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Assessment Agency

GREEN TAX REFORM

ENERGY TAX CHALLENGES FOR THE NETHERLANDS

PBL Policy Brief

Green tax reform: Energy tax challenges for the Netherlands

Herman Vollebergh

PBL Policy Brief

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Corresponding author

herman.vollebergh @pbl.nl

Author

Herman Vollebergh

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Summary

The central topic of this Policy Brief is the tension between two objectives of green tax reform: raising revenue from environmental taxes, and reducing environmental pollution. This tension between ‘green revenue’ and ‘green result’ is certainly present in the tax system of the Netherlands, which has a long tradition of green fiscal reform. The present taxes on energy products, such as natural gas, electricity and motor fuels, generate considerable revenue for the Dutch treasury and at the same time play a role in improving environmental quality. Climate change and air pollution are the main environmental problems caused by consumption of these energy products, and the government plays an important role in correcting the underlying market failure.

The challenge for (further) green tax reform in the Netherlands is to find an optimal, future-proof balance between raising ‘green revenue’ from energy taxes and achieving a ‘green result’ from these taxes, so as to reduce environmental damage from energy consumption. This is a delicate balance. Green tax reform aimed solely at increasing or stabilising tax revenue for the treasury will favour environmental tax bases that are unlikely to ‘erode’. However, the opposite is usually the case for environmental taxes aimed at achieving a green result, because tax base reduction generally means that environmentally harmful emissions decrease, and, therefore, the capacity to raise revenue suffers.

A well-known perspective that strikes an optimal balance is that of environmental pricing based on tax rates that are equal to the marginal cost of environmental damage. On the basis of a background report on the present Dutch energy tax structure in relation to the monetary costs of environmental pollution, published at the same time as this Policy Brief, we are now able to assess the current tax structure, as well as options for green tax reform in the Netherlands, from the perspective of environmental pricing.

The analysis in this Policy Brief shows, first of all, that the Dutch energy tax structure has been designed to tax environmental damage mostly *indirectly*, that is, via taxes on consumption of natural gas, electricity and motor fuels. In addition, the emphasis of energy taxation is on small users, households in particular. This choice has mainly been guided by concerns over international tax competition; high environmental taxes could

drive large companies out of the country. For households it is obviously more difficult to move abroad just to avoid taxes. One of the disadvantages of taxing *consumption* is that the environmental tax base is taxed mostly indirectly. Moreover, the taxed energy products are only indirectly related to the emissions released during fuel combustion, while regulation of supply chain emissions is not always consistent.

Our analysis further shows that energy tax reform should not focus only on the *climate* impact (carbon tax base) of energy consumption, but should also take into account the various effects of fuel use on *air quality*. This applies in particular to biomass and motor fuels. While biomass is an inexpensive way to help achieve climate targets, the price is high in terms of air pollution from particulate matter and NO_x emissions. The air quality impact of motor fuels is also considerable, particularly when indirect (i.e. supply chain) emissions are taken into account. Natural gas and renewable energy sources other than biomass are much cleaner and therefore should play a major role in the energy system.

A third conclusion of our analysis is that a better balance could be found between green revenue generation and achieving green results. The fact that the Netherlands is a front runner in environmental taxation, with about 10% of total tax revenue raised from environmental taxes, does not necessarily mean that the present energy tax structure delivers the best possible environmental result. For example, tax rates on various energy products are not optimal, from an environmental pricing perspective. In particular, present rates on electricity – of which only production, not consumption, leads to emissions – are relatively high. Moreover, rates are independent of the production method used (natural gas, coal, biomass, nuclear), while these methods vary greatly in terms of environmental damage caused. Conversely, tax rates on some fossil fuels, such as coal, are currently (much) too low. Tax exemptions for self-generated renewable energy are perfectly justifiable on environmental grounds, even if they reduce tax revenue.

Fourthly, this report discusses a number of reform options that are sure to be ‘no-regret’ in terms of environmental benefits. One such option is to abolish the tax exemptions on fuel products used in aviation and shipping. Furthermore, from an environmental point of view it would be a bad idea to reintroduce the exemption on the most polluting fossil fuel for electricity generation, i.e. coal, as has been agreed in the 2013 National Energy Agreement. Even if the Dutch coal tax does not contribute much to CO₂ emissions reduction within the European Union (EU) in the short term, it does have a positive effect on air quality, and possibly also on the functioning of the EU emissions trading system (EU ETS), in the longer term. Similarly, even a tax on biomass for electricity production would be justifiable on the grounds of air quality effects; biomass combustion causes considerable emissions of particulate matter and NO_x. An additional issue is the unequal tax treatment of petrol versus diesel. In various applications diesel is much more polluting than petrol, while it is taxed at a much lower rate. Furthermore, it is worth considering to reduce a number of ‘perverse’ effects from an environmental point of view. For example, it is remarkable that no tax is levied on the incineration of

combustible waste (which includes non-energy products made from fossil fuels, such as plastics). After all, this 'resource' is not taxed at any other stage in the supply chain.

Fifth and finally, the viability of the present Dutch energy tax structure is likely to be limited in the long term. The ever increasing tax rates, combined with other policies aimed at curbing fossil fuel use, are leading to a decrease in fossil energy consumption and thus to tax base erosion. Technological innovations are accelerating this trend. For example, vehicle fuel efficiencies are rapidly improving, and thanks to better insulation techniques and other innovations it is no longer a given that new housing developments will be connected to the gas network. The Netherlands therefore needs to start thinking now about an alternative design of its energy taxes. Reforms that merely build on the present energy system should be avoided, because they are likely to result in decreasing tax revenues. A better strategy is to anticipate the technological changes that are already on the horizon.

Energy tax reforms should be prioritised on the basis of their long-term contribution to a robust tax structure, both in terms of revenue and environmental regulation. The present energy tax structure is not technology-neutral and does not always stimulate the best energy options from an environmental point of view. However, to simply base tax rates on carbon content does not adequately take into account the different effects of various energy products on air quality. Furthermore, many tax reform options require policy coordination at the international level to limit the risk of international tax competition. A strong case in point is the current discussion on diesel taxes. Here, policy coordination at the EU level is essential to ensure a 'level playing field', and the same applies to other measures related to activities within EU territory, such as freight transport between EU countries. However, in some cases coordination beyond EU borders is required; for example with regard to tax rates for intensive energy users competing in global markets, or with regard to tax exemptions on fuels used in international aviation and shipping. International policy coordination will be all the more important in the transition from a tax regime based primarily on taxing consumption of final energy products, to a tax regime based more on taxing environmental pollution.

1 Green taxes and green tax reform in the Netherlands

Using taxes to price environmental pollution is generally considered a key element of green tax reform. However, no consensus exists about the main purpose of green taxes or green tax reform. Some people emphasise the importance of increasing green tax revenues, based on the argument that higher environmental tax receipts would allow to shift the tax burden from labour to pollution. Others consider green tax reform mainly as an opportunity to improve environmental pricing, i.e. to better align tax rates with the monetary costs of environmental damage caused by emissions. A third group emphasises the importance of using taxes for better regulation of behaviour. Their priority is to achieve specific environmental targets.

However, the tension between the use of taxes for raising revenue for the treasury, and the – intended or unintended – side effects of taxation, such as a reduction in environmental pollution, is well-known (Fullerton et al., 2010; Vollebergh, 2012). For example, excise duty on petrol and diesel generates considerable revenue for the government, but at the same time discourages car use. The total number of car miles driven in the Netherlands would be much greater in the absence of fuel tax. As a rule, each tax that brings in revenue will also influence behaviour. This is particularly relevant to environmental regulation, because the government is responsible for an effective ‘pricing’ of environmental goods. Through environmental pricing the government may correct the market failure underlying environmental pollution. In this context, the instrument of taxation, in particular, offers interesting possibilities; imposing taxes on polluting goods will reduce their consumption and, hence, the environmental damage they cause.

Whichever angle is taken, the call for green tax reform appears to be a sympathetic one. However, in all cases, there is a tension between increasing environmental tax revenues (‘green revenues’) and achieving environmental gains (‘green results’). This applies in particular to the Netherlands, which has a long tradition of green tax reform and some of the highest environmental tax revenues and rates in Europe. According to the OECD, the Netherlands was one of the first countries to experiment with incentive-based environmental taxes (Opschoor and Vos, 1989), and green taxes, today, raise about 10% of the overall tax revenue. This is exactly why green tax reform is the subject of such a heated debate in the Netherlands. Some people are concerned about the long-term viability of the present tax structure, and therefore advocate simplicity. They argue that

the present system results in ‘pumping money around’ via all kinds of rebates and allowances. This increasingly affects society with individual choices continually being influenced by fiscal incentives, such as tax breaks on clean cars and self-generated solar electricity. Others argue that current taxes on labour are too high and a shift from labour taxes to environmental taxes may improve the labour market as well as reduce pollution. Lower labour taxes would be good for both labour demand and supply, while environmental pollution would be reduced through higher taxes on pollution. Finally, some argue that current environmental tax rates, such as the excise duty on petrol and diesel, are already too high and encourage large-scale cross-border ‘fuel tourism’.

The tension between green revenue generation and achieving green results is also the central topic of this Policy Brief. The challenge of further green tax reform in the Netherlands is to find an optimal, ‘future-proof’ balance between generating environmental tax revenues to finance public expenditure, and achieving a ‘green result’ in terms of reducing the environmental impact of energy consumption. This analysis is limited to taxes on energy, because these form the lion’s share of environmental taxes in the Netherlands. Despite the Netherlands having a very open and energy-intensive economy, the Dutch environmental tax base includes a broad energy tax; i.e. taxes on energy products, such as natural gas, electricity and motor fuels, which together generate considerable tax revenue and at the same time have (indirect) environmental effects. Consumption of these energy products, particularly when involving combustion of fossil fuels, leads to two important environmental problems: climate change and air pollution. Hence, energy taxes are extremely relevant for the long-term goal of the Netherlands to reduce its dependence on fossil fuels. This Policy Brief explores the challenges for green tax reform from an environmental perspective. Chapter 2 discusses in greater detail the challenges for further green tax reform in the Netherlands. Next, Chapter 3 analyses the relation between the present energy tax structure in the Netherlands and the two main environmental problems caused by energy consumption, i.e. climate change and air pollution. With these two problems in mind, Chapter 4 explores the short-term and long-term options for energy tax reform from an environmental perspective.

This Policy Brief builds heavily on two other reports. The first report presents a framework that provides a coherent view as to how environmental policy objectives could be linked to the use of tax instruments (see Vollebergh, 2012). The other report is published at the same time as this Brief: *Environmental taxes and Green Growth Part II – Evaluation of energy taxes in the Netherlands from an environmental perspective* (available only in Dutch (PBL, 2014b)). The statistics and detailed analysis cited in this Brief are elaborately explained and justified in the background report. Both the Policy Brief and the two reports focus on environmental regulation through environmental taxes. This does not mean that taxation is the only instrument available for achieving environmental objectives; other policy instruments can also contribute to environmental pricing (e.g. emission standards and emission trading systems). However, it requires a thorough analysis of the specific case at hand to determine which instrument (or instrument

package) would be most effective and efficient in achieving the environmental objectives, not in the least because the relevant context and actual design are of overriding importance for both effectiveness and efficiency (OECD, 2007). Similarly, limiting our analysis to taxes on energy products does not mean that other environmental taxes, such as taxes on car ownership, water consumption or waste production, are not also important for green tax reform. However, each of these cases is highly specific and calls for a separate analysis (e.g. PBL, 2014a).

2 Challenges of further green tax reform

This section discusses four challenges that complicate further green tax reform in the Netherlands:

- i) Increasing green tax revenue not necessarily improves green results;
- ii) The small, open economy of the Netherlands is vulnerable to tax competition;
- iii) Taxes that are good for the environment are not always easy to implement;
- iv) Green tax results may be limited due to interaction with other policies.

The following sections briefly discuss each of these challenges.

2.1 Increasing green tax revenue not necessarily improves green results

In essence, green tax reform boils down to two possible perspectives. One perspective focuses on increasing *green tax revenue*, often with the aim to shift taxation from labour to environmental pollution. The second perspective emphasises the *green result*, that is, using environmental taxes to reduce polluting emissions.

However, it is a misconception that raising additional green revenue will automatically lead to better green results. On the contrary, an important dilemma for green tax reform is the fact that there is a trade-off between raising green revenue and achieving green results. Environmental taxes create an incentive for citizens and firms to reduce their environmental impact, the 'green result' of which is that the environmental tax base will erode. This, in turn, *reduces* the amount of revenue that can be raised for the treasury. The environmental tax base will erode because production of taxed emissions – or production and sales of taxed products that directly or indirectly cause emissions – will decrease. This decrease is desirable if it leads to actual emission reduction, as was the case when leaded petrol was replaced with unleaded petrol (where the incentive was a much lower tax rate on the latter). This is a good example of what could be called the Laffer curve for environmental taxes (see Text box I).

I The Environmental Laffer curve

The Laffer curve represents the non-linear relationship between the amount of revenue raised by a tax, and the rate of that tax (Laffer, 2012). If, for a certain tax base – be it income or a specific product – the (marginal) tax rate increases, revenue from this tax will initially also increase. However, if the tax rate keeps increasing taxpayers will change their behaviour and increasingly avoid having to pay this tax. This will continue up to the point where tax revenue will actually start to drop.

This interaction is shown in Figure 1. The X-axis represents the tax rate on a specific tax base, for example income, and the Y-axis represents the amount of revenue raised by this tax. As the curve shows, there is a point where an additional rate increase no longer leads to more, but rather to *less* revenue. This is due to the fact – as noted – that the higher the tax rate, the stronger the incentive for taxpayers to change their behaviour so as to avoid the tax. An example of such tax avoidance behaviour in the case of a tax on income, is that people may decide to work fewer hours because the additional income of one extra hour of labour no longer offsets the welfare loss of one hour less spare time. Other behavioural responses are possible, as well. For example, tax payers may simply not report income to the tax administration.

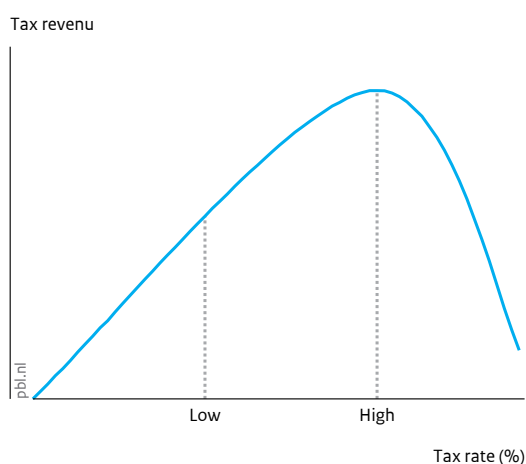
The Laffer curve also applies to environmental taxes. However, there is one major difference: tax base erosion of taxes aimed at correcting environmental externalities is a *desirable* effect, at least if these taxes are well designed and polluting emissions are really being reduced. If an environmental tax leads to illegal evasion behaviour, such as the dumping of waste or increased use of more polluting energy sources, then the tax is ineffective and both treasury and environment will suffer. This effect may be observed even if the rates are not increased, as has been the case with the Dutch landfill tax. However, in the latter case, interaction with other policies (in particular, a ban on landfilling combustible waste) also plays a role.

Much depends on the specific characteristics of the market affected by the tax. In a single-product market, for example, the Laffer curve implies that the price elasticity of this product increases with tax rate. Indeed, if the absolute value of price elasticity becomes greater than 1 – which is more likely with higher tax rates – sales will drop and, hence, tax revenues from this product will decline. A common strategy is therefore to avoid tax revenue losses under increasing tax rates by choosing a relatively inelastic tax base. However, in the case of environmental taxes, the disadvantage of an inelastic tax base is that its relation with environmental pollution may be (too) indirect.

For energy products with low price elasticity, such as electricity and natural gas used for heating, higher tax rates will not lead to lower consumption and revenue loss in the short term.³ In this case, price has relatively little effect on ‘good

housekeeping' behaviour such as turning down the room thermostat, pulling on a jumper, or turning off appliances when they are not in use. However, higher tax rates do have an effect in the longer term, particularly because they encourage innovation (Vollebergh, 2012 and 2013); for example, better insulation techniques and energy-saving appliances will ultimately result in lower consumption. In fact, radical innovations, such as micro-CHP (combined heat and power), solar water heating systems and heat exchangers, are already on the market. Higher energy taxes will make these options increasingly attractive financially. These examples illustrate that shifting the tax base from labour to environmental taxes has limits in terms of ensuring stable revenues.

Figure 1
The Laffer curve for environmental taxes



Source: PBL

If green tax reform is aimed primarily at achieving environmental benefits, the emphasis will be on the regulating impact of environmental taxes. In that case, tax bases and rates must be designed in such a way that environmental targets can be achieved (at some point in time). This requires an adequate estimation of the behavioural response. The stronger this response – i.e. the higher the elasticity of supply and/or demand – the stronger the regulating effect, but also the lower the revenue in the long term. With every step towards achieving the environmental target the tax base will further erode. This is the typical trade-off between green tax revenue and green result. This trade-off is rather inconvenient for a government that aims to generate stable tax revenues.

A well-known example of a regulating tax is the excise duty on leaded petrol during the 1980s. In order to stimulate the transition from leaded to unleaded petrol, the Dutch Government has differentiated excise duties on petrol on the basis of lead content. This resulted in a rapid phase-out of leaded petrol and a corresponding loss of tax revenues from this fuel. A more recent example is the purchase tax on passenger vehicles and motor cycles, known as the 'bpm' tax in the Netherlands. To stimulate the purchase of energy-efficient cars, the Dutch Government decided to differentiate the purchase tax rate on the basis of CO₂ intensity. This measure was so successful that purchase tax revenue declined considerably within a relatively short time (PBL, 2014a).

The Netherlands also has environmental taxes with a relatively stable tax base and a more limited regulating effect. As discussed in Text box I, this applies in particular to the present taxes on natural gas, motor fuels and electricity, which are the central topic of this Policy Brief. Revenues from these taxes are unlikely to decline in the short term, although unexpected effects are always possible (see Chapter 4). The fact that tax effectiveness and revenues may change in the long term is illustrated by the case of the Dutch water pollution tax. The introduction of this tax in the 1970s initially led to a rapid reduction in pollutants in waste water, partly thanks to the construction of wastewater treatment installations (Opschoor and Vos, 1989). However, after some time, it proved difficult to further reduce residual emissions. As a result, the tax base of the water pollution tax has become relatively stable, with limited further environmental gains.

The example above clearly shows that tax effectiveness and revenues may change over time. The effect of taxation on innovation also plays a role here (Acemoglu et al., 2012; Vollebergh, 2013). Taxes provide a continuous incentive for market parties to avoid the tax base in question. To reduce their tax burden, firms may invest in Research and Development (R&D) aimed at new products and technologies that use less energy or cause lower emissions. If innovation is successful, the same production (output) or consumption levels can be achieved with less energy and lower emissions, resulting in lower environmental tax revenues. Furthermore, taxation continually stimulates diffusion of new technologies if investment in these technologies implies tax savings for users. The underlying mechanisms have been elaborately described by the OECD (2010).

2.2 The small, open economy of the Netherlands is vulnerable to tax competition

The second challenge for green tax reform is the fact that the Dutch economy is relatively small, open, and energy-intensive. As a result, the energy tax base is more likely to be affected by international (tax) competition. If the Netherlands increases its energy taxes, for example excise duty on petrol and diesel, this will inevitably lead to cross-border effects. Motorists will tend to buy their petrol in Belgium or Germany if

fuel prices are much lower there. In fact, tax planning is already common practice in road freight transport; international transport agencies are planning their truck routes via Luxembourg in order to benefit from the much lower excise duty on diesel in this country (Evers et al., 2004).

Governments compete with each other over revenues – not only in the form of direct taxes, such as income tax and capital gains tax, but also in the form of indirect taxes, such as excise duty and environmental taxes. Particularly with regard to cross-border trade and traffic, countries may try to attract revenue by imposing a lower excise duty than their neighbours (Brueckner, 2003). Luxembourg's environmental tax revenue is relatively high, because low excise duty on petrol and diesel encourages fuel tourism from other countries. Hence, just like tax avoidance behaviour, international tax competition leads to tax base erosion in countries with high tax rates. This is, in fact, another example of the environmental Laffer curve (see Text box 1).

International tax competition complicates green tax reform in various ways. First of all, the risk exists that tax revenue will decline if tax rates keep increasing. If the tax on energy products becomes too high, energy-intensive industries may decide to leave the Netherlands, even though the country has an otherwise attractive business environment and a strategic location in north-western Europe.

Secondly, environmental pollution might increase, rather than decrease. Although higher environmental taxes often lead to local emission reduction, the effect may be quite different for emission reductions at the global level, as is the case with climate change. If production moves to countries where emission efficiency is lower, global CO₂ emissions are likely to increase. Such emission increases are known as 'carbon leakage'. Nonetheless, local air quality does benefit, also on a national level, if polluting industries move abroad. With cross-border fuel tourism, however, even these gains may be limited. If too many people buy their petrol across the border, not only will the treasury miss out on revenues, but emissions will increase, as well, because of the extra miles driven.

While these risks are real, they should not be exaggerated. For the Netherlands, little evidence exists that companies are moving abroad to avoid high energy taxes (CPB, 2001). This is probably the result of specific compensation measures for sectors exposed to international competition, which offset the impact of tax competition (Bollen et al., 2012). In addition, an EU-wide agreement on environmental taxes defines minimum rates for most energy products, including diesel and petrol. This agreement also reduces adverse effects of tax competition between EU countries.

2.3 Taxes that are good for the environment are not always easy to implement

Another often mentioned problem is that environmental taxes are difficult to implement. Complex tax systems are difficult to comprehend for both private citizens and firms and have high implementation costs. Hence, many people advocate tax simplification. However, a simple tax system offers little room for targeted regulation, while this is exactly what the government needs in order to achieve better environmental pricing.

Clearly, there is a tension between simplicity and effective implementation of taxes aimed at achieving environmental goals (Fullerton et al., 2010; Vollebergh, 2012). Ideally, each type of emission would have its own tax. However, such specific charges are likely to have high collection and compliance costs (including administration and audit costs), particularly if they are completely new taxes. Potential tax evasion, (waste) dumping, and fraud with invoices and emission accounts will make implementation very costly. This effect will be stronger with increasing tax rates, as the preceding discussion of the Laffer curve has shown.

Clearly, a simple tax structure is definitely not achieved by creating separate taxes for each and every emission to be mitigated (Vollebergh, 2012). Fortunately, there are alternative solutions, such as cleverly designed environmental taxes, implementation of other policies, or combinations of taxes with other instruments. For example, rather than a direct tax on emissions, taxes can be imposed on goods that are complementary to the emission in question. The consumption of complementary goods directly results in emissions, and these goods cannot readily be substituted. An example is the tax on coal, which is an indirect tax on the carbon emissions caused by coal combustion. A second possibility is to include supply chain emissions in the tax base; for example, emissions from oil refining could be taxed through the excise duty on petrol and diesel. Thirdly, other policies besides taxation are also possible, such as subsidies on green investments, emission quotas and standards, information provision and moral appeals to save energy. These policies and instruments also contribute to environmental pricing, and can be combined with environmental taxes. Whichever the choice, it is clear that practicability of these measures may be at odds with effective environmental pricing.

II Fiscal specialists and economists

Traditionally, fiscal specialists are not particularly fond of green tax reform. They tend to paint a negative picture of the use of taxes for environmental purposes. In their view, the sole objective of taxation is to raise money for the treasury; this objective should not be clouded with other goals, such as environmental regulation. Including these other goals (which they call ‘instrumentalisation’) would be at odds with ‘simplicity’. Furthermore, they argue that environmental taxes do not bring in enough money and are difficult to implement.

However, this ‘practitioners’ view’ neglects an important insight from economic science; with the exception of lump sum taxes (a fixed amount per head of population), taxes *always* result in a behavioural response.² In other words, each tax has an effect, to a smaller or larger extent, on relative prices and therefore induces changes – whether desirable or not – in the consumption and production decisions of consumers and firms. In that sense, tax neutrality (the concept that taxes do not distort choices or behaviour) is an illusion. Taxes, also those that are not intended to do so, inevitably influence behaviour, if not in the short term, then in the long term.

This is not to say that tax neutrality is unimportant, on the contrary; for most taxes, it is definitely preferable that their effect on decisions by market parties is as small as possible.^{3,4} The story is different for environmental taxes, however. Environmental taxes play a role as an instrument to correct for market failures underlying environmental pollution. They are an important element in the toolkit for pricing environmental externalities. However, taxes that correct or regulate market failures will inevitably also lead to revenue losses, in the long term, which, in turn, create problems for financing public expenditure.

The question whether taxation is a useful instrument for environmental pricing can be answered with a clear and unambiguous ‘yes’. Nonetheless, the *ex ante* assessment of tax reform options will be faced with difficult dilemmas. A more elaborate analysis of these dilemmas is presented in Vollebergh (2012).

2.4 Green tax results may be limited due to interaction with other policies

As indicated previously, environmental taxes are not the only means for achieving environmental pricing. Other policies, such as (emission) standards, subsidies and tradable permits, also contribute to adequate pricing (Fullerton et al., 2010:7–12). One specific example is the regulation of climate emissions through the EU Emissions Trading System (EU ETS), which covers all large installations that emit CO₂. The question in this case is whether environmental pricing or regulation through taxes has any additional effect on emission reduction (Vollebergh, 2012).

One of the problems is that efforts to further reduce carbon emissions in the Netherlands are potentially undermined by the EU-wide carbon emission ceiling for large installations (Van der Werf et al., 2010: 145ff; Verdonk et al., 2013). For example, a comprehensive tax on CO₂ emissions would reduce these emissions in the Netherlands, but not in Europe as a whole. The CO₂ credits from additional emission reductions in the Netherlands simply will be used elsewhere in Europe (the ‘waterbed effect’).

The example above illustrates that policy interaction may limit the effectiveness of environmental taxes. At the same time, this argument is only valid in the short term. For example, the additional emission reduction in the Netherlands can be factored in when the new emissions ceiling for the next EU ETS trading period is adequately updated. In fact, the latest EU proposals for the new emission reduction plans already substantiate this possibility (Verdonk et al., 2013). In this way, national environmental taxes could still contribute to EU-wide emission reduction, but this longer term effect is often overlooked.⁵

It should also be noted that the waterbed effect does not apply to European efforts to improve air quality, because there are no tradable permits and emission ceilings in relation to air pollutants. Nonetheless, it is important to always carefully assess the added value of introducing or reforming an environmental tax. This added value will partly depend on the specific context in which the tax is aimed to contribute to emission reduction (Verdonk et al., 2013).

Notes

- 1 Energy taxes are a typical example of second-best environmental taxation and can be used to alleviate the tension created by using a single instrument – emission tax – to serve two goals, i.e. addressing externalities and raising revenues. Energy taxes, in particular if levied on consumption, may also play a useful role in the broader tax system, from a revenue perspective. Such second-best considerations fall outside the scope of this Policy Note, however (see also Fullerton et al., 2010; Vollebergh, 2012; Parry et al., 2014).
- 2 Even lump sum taxes may indirectly distort allocative decisions because they affect disposable income: the relative share of income-elastic goods will decrease as a result of lump sum taxation.
- 3 Tax neutrality, in this sense, is similar to the Ramsey perspective that aims to minimise the dead-weight loss from imposing taxes.
- 4 Moreover, some taxes even have a ‘merit goods’ function; as a ‘benevolent interference’ by the government, these taxes explicitly aim to discourage the consumption of harmful products. For example: excise duties on tobacco and cigarettes (see also Cnossen, 2005).
- 5 Another issue is the linkage between taxation and EU ETS. Energy taxes are also an indirect instrument to guarantee a set floor price in the EU ETS and, thus, indirectly improve the system if it is not properly designed in the status quo (see Hepburn, 2006).

3 Current state of affairs in the Netherlands

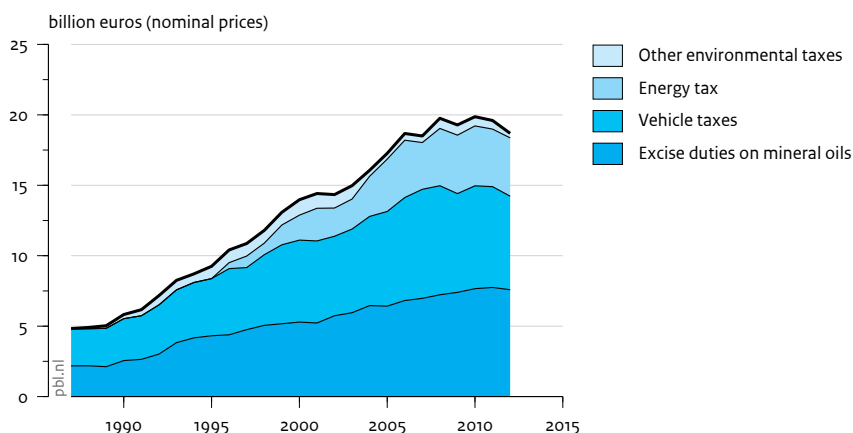
Before exploring the options for green tax reform with regard to energy taxes in the Netherlands, the present chapter analyses the current relation between green revenues and green results. How has green tax reform in the Netherlands been designed and implemented so far, and what have been the main choices of tax design? First, the Brief concisely describes the development of environmental tax revenue over the last decades, the main energy products taxed, and the position of the Netherlands relative to other countries. Next, it discusses the energy tax structure in more detail, and relates it to current environmental policies on climate change and air pollution. This discussion is followed by an assessment of the effectiveness of 'green regulation' with regard to the emissions from the combustion of the taxed energy products. Finally, the Brief analyses the energy tax structure in relation to the estimated monetary costs of environmental damage.

3.1 The Netherlands is front runner, but revenues are declining

Whether a tax can be called 'green' depends on the tax base (the goods taxed). The tax base of 'green' or environmental taxes is related to negative environmental effects directly or indirectly related to the products and goods that constitute the tax base. As mentioned previously, all taxes on energy products, particularly those on fossil fuels such as natural gas, coal and mineral oils, are considered 'green' taxes. These fuels are responsible for emissions of greenhouse gases, such as CO₂, and air pollutants that harm human health, such as particulate matter and NO_x. In the case of the electricity tax the relation with emissions is more indirect, because electricity consumption itself does not lead to emissions; only production of electricity leads to emissions, at least if it is based on fossil fuels or biomass. Taxation increases the price of all these energy products, and hence indirectly increases the price of emissions. This is precisely why taxes contribute to environmental pricing.

At present about 10% of total tax revenue in the Netherlands comes from green taxes. This makes the Netherlands one of the front runners in environmental taxation. The EU

Figure 2
Environmental tax revenue in the Netherlands



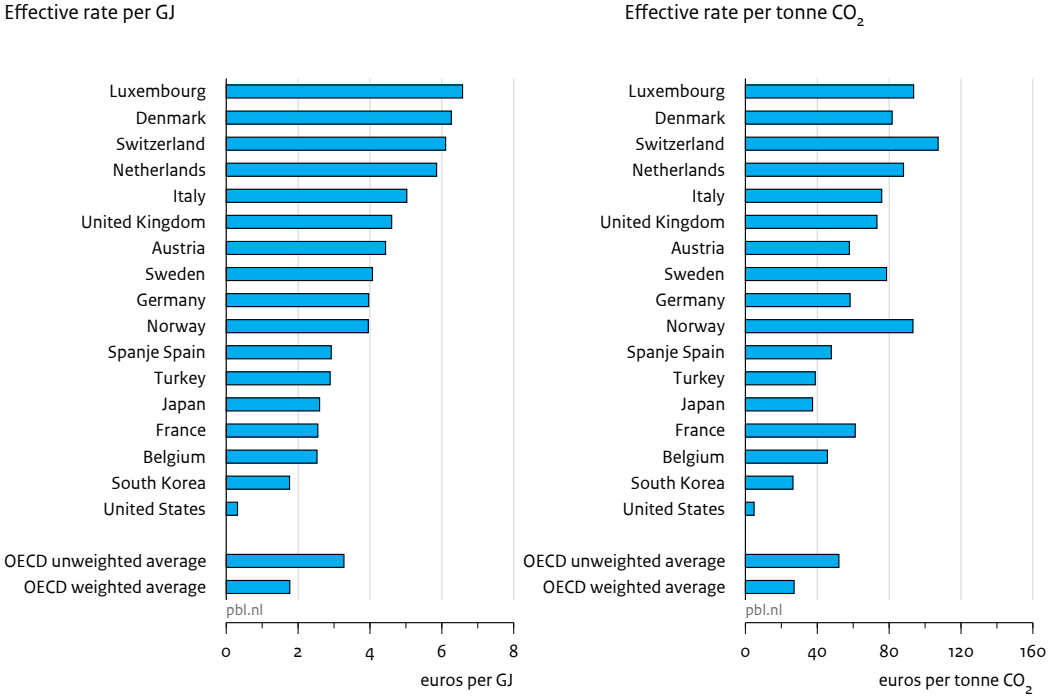
Source: CBS; Budget Memorandum 2013

average is about 7%. Its neighbours Belgium, Germany and France are lagging behind with even lower percentages. In fact, in those countries, the *relative share* of green tax revenue shows a downward trend, but not so in the Netherlands, where the relative share has stabilised, while total environmental tax revenue decreased slightly in recent years (see Figure 2).¹

Figure 2 also shows that environmental tax revenue in the Netherlands is collected mainly from taxes on energy products. The Dutch energy tax applies to the combustion of *natural gas* and the consumption of *electricity*. Furthermore, excise duties are imposed on the combustion of *mineral oils*, such as petrol and diesel. In addition to excise duty on fuel, motor vehicles are also taxed through taxes on purchase and ownership. Even though the last two do have an important indirect effect on energy consumption and emissions (PBL, 2014b), they are not further considered in this Policy Brief. The same applies to other, minor environmental taxes, such as on waste.

The Netherlands is not only one of the front runners in Europe in terms of environmental tax revenue, but it also has relatively high taxes on some energy products. This applies in particular to the tax rates on natural gas and electricity consumption for households and small and medium-sized enterprises. These high rates do not apply to energy-intensive companies thanks to a unique degressive rate structure. The higher the consumption of gas or electricity, the lower the rates. In this way, the Dutch energy tax rates for large users stay in line with rates charged in other countries.

Figure 3
Effective tax rates on total energy consumption in OECD countries, 2012



Source: OECD, 2013

When comparing the energy tax policies of different countries, it is not enough to look at the revenue or rates of the present energy taxes. What counts is the combination of tax bases (products and activities that are taxed), exemptions (products and activities that are *not* taxed) and the level of the tax rates. The effective tax burden weighs these various aspects by comparing total tax revenue to total national energy consumption. Hence, if a country has high tax rates on energy products but grants exemptions for most uses of these products, the effective energy tax burden will be low.

A recent OECD study shows that the Netherlands not only has high energy tax rates, but also a high *effective tax burden* on energy consumption (OECD, 2013). Thus, despite its degressive tax rates for large users of natural gas and electricity, the Netherlands is still ranking high when comparing effective rates between OECD countries (see Figure 3). The OECD comparison also illustrates various other relevant issues discussed in previous sections. For example, the high effective tax burden in Luxembourg is mostly due to cross-border fuel tourism. In Luxembourg, the share of petrol and diesel in total energy consumption is very high, with 63%.² While the excise duty on these motor fuels is low compared to the surrounding countries, they are still high compared to other energy

products in Luxembourg. The combination of these relatively high rates and the large share of motor fuels in total energy consumption automatically results in a high effective tax burden. However, this does not mean that this entire burden falls on the Luxembourgers themselves. After all, the lion's share of excise duties on petrol and diesel is paid by non-residents, travelling through the country.

Figure 3 also shows that the effective tax burden in the Netherlands is high per gigajoule (GJ) energy consumption and per tonne CO₂ emission.³ For a given level of energy tax revenue, the effective rate per tonne CO₂ will be lower in countries where fossil fuel consumption is high, compared to countries with a greater share of nuclear and or renewable energy. This is because in the latter countries total CO₂ emissions will be lower. Switzerland and Norway, both large producers of hydropower, therefore have the highest effective tax burden per tonne CO₂ among OECD countries. In fact, their hydropower production must be quite high, considering the much lower ranking of countries with significant nuclear energy production, such as Belgium, France and Sweden. To summarise, despite its energy-intensive, fossil-fuel-based economy, the Netherlands still has a relatively high effective tax burden per tonne CO₂.

3.2 Characterising the Dutch energy tax structure

To properly assess the energy tax structure in the Netherlands, a detailed analysis of the present tax bases, exemptions, rates and other relevant policies is required (see also Text box III). As mentioned previously, the Netherlands levies energy taxes on the combustion of *natural gas* and the consumption of *electricity* and *mineral oils*. The chosen tax structure ultimately determines how much green tax revenue is raised and how much green result is achieved (i.e. to what extent emissions from fuel combustion will be reduced).

Table 1 summarises the main elements of the present Dutch energy tax structure. The table also lists other relevant instruments of climate and air quality policy, which may influence the effectiveness of energy taxes.⁴ For example, an important instrument of climate policy is the European Emissions Trading System (EU ETS), which regulates CO₂ emissions from combustion processes in large installations.⁵ The EU ETS aims for a 21% reduction in CO₂ emissions from large industrial sources and power plants by 2020. With regard to reducing emissions of air pollutants, emission standards on installations and combustion engines are the main policy instruments.

From Table 1, the following conclusions can be drawn with regard to current regulation of emissions from various fuels. Firstly, the *combustion of natural gas* is taxed across the board, with power stations as the main exemption. Tax rates are (much) higher for small users than for large users. Natural gas consumption for non-energy uses is tax exempt and is also not covered by the EU ETS. Non-energy use constitutes about 30% of total natural gas consumption by the industrial sector as a whole, but amounts to as much

III Characteristics of the tax structure

In this report, the term *tax structure* covers the design of tax bases, rates and exemptions with regard to both taxes and excise duties. In the Netherlands, the tax structure consists of three categories: taxes on labour (e.g. income tax), taxes on capital gains (e.g. corporation tax), and taxes on consumption (e.g. value-added tax and excise duties). Environmental taxes fall within the last category. In recent decades, the share of taxes on consumption, including environmental taxes, has shown a notable increase; from 24% in 1975 to 31% in 2007. This rise was mostly due to a doubling of environmental tax revenue. Within each of these three categories, the tax bases must be established in law. The law must explicitly state object and subject of the tax, unit of measurement of the tax, tax rate, exemptions and compensations (Stevens, 2013). For each of these, there are many options to choose from. These choices determine the final design or tax structure of a tax and, in turn, its effect on behaviour.

It should be noted that an energy tax as such does not exist. Legislators have to make a deliberate choice to include a number of energy products in the tax base and specify them (e.g. petrol, coal) and application (e.g. transport, heating). In addition, there is a menu of design options, for example, on the level of the tax rate and on exemptions. Tax reform options simply boil down to changes in the design of this tax structure. With respect to energy tax reform, there are roughly three possibilities: revising the tax bases and exemptions, changing the unit of measurement of the tax, or changing the tax rates.

In practice, 'adding a tax base' means including a previously untaxed (energy) product in the tax. Tax *rates* can be determined in various ways. In the case of *ad valorem* taxes, the tax rate is a percentage of the product's price (e.g. VAT). In the case of *specific* taxes (including most energy taxes), the rate is a fixed amount per unit of product, for example, per package of cigarettes or per unit of emission. In the last case, various units of measurement are possible, such as energy content or carbon content. *Exemptions* determine whether a product or any of its uses will actually be taxed. Energy taxes often include exemptions for specific sectors and applications. For example, the greenhouse horticulture sector and CHP applications in the Netherlands are exempt from the tax on natural gas. Finally, legislators may choose to include *tax allowances and compensations* to relieve the tax burden of selected groups of taxpayers. For example, small users of natural gas and electricity (households and SMEs) are entitled to a fixed compensation per connection.

Table 1
Overview of the Dutch energy tax structure and directly relevant environmental policies¹⁾

Energy product	Tax rate ²⁾	Exemptions	Climate: EU ETS (CO ₂)	Air quality (SO ₂ ; NO _x ; PM) ³⁾
Natural gas				
Small use	Average ⁴⁾	CHP	No	Standards for gas appliances
Large use	Low	Electricity generation CHP/Heat Non-energy use	Yes (emissions)	Standards for power plants (strict) Standards for heat installations
Coal				
Large use	Low	Dual use Non-energy use	Yes (emissions) No	Standards for power plants (strict)
Electricity				
Small use	High ⁴⁾	Net metering ⁵⁾ Self-generation ⁵⁾ Reduced rates local community ⁵⁾	n/a	n/a
Large use	Low ⁶⁾	Own use of CHP electricity	n/a	n/a
Crude oil				
Oil refinery	None	Yes (entirely) Non-energy use	Yes	Standards for refinery installations
Petrol	Very high	None	No	Engine standards (strict)
Diesel, Passenger transport	High	None	No	Engine standards (strict)
Diesel, Road freight transport	High	None	No	Engine standards (strict)
Diesel, Inland shipping	None	Yes (entirely)	No	Engine standards (moderate)
Kerosene	Low	Yes (aviation)	No	Engine standards (strict)
Heavy fuel oil	High	None	No	Engine standards (weak)

Table notes:

- 1) This table focuses on consumption of energy products; for example, electricity consumption is not covered by the EU ETS, but consumption of natural gas and coal for electricity production is.
- 2) Rough indication of tax rate per GJ (see also Section 3.4)
- 3) According to the latest emission standards for installations and engines (e.g. the Euro VI standards for heavy-duty vehicles)
- 4) Taxpayers receive a tax refund to compensate lost income (318 euros per electricity connection).
- 5) This exemption only applies to self-generation of energy from renewable sources (solar and wind) by, for example, community energy cooperatives within a prespecified postal code.
- 6) There is a refund scheme for installations using more than 10 million kWh per year, provided the average tax amount paid is higher than the EU minimum rate.

as 76% of the fertiliser industry. Non-energy use of natural gas is not taxed, because it causes no direct emissions. However, emissions from the use of non-energy products further 'downstream' (e.g. emissions from fertilisers after they have been applied to the soil) are also not taxed.

The use of natural gas in Combined Heat and Power (CHP) installations is exempt from taxation if the installation is covered by the EU ETS. The reason for this is that energy production through CHP, which produces heat *and* electricity, makes very efficient use of natural gas. CHP-generated *heat* is therefore not taxed, while CHP-generated *electricity* is taxed only if it is sold to third parties. Natural gas consumption for electricity production is also tax exempt, because it is covered by the EU ETS, at least in the case of large installations (power plants). The EU ETS does not cover natural gas combustion by households and installations that are too small to be included in the EU ETS; in this case, CO₂ emissions are priced through the energy tax. However, the exemption on CHP also applies here. Regulation of air polluting emissions from natural gas combustion mainly takes place through emissions standards. These standards are stricter for larger than for smaller installations.

Coal is used mainly in iron and steel production, and for power production. In principle, coal is only taxed when it is combusted for energy purposes. Dual use in crude steel production – where coal serves both as a feedstock and energy source (heat) – is tax exempt, and also excluded from the EU ETS. However, coal consumption for power production is taxed; hence, the associated CO₂ emissions are taxed implicitly, as well. In addition, CO₂ emissions from coal combustion for power production are also regulated through the EU ETS, provided the installations are large enough to meet ETS criteria. Non-energy use of coal, such as for medical use, is also exempt. As for emissions of air pollutants, all installations have to meet stringent standards.

All consumption of *electricity* is taxed in the Netherlands. As discussed previously, electricity consumption in itself does not cause emissions. Therefore, regulation of electricity consumption does not have a direct environmental effect. Only electricity *production* is polluting, at least if it is based on fossil fuels (in the Netherlands almost exclusively natural gas and coal) or biomass. Currently, various tax exemptions are provided to stimulate self-generation of energy from renewable, non-fossil sources (solar and wind) by small users (households, energy cooperatives, SMEs). In addition, own use of CHP-generated electricity is tax exempt.⁶

To stimulate self-generation from renewable sources, households and other small users are exempt from the energy tax with regard to electricity generated by renewables, such as solar panels. Furthermore, they are allowed to use 'net metering'. This method implies that connections to the electricity grid are billed only for *net* (annual) energy use. As a result, only energy tax, VAT and transmission costs have to be paid on the balance of kilowatts 'imported' from the public grid minus the kilowatts 'exported' to the grid. Finally, as from 1 January 2014, members of community energy cooperatives and

associations of owner-occupiers within a given postal area are eligible for a tax reduction of 7.5 eurocents/kWh for collective renewable electricity production.

Mineral oils are taxed chiefly via consumption of secondary fuels, i.e. fuels derived from oil refining. These fuels are mainly used as road fuels (petrol and diesel), and for shipping (diesel) and aviation (kerosene). Hence, no environmental taxes are levied on crude oil itself, nor on emissions of CO₂ and air pollutants from oil refining processes. However, CO₂ emissions from oil refining are regulated through EU ETS. As is the case for coal, *non-energy use* of crude oil is tax exempt and also falls outside the scope of the EU ETS. Non-energy use amounts to about 40% of total oil consumption, and is particularly high in the chemical industry (naphtha) but also in other sectors (e.g. use of lubricants and bitumen). Emissions from non-energy products are neither taxed further 'downstream'; for example, there is no tax on emissions from waste incineration (plastics).

Hence, it is chiefly the *end-users of secondary mineral oil products* (e.g. households, transport companies) who pay taxes or excise duties on oil. CO₂ emissions from combustion of secondary oil products are not covered by the EU ETS. As for air pollutants, a wide range of emission standards for combustion engines are in place. However, the combustion standards for road transport are much stricter than for inland shipping. Excise duties on all secondary fuels are relatively high. These rates in the Netherlands are among the highest in Europe. Furthermore, there is a notable difference between the tax treatment of petrol and diesel. Petrol is mostly used for private transportation (households) and is relatively clean, but taxed heavily. Diesel is chiefly used in the transport sector and is relatively dirty, but it is taxed less heavily than petrol. Notably, diesel consumption is tax exempt for freight transport by water (inland shipping). Furthermore, consumption of kerosene and other aviation fuels is exempt from both environmental tax and VAT, as is the case in most countries (Keen et al., 2013).

3.3 Energy products and monetary costs of environmental damage

In addition to assessing how *green tax revenue* has developed over time (Section 3.1), it is also important to gain insight into the *green result* of environmental taxation. The overall effectiveness of green taxes – in combination with other policy instruments and other exogenous shocks – is revealed in the amount of current overall annual emissions from fossil-fuel combustion. These emissions have various negative effects on the environment. To compare fuels in terms of their environmental impact, it is necessary to estimate the monetary costs of the environmental damage they cause, both in terms of climate damage and the health effects of air pollution. Such calculations are complex and uncertainty ranges are large (see Text box IV).

IV Estimating the monetary costs of environmental damage and other externalities

Our analysis focuses on the environmental damage caused by greenhouse gases and air polluting emissions from combustion processes. Combustion of coal, oil and natural gas not only leads to emissions of carbon dioxide (CO₂), one of the principal greenhouse gases related to climate change, but also to emissions of air pollutants, such as sulphur dioxide (SO₂), mono-nitrogen oxides (NO_x), particulate matter (fine particles, e.g. PM₁₀ and PM_{2.5}) and non-methane volatile organic compounds (NMVOC).

Our analysis focuses on these substances because they cause the greatest *environmental damage* in *monetary* terms. In recent years considerable progress has been made in estimating the damage from these emissions to climate and air quality (Shindell et al., 2012). Damage estimates with regard to climate change focus mostly on the effect of rising temperatures (for which the time lag is considerable). In the case of climate change, each and every tonne of greenhouse gas equally contributes to environmental damage, independent of when and where emission took place. Air polluting substances are not only harmful to human health (causing illness and premature death), but also reduce agricultural yields, corrode buildings and capital goods, and affect ecosystems (including biodiversity). However, in monetary terms the dominant effect is human health damage. In contrast to greenhouse gases, the impact of air polluting emissions does depend on time and place. Hence, calculations of air pollution damage costs apply an adjustment factor for emissions in densely populated regions.

Estimating the monetary value of emission damage has always been fraught with uncertainties. However, considerable progress has been made in recent years. On the basis of damage estimates, indices have been developed that allow comparison of environmental damage costs (Desaigues et al., 2007; CE, 2010a; US Government, 2013). Nevertheless, uncertainty ranges remain considerable. For example, damage estimates may vary by as much as a factor of 10 in the case of climate change, and by a factor of 3 in the case of air pollution health effects. The uncertainty bars in Figures 5 and 7 illustrate these uncertainties.

It is also possible to estimate the damage costs of other environmental problems caused by fossil fuel use, such as visual pollution (unattractive landscapes), radiation, and human toxicity of heavy metals and dioxins. It should be noted that these (and other) problems may also occur as a result of non-fossil-fuel use. However, in monetary terms, the environmental damage caused by non-fossil fuels is much smaller than for fossil fuels. In the latter case, the main damage is due to emissions of greenhouse gases and air polluting substances; hence the focus of our study (see also CE, 2013; PBL, 2014b).

Our study not only covers the damage caused by *direct* emissions from fuel combustion, but also explicitly includes emissions *upstream in the energy chain*, before actual combustion (indirect emissions) (see e.g. Figure 4). An example of

the latter is that of the CO₂ and air pollutant emissions from oil refining processes required for motor fuel production. Other examples include emissions produced during transport and distribution of biomass, mineral oils and coal, and emissions from natural gas pipeline leaks.

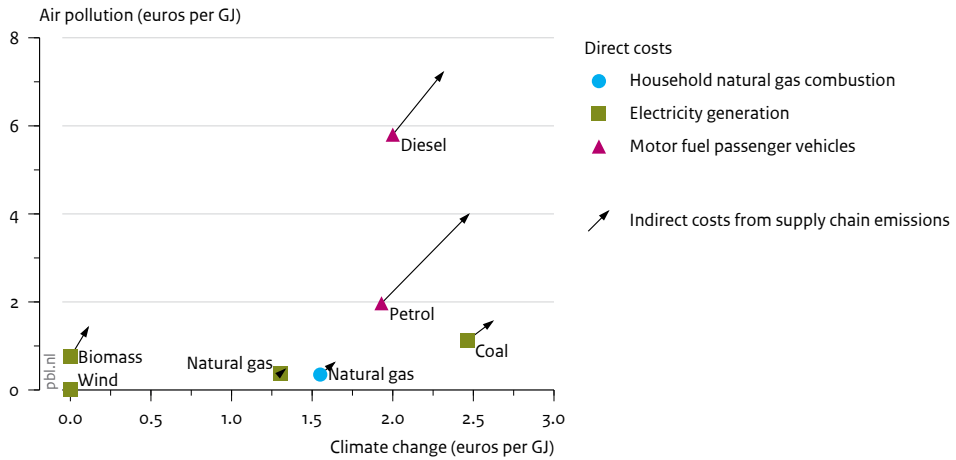
Finally, we should emphasise that our analysis is far from complete. Our figures do not include the monetised damage from other (non-environmental) externalities of fossil fuel use, such as earthquakes, traffic congestion and accidents. For a complete *social cost-benefit analysis*, these effects should also be taken into account (CPB & PBL, 2013). Taxes on energy products may also have a correcting effect on these externalities.

Our analysis is based on average damage estimates found in the current literature (PBL, 2014b). These damage costs are directly related to emissions from fossil fuel combustion within the energy chain. Natural gas is combusted by households and firms for heating purposes, but also in power plants to generate electricity. Furthermore, it is used for the production of chemical fertiliser. Likewise, coal is combusted to generate electricity, but also used as fuel and feedstock in iron and steel production. Crude oil is used primarily for production of motor fuels such as petrol and diesel, but also as feedstock in the chemical industry. By comparing the different energy products and their emissions on the basis of energy content, it is possible to classify the various fuels along the two most relevant dimensions of environmental costs: climate change damage and air pollution damage (Figure 4).

In this classification, environmental damage from electricity production is shown for different power generation methods, in particular natural gas, coal and biomass combustion (the latter mainly as co-fuel). Climate damage is mostly a function of fuel carbon content, while air quality damage strongly depends on the combustion technique used. The latter also varies considerably with emission source. For example, one tonne of air polluting emissions from a power plant in the countryside causes far less damage to air quality than a similar tonne of emissions from motor vehicles in a densely populated area. Hence, calculations of the monetary damages caused by motor fuels apply an adjustment factor to account for the fact that most car miles are driven within built-up areas.

Figure 4 shows the environmental damage costs based on average estimates found in the literature. It should be noted that these values most likely represent the *lower limits* of monetary damage (see also Text box IV). Firstly, these estimates do not include all environmental costs from fossil fuel use, but only climate change and air pollution costs (which are by far the most important in monetary terms). Secondly, they do not include the costs of *non-environmental* externalities, such as earthquakes, traffic congestion and accidents. Particularly in the case of motor fuels, monetary damage from non-environmental externalities is substantial.

Figure 4
Direct and indirect costs of environmental damage from burning fossil fuel energy products, 2013



Source: PBL

Notes

- 1) Damage costs have been calculated relative to fuel energy content (euros/GJ). In the case of electricity, estimates are based on the emission characteristics of the fuel used for electricity production, as well as the relative energy efficiency of the different types of power plants
- 2) In the case of motor fuels (diesel in particular), air polluting emissions per litre (and per GJ) vary strongly due to considerable variation within the vehicle fleet.
- 3) The arrows indicate the indirect damages (i.e. the costs of damage due to supply chain emissions), both in terms of climate damage and air pollution damage.

Figure 4 shows that coal-fired electricity generation causes the greatest damage in terms of climate change. In contrast, the level of climate change damage is relatively low for natural-gas-based domestic heating, and even lower for natural-gas-fired power plants. Petrol and diesel use by passenger vehicles occupies an intermediate position in terms of climate costs. Interestingly, central electricity generation from natural gas is significantly cleaner than household combustion of natural gas, because the latter is less efficient. Biomass and wind energy do not cause direct climate damage.

The picture is quite different for the health damage costs of air pollution. As Figure 4 shows, wind is again the cleanest option for electricity production, but this time biomass performs relatively poorly, with only coal-fired electricity generation performing worse. Natural gas turns out to be the cleanest fossil fuel for electricity production, both in terms of climate costs and air pollution costs. The air pollution costs of motor fuels are particularly high. As discussed previously, this is due to the fact that emissions from motor fuels mostly take place in or near densely populated areas.

Furthermore, it is important to consider the *indirect* costs of fuel consumption. These are the damage costs associated with supply chain emissions, including emissions from extraction, refining and distribution. These indirect costs are very difficult to quantify; our estimates, indicated by the arrows in Figure 4, are therefore only indicative. As Figure 4 shows, the indirect costs of natural gas combustion for domestic heating are relatively low, at about 20% of the direct costs. However, indirect costs of some of the other fuels are considerable. For example, in the case of biomass-based electricity production, indirect costs are higher than direct costs. This is mainly due to the additional health damage caused by emissions during biomass production, harvest and transport. In comparison, indirect costs of coal-fired electricity generation are lower, but nevertheless still considerable. Again, natural gas-fired electricity generation turns out to be relatively clean; supply chain emissions, and hence indirect costs, are extremely low. By far the highest indirect costs are associated with motor fuel consumption (also known as ‘well-to-tank emissions’). This is mostly due to high emissions of both CO₂ and air pollutants during oil refining and fuel distribution. As Figure 4 shows, diesel and particularly petrol are the most polluting fuels in terms of supply chain emissions.

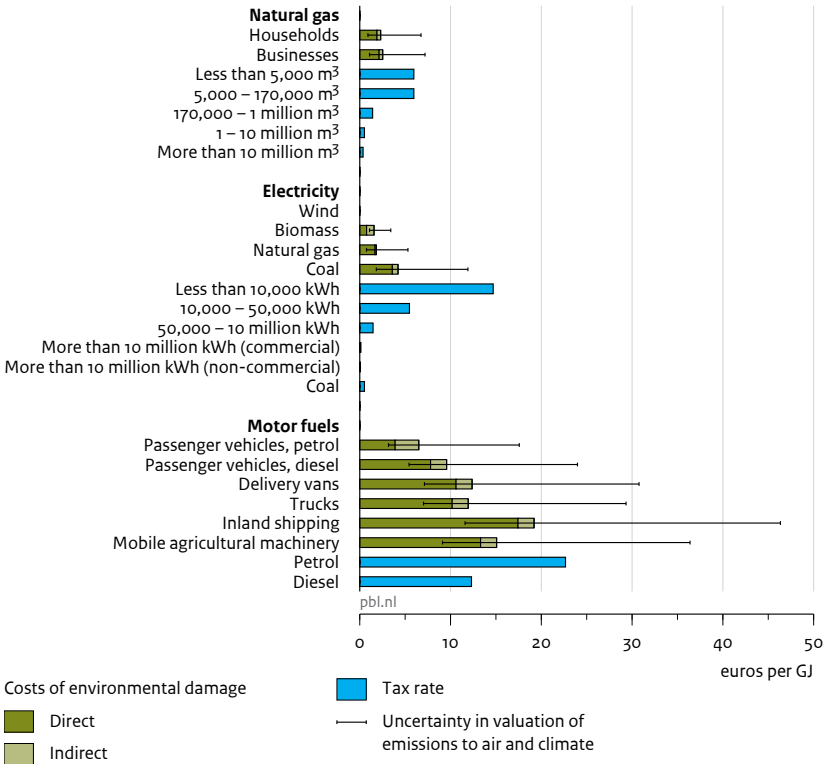
3.4 Tax structure and the costs of environmental damage

How does the present energy tax structure in the Netherlands relate to the costs of environmental damage, and what insights does this provide with regard to the choices made? Figure 5 compares present energy tax rates to the direct and indirect environmental damage costs of energy products that are currently most important for raising green tax revenue. As indicated previously, estimated damage costs only cover climatic and air quality effects, and do not include the social costs of traffic incidents, congestion and infrastructure. The uncertainty bars in the figure indicate the uncertainty associated with the cost estimates.

In the present situation (residual) emissions are taxed mostly indirectly, via taxes on consumption of natural gas, mineral oils (petrol and diesel), coal and electricity. Figure 5 clearly shows that households and small firms are paying the highest rates for all energy taxes. Particularly for electricity, rate differences between small and large users are considerable. Furthermore, when considering *average* damage costs (coloured bars in Figure 5), it appears that the high rates for small users cannot really be justified on the grounds of environmental damage alone. However, if the *uncertainty* of these estimates is taken into account (uncertainty bars in Figure 5), present rates may not be too high after all – except for electricity generated from natural gas, biomass and wind. Figure 5 also shows that environmental damage costs differ considerably *between* electricity production methods (wind, biomass, natural gas and coal), while the tax rate is the same for all electricity, regardless of how it is produced.

Figure 5

Direct and indirect costs of environmental damage versus standardised environmental tax rates, 2013



Source: PBL, 2013

In contrast to the relatively high rates for small users, rates for large users are much lower than the estimated environmental damage costs, both for natural gas and electricity. In theory, this need not be a problem as far as climate costs are concerned, because CO₂ emissions of large installations are also regulated through the European Emissions Trading System (EU ETS). However, the price of tradable permits is currently so low, that large users of natural gas and coal do not even come close to paying for the current monetary damage of climate change. It should be noted that this is also the case for large users in other countries, particularly in countries that do not regulate CO₂ emissions at all.

The EU ETS does not apply to *air polluting* emissions, and therefore cannot compensate the low tax rates for large users with regard to air pollution damage. Air pollution has a strong local effect, and any additional emission reduction would first and foremost benefit the Dutch population itself. Coal-fired power plants and natural gas combustion still cause considerable air quality damage, and this is also true for power plants (co-)firing biomass. Again, damage costs are much higher than tax rates for large users. However, as Figure 5 shows, the coal tax compensates at least some of the damage.

As for motor fuels, the relation between excise rates and environmental damage costs shows a number of interesting points. For petrol, it appears that the high excise rates cannot be justified when compared to the average environmental damage costs caused by petrol combustion in an average Dutch car engine. However, when considering the upper limit of the uncertainty range, the gap between petrol excise rates and environmental damage costs becomes considerably smaller. In addition, it should be emphasised that (heavy) taxation of petrol can be justified on numerous other grounds, such as the high damage costs of traffic accidents and congestion. If the latter costs are added to the environmental costs, petrol excises are too low, rather than too high (CE, 2008). However, for such a comprehensive assessment a more elaborate analysis is required, including other traffic-related taxes, such as the vehicle purchase tax on new vehicles (in the Netherlands called 'bpm' tax) (PBL, 2014a).

As for diesel, the relation between excise rates and environmental damage costs depends on the consumption category considered. In the case of passenger vehicles, the excise rate on diesel appears too high compared to the average costs of environmental damage caused by diesel cars, but the gap is much smaller than for petrol (and even reversed if the uncertainty of cost estimates is taken into account). This is due to the fact that diesel cars are much dirtier than petrol cars while the excise rates (per GJ) are considerably lower for diesel than for petrol. Furthermore, if all other unpriced externalities of car use are taken into account, the diesel excise rate for passenger vehicles is likely too low rather than too high, as was discussed above for petrol.

Compared to diesel cars, diesel-driven vans and trucks contribute more to local air pollution, because their engine emission standards are less strict. In this case, the diesel excise rate more or less corresponds with the average environmental damage costs. However, for all diesel vehicles (regardless of whether they are cars, vans or trucks) diesel excise rates are too low when compared to the *maximum* estimated costs of environmental damage – while these costs do not even include the social costs of other road-traffic-related externalities. Last but not least, the highest environmental damage costs of diesel consumption are on account of inland shipping. This is due to the fact that technical standards for inland vessel engines are far less advanced than for road vehicle engines. These damage costs are not compensated, because inland shipping is entirely exempt from paying diesel excise duty.

V Effective environmental tax burden and environmentally harmful subsidies

A highly relevant topic for the discussion on green tax reform is the issue of environmentally harmful subsidies. These are explicit or implicit subsidies that unintentionally lead to higher, rather than lower emissions. They range from direct government grants for environmentally harmful activities, to reduced tax rates, exemptions, and even loan guarantees (see also PBL, 2011).

Environmentally harmful subsidies reduce market prices and therefore increase emissions. For example, if a subsidy reduces the production costs of a product or activity, production will usually increase (too much) (see also PBL, 2014b).

For this reason it is often argued that the key policy measure towards adequate environmental pricing would be to eliminate environmentally harmful subsidies (OECD, 2012a). As an additional benefit, this would also reduce government spending.

However, to determine whether a subsidy is environmentally harmful we need to define a reference by which the subsidy can be judged, which is far from easy. It is beyond the scope of this report to discuss this in detail (but see Oosterhuis & Ten Brink, 2014). One approach is to start from the standard tax rate on an energy product, and then determine whether any sectors are eligible for reduced rates or exemptions from this tax. A similar approach is used for calculating the effective energy tax burden (see also OECD, 2013).

The Netherlands represents an interesting case here. If the highest tax rates on natural gas and electricity for small users are used as a reference point, one can only conclude that the Netherlands, with its degressive rate structure (the more energy used, the lower the rate), has exceptionally high environmentally harmful subsidies. However, this type of benchmark would imply that environmentally harmful subsidies do not exist in countries that levy no energy taxes at all.

Nonetheless, the degressive rate structure is a good indicator of the striking differences in the fiscal treatment of various sectors. Table 2 illustrates these differences in terms of effective tax burden (see also PBL, 2014b). The rates in this table have been determined by comparing total energy tax revenue to fuel consumption per sector, per fuel type. The result clearly shows that effective tax rates are generally highest for households, followed by services, agriculture, and, finally, industry. Furthermore, the degressive rate structure is clearly reflected in the different effective rates for natural gas and electricity between sectors. For motor fuels there are no sector-specific exemptions or reduced rates for large users. Hence, effective rates do not differ between sectors and are in fact equal to nominal rates. This is mostly the result of the abolition of reduced rates for 'red diesel' in the Netherlands in 2012.

Table 2

Effective energy tax rates in the Netherlands, in euros per GJ¹

	Households	Services and other	Industry	Agriculture
Natural gas	5.3	3.5	0.7	0.8
Electricity	14.3	3.8	0.9	11.2
Petrol	22.7	22.7	22.7	22.7
Diesel	12.3	12.3	12.3	12.3
LPG	4.0	4.0	4.0	4.0

Note:

1) Estimates are based on tax rates in 2013 and consumption data from 2009.

Source: PBL (2014b)

In summary, we may conclude that present tax rates on natural gas and electricity for small users are high, compared to the direct costs of environmental damage, whereas for large users they are low. This conclusion does not change if indirect costs (environmental damage from supply chain emissions) are included. As for motor fuels, it appears that petrol excise rates for passenger vehicles are too high if only *environmental* damage costs are considered. In the case of diesel, the gap between excise rates and damage costs is smaller (and even reversed if *maximum* cost estimates are considered), because diesel vehicles (heavy goods vehicles in particular) have a greater impact on local air quality. However, other (non-environmental) externalities of traffic and transport, such as traffic accidents and congestion, would have to be included to fully assess the social costs of motor fuel use.

Notes

- 1 In fact, when considering real prices – i.e. prices corrected for inflation – the decline in tax revenue in recent years is even stronger. Nonetheless, the relative contribution of environmental taxes to total tax receipts has fluctuated around 10% for many years now.
- 2 ‘Fuel tourists’ account for 80% of petrol and diesel consumption in Luxembourg (OECD, 2013: 155).
- 3 Fuels can be compared on the basis of their relative energy content (standard units, such as cubic metres, kilograms and litres, do not account for differences in calorific value). In this analysis (Figure 3), electricity was weighed according to the average efficiency of Dutch power plants (about 55%).
- 4 See PBL (2014b) for a detailed and comprehensive discussion of all aspects of the Dutch energy tax structure.

- 5 The EU ETS applies to all large combustion installations (including CHP) and industrial facilities with a net heat excess of 20 MW_{th} (combined heat and electricity output) and at least 25 kt CO₂ emissions. Combinations of smaller units, each with a net heat excess of at least 3 MW_{th}, are also possible. Energy production (heat and electricity) in waste-incineration plants is excluded from participation in the EU ETS.
- 6 The Netherlands also has a long-running subsidy scheme (SDE+) to encourage clean (renewable) energy production. The SDE+ scheme not only applies to solar and wind energy, but also to electricity generation from waste (either through incineration or fermentation (biogas)).

4 Building blocks for energy tax reform

With this detailed information in mind, the question of what the Dutch options are for green tax reform in the energy domain can be answered. The considerable environmental damage that is still being caused by fossil-fuel combustion (climate change and air pollution, in particular) is the main reason for discouraging consumption of these fuels in many countries. This can be achieved through clever use of environmental taxes (Parry et al., 2014). The Netherlands, however, has already made significant efforts in this area, and a further increase in environmental taxation is not as simple as it seems. The previously discussed trade-off between green tax revenue and green result plays a role here. Partly as a result of comprehensive policies aimed at reducing fossil fuel use, green tax receipts are likely to decrease in the long-term. In this chapter we first evaluate the present energy tax structure from an environmental perspective, and discuss the short-term options for energy tax reform. Taking into account some of the expected fundamental changes in the Dutch energy system, the future outlook for energy taxation is discussed below, and a number of long-term policy options are proposed.

4.1 Green tax revenue and environmental regulation via taxation; short-term policy options

Our analysis of the Dutch energy tax structure shows that the Netherlands has found a smart solution to deal with the complicating factors discussed in Chapter 2. The first thing to notice is that the present *tax base* for energy taxes is relatively stable, as it mainly relates to consumption of natural gas, electricity and secondary mineral oils (diesel and petrol). In the Netherlands, energy consumption is a stable factor in the expenses of households and firms, growing more or less at the same rate as national income. Hence, as tax base for raising green tax revenue, energy consumption is an understandable choice. In contrast to the landfill tax (which mostly affects waste management companies), the energy tax base has not steadily eroded over time, and energy tax receipts have not shown a marked decrease. Despite the heavy excise duties on petrol and diesel, car use is still high, bringing in substantial revenue for the treasury¹. At present, the energy tax base excludes non-energy use of fossil fuels and

own use of self-generated energy products. Furthermore, various tax exemptions have been created to encourage more efficient fuel use, such as CHP, and renewable electricity production.

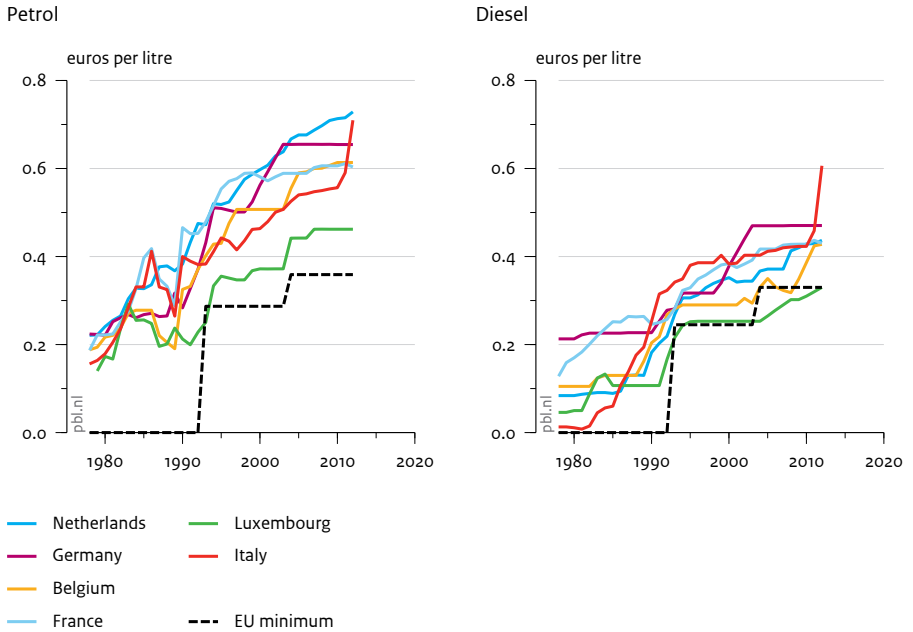
Secondly, the emphasis of present energy taxation is on energy *consumption*, in particular of *small users* (households and small to medium-sized enterprises). This choice is mainly guided by concerns over international tax competition; if energy taxes would be too high, internationally operating firms could decide to move abroad. However, an important disadvantage of taxing *consumption* is that the environmental tax bases are taxed mostly indirectly. In other words, there are no direct charges on the emissions from fossil fuel combustion. As a result, the relation between current energy taxes and environmental emissions is indirect and sometimes weak. This is particularly true for the tax on electricity.

Figure 6 illustrates how international tax competition may limit countries such as the Netherlands in setting their own excise duty rates for fuel. As the figure shows, the Netherlands has a tradition of relatively high excise duties on petrol, compared to other European countries. In the case of diesel, rates used to be average but have recently risen to the highest of the neighbouring countries. This rise has partly been due to the policy choice to index excise rates to annual inflation, whereas other countries do not have such a policy. Figure 6 also implicitly shows the influence of cross-border traffic on national excise duties; the greater this traffic, the less room countries have to set their own rates. Diesel is mostly used for freight transport. Trucks, however, can drive large distances before they need to refuel and hence are more likely to buy fuel across the border (Evers et al., 2004). Therefore, diesel rates vary less between countries than petrol rates (Figure 6).

Thirdly, the *practicability* of the present design is fairly good. For an energy tax to be legally feasible and enforceable it is essential that consumption is metered and records can be inspected. This is relatively simple in the case of energy taxes on natural gas and electricity, because gas and electricity are supplied through the utility network; the tax administration can make use of the consumption records kept by the energy supplying companies. Collection costs for the coal tax are also limited, because the number of coal users is small. Finally, for excise duty on motor fuel, the tax administration can make use of the fuel station network to keep track of consumption and collect excise duties. This way, the tax administration does not have to deal with individual consumers.

Fourth, interaction with other policies is simply inevitable, particularly in the case of climate policy, which is mostly a European affair. Energy taxes not only interact with the EU ETS, but also with European emission standards for air quality. For example, the effectiveness of increasing 'upstream' taxes (such as taxes on coal, crude oil and natural gas) may be limited due to the 'waterbed effect' (see Section 2.4). In fact, even an increase in a 'downstream' tax such as the electricity tax could have such an effect.² At the same time these taxes do contribute to a more stable carbon price, which could

Figure 6
Excise duty on motor fuels in the EU



Source: IEA, 2013

be an incentive for investment in technologies that expedite the achievement of long-term carbon reduction targets (Verdonk et al., 2013). Hence, from a longer-term perspective, policy interaction is not necessarily a problem.

Against this background the options for further green tax reform can be determined from an environmental perspective. The fact that the Netherlands already has relatively high energy taxes compared to other countries justifies the question of whether further green tax reform is desirable and, if so, in which form. Relevant questions, from an environmental point of view, for instance, are whether the present energy tax structure provides the right incentives, and if there are any reform options that could improve the 'green result'. Furthermore, not only effectiveness but also efficiency is important (Vollebergh, 2012). From the perspective of optimal environmental pricing, energy tax rates should be equal to the marginal value of environmental damage, such that all damage costs are properly discounted in the price.³ This perspective, thus, would require tax rates do not exceed environmental damage costs, although in some cases a surcharge may be needed to improve tax efficiency (when the taxed products have low price elasticity) or to correct for other externalities (such as traffic accidents, in the case of petrol and diesel excise duties).

Figure 7
Costs of environmental damage relative to energy tax rates, 2013

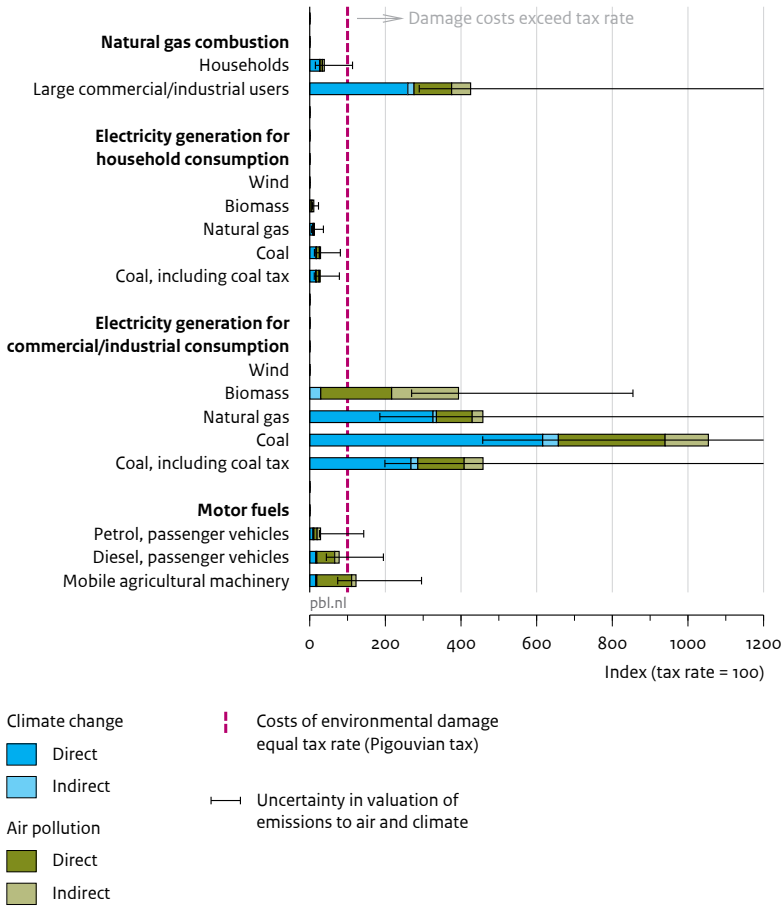


Figure 7 summarises the key findings of the background study (see PBL, 2014b). This graph shows the estimated environmental damage costs of energy use (focusing on climate change and air pollution) relative to the main energy tax rates in 2013. If the ratio is 100, the tax rate is exactly equal to the (marginal) damage costs.⁴ However, if the ratio is greater than 100, damage costs exceed the tax rate, which would justify a rate increase on environmental grounds. Conversely, if the ratio is smaller than 100, a rate decrease would be justified on environmental grounds. As discussed previously the uncertainty of

the cost estimates is high; hence, this graph mainly serves to indicate the direction in which tax rates could be reformed if the green result of energy taxes is to be improved.

On the basis of Figure 7 and the underlying analysis, we suggest the following starting points for green tax reform aimed at improving green results:

- Pricing environmental damage from fuel use solely in terms of climate costs (carbon tax base) overlooks the significant and highly variable contribution of fuels to air pollution (see also Figure 4). This is particularly true for biomass and motor fuels. Although the use of biomass is an inexpensive way to achieve carbon emission reduction targets, the price is high in terms of increased air pollution.
- The (environmental) efficiency of present energy taxes is limited, as they do not adequately price the environmental damage caused by fuel combustion (see Figure 7). The green result could be significantly improved by better aligning the energy tax structure with environmental damage costs.
- As a result of the choice to primarily tax consumption of energy products, the excise duty rates for small users (households and SMEs) of natural gas and electricity and the fuel for passenger vehicles presently exceed environmental damage costs. The reverse is true for large commercial and industrial rates, which are much lower than environmental damage costs. In the latter case, concerns over tax competition seem to outweigh environmental concerns, even though not all large users are subject to international competition.
- From an environmental perspective, electricity taxation is a rather roundabout way to correct environmental damage from fuel combustion, compared to direct taxes on emissions. A more direct relation with emissions would allow a much lower tax rate per unit of (implicit) emissions. Hence, the emphasis of electricity taxation appears to be on green revenue generation, in the first place.
- The high excise rates on road fuels are justified not only on the grounds of the relatively high costs of air pollution from motor fuel combustion, but also because of the considerable damage from supply chain emissions – particularly when compared to other energy sources, such as natural gas and coal, for which supply chain emissions are much lower.
- The rate scheme for motor fuels could be improved to better reflect the relative contribution of different fuels to environmental damage, particularly in the case of petrol versus diesel in various applications (e.g. private transport versus freight transport), but also for biofuels, LPG and electric driving.

These insights can be translated into a number of short-term policy options. On the basis of the present energy system and current revenue level, the green result of energy taxation could mainly be improved through a careful analysis of the environmental effects of design choices with regard to tax base, exemptions, rates and units of measurement (e.g. carbon content, energy content). The resulting options are summarised in Table 3. It should be noted that these options are preliminary suggestions; further study is required to assess whether they would indeed produce the desired result.

Table 3

Short-term policy options for green tax reform from an environmental perspective; preliminary suggestions

	Option	Elaboration	Notes
Tax base	Shift taxation from outputs to inputs	In the short term, this could largely be achieved through adjustment of exemptions and rates	Budget neutral
Exemptions	– Keep the coal tax	Tax coal for its impact on air quality and to raise EU ETS floor price	Short-term interaction with EU ETS (waterbed effect)
	– Reconsider the favourable tax treatment of biomass and biogas	Tax the fuels used for co-firing, because of their impact on air quality	Interference with renewable energy targets and air quality standards
	– Maintain the exemption for self-generated renewable electricity	This is the only incentive for clean, non-fossil electricity generation	Limited impact on revenue
	– Abolish the exemption for waste incineration	Non-energy applications of fossil fuels are not taxed anywhere else in the supply chain. This would generate extra revenue and green result	Interference with renewable energy targets
	– Revise exemptions for aviation and shipping	This would generate extra revenue and green result	Requires modification of international agreements
Unit of measurement	– Align with emission reduction incentives	Do not focus only on fuel <i>carbon</i> content; air quality regulation requires other measures	Budget neutral
Rates	– Align energy tax rates with relative environmental damage costs	Shift taxation from electricity to natural gas; Shift taxation from small users to large users	Budget neutral in combination with rate reform
	– Account for supply chain emissions	This has already been done for petrol, but not for various uses of diesel	Requires coordination with neighbouring countries
	– Align diesel and petrol rates with relative environmental damage costs	Shift taxation from petrol to diesel	Requires coordination with long-term policy and EU policy

The most obvious option is to abolish the tax exemptions on fuels used in aviation and shipping (Keen et al., 2013). This reform would also increase green tax revenue – just like the recent abolition of the environmentally damaging subsidy on ‘red diesel’. The problem is that these exemptions can only be removed after modification of international agreements, which is a time-consuming process. Most other options in Table 3 can be implemented in the short term, without affecting green tax revenue. However, these options do involve a *redistribution* of the tax burden; activities that cause more pollution will be taxed more heavily than is presently the case. But this would be completely in line with the principle of environmental pricing.

Several policy options in Table 3 do not require coordination at the EU level.

Nonetheless, the EU does offer useful possibilities to reduce perverse international tax competition, such as setting minimum tax rates on energy products. For example, EU minimum tax rates on motor fuels have forced Luxembourg in particular to increase its extremely low national rates (see also Figure 6). The EU has a similar policy for heating fuels, except that in this case exemptions are allowed for energy products covered by the EU ETS (COM(2011)168/3). This narrow focus on climate change, however, takes insufficient account of damage from air pollution, as discussed in previous sections.⁵

4.2 Long-term policy options

The emphasis of the current energy tax structure in the Netherlands is on tax bases that are relatively stable. Although taxes on electricity and natural gas for heating are likely to evoke a behavioural response, particularly when rates are increasing, this effect has been limited so far. Heating is a basic need and electricity consumption is only growing. Hence, these tax bases are useful elements in a tax structure aimed primarily at *neutrality*, i.e. at minimising the behavioural effects of taxation. Stable tax bases are also the first choice for green tax reform aimed solely at stabilising or increasing green tax revenue. In that case taxes are not supposed to have a large influence on taxpayers’ behaviour, because this would lead to tax base erosion and revenue loss. However, this choice does not necessarily lead to the best green result in terms of emissions reduction.

Despite the choice of relatively stable tax bases, there are a number of trends that threaten the long-term viability of the Dutch energy tax structure. These trends will increase the previously discussed tension between ‘green revenue’ and ‘green result’. One of these trends is temperature rise. Due to climate change, the Netherlands will have increasingly warmer winters. Natural gas consumption for heating has already been decreasing; during the last thirty years, the number of ‘heating degree days’ (a measure of the demand for energy needed to heat a building) has declined by 17% (Sluiter, 2011: 28).

Another, more important trend is that fossil fuel use is expected to decline as a result of environmental and energy policies aimed at mitigating climate change and air pollution. For example, the EU has an ambitious policy package aimed at a 20% reduction in CO₂ emissions by 2020 relative to 1990 levels, and no less than an 80% to 95% reduction by 2050. Aside from the EU ETS, the package includes renewable energy targets (e.g. to increase the share of renewable energy in the Netherlands to 14% by 2020) and annual targets for improving energy efficiency, for example in housing construction. Furthermore, targets have been set for the road transport sector to increase the share of renewable motor fuels (to 10% by 2020) and to improve fuel efficiency of passenger vehicles and delivery vans.

In the long run, these policies will inevitably undermine the present energy tax bases for natural gas, electricity and motor fuels. For example, trends such as climate-neutral housing construction will eventually lead to lower consumption of grid-supplied natural gas and electricity. Heating demand will keep decreasing due to better insulation techniques, which, in combination with other innovations such as heat exchangers, geothermal energy and micro-CHP, may cause a turning point in natural gas consumption. The same can be said of the growing trend of self-generation of electricity (also known as behind-the-meter generation), although the total installed capacity is still relatively small. Furthermore, use of natural gas-fired CHP is likely to increase because it is tax exempt. Similar changes are emerging in the transport sector, mostly as a result of EU policies aimed at increasing vehicle fuel efficiency, biofuel use and electric driving.

The relatively high tax burden on fossil fuels in the Netherlands will certainly help to bring about these changes. A high burden discourages consumption and stimulates more efficient use of fossil energy products such as natural gas, electricity and motor fuels.⁶ High tax rates (combined with smart tax incentives) do stimulate innovation and this impact, together with other behavioural responses in both demand and supply, is reflected in the long-term price elasticities of energy products (OECD, 2010; Vollebergh, 2012 and 2013).⁷ Indeed, high energy prices lead to greater demand for (and hence supply of) energy-efficient appliances, central-heating boilers and cars. Existing fossil-fuel-based technologies are also being improved; combustion techniques have become significantly more efficient, and diesel cars have become much cleaner. But also more radical innovations that exploit sustainable energy conversion methods have entered the market. For example, residential homes can be heated using heat exchangers that run on self-generated electricity or electricity from highly efficient gas-fired power plants. This is already a reality.

The relatively high tax burden on fossil fuels in the Netherlands is likely to further increase over the coming years. A case in point is the recently introduced energy tax surcharge on natural gas and electricity. The Dutch Government has introduced this surcharge to finance its ambition to increase renewable energy production. Receipts for 2020 are now expected to rise to an additional 2 billion euros. At the same time, this

Table 4

Long-term policy options for green tax reform from an environmental perspective; preliminary suggestions

	Option	Elaboration
Tax base	– Shift energy taxes from outputs to inputs	– Reduce taxes on electricity (end product) and increase taxes on inputs such as natural gas and, particularly, coal – Increase upstream taxation, in combination with tax refund for downstream emission abatement
	– Impose a tax on non-energy use	– Alternatively, abolish the exemption on waste incineration (see Table 3)
Exemptions	– Abolish the exemption on CHP	– Equal treatment of fossil and renewable options, taking into account both climate damage and air pollution damage
	– Maintain the exemption for self-generated electricity	– Combine with an imposed surcharge to pay for supply security through central electricity production
	– Limit incentives for biomass and biofuels	– Current incentives are problematic because of air pollution effects and energetic inefficiencies
Unit of measurement	– Align with (future) environmental damage	– Account for <i>long-term</i> impacts on both climate change and air pollution
Tax rate	– Align with (future) environmental damage	– Align tax rates with marginal damage costs, taking into account energetic differences between fuels

additional rate increase will reinforce the trends discussed above (reduced consumption and innovation), leading to tax base erosion, in the long term.

From an environmental perspective, the present energy tax structure in the Netherlands has several shortcomings, including the relatively high tax burden on relatively clean energy products, such as natural gas and electricity (see previous section). Simply raising all current rates will exacerbate rather than solve these shortcomings; dirty fuels, such as coal, would become relatively cheaper because their market price is lower and this is unlikely to change over the coming years (Vollebergh and Drissen, 2014). Hence, higher energy tax rates may even lead to an *increase* rather than decrease in environmental damage in the Netherlands; for example, due to additional air pollution from increased coal consumption. A simple rate increase across the board would also negatively affect the efficiency of environmental policy. In particular, the unequal treatment of small versus large users would be maintained which leaves additional, usually cheaper reduction options with large users unexplored.

Given the present shortcomings and anticipated changes discussed above, it is imperative to start thinking now about an alternative design of the energy tax structure. Tax reforms should be prioritised on the basis of their long-term contribution to a robust

energy tax structure, both in terms of revenue and environmental regulation. The present energy tax structure is not technology-neutral, and current taxes do not always stimulate the best energy options from an environmental point of view. It is beyond the scope of this Policy Brief to present an in-depth assessment of long-term reform options. However, on the basis of the analysis above, some preliminary suggestions can be made. These are summarised in Table 4.

The policy options listed in Table 4 are preliminary suggestions; they have yet to be analysed in terms of possible drawbacks, such as tax competition and practicality. The main purpose of these suggestions is to provide starting points for a more systematic analysis of green tax reform options. Such analysis should not only consider the anticipated changes in the energy system discussed above, but also future developments of environmental damage. For example, climate damage is very likely to increase over the next decades, which will justify higher tax rates on fossil fuels. Future trends in air pollution are less clear. On the one hand, health damage from air pollution (notably particulate matter) is likely to increase because of further urbanisation and greying populations (OECD, 2012b). On the other hand, the already agreed on more stringent emission standards for cars and lorries will help to reduce damage from air pollution.

The policy suggestions in Table 4 assume that energy consumption will gradually shift to non-fossil sources. At this point in time it is difficult to predict what would be the best technological options to support such gradual transition. From a Pigouvian point of view, pricing environmental damage will suffice. In that case, fuel tax rates should be equal to the marginal costs of environmental damage, taking into account differences in fuel energy content (see Figure 7). This would also be the best approach when fuel substitution becomes easier. As a result, consumers will increasingly be guided by environmental costs, and less by other characteristics.

On the basis of the Pigouvian approach, it also makes more sense to tax upstream energy inputs (i.e. primary fossil fuels) rather than downstream energy outputs (i.e. secondary energy products such as electricity and motor fuels). Also, there is no reason to treat non-energy uses of fossil fuels differently. Both energy use and non-energy use of fossil fuels lead to emissions, be it at different points in time. An option worth considering is to tax non-energy products only at the time of actual emissions, for example when waste is incinerated. Inputs that do not cause environmental damage (e.g. wind and solar energy) should remain exempt from environmental taxes.

Notes

- 1 Nevertheless, car use would be (much) greater if motor fuels were not taxed.
- 2 Higher electricity taxes may reduce electricity consumption and hence demand, leading to lower fossil-fuel-based electricity production in power plants. These installations are covered by the EU ETS; hence, the resulting emission reduction in the Netherlands is likely to lead to higher emissions elsewhere in Europe, because the EU ETS ceiling applies to the EU as a whole, not to individual countries.
- 3 It should be noted that this implies the inclusion of all relevant tax bases, as well. Simply excluding some energy products may impose additional cost on society, although the inclusion of all relevant energy tax bases is costly, as well (Smulders and Vollebergh, 2001).
- 4 In the literature this is known as the Pigouvian tax rate, named after the economist Pigou (see PBL, 2013).
- 5 Furthermore, these exemptions disregard the fact that energy taxes within the EU ETS sector could play a role by raising the carbon floor price (Hepburn, 2006; Verdonk et al., 2013).
- 6 One indication of such an effect is that several sectors in the Netherlands have improved their energy efficiency after the introduction of the 1996 tax on natural gas and electricity (see Mulder and De Groot, 2013).
- 7 However, it should be kept in mind that the income elasticity of energy is positive. This is due to the fact is that energy demand is strongly related to economic growth. Once the economy recovers the demand for energy products will undoubtedly *grow* again.

5 Conclusions

The proposition of this PBL Policy Brief is that green tax reform offers various interesting possibilities for improving environmental quality. In principle, the present taxes on energy products in the Netherlands fit in well with the ambition to substantially reduce the country's dependence on fossil fuels, in the long run. High tax rates are an incentive for innovation and trigger behavioural change both at the demand and supply side. This is exactly what green tax reform aims to achieve – at least if the main objective is to achieve a *green result*, i.e. to reduce environmental pollution.

Green tax reform aimed solely at increasing or stabilising tax revenue for the treasury will favour tax bases that are unlikely to erode. However, the opposite is usually the case for environmental taxes aimed at achieving a green result, because tax base reduction generally means that environmentally harmful emissions are decreasing. In this case, environmental pricing calls for tax rates that are equal to the marginal costs of environmental damage. The analysis in this Policy Brief and a simultaneously published PBL background report on the present energy tax structure in the Netherlands shows that it will be quite a challenge to balance environmental and revenue objectives. In the Netherlands, environmental tax revenues – and some of the tax rates on energy – are already quite high. Therefore, the question is whether there are any possibilities left to increase green tax revenues, and, if so, what the best options would be if the other objective is to achieve green results.

As discussed in Chapter 4, the tax burden on present energy consumption in the Netherlands is expected to increase. A case in point is the recently introduced energy tax surcharge on natural gas and electricity, the receipts of which are earmarked to expand renewable energy capacity. At the same time, this further rate increase will reinforce the previously discussed behavioural response (reduced consumption and innovation), leading to tax base erosion in the long term. Hence, green tax reform aimed solely at stabilising or increasing green tax revenue is not without risk. A narrow focus on revenue also means that potential environmental gains are likely to be sacrificed. For example, ending the tax exemption on self-generated energy would be a conceivable option from a revenue perspective, but this choice would be at the expense of a better green result.

The analysis in this Policy Brief shows that the energy tax structure in the Netherlands has been designed to tax environmental damage from fossil fuel use mostly indirectly, that is, via the consumption of natural gas, electricity and motor fuels. In addition, the emphasis of energy taxation is on small users, households and SMEs in particular. This choice has mainly been guided by concerns over international tax competition; if environmental taxes are all too high, internationally operating firms may decide to move their activities to other countries. For households and SMEs it is obviously more difficult to move abroad just to avoid taxes. One disadvantage of taxing *consumption* is that the environmental tax base is taxed mostly indirectly. For most energy products, consumption is only indirectly linked (in the case of electricity, only weakly linked) to emissions from fossil fuel combustion, while regulation of supply chain emissions is not always consistent.

Our analysis also shows that the Dutch energy tax structure is rather complex; it covers a wide range of energy products, which have varying effects on the two most important environmental problems: climate change and air pollution. Furthermore, taxes are levied at various stages of the supply chain and are subject to interaction with other policy instruments. Hence, any changes to this structure should be very carefully considered. It should also be kept in mind that environmental taxes are not the only means to achieve environmental policy objectives, and that combinations with other instruments, such as emission standards and emission trading systems, can also be effective.

The first conclusion from the analysis in this Policy Brief is that green tax reform should not focus solely on the *climate* impact of energy consumption; a carbon tax base fails to account for the considerable differences in the *air quality* impact of various energy products. This applies in particular to biomass and motor fuels. Although biomass is useful for achieving climate targets, the price is high in terms of increased air pollution. The air quality impact of motor fuels is also considerable, particularly when indirect (i.e. supply chain) emissions are taken into account. Renewable electricity (wind, solar) and natural gas are much cleaner and therefore deserve a major role in the energy system.

The second conclusion of our analysis is that a balance should be found between the two objectives of green tax reform, i.e. raising green revenue and achieving green results. The fact that the Netherlands is a front runner in environmental taxation, with about 10% of total tax revenue raised from green taxes, does not necessarily mean that the present energy tax structure delivers the best possible environmental result. For example, tax rates on various fuels could be improved, from an environmental pricing perspective. In particular, present rates on electricity – of which only production, not consumption, leads to emissions – are relatively high. Conversely, tax rates on some primary fuels, such as coal, are currently (much) too low. Tax exemptions for self-generated renewable energy are perfectly justifiable on environmental grounds, even if they somewhat reduce green tax revenue.

Thirdly, there are a number of reform options that are sure to be ‘no-regret’ in terms of environmental benefits. One of these is to end the exemption on fuels used for aviation and shipping. Furthermore, from an environmental point of view it would be a bad idea to reintroduce the exemption on the most polluting fossil fuel for electricity generation, i.e. coal, as has been agreed in the 2013 National Energy Agreement. Even if the Dutch coal tax does not contribute much to CO₂ emissions reduction within the EU in the short term, it does have a positive effect on air quality, and possibly also on the functioning of the EU ETS, in the long term. Similarly, a tax on biomass for electricity production would also have a positive effect on air quality. The unequal tax treatment of petrol versus diesel is an additional issue. In various applications diesel is much more polluting than petrol, but it is taxed at a much lower rate. Furthermore, electric driving – the cleanest option for cars – is heavily taxed through the tax on electricity. Finally, it is worth considering to reduce a number of ‘perverse’ effects from an environmental point of view. For example, it is remarkable that no tax is levied on the incineration of combustible waste (which includes non-energy products of fossil fuels, such as plastics). After all, this ‘resource’ is not taxed at any other stage in the supply chain.

Fourth and finally, the long-term viability of the present Dutch energy tax structure is likely to be limited. The ever higher tax rates will increasingly stimulate taxpayers to reduce their consumption of presently taxed energy sources, i.e. fossil fuels. Hence, green tax reform should not simply build on the present energy system, but anticipate the technological changes that are already on the horizon. For example, vehicle fuel efficiencies are rapidly improving, and thanks to better insulation techniques and other innovations it is no longer a given that new housing developments will be connected to the gas network. Therefore, the Netherlands needs to start thinking now about an alternative design of its energy taxes. This is necessary in order to ensure that the government does not lose its credibility (again) and will not suffer significant revenue losses.

Hence, energy tax reforms should be prioritised on the basis of their long-term contribution to a robust energy tax structure, both in terms of revenue and environmental regulation. The present energy tax structure is not technology-neutral and does not always stimulate the best energy options from an environmental point of view. However, to simply base taxes on carbon content, as is sometimes advocated, does not adequately take into account the different impacts of various energy products on air quality.

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**PBL Netherlands Environmental
Assessment Agency**

Mailing address

Postbus 30314
2500 GH The Hague
The Netherlands

Visiting address

Oranjevuitensingel 6
2511 VE The Hague
T +31 (0)70 3288700

www.pbl.nl/en