-in tariff for natural gas used in CHP plants, SVN_dt_02 Data from 2002		
Brief description	Value of the feed-in tariff is determined by the reference cost of electricity production		
Reference in E3ME	SI_S2	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€12.98m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Slovenia		
Subsidy	Exemption from excise duty for certain uses of energy products, SVN_te_01		
Brief description	Data from 2000. Applied from 1999 Exemption from excise duty as motor fuel in commercial air, maritime transport, in power plants for combined heat and power generation and in production facilities for further processing or production of other non-excise products (not transportation). The estimates do not include maritime transport or international air. For coal, diesel oil, motor gasoline, kerosene and natural gas.		
Reference in E3ME	SI_S3	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€17.78m	**Expiry date (if applicable)**	none
middle distillates	€9.61m	**Expiry date (if applicable)**	none
natural gas	€5.11m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Slovenia		
Subsidy	Exemption from excise duty on fuels used in fishing boats, SVN_te_02		
Brief description	Data from 2000. Applied from 1999 Private boats not included. For motor gasoline.		
Reference in E3ME	SI_S4	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€0.07m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	Slovenia		
Subsidy	Exemptions from excise duty on fuel for diplomatic missions, etc., SVN_te_03		
Brief description	Data from 2000. Applied from 1999 Fuels include diesel and petrol.		
Reference in E3ME	SI_S5	**Support type**	Consumer
Subsidy value in 2011 middle distillates	€0.19m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.001	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	Slovenia		
Subsidy	Partial refund of excise duty on fuel used in stationary working machinery, SVN_te_04		
Brief description	Data from 2000. Applied in 1999 50% refund of the excise tax on motor fuel when used by construction engineering stationary machines, for tools in railway transport or in cable cars. For diesel oil.		
Reference in E3ME	SI_S6	**Support type**	Consumer
Subsidy value in 2011 middle distillates	€12.78m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.035	CO2 emission	-0.058
GDP	0.020	Employment	0.011

Country	Slovenia		
Subsidy	Partial refund of excise duty on motor fuel used in agricultural and forestry machinery, SVN_te_05		
Brief description	Data from 2000 – 2010 (OECD typo?) Applied from 1999 70% partial refund on the excise duty applied to motor fuel if used by agricultural and forestry machinery.		
Reference in E3ME	SI_S7	**Support type**	Consumer
Subsidy value in 2011 middle distillates	€15.32m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.032	CO2 emission	-0.028
GDP	0.019	Employment	0.019

Country	Slovenia		
Subsidy	Refund of excise duty on diesel used as fuel for commercial purposes, SVN_te_06		
Brief description	Data/Applied from 2009 Refund size limited by EU minimum excise duty on diesel.		
Reference in E3ME	SI_S8	**Support type**	Consumer
Subsidy value in 2011 middle distillates	€45.63m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.219	CO2 emission	-0.143
GDP	0.035	Employment	0.026

7.23 Slovakia

Table 7.23: Slovakia EHSs

Country	Slovakia		
Subsidy	Raising accessibility of lignite reserves in hornonitranske bane, prievidza, a.s. SVK_dt_01		
Brief description	Data from 2006 Direct grants given to a particular lignite mining company.		
Reference in E3ME	SK_S1	**Support type**	Producer
Subsidy value in 2011			
other coal	€4.7m	**Expiry date (if applicable)**	2020
Country impacts in 2020 (percentage difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Slovakia		
Subsidy	Feed-in tariff for domestic lignite, SVK_dt_01		
	Data from 2007. Applied since 2005		
Brief description	Up to 15% of total electricity generation can be subject to a refund when lignite is used in the production as an energy source to produce electricity. Lignite is significantly more expensive to use than other energy sources. Only one power plant benefiting.		
Reference in E3ME	SK_S2	**Support type**	Consumer
Subsidy value in 2011			
other coal	€70.7m	**Expiry date (if applicable)**	2020 (possibility of extension until 2035)
Country impacts in 2020 (percentage difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Slovakia		
Subsidy	Exemptions from the coal tax, SVK_te_01		
Brief description	Data from 2008 Exemption from the coal tax if it is used: as a duel fuel; in mineralogical processes; Not for motor fuel or heat generation; in the combined generation of electricity and heat; in electricity generation; for the production of coke and semi coke; by households (not allocated to households from 1/1/2011); operational and technological purposes in a mining and coal processing company.		
Reference in E3ME	SK_S3	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€39.0m	**Expiry date (if applicable)**	2020
Country impacts in 2020 (percentage difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Slovakia		
Subsidy	Exemptions from the natural gas tax, SVK_te_02		
Brief description	Data from 2008. Applied from 2004 Exemption from the coal tax if it is used: as a duel fuel; in mineralogical processes; in the combined generation of electricity and heat; in electricity generation; by households; for operational and technological purposes in a gas undertaking; in commercial activities directly related to railroad or river transportation of persons or cargo.		
Reference in E3ME	SK_S4	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€50.2m	**Expiry date (if applicable)**	2020
Country impacts in 2020 (percentage difference from baseline)			
Energy demand	n/a	CO2 emission	n/a
GDP	n/a	Employment	n/a

Country	Slovakia		
Subsidy	Coal allowances for former miners and miners' widows, SVK_dt_06		
Brief description	Data from 2007. Applied since 1992 In-kind benefits for miners including free provision of coal for heating and water heating purposes for eligible miners.		
Reference in E3ME	SK_S5	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€0.38m	**Expiry date (if applicable)**	2020
Country impacts in 2020 (percentage difference from baseline)			
Energy demand	n/a	CO_2 emission	n/a
GDP	n/a	Employment	n/a

7.24 Finland

Table 7.24: Finland's EHSs

Country	Finland		
Subsidy	Reduced energy-tax rate on diesel used in transport, FIN_te_01		
Brief description	Data from 2002 Increase in the rate of reduction per litre in 2012.		
Reference in E3ME	FI_S1	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€969m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-1.862	CO2 emission	-1.885
GDP	0.174	Employment	0.296

Country	Finland		
Subsidy	Reduced energy-tax rate for light fuel oil used in mobile machinery, FIN_te_04		
Brief description	Data from 2008		
Reference in E3ME	FI_S2	**Support type**	Consumer
Subsidy value in 2011			
crude oil	€470m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.974	CO2 emission	-0.536
GDP	0.089	Employment	0.117

Country	Finland		
Subsidy	Reduced energy-tax rate for natural gas used in heating, FIN_te_07		
Brief description	Data from 2008		
Reference in E3ME	FI_S3	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€75m	**Expiry date (if applicable)**	2015
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.308	CO2 emission	-0.099
GDP	0.024	Employment	0.018

Country	Finland		
Subsidy	Reduced energy tax for heavy and light fuel oils used in greenhouses, FIN_te_08		
Brief description	Data from 1998 Rebates on energy taxes on for commercial greenhouses using heavy and light fuel oils for heating purposes.		
Reference in E3ME	FI_S4	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€4.2m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.003	CO2 emission	-0.007
GDP	0.001	Employment	0.001

Country	Finland		
Subsidy	Energy-tax refund for energy-intensive enterprises, FIN_te_09		
Brief description	Data from 1999 In 2012 annual estimates expect the level to rise to EUR 200 million due to the structural change in the programme (many more companies to participate). For coal, natural gas and heavy fuel oil.		
Reference in E3ME	FI_S5	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€1.5m	**Expiry date (if applicable)**	none
heavy fuel oil	€1.8m	**Expiry date (if applicable)**	none
natural gas	€5.2m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.766	CO2 emission	-1.473
GDP	0.047	Employment	0.034

Country	Finland		
Subsidy	Energy-tax rebates for certain fuels used in agriculture, FIN_te_10		
Brief description	Data from 2005. Applied from 2006 (OECD typo?). Light fuel oil		
Reference in E3ME	FI_S6	**Support type**	Consumer
Subsidy value in 2011			
crude oil	€30.3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.021	CO2 emission	-0.047
GDP	0.005	Employment	0.006

Country	Finland		
Subsidy	Reduced energy-tax rate on peat used in heating, FIN_te_11		
Brief description	Data from 2010 N.B small peat plants are exempt from the energy tax.		
Reference in E3ME	FI_S7	**Support type**	Consumer
Subsidy value in 2011			
other coal	€126.0m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.089	CO2 emission	-0.109
GDP	0.009	Employment	0.008

Country	Finland		
Subsidy	Reduced CO2-tax rate for combined heat and power production, FIN_te_12		
Brief description	Data from 2011 50% Reduction of the CO2 tax applied to light fuel oil, biofuel oil, heavy fuel oil, coal, or natural gas-fired CHP production		
Reference in E3ME	FI_S8	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€28.5m	**Expiry date (if applicable)**	none
heavy fuel oil	€1.22m	**Expiry date (if applicable)**	none
Natural gas	€26.7m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.184	CO2 emission	-0.442
GDP	0.001	Employment	0.003

Country	Finland		
Subsidy	Energy-tax exemption for LPG, FIN_te_13		
Brief description	Data from 2010 Exemption form energy tax that is normally levied on all other energy products		
Reference in E3ME	FI_S9	**Support type**	Consumer
Subsidy value in 2011			
crude oil	€10.0m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.042	CO2 emission	-0.042
GDP	0.004	Employment	0.002

Country	Finland		
Subsidy	Energy-tax exemption for fuels used in vessel traffic, FIN_te_14		
Brief description	Data from 2003 Exemption from energy tax when domestically used in commercial vessels. Light and heavy fuel oils.		
Reference in E3ME	FI_S10	**Support type**	Consumer
Subsidy value in 2011			
crude oil & heavy fuel oil	€42.6m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.032	CO2 emission	-0.123
GDP	0.019	Employment	0.015

Country	Finland		
Subsidy	Peat storage cover, FIN_dt_03		
Brief description	Data from 2008-2009 (OECD typo?) Monthly fee paid to peat producers to cover the costs of non-commercial stockpiling part of the peat harvested in a given year.		
Reference in E3ME	FI_S11	**Support type**	Consumer
Subsidy value in 2011			
other coal	€0.16m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

7.25 Sweden

Table 7.25: Sweden's EHSs

Country	Sweden		
Subsidy	Reduced CO_2-tax rate for district heating supplied to industry, SWE_te_22		
Brief description	Data from 2000 70% reduction in 2011 on CO_2 tax. Planned to fall to 40% reduction in 2015. For coal, LPG and natural gas.		
Reference in E3ME	SW_S1	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€1.15m	**Expiry date (if applicable)**	none
crude oil	€1.05m	**Expiry date (if applicable)**	none
natural gas	€1.12m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.004	CO_2 emission	-0.052
GDP	0.000	Employment	0.000

Country	Sweden		
Subsidy	Reduced energy-tax rate on heating fuels for industrial consumers, SWE_te_09		
Brief description	Data 2004-2010 2011 onwards a 30% reduction in the standard tax rate on heating fuels. For LPG, natural gas and coal.		
Reference in E3ME	SW_S2	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€36.9m	**Expiry date (if applicable)**	none
crude oil	€33.6m	**Expiry date (if applicable)**	none
natural gas	€42.2m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.156	CO_2 emission	-0.871
GDP	0.018	Employment	0.011

Country	Sweden		
Subsidy	Reduced CO2-tax rate for industrial consumers outside EU ETS, SWE_te_11		
Brief description	Data from 2000 Concession on CO2 tax rate on all fossil fuels for heating purposes. Reduced to 70% in 2011 and 40% in 2015. For LPG, natural gas and coal.		
Reference in E3ME	SW_S3	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€43.5m	**Expiry date (if applicable)**	none
crude oil	€39.6m	**Expiry date (if applicable)**	none
natural gas	€42.2m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.172	CO2 emission	-1.359
GDP	0.021	Employment	0.013

Country	Sweden		
Subsidy	Reduced CO2-tax rate for energy-intensive companies, SWE_te_13		
Brief description	Data from 1997 24% reduction on CO2 tax rate when the value of the tax in 2011 exceeds 1.2% of sale value. To be completely phased out from 2015 onwards. For coal, gas and diesel products.		
Reference in E3ME	SW_S4	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€0.53m	**Expiry date (if applicable)**	none
middle distillates	€0.58m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.006	CO2 emission	-0.030
GDP	0.001	Employment	0.000

Country	Sweden		
Subsidy	Reduced energy-tax rate on diesel used in transport, SWE_te_01		
Brief description	Data from 1997 Rate of tax than for gasoline so considered a subsidy. Rate of tax planned to be increased so subsidy will effectively be removed. Has a specific size increase in 2013 relative to the bench mark.		
Reference in E3ME	SW_S5	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€1251.9m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-1.191	CO2 emission	-2.226
GDP	0.051	Employment	0.049

Country	Sweden		
Subsidy	Energy-tax exemption for natural gas and LPG used in transport, SWE_te_02		
Brief description	Data from 2007 For natural gas only since LPG consumption is negligible.		
Reference in E3ME	SW_S6	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€25.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.069	CO2 emission	-0.126
GDP	0.000	Employment	-0.002

Country	Sweden		
Subsidy	Energy-tax exemption for diesel power trains, SWE_te_03		
Brief description	Data 1997		
Reference in E3ME	SW_S7	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€3.3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.002	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	Sweden		
Subsidy	Reduced CO2-tax rate for natural gas and LPG used in transport, SWE_te_12		
Brief description	Data 2007 In 2011 plans to be 30% reduction for both. 2013 a 20% reduction for both. To be completely phased out from 2015 onwards. For natural gas only since LPG consumption is negligible.		
Reference in E3ME	SW_S8	**Support type**	Consumer
Subsidy value in 2011 natural gas	€4.4m	**Expiry date (if applicable)**	2015
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.033	CO2 emission	-0.061
GDP	0.000	Employment	-0.001

Country	Sweden		
Subsidy	CO2-tax exemption for domestic aviation, SWE_te_18		
Brief description	Data from 2004 For kerosene type jet fuel only.		
Reference in E3ME	SW_S9	**Support type**	Consumer
Subsidy value in 2011 middle distillates	€95.3m	**Expiry date (if applicable)**	2012
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.127	CO2 emission	-0.052
GDP	0.016	Employment	0.009

Country	Sweden		
Subsidy	Energy-tax exemption for domestic aviation, SWE_te_05		
Brief description	Data from 2007 Exemption from energy tax for fuel used in domestic commercial aviation, not including private domestic aviation. For kerosene type jet fuel only.		
Reference in E3ME	SW_S10	**Support type**	Consumer
Subsidy value in 2011 middle distillates	€103.0m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.086	CO2 emission	-0.036
GDP	0.011	Employment	0.007

Country	Sweden		
Subsidy	CO2-tax exemption for domestic shipping, SWE_te_19		
Brief description	Data from 2004 Exemption from energy tax for fuel used in domestic commercial shipping, not including private domestic shipping. For diesel and fuel oils.		
Reference in E3ME	SW_S11	**Support type**	Consumer
Subsidy value in 2011			
middle distillates & heavy fuel oil	€55.4m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.004	CO2 emission	-0.011
GDP	0.002	Employment	-0.001

Country	Sweden		
Subsidy	Specific CO2-tax reduction for greenhouses and agriculture, SWE_te_14		
Brief description	Data from 2008 24% CO2 tax reduction when the value exceeds 1.2% of their sales. To be completely phased out from 2015 onwards. For diesel, LPG, natural gas and fuel oil.		
Reference in E3ME	SW_S12	**Support type**	Consumer
Subsidy value in 2011			
crude oil & middle distillates	€1.95m	**Expiry date (if applicable)**	none
natural gas	€0.27m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.014	CO2 emission	-0.055
GDP	0.000	Employment	0.000

Country	Sweden		
Subsidy	General CO2-tax reduction for greenhouses and agriculture, SWE_te_15		
Brief description	Data from 2004 70% reduction for CO2 tax rate on all fossil fuels used for heating. In 2015 a 40% reduction. For diesel, LPG, natural gas and fuel oil.		
Reference in E3ME	SW_S13	**Support type**	Consumer
Subsidy value in 2011			
crude oil & middle distillates	€36.4m	**Expiry date (if applicable)**	none
natural gas	€4.6m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.166	CO2 emission	-0.489
GDP	0.007	Employment	0.003

Country	Sweden		
Subsidy	CO2-tax reduction for diesel used in agriculture and forestry, SWE_te_16		
Brief description	Data from 2005 70% reduction for CO2 tax rate on diesel for machinery		
Reference in E3ME	SW_S14	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€136.3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.295	CO2 emission	-0.557
GDP	0.016	Employment	0.006

Country	Sweden		
Subsidy	Reduced energy-tax rate on heating fuels for greenhouses and agriculture, SWE_te_10		
Brief description	Data from 1997 From 2011 onwards only 30% reduction on the standard rate on heating fuels. For LPG and natural gas.		
Reference in E3ME	SW_S15	**Support type**	Consumer
Subsidy value in 2011			
crude oil	€0.23m	**Expiry date (if applicable)**	none
natural gas	€10.15m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.073	CO2 emission	-0.309
GDP	0.003	Employment	0.001

Country	Sweden		
Subsidy	Reduced energy-tax rate for fuels used in CHP (combined heat & power) plants, SWE_te_07		
Brief description	70% reduction in standard rate of rate on heating fuels on CHP plants that are not encompassed by the EU ETS system. For coal, blast furnace gas, natural gas and heavy fuel oil.		
Reference in E3ME	SW_S16	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€9.7m	**Expiry date (if applicable)**	none
heavy fuel oil	€15.9m	**Expiry date (if applicable)**	none
natural gas	€22.0m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.018	CO2 emission	-0.015
GDP	0.006	Employment	0.003

Country	Sweden		
Subsidy	CO2-tax exemption for diesel-powered trains, SWE_te_17		
Brief description	Data from 1997		
Reference in E3ME	SW_S17	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€3.3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.004	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	Sweden		
Subsidy	Reduced CO2-tax rate for diesel used by the mining industry, SWE_te_21		
Brief description	70% concession on CO2 tax rate on all fossil fuels used for heating purposes. To be reduced to 40% in 2015.		
Reference in E3ME	SW_S18	**Support type**	Consumer
Subsidy value in 2011			
crude oil, middle distillates & heavy fuel oil	€21.1m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.017	CO2 emission	-0.216
GDP	0.004	Employment	0.001

Country	Sweden		
Subsidy	Reduced energy-tax rate on diesel for the mining industry, SWE_te_08		
Brief description	84% energy tax reduction on diesel used for fuelling stationary machinery used for mining purposes. To be increased to 86% reduction in 2013.		
Reference in E3ME	SW_S19	**Support type**	Consumer
Subsidy value in 2011			
middle distillates	€13.3m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.008	CO2 emission	-0.108
GDP	0.002	Employment	0.001

7.26 UK

Table 7.26: UK's EHSs

Country	UK		
Subsidy	PRT exemption for sales to British gas, GBR_te_01		
Brief description	Data from 1997 Exemption from PRT (Petroleum Revenue Tax) when sold to British Gas when contracts were signed (and have not been significantly changed) before 1975.		
Reference in E3ME	UK_S1	**Support type**	Producer
Subsidy value in 2011			
natural gas	€0m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	0.000	CO2 emission	0.000
GDP	0.000	Employment	0.000

Country	UK		
Subsidy	PRT tariff receipts allowance, GBR_te_02		
Brief description	Data from 1997. Applied from 1983 Tariff receipts from taxable profits. For the use of its assets by other oil gas companies. For oil and natural-gas extraction.		
Reference in E3ME	UK_S2	**Support type**	Producer
Subsidy value in 2011			
crude oil, middle distillates & heavy fuel oil	€26.1m	**Expiry date (if applicable)**	none
natural gas	€20m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.005	CO2 emission	-0.019
GDP	0.000	Employment	0.000

Country	UK		
Subsidy	PRT oil allowance, GBR_te_04		
Brief description	Data from 1997. Applied from 1975 Relief against PRT applicable to profits to encourage small and marginal fields. Value depends on date field was developed and location. Available for 10 years but can be claimed for longer is sufficient profits. For oil and natural-gas extraction.		
Reference in E3ME	UK_S3	**Support type**	Producer
Subsidy value in 2011			
crude oil, middle distillates & heavy fuel oil	€156.8m	**Expiry date (if applicable)**	none
natural gas	€119.8m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.033	CO2 emission	-0.105
GDP	0.000	Employment	0.000

Country	UK		
Subsidy	Reduced rate of VAT for fuel and power, GBR_te_06		
Brief description	Data from 1997. Applied from 1973 5% VAT paid on fuel and power by consumers for heating and general power. For fossil fuels like natural gas, kerosene, and coal.		
Reference in E3ME	UK_S4	**Support type**	Consumer
Subsidy value in 2011			
hard coal & other coal	€93.7m	**Expiry date (if applicable)**	none
crude oil, middle distillates & heavy fuel oil	€ 438.20m	**Expiry date (if applicable)**	none
natural gas	€4044.5m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.628	CO2 emission	-0.535
GDP	0.002	Employment	0.012

Country	UK		
Subsidy	Reduced rate of ETD for households fuel		
Brief description	Applied since 2003 Exemption from the Energy Taxation Direction (ETD) for fuels used by households.		
Reference in E3ME	UK_S5	**Support type**	Consumer
Subsidy value in 2011			
natural gas	€ 1123.80 m	**Expiry date (if applicable)**	none
electricity	€ 55.36 m	**Expiry date (if applicable)**	none
Country impacts in 2020 from removing subsidy (E3ME, % difference from baseline)			
Energy demand	-0.150	CO2 emission	-0.145
GDP	-0.005	Employment	-0.002

8 Appendix B: Description of E3ME

This appendix provides a short non-technical description of the Energy-Environment-Economy Model for Europe (E3ME), developed by Cambridge Econometrics (CE).

For further details, including the full technical manual, the reader is referred to the E3ME website: http://www.e3me.com. E3ME is also described in the IA Tools model inventory.

For a list of acknowledgements see the preface of the model manual.

8.1 Introduction to E3ME

E3ME is a computer-based model of Europe's economic and energy systems and the environment. It was originally developed through the European Commission's research framework programmes and is now widely used in Europe for policy assessment, for forecasting and for research purposes.

E3ME's structure

The structure of E3ME is based on the system of national accounts, as defined by ESA95 (European Commission, 1996), with further linkages to energy demand and environmental emissions. The labour market is also covered in detail, with estimated sets of equations for labour demand, supply, wages and working hours. In total there are 33 sets of econometrically estimated equations, also including the components of GDP (consumption, investment, and international trade), prices, energy demand and materials demand. Each equation set is disaggregated by country and by sector.

E3ME's historical database covers the period 1970-2010 and the model projects forward annually to 2050[229]. The main data sources are Eurostat, DG Ecfin's AMECO database and the IEA, supplemented by the OECD's STAN database and other sources where appropriate. Gaps in the data are estimated using customised software algorithms.

The main dimensions of the model

The other main dimensions of the model are:

- 33 countries (the EU27 member states, Norway and Switzerland and four candidate countries)
- 69 economic sectors, including disaggregation of the energy sectors
- 43 categories of household expenditure
- 22 different users of 12 different fuel types
- 14 types of air-borne emission (where data are available) including the six greenhouse gases monitored under the Kyoto protocol
- 13 types of household, including income quintiles and socio-economic groups such as the unemployed, inactive and retired, plus an urban/rural split

Typical outputs from the model include GDP and sectoral output, household expenditure, investment, international trade, inflation, employment and unemployment, energy demand and CO2 emissions. Each of these is available at national and EU level, and most are also defined by economic sector.

[229] See Chewpreecha and Pollitt (2009).

The econometric specification of E3ME gives the model a strong empirical grounding and means it is not reliant on the assumptions common to Computable General Equilibrium (CGE) models, such as perfect competition or rational expectations. E3ME uses a system of error correction, allowing short-term dynamic (or transition) outcomes, moving towards a long-term trend. The dynamic specification is important when considering short and medium-term analysis (e.g. up to 2020) and rebound effects[230], which are included as standard in the model's results.

E3ME's key strengths

In summary the key strengths of E3ME lie in three different areas:

- the close integration of the economy, energy systems and the environment, with two-way linkages between each component
- the detailed sectoral disaggregation in the model's classifications, allowing for the analysis of similarly detailed scenarios
- the econometric specification of the model, making it suitable for short and medium-term assessment, as well as longer-term trends

A longer description of E3ME is provided in the next chapter. For further details, the reader is referred to the model manual available online from www.e3me.com.

8.2 A brief history of E3ME

The first version of the E3ME model was built by an international European team under a succession of contracts in the JOULE/THERMIE and EC research programmes. More recently, the model has been supported solely through application for policy analysis. E3ME has been used to contribute to several high-profile European Impact Assessments, including reviews of the EU ETS, Energy Taxation Directive, SO_2/NO_x trading and Energy Efficiency Directive. E3ME is also now applied at the national, as well as European, level.

A full list of recent projects involving E3ME is available from the model website. As a result of its programme of continuing application and improvement, E3ME is now firmly established as a tool for policy analysis in Europe. The current version is closely linked to the global E3MG[231] model, which is similar in structure and dimensions.

[230] Where an initial increase in efficiency reduces demand, but this is negated in the long run as greater efficiency lowers the relative cost and increases consumption. See Barker et al (2009).

[231] See www.e3mgmodel.com

8.3 The theoretical background to E3ME

Economic activity undertaken by persons, households, firms and other groups in society has effects on other groups after a time lag, and the effects persist into future generations, although many of the effects soon become so small as to be negligible. But there are many actors, and the effects, both beneficial and damaging, accumulate in economic and physical stocks. The effects are transmitted through the environment (with externalities such as greenhouse gas emissions contributing to global warming), through the economy and the price and money system (via the markets for labour and commodities), and through the global transport and information networks. The markets transmit effects in three main ways: through the level of activity creating demand for inputs of materials, fuels and labour; through wages and prices affecting incomes; and through incomes leading in turn to further demands for goods and services. These interdependencies suggest that an E3 model should be comprehensive, and include many linkages between different parts of the economic and energy systems.

These economic and energy systems have the following characteristics: economies and diseconomies of scale in both production and consumption; markets with different degrees of competition; the prevalence of institutional behaviour whose aim may be maximisation, but may also be the satisfaction of more restricted objectives; and rapid and uneven changes in technology and consumer preferences, certainly within the time scale of greenhouse gas mitigation policy. Labour markets in particular may be characterised by long-term unemployment. An E3 model capable of representing these features must therefore be flexible, capable of embodying a variety of behaviours and of simulating a dynamic system. This approach can be contrasted with that adopted by general equilibrium models: they typically assume constant returns to scale; perfect competition in all markets; maximisation of social welfare measured by total discounted private consumption; no involuntary unemployment; and exogenous technical progress following a constant time trend (see Barker, 1998, for a more detailed discussion).

8.4 E3ME as an E3 model

The E3ME model comprises:

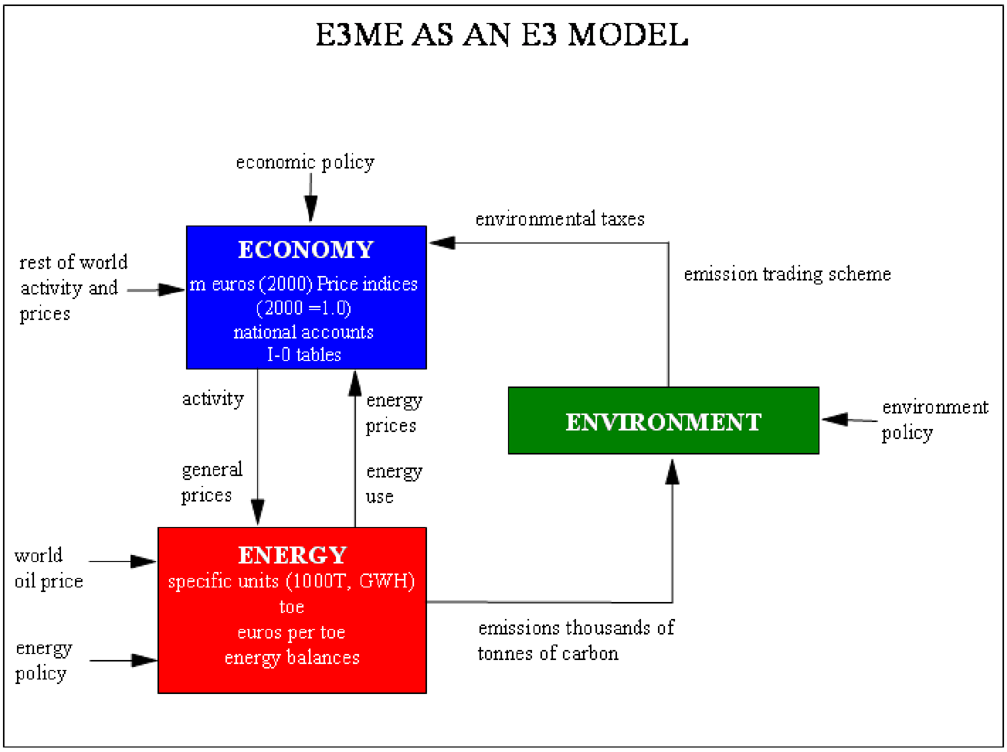
- the accounting balances for commodities from input-output tables and the national accounts, for energy carriers from energy balances, and flows of emissions and material consumption
- a large historical database covering the period from 1970 annually
- 33 sets of time-series econometric equations (aggregate energy demands, fuel substitution equations for coal, heavy oil, gas and electricity; intra-EU and extra-EU commodity exports and imports; total consumers' expenditure; disaggregated consumers' expenditure; industrial fixed investment; industrial employment; industrial hours worked; labour participation; industrial prices; export and import prices; industrial wage rates; residual incomes; investment in dwellings; normal output equations and physical demand for seven types of materials)

Energy supplies and population stocks and flows are treated as exogenous.

The E3 interactions

Figure 8.1 shows how the three components (modules) of the model - energy, environment and economy - fit together. Each component is shown in its own box with its own units of account and sources of data. The linkages between the components of the model are shown explicitly by the arrows that indicate which values are transmitted between components.

Figure 8.1



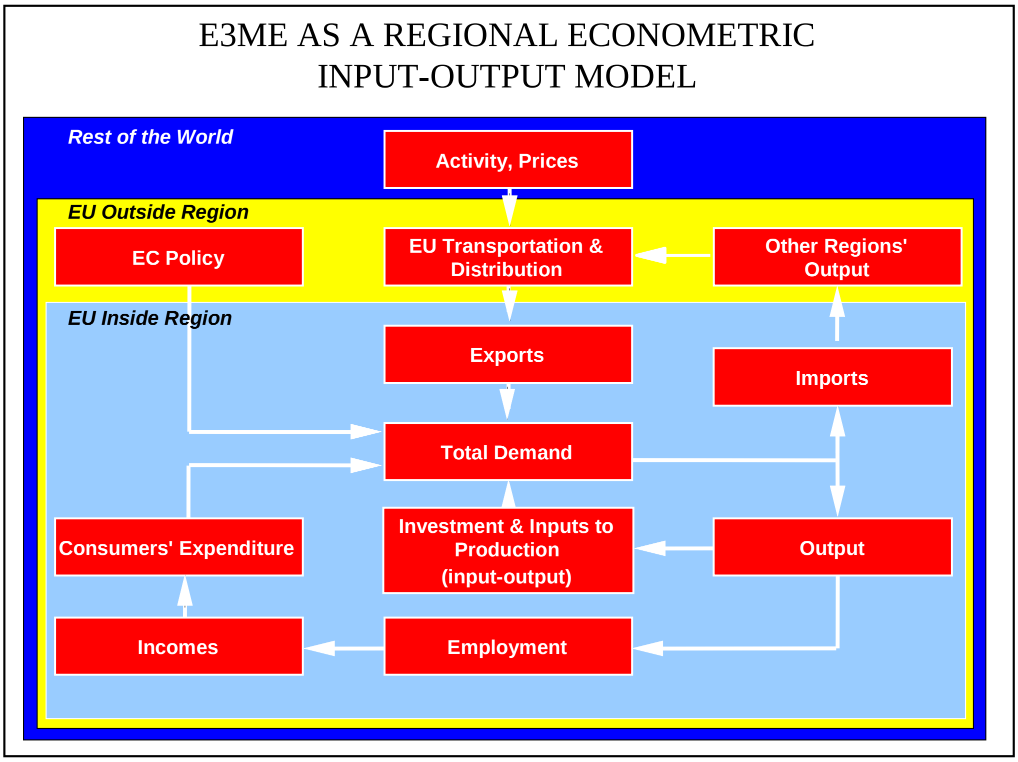
The economy module provides measures of economic activity and general price levels to the energy module; the energy module provides measures of emissions of the main air pollutants to the environment module, which in turn gives measures of damage to health and buildings (estimated using the most recent ExternE[232] coefficients). The energy module provides detailed price levels for energy carriers distinguished in the economy module and the overall price of energy as well as energy use in the economy.

8.5 The E3ME regional econometric input-output model

Figure 8.2 shows how the economic module is solved as an integrated EU regional model. Most of the economic variables shown in the chart are at a 69-industry level. The whole system is solved simultaneously for all industries and all 33 countries, although single-country solutions are also possible. The chart shows interactions at three spatial levels: the outermost area is the rest of the world; the next level is the European Union outside the country in question; and finally, the inside level contains the relationships within the country.

[232] http://www.externe.info/tools.html

Figure 8.2



The chart shows three loops or circuits of economic interdependence, which are described in the paragraphs below. In addition there is a dependence loop between sectors through their input-output linkages; this is not shown in the macro-level linkages in the figure but is similar to a Type I multiplier. The second loop, through incomes and household expenditure, provides something similar to Type II multipliers. The other loops are through investment and through international trade.

Determination of output

Output, measured in gross terms, is determined through the macroeconomic identity as the sum of intermediate and final demands. Intermediate demand is the demand from other economic sectors and is determined by input-output relationships (including domestic and import supplies). Final demand consists of household and government demand, investment and exports.

In E3ME imports are defined as a negative demand. Imports are subtracted from total demand to provide output by sector.

GDP

GDP on the expenditure side is an identity that is defined as the sum of the final components of demand.

Gross Value Added

GVA by sector is determined as the difference between gross output (i.e. turnover) and intermediate costs, corrected for taxes. GVA includes wage costs and profit margins, plus taxes on production.

International trade

E3ME includes export and import equations for the trade of commodities within and outside of Europe. The basic assumption is that, for most commodities, there is a ‘pool’ into which a country supplies part of its production and from which the country satisfies part of its demand. *This might be compared to national electricity supplies and demands: each power plant supplies to the national grid and each user draws power from the grid and it is not possible or necessary to link a particular supply to a particular demand.*

The demand for a country's exports of a commodity is related to three factors:

- domestic demand for the commodity in all the other countries, weighted by their economic distance (determined by OECD bilateral trade data)
- the quality of national produce, determined by the technical progress indicators
- relative prices, including the effects of exchange rate changes

Econometric equations are estimated to determine the magnitude of these effects.

Investment

Forecast changes in output are important determinants of investment in the model. Other determinants of investment are the relative price of capital, real interest rates and position in the economic cycle.

Investment and output

Sectoral investment is transformed by a converter matrix to go from the sector making the investment, to the one that receives the payment (e.g. construction or engineering). The resulting vector is a component of output (see above), providing the feedback loop between output and investment.

Accumulation of knowledge and technology

Gross fixed investment, enhanced by R&D expenditure in constant prices, is accumulated to provide a measure of the technological capital stock. This avoids problems with the usual definition of the capital stock and lack of data on economic scrapping. The accumulation measure is designed to get round the worst of these problems. Investment is central to the determination of long-term growth and the E3ME model embodies endogenous technical change and a theory of endogenous growth which underlies the long-term behaviour of the trade and employment equations.

Incomes and household expenditure

As described below, increases in economic output generate employment which, when multiplied by average wage rates, provides incomes to households. These are some of the largest payments to the personal sector, but not the only ones. There are also payments of interest and dividends, transfers from government in the form of state pensions, unemployment benefits and other social security benefits. Payments made by the personal sector include mortgage interest payments and personal income taxes. Personal disposable income is calculated from these accounts, and deflated by the consumer price index to give real personal disposable income.

Employment and wages

E3ME includes equation sets for headcount employment, average wages, working hours and labour market participation. Increased economic output is expected to lead to higher levels of employment, greater wage demands and more incentive to work. Higher wage rates, however, are a deterrent to job creation.

Unemployment is calculated as the difference between employment and labour supply. It is an important determinant in wage bargaining.

Household expenditure

Totals of consumer spending are derived from consumption functions estimated from time-series data. These equations relate consumption to real personal disposable income, a measure of wealth for the personal sector, inflation and interest rates.

Sets of equations have been estimated from time-series data for each of the 43 consumption categories. Consumption in these categories is then scaled to be consistent with the total above.

Consumption and output

Household consumption by product is converted to demand by sector using a transition matrix. This also subtracts consumption taxes, such as VAT. The resulting vector is used in the calculation of sectoral output. Sectors that typically benefit from higher rates of consumption include retail, hotels and catering and other personal services.

Prices Each real economic variable has an associated price variable that goes with it. The relationships between prices and quantities are often complex and are estimated using behavioural relationships. It is also important to note the interaction between prices and wages. While inflation pushes up wage rates, higher unit wage costs for sectors lead to price increases which, when aggregated, lead to higher rates of inflation. There is thus a strong feedback loop in price effects.

8.6 Energy-Environment links

Top-down and bottom-up methodologies E3ME is intended to be an integrated top-down, bottom-up model of E3 interaction. In particular, the model includes a detailed engineering-based treatment of the electricity supply industry (ESI). Demand for energy by the other fuel-user groups is top-down, but it is important to be aware of the comparative strengths and weaknesses of the two approaches. Top-down economic analyses and bottom-up engineering analyses of changes in the pattern of energy consumption possess distinct intellectual origins and distinct strengths and weaknesses (see Barker, Ekins and Johnstone, 1995).

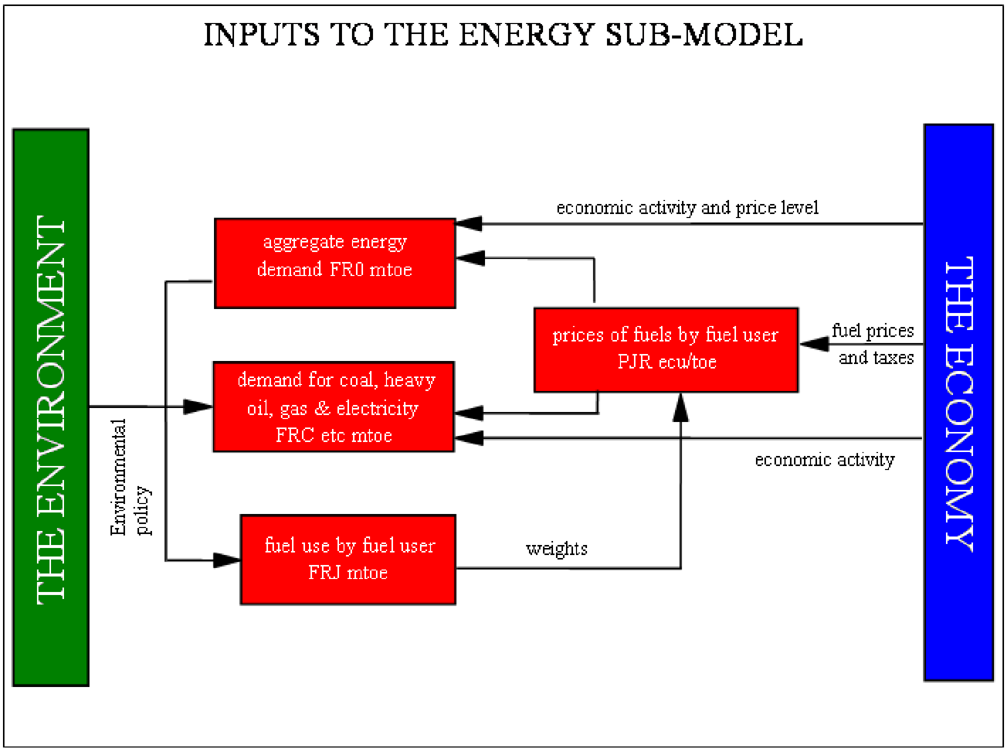
A top-down submodel of energy use The energy submodel in E3ME is constructed, estimated and solved for 22 fuel users, 12 energy carriers (termed fuels for convenience below) and 33 countries. Figure 2.3 shows the inputs from the economy and the environment into the components of the submodel and Figure 8.3 shows the feedback from the submodel to the rest of the economy.

Determination of fuel demand Aggregate energy demand, shown at the top of Figure 2.3, is determined by a set of co-integrating equations[233], whose the main explanatory variables are:

- economic activity in each of the 22 fuel users
- average energy prices by the fuel users relative to the overall price levels
- technological variables, represented by investment and R&D expenditure, and spill overs in key industries producing energy-using equipment and vehicles

[233] Cointegration is an econometric technique that defines a long-run relationship between two variables resulting in a form of ‘equilibrium’. For instance, if income and consumption are cointegrated, then any shock (expected or unexpected) affecting temporary these two variables is gradually absorbed since in the long-run they return to their ‘equilibrium’ levels. Note that a cointegration relationship is much stronger relationship than a simple correlation: two variables can show similar patterns simply because they are driven by some common factors but without necessarily being involved in a long-run relationship.

Figure 8.3



Fuel substitution Fuel use equations are estimated for four fuels - coal, heavy oils, gas and electricity – and the four sets of equations are estimated for the fuel users in each region. These equations are intended to allow substitution between these energy carriers by users on the basis of relative prices, although overall fuel use and the technological variables are allowed to affect the choice. Since the substitution equations cover only four of the twelve fuels, the remaining fuels are determined as fixed ratios to similar fuels or to aggregate energy use. The final set of fuels used must then be scaled to ensure that it adds up to the aggregate energy demand (for each fuel user and each region).

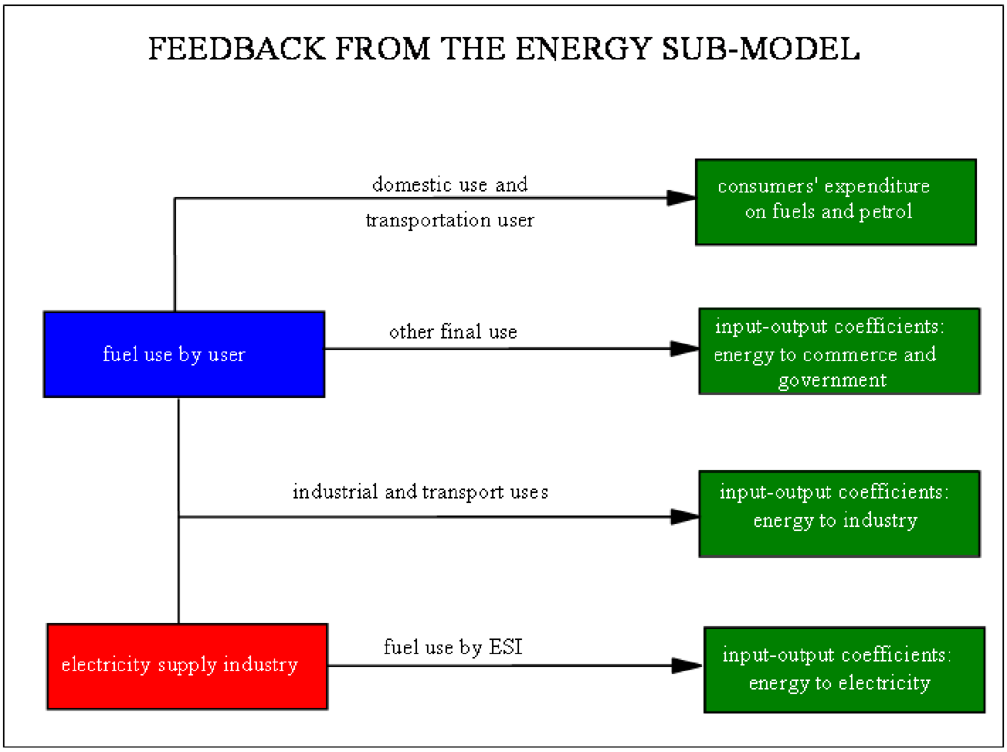
Emissions submodel The emissions submodel calculates air pollution generated from end-use of different fuels and from primary use of fuels in the energy industries themselves, particularly electricity generation. Provision is made for emissions to the atmosphere of carbon dioxide (CO2), sulphur dioxide (SO2), nitrogen oxides (NOx), carbon monoxide (CO), methane (CH4), black smoke (PM10), volatile organic compounds (VOC), nuclear emissions to air, lead emissions to air, chlorofluorocarbons (CFCs) and the other four greenhouse gases: nitrous oxide (N2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulphur hexafluoride (SF6). These four gases together with CO2 and CH4 constitute the six greenhouse gases (GHGs) monitored under the Kyoto protocol. Using estimated (ExternE) damage coefficients, E3ME may also estimate ancillary benefits relating to reduction in associated emissions e.g. PM10, SO2, NOx.

CO2 emissions Emissions data for CO2 are available for fuel users of solid fuels, oil products and gas separately. The energy submodel estimates of fuel by fuel user are aggregated into these groups (solid, oil and gas) and emission coefficients (tonnes of carbon in CO2 emitted per toe) are calculated and stored. The coefficients are calculated for each year when data are available, then used at their last historical values to project future emissions. Other emissions data are available at various levels of disaggregation from a number of sources and have been constructed carefully to ensure consistency.

Feedback to the rest of the economy

Figure 8.4 shows the main feedbacks from the energy submodel to the rest of the economy. Changes in consumers' expenditures on fuels and petrol are formed from changes in fuel use estimated in the energy submodel, although the levels are calibrated on historical time-series data. The model software provides an option for choosing either the consumers' expenditure equation solution, or the energy equation solution. Whichever option is chosen, total consumer demand in constant values matches the results of the aggregate consumption function, with any residual held in the unallocated category of consumers' expenditure. The other feedbacks all affect industrial, including electricity, demand via changes in the input-output coefficients.

Figure 8.4



8.7 Parameter estimation

The econometric model has a complete specification of the long-term solution in the form of an estimated equation that has long-term restrictions imposed on its parameters. Economic theory, for example the recent theories of endogenous growth, informs the specification of the long-term equations and hence properties of the model; dynamic equations that embody these long-term properties are estimated by econometric methods to allow the model to provide forecasts. The method utilises developments in time-series econometrics, in which dynamic relationships are specified in terms of error correction models (ECM) that allow dynamic convergence to a long-term outcome. The specific functional form of the equations is based on the econometric techniques of cointegration and error-correction, particularly as promoted by Engle and Granger (1987) and Hendry et al (1984).

8.8 Application of E3ME

Scenario-based analysis

Although E3ME can be used for forecasting, the model is more commonly used for evaluating the impacts` of an input shock through a scenario-based analysis. The shock may be either a change in policy, a change in economic assumptions or another change to a model variable. The analysis can be either forward looking (ex-ante) or evaluating previous developments in an ex-post manner. Scenarios can be used either to assess policy, or to assess sensitivities to key inputs (e.g. international energy prices).

For ex-ante analysis a baseline forecast up to 2050 is required; E3ME is usually calibrated to match a set of projections that are published by the European Commission. The scenarios represent alternative versions of the future based on a different set of inputs. By comparing the outcomes to the baseline (usually in percentage terms), the effects of the change in inputs can be determined.

8.9 Typical scenarios

It is important to design scenarios carefully so that they do not present a biased set of outcomes, for example in a scenario where public spending increases there should be a similar increase in tax receipts (ensuring 'revenue neutrality', so that the scenario represents a shift in resources rather than an increase or decrease).

It is possible to set up a scenario in which any of the model's inputs or variables are changed. In the case of exogenous inputs, such as population or energy prices, this is straight forward. However, it is also possible to add shocks to other model variables. For example, investment is endogenously determined by E3ME, but additional exogenous investment (e.g. through an increase in public investment expenditure) can also be modelled as part of a scenario input.

Price or tax scenarios

Model-based scenario analyses often focus on changes in price because this is easy to quantify and represent in the model structure. Examples include:

- changes in tax rates
- changes in international energy prices
- emission trading schemes

Regulatory impacts

All of the above can be represented in E3ME's framework reasonably well, given the level of disaggregation available. However, it is also possible to assess the effects of regulation, albeit with an assumption about effectiveness and cost. For example, an increase in vehicle fuel-efficiency standards could be assessed in the model with an assumption about how efficient vehicles become, and the cost of these measures. This would be entered into the model as a higher price for cars and a reduction in fuel consumption (all other things being equal). E3ME could then be used to determine:

- secondary effects, for example on fuel suppliers
- rebound effects[234]

[234] In the example, the higher fuel efficiency effectively reduces the cost of motoring. In the long-run this is likely to lead to an increase in demand, meaning some of the initial savings are lost. Barker et al (2009) demonstrate that this can be as high as 50% of the original reduction.

8.10 Standard outputs from the model

As a general model of the economy, based on the full structure of the national accounts, E3ME is capable of producing a broad range of economic indicators. In addition there is range of energy and environment indicators. The following list provides a summary of the most common outputs:

- GDP and the aggregate components of GDP (household expenditure, investment, government expenditure and international trade)
- sectoral output and GVA, prices, trade and competitiveness effects
- consumer prices and expenditures, and implied household distributional effects
- sectoral employment, unemployment, sectoral wage rates and labour supply
- energy demand, by sector and by fuel, energy prices
- CO_2 emissions by sector and by fuel
- other air-borne emissions
- material demands

This list is by no means exhaustive and the delivered outputs often depend on the requirements of the specific project. In addition to the sectoral dimension mentioned in the list, all indicators are produced at the member state level and annually over the period up to 2050.

8.11 Limitations to the analysis

The main limitation of E3ME is the sectoral disaggregation of its sectors. The industry classification is relatively detailed, covering 69 sectors at the NACE 2-digit level. However, due to the availability of the data, it is not possible to go into more detail, for example to the firm-based level, or to very detailed product groups. For this type of analysis our recommendation is that the model (which provides an indication of indirect effects) is used in conjunction with a more detailed bottom-up or econometric analysis (which can capture detailed industry-specific effects).

The other main limitations to the model relate to its dimensions and boundaries. Broadly speaking E3ME covers the economy, energy and material demands and atmospheric emissions. While it is possible to provide an assessment of other policy areas, it is necessary to make assumptions about how this is translated into model inputs. Other limitations, such as the geographical scope (Europe) and time horizon (2050) are more obvious, although it should be noted that the global E3MG model can be used to address the first of these issues. A global version of the E3ME model is expected to be available from 2013.