Limits to green?

Greening tax system in the Netherlands

Report
Delft, September 2010

Authors:
Martijn Blom
Arno Schroten
Sander de Bruyn
Frans Rooijers

Bibliographical data:

Martijn Blom, Arno Schroten, Sander de Bruyn, Frans Rooijers
Limits to green?
Greening tax system in the Netherlands
Delft, CE Delft, September 2010

Taxes / Sustainability / Environment / Policy instruments / Social factors / Economic factors

Publication code: 10.7137.12e

This report was commissioned by the Netherlands Ministry of Housing, Spatial Planning and the Environment (VROM).
All publicly available CE publications can be downloaded from www.ce.nl

More information on the study is available from project leader Martijn Blom.

Committed to the Environment

CE Delft is an independent research and consultancy organisation specialised in developing structural and innovative solutions to environmental problems.
CE Delft's solutions are characterised in being politically feasible, technologically sound, economically prudent and socially equitable.

Foreword

Can the Netherlands' tax system be 'greened' any further in the years ahead, increasing the share of environmental taxes from the current figure of 14% to 20%, say? And, if so, what kind of tax bases are available for the purpose? These are the key questions addressed in the present report by CE Delft on 'Elements of a green tax system', drawn up to provide input for an essay to be presented to the Dutch government's Tax Structure Study Commission by Bernard ter Haar, Environmental Director-General of the Dutch Environment Ministry, VROM. This study commission, comprising academics and policy advisors, is looking into the future resilience of the Dutch tax system, the last major reform of which took place in 2001.

Delft, September 2010

Martijn Blom
Arno Schroten
Sander de Bruyn
Frans Rooijers

Contents

Summary

Introduction

The central issue considered in this report is the extent to which a further extension of environmental taxation can contribute to building a sustainable economy. In the context of the present study, a sustainable economy is taken to mean that the risks associated with climate change and resource depletion are reduced to an acceptable level by 2050 and that the shifting of costs and risks onto future generations is halted. This implies a need to move towards very low CO_2 emissions and prudent use of natural resources, with no further loss of biodiversity. A sustainable economy will not materialise of its own accord and governments will need to design suitably effective policies to reduce emissions and safeguard resources and nature. Environmental taxes can provide an effective strategy for achieving the goals of a sustainable economy.

In the Netherlands the share of green taxes in aggregate tax revenue has remained stable for a number of years at 14% of Gross Domestic Product. In several other European countries, however, this share has been declining, constituting a 'degreening' of the tax system. This may be because green taxes have had a regulatory impact, which means reduced environmental pollution has led to declining tax revenues. This in turn begs the question whether the share of green taxes can rise much further without such taxes becoming undermined by their own success. This study explores whether and to what extent there are fiscal, social or socio-economic 'limits to growth' as far as green taxes are concerned.

The philosophy of environmental tax reform

One important motive for a further greening of the tax system is to achieve internalisation of environmental costs in prices ('getting the prices right'), so that consumers and industry can bring their decisions more in line with the external costs to which they give rise. Wherever market prices fail to cover the full social costs of pollution and resource depletion there is a tangible motive for implementing or raising taxes or abolishing reduced tax rates and energy subsidies. This is particularly relevant for greenhouse horticulture, industry and international transport. Such moves represent an initial and efficient step towards a sustainable economy. The climate targets set by the Dutch government demand more than just internalising environmental costs, though: everyday behaviour and decisions also need to be changed. For the built environment and passenger transport, such change requires higher carbon tax rates, because of the low *price* elasticities and high *income* elasticities of demand for fuels and energy. This principle of *target-based pricing* (prices as a means of securing a given target) is becoming a growing feature of European climate policy.

One strategy towards achieving this aim could comprise the following key elements:

1. Introduction of a new carbon tax as part of the Energy Tax.
2. A broadening of the scope of the Energy Tax to include sectors like agriculture and industry and removal of other fiscal subsidies and reduced rates.
3. Extension of the tax system to include new tax bases on the import/production of natural resources (timber, fish, meat) and land use.
4. A European agenda on green tax reform.

Track 1: A carbon tax

A new carbon tax is essential because current taxes on energy and fuels make too little allowance for the highly variable carbon content of present and future (bio)fuels and sustainable forms of energy. In other words, the way fuels are treated in today's tax system does not reflect the CO_2 emissions they embody. Lowering the excise duty on LPG and the 'red diesel' used by farmers and construction vehicles, for example, is not in line with the carbon content of these fuels and can no longer be justified simply with reference to air quality, moreover. This carbon tax can be levied on top of the excise duty on car fuels and the Energy Tax. This would mean the taxes having a carbon component indexed to the fuel's carbon content (over the entire life cycle), and an energy component indexed to its energy content. This combined tax would have two clear policy motives: the desire to reduce the country's dependence on energy imports (both fossil fuels and biomass: the energy component) and the government's ambitious climate targets (the CO_2 component).

Track 2: Broadening the Energy Tax

Broadening the scope of the Energy Tax (ET) is essential, because the incremental increases that have occurred to date have focused on the first tier, comprising households and other small-scale consumers. As a result, there is still insufficient incentive for medium-sized and large-scale consumers to conserve energy. With the highly degressive structure of the ET, the Netherlands is ignoring opportunities for cost-effective energy-saving policies and reducing the energy efficiency of the country's industrial base. Table 1 reviews current Dutch ET rates, expressed in Euros per tonne of avoided emissions.

Table 1 **Dutch Energy Tax rates, € per tonne CO_2 (excl. VAT)**

	Gas	Electricity	Typical consumers
Tier 1	89	192	Households
Tier 2	78	70	SME*, commercial services
Tier 3	22	19	SME*, government
Tier 4	7	2	Industry (probably partly in ETS)
Tier 5 (non-commercial)	6	1	Non-commercial
Tier 6 (commercial)	5	-	Energy, steel and aluminium industries (ETS)

* SME: Small and Medium-sized Enterprises.

On top of the degressive structure of the ET, there are currently tax breaks in force for, in particular, energy-intensive industries (including an exemption from the ET on electricity for companies that have signed up to voluntary agreements on improving their energy efficiency) and agriculture (a reduced ET rate for greenhouse horticulture and the lower duty on 'red diesel'). Abolishing these unsustainable tax arrangements is an indispensable part of any serious effort to green the tax system. Removing exemptions and tax reductions simplifies the tax system, moreover. The same holds for raising the tax rates for the second and third tiers to the level of the first (i.e. a 'flat-rate' ET). Within the last tier, the share of energy in production costs and the degree of international orientation are in all likelihood only modest, implying little if any impact on competitiveness. For those sectors in which energy does

make up a sizeable proportion of production costs, recycling of revenues is a serious option, because intensifying the tax burden is *not* the aim of green tax reform.

Track 3: New tax bases

The third track involves introducing new tax bases into the system, in the form of a tax on use of non-sustainable resources (such as livestock feed) and a tax on land use. Current consumption of raw materials and resources in the Dutch economy is unsustainable and gives rise to external effects, frequently in other parts of the world. A tax to address these issues could be levied at either the 'back end' of the supply chain (e.g. a tax on non-sustainable resources like animal feed) or the 'front end' (e.g. a tax on meat consumption). The simplest policy measure would be to transfer meat from the low VAT rate (currently 6%) to the high rate (19% in the Netherlands), which would be in line with the overall desirability of moving towards a diet comprising less (animal) protein. This measure would require no changes to the current VAT directive and could be introduced by the Netherlands 'unilaterally'. It would have a neutral impact on the competitiveness of the Dutch livestock sector (level playing field). Intervening early in the supply chain (animal feed) would probably lead to even greater environmental gains. While this might provide adequate justification for such a tax, because of WTO trade rules it would still need to be carefully crafted.

Besides natural resources, land use might also provide an important base for a further greening of the tax system. In this area there appears to be greater policy manoeuvring space than for natural resources, which often involve a combination of remote, cross-border impacts and convoluted international product chains. Particularly in the Netherlands, the negative externalities of land use may well become increasingly important in the future because of growing claims on available space and a desire for more 'compact' development. Land use and housing construction are becoming more and more intertwined with energy and transport issues and the growing externalities of land use provide a very strong case for introducing a tax on 'green-field' land.

Track 4: The European agenda

European climate policy needs to be accompanied by a parallel Europe-wide strategy in the realm of taxation. In particular, harmonisation is required in the following areas:

- European harmonisation is needed to avoid unwanted impacts on the competitiveness of (certain sections of) industry, but also as an essential first step towards reviewing international agreements and treaties that currently stand in the way of abolishing environmentally harmful subsidies and those on fuels and energy (clearing the way for a tax on jet fuel and the levying of VAT on air tickets, for example).
- Via the Energy Tax for large-scale industrial users, a CO_2 price floor can be created under the European Emissions Trading Scheme (ETS) to address the issue of highly volatile and generally low carbon prices. Reducing uncertainty has a positive impact on the affordability of climate policy and can therefore in the longer term result in greater public support for more vigorous efforts in this area.
- Another option is a carbon tax on road vehicle fuels. To avoid border effects, EU harmonisation is required.
- Likewise, a resource tax (on animal feed) is likely to require European harmonisation.

The package in more detail

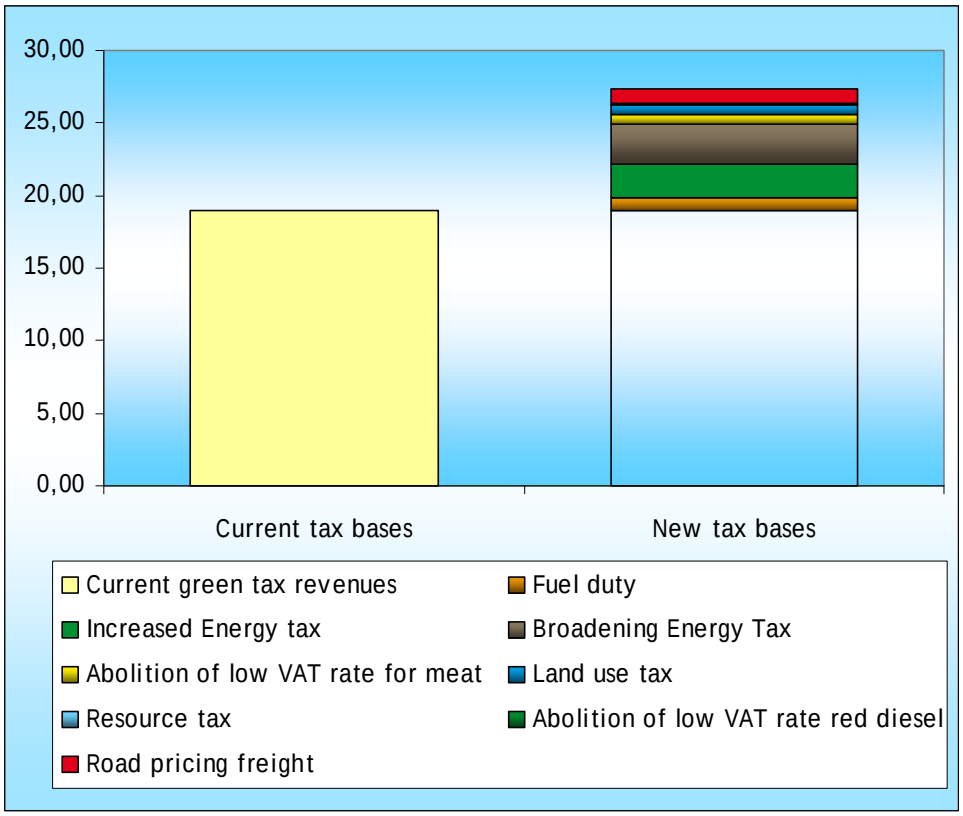
The proposed 'additional greening' package thus comprises:

- An increase in the duty on motor fuels combined with the proposed carbon tax (average overall increase in tax on motor fuels: 20%).
- Abolition of Energy Tax reductions for business and industry by setting the second and third tier rates equal to the first, combined with subsidies for energy conservation.
- On top of the existing Energy Tax, introduction of a CO_2-indexed component of 50%, to induce further energy-saving and introduce differentiation with respect to the carbon content of the various energy sources.
- Introduction of a tax on meat or animal feed that ensures that the harmful impacts of meat consumption, many of them outside the Netherlands, are passed on to Dutch consumers.
- Abolition of tax breaks such as that in force for 'red diesel' and reduced Energy Tax rates for greenhouse horticulture and industry.
- Introduction of a tax on 'green-field' land development.

Tax revenues

With the ambitious package of environmental taxes outlined, a 20% share of green tax revenue is feasible in the Netherlands, equivalent to 5% of the country's Gross Domestic Product. This figure of 5% is in line with what international studies anticipate as being the fiscal limits of a green tax system. For this level of greening, European coordination is not essential. In calculating the figure of 20% green tax revenue, due allowance has been made for the fact that reduced pollution will lead to declining tax revenues. Expectations are that this package will make a major contribution to achieving the government's environmental and climate targets, particularly the latter. With this package, an additional greening of around € 8 billion can be achieved over and above existing green revenues of some € 19 billion. The share of green taxes would then rise from 14% today to around 20%. These revenues can be recycled in the form of lower taxes on corporate profits or labour, with the additional option of using some fraction to incentivise further energy-saving by selected target groups.

Figure 1 **Revenues from current and future green taxes in 2020, € billion**



Constraints

In elaborating this strategy for further environmental tax reform, a number of constraints will need to be reckoned with:

- **Fiscal feasibility**: If they are effective, green taxes will lead to declining fiscal revenues as CO_2 emissions (etc.) fall, which is indeed the desired outcome. These declining revenues can be reasonably well forecast up to 2020/2025 and one option until then is to offset these by progressively raising the tax rate. In the longer term (post-2025) the question becomes relevant whether further reform towards new kinds of green taxes is again required in the light of the then substantially narrower tax base.
- **Public acceptance**: One crucial issue is how to ensure that private citizens and businesses accept the steady incremental rises in carbon tax rates. This is a political choice. The current linkage of tax revenue to economic growth is something that occurs automatically and with little visible prominence. The tangible visibility of rising environmental tax rates that are not linked to economic growth will be one of the thorniest issues that need to be tackled. In this study it is proposed to lay down these rates for a number of years in advance or apply an automatic correction. In addition, public acceptance will gain from visible redistribution of revenues (balancing the sweet with the sour…), for example by subsidising energy conservation or by lowering tax on labour.

– **Socio-economic feasibility**: To prevent low-income groups being disproportionately hit, the green taxes can be straightforwardly compensated, by raising the tax-free allowance (which for these groups is relatively more important). There also needs to be particular focus on energy-intensive industries competing in global markets. If these industries are unable to pass on their higher costs to consumers, the higher energy prices would need to be compensated by means of flanking fiscal policy, in the form of a subsidy on energy efficiency investments, for example.

Conclusion

The overall conclusion is that further growth of environmental taxes is feasible and that it can make a substantial contribution to building a sustainable economy, without jeopardising the stability of government revenues. If green taxes are to be effectively applied in the context of environmental and climate policy, steadily rising tax rates are essential. This is necessary not only to achieve robust improvements in environmental quality, but also to reduce the risk of financial disappointment for the Treasury. More so than today, rising tax rates subject to automatic corrections should become an integral part of fiscal legislation.

1 Introduction

1.1 The challenge of a sustainable economy

In a sustainable economy there are incentives for consumers and producers to act sustainably. Does the current tax system do this sufficiently?

Building a sustainable economy is a crucial challenge if we are to get to grips with the risks of climate change, resource depletion and biodiversity loss in the twenty-first century. A sustainable economy respects material, ecological, human and social capital by investing in it rather than consuming it. In this kind of economy, green taxes are indispensable. In this context, 'greening' the tax system can be understood as a rise in taxes on activities that are environmentally harmful and a decrease in taxes levied on other grounds, such as labour or corporate profits.

The Dutch Cabinet has stated its intention to engage in fundamental deliberations about what the Netherlands should look like in 2020, the aim being to create a smarter, greener and more robust society characterised by greater solidarity. The question then arises whether the various tax bases (labour, profit, consumption, wealth (including real estate), environmentally harmful behaviour, etc.) will provide foundations that are sustainable in the longer term. Another issue that needs to be factored in is climate change, the economic and social impacts of which will put growing pressure on public finances. This in turn begs the question whether the current mix of tax bases is sufficiently 'climate-proof'. And, finally: does the current tax system provide sufficient support for the goal of achieving a green, sustainable economy?

One important constraint in this context is that the tax system should remain as simple as possible: can the new revenue be obtained while still respecting the other goals of lower implementation costs and administrative burden?

Further utilisation of the fiscal opportunities for putting a price on the environment requires a substantive debate on the scope and limits of fiscal policy. With this report setting out elements of a green tax system we hope to give that debate a well-informed start.

1.2 Problem definition

With 14% green taxes, the Netherlands is still the frontrunner in the EU, but this figure has not risen since 1996. Is there scope for increasing the share of green taxes further?

For a number of years now, the Dutch tax authorities have been collecting some 13-14% of its revenues from green taxes in one form or another. It should be noted, though, that this kind of figure for the share of green taxes is somewhat misleading as an indicator. This is because, as in most other OECD nations, there are numerous fiscal subsidies in place in the Netherlands that have an *unintended* impact on the environment. The significance of these unsustainable fiscal subsidies is considerable, in terms of both environmental impact and budgetary claim. With these provisos in mind, though, the Netherlands still ranks among the frontrunners among EU member states with its 14% share of environmentally based taxes. Since 1996 this figure has remained more or less unchanged, however, with no major steps being taken since then to achieve any further greening of the tax system.

This begs the question of whether the tax system might at some stage run up against its own green limits and, if so, when. In concrete terms: is it feasible for the share of green taxes to grow from the current figure of 14% to, say, 20% of aggregate tax revenue? Or will we be confronted with certain limits of fiscal, social and economic feasibility?

In terms of their tax base, regulatory charges provide little stability. There is a tension between the generation of revenue and the regulation of CO_2 emissions by means of a tax.

In the first place there is a tension between the budgetary function of fiscal policy and its instrumental function for the benefit of the environment. The question here is whether a single policy instrument can be used to achieve two different objectives. The primary function of taxes is to generate government revenue for funding collective expenditures and maintaining public services. If a tax is regulatory in nature, it means the tax base provides little stability. As the economist Tinbergen demonstrated, it is impossible to secure two goals with one and the same instrument. To put it even more bluntly: if CO_2 emissions or fossil fuels were to become a pivotal steering mechanism for government revenue, we know that that revenue source can only be either 0 or 20% in 2050. On this line of argument, there are solid limits to environmental tax reform (henceforth: ETR), in the sense that CO_2 can never serve as the sole source of tax revenue, not even if the tax rates are regularly adjusted.

Secondly, continued ETR may run up against social limits. If people are to pay more for using the available 'environmental space' and ditto energy and resources, public acceptance may start to dwindle. This may mean there is a limit to what is economically and socially feasible, as illustrated by the following questions:

- Would the residents of Amsterdam be willing to pay € 5 an hour to park in the city centre?
- Would we be prepared to accept a doubling of the Energy Tax on gas and electricity, implying a 30% rise in energy prices?
- Can the proposed 'kilometre charge' – which in its current design is based on tax neutrality for the average motorist so as not to jeopardise acceptance of this new road-pricing scheme[1] – be increased further in the period up to 2020?

Is there support in society for more green taxes? And will further ETR have undesirable effects on consumer purchasing power or the international competitiveness of industry?

It may be that these questions can be answered in the affirmative if certain conditions are met with respect to redistribution of the various tax revenues. Perhaps it is not feasible at all, though, and we are set to exceed the 'collective pain threshold' for ETR in the Netherlands. While nobody is particularly happy when the taxman's blue envelope arrives with the mail, it is a key condition for the functioning of any tax system that there be faith in its basic premises.

Thirdly, there are also potentially limits to the economic feasibility of ETR in terms of impacts on income for various parties. Social acceptance and limitation of undesirable purchasing-power effects are crucial if the robustness of the future system is to be guaranteed. Energy, above all, fulfils an essential function for households. For industries competing in the international marketplace, too, the affordability of energy may be at stake. Even though there is plenty of scope for compensating the income effects of environmental taxes, there will always be redistribution effects, even if these only relate to the (intended) impact on high and low consumers.

[1] *Anders Betalen voor Mobiliteit* ('A new charge scheme for mobility').

Green taxes need to be integrated with the EU's Emissions Trading Scheme.

Fourthly, ETR also needs to be dovetailed into the existing climate and environmental policy framework. Of particular importance in this context is the relationship with the EU Emissions Trading Scheme.

Finally, in this study we have explored the scope for applying the tax system to secure environmental policy objectives. In doing so we have focused on persistent, structural environmental problems like climate change, biodiversity loss and natural resource depletion. Public acceptance of the 'green fringe' of the tax system has everything to gain from a simple message: large-scale emissions of CO_2 and squandering of natural resources are undesirable activities embodying major risks to society and are henceforth to be strongly discouraged by the government – and increasingly so as time progresses, thanks to rising tax rates.

1.3 Motives for environmental tax reform

The main goal of the tax system is to generate funds for government expenditure in an equitable and efficient manner. However, taxes can also be used for environmental protection. Three arguments can be given in favour of 'fiscal greening'.

ETR encourages a switch from environmentally harmful to environmentally friendly behaviour.

The first argument for further ETR is the environmental argument *pur sang*. The degree to which environmental taxes benefit the environment depends on price elasticity, i.e. the extent to which consumers and producers take the price rise into account in their demand for products and raw materials. The level of elasticity depends on the extent to which there is perspective for action in the form of attractive, environmentally more benign alternatives and by the design of the tax itself. By altering consumption behaviour, a structural market for sustainable goods and services will also be created.

ETR can improve overall economic efficiency by laying down pollution costs where they arise.

The second argument for ETR is that it contributes to improved economic efficiency. The basic rule here is that environmental taxes are in principle efficient if the charge rate equals the marginal social costs. It is a persistent misunderstanding that environmental taxation needs to be effective from an environmental perspective. This is not necessarily true, though. Regardless of the environmental benefits achieved, putting a price tag on social (i.e. external) costs is efficient for the economy as whole, because only in this way can consumers come to proper decisions as to the volume of environmentally harmful goods and services they should consume. Conversely, it also holds that perverse incentives for environmentally harmful forms of behaviour are economically inefficient and should therefore be abolished. Indeed, this is in line with the universally accepted 'polluter pays principle', as laid down in Article 191 of the EU's Lisbon Treaty.

The third and final argument relates to reducing the distortionary impact of taxes on the economy, as in the case of taxes on income and corporate profit. The core argument here is that revenue from green taxes allows these kinds of distortionary taxes to be pruned back, for under suitable assumptions environmental taxes may be less distortionary than other taxes. Regardless of this, though, it is socially optimal to internalise externalities in tandem with a lowering of distortionary taxes (motive 2).

2 Sustainable economy and taxation

2.1 The urgency of green taxes for a sustainable economy

Green taxes put a price on pollution and encourage sustainable change. They are an efficient instrument, securing environmental targets at lowest cost.

If in the century ahead we are serious about avoiding the threat of climate change as well as geopolitical conflicts over resources and other scarce goods, we shall have to achieve a transition to a sustainable economy by around mid-century[2]. For economists, pursuit of such an economy by the middle of the century – an economy in which the risks of climate change and biodiversity loss have been adequately reined in – is a entirely new phenomenon: a transition to be attained in a limited period of time. It is an unprecedented global challenge and while the Netherlands is by no means an insignificant player, it cannot act alone.

One of the key premises for a sustainable economy is that a price tag is put on greenhouse gas emissions and that markets and entrepreneurial acumen are then free to operate under this new constraint. This holds not only for climate change – one of the greatest challenges ever faced by mankind – but also for other forms of unsustainable resource consumption. For ease of illustration, however, we shall here focus on greenhouse gases like CO_2.

Environmental taxes and emissions trading can both lead to the 'right' price being set for carbon. Each of these strategies has its up- and downsides, which we shall not discuss here at length. Particularly when there are a multitude of emitters whose decisions extend over a longer period, though, a tax has major economic advantages over emissions trading. Under such conditions, environmental taxes that are levied *upstream* in the supply chain can make a solid contribution to environmental improvements.

In the first place, environmental taxes are an effective instrument for tackling environmental problems and climate change (OECD,1996). Environmental taxes put a price on pollution, enabling consumers and producers to make due allowance for the environment in their decisions. If the price tag is sufficiently high and there are enough green alternatives on offer, a strong, economy-wide incentive for sustainable change will be set in motion. Sterner (2006) shows, for example, that energy taxes have proved the most powerful instrument to date in the context of European climate policy. If such pricing policy had not been introduced in Europe, energy consumption would by now have risen to twice its current level.

Green taxes are also a highly efficient way of pursuing sustainability targets, as these can then be secured at the lowest possible cost. This is because individual companies that are obliged to pay a carbon tax, for example, will cut their emissions to the point at which the cost of reducing these emissions

[2] A sustainable economy can be defined as an economy that can continue to function indefinitely into the future and has thus stopped shifting its problems onto future generations and other regions of the world.

by one tonne is precisely equal to the carbon tax levied on that amount[3]. Compared with other instruments (emissions trading, regulation), the transaction costs are relatively low, moreover.

As a component of the tax system, environmental taxes provide a permanent incentive for more efficient use of energy stocks and other natural resources. In this way ETR will encourage ongoing innovation and efficiency improvements. The emergence of the effluent-treatment and waste-processing industries as well as major innovations in energy technologies (gas, carbon capture and storage, solar) are due at least in part to forward-looking fiscal policies. Conversely, the demise of the US car industry cannot be seen in isolation from the lack of sufficient efficiency incentives, as reflected in low fuel duty, with the gas-guzzling Hummer the most emblematic embodiment. In the American auto market there was, in short, a structural lack of motivation for firms to innovate.

2.2 The philosophy behind green taxes

What is required is economy-wide internalisation of environmental externalities in prices and abolition of reduced Energy Tax rates. The basic premise should be that 'the polluter pays'. An additional charge is sometimes needed to get sustainable behaviour 'kick-started', as in the case of the low price elasticities in the built environment and transportation, for instance.

Can further ETR make a major contribution to securing climate and environmental targets? From the angle of economic efficiency, the best solution is to internalise external environmental effects in prices, preferably across as much of the economy as possible. The abatement targets in force will then be allocated across companies, consumers and industrial sectors with maximum efficiency. If climate policy is to be optimal, all the various sectors therefore need to be confronted with one and the same CO_2 price, equal to the marginal costs (key concept: *internalisation*, or *efficient pricing*).

To secure the climate targets set by the Dutch government will require more than just internalising environmental costs, however. There will need to be a swathe of behavioural changes that will not be engendered simply by internalising costs. Domestic power consumption and transport mobility are characterised by limited price elasticity and considerable income elasticity. Under conditions of strong income growth, the impact of higher prices will be rendered null and void. Given issues of competitiveness, moreover, we have opted to spare the energy-intensive sectors of industry, which means a greater share of the required emission cuts is borne by 'sheltered' sectors like transportation, confronting them with higher marginal CO_2 prices.

To successfully slow down the growth of CO_2 emissions in sheltered sectors requires more than just cost internalisation, though. This kind of '*target-based pricing*' needs to be accompanied by rising tax rates, so as to steer behaviour effectively in a environmental friendly direction. Increasingly, this principle is being incorporated in European climate policy.

In many sectors, external costs are still not covered by the taxes and charges levied. While this is true of depletion of a broad range of natural resources, it is above all pertinent for carbon emissions. In the case of agriculture, for example, there is scarcely any kind of policy geared to internalising carbon costs. Indeed, for greenhouse horticulture and agriculture there are various tax breaks in force, such as lower Energy Tax rates and lower duty on 'red diesel', motivated among other things by considerations of competitiveness. For industry, too, a similar picture emerges, with substantially lower rates in

[3] If a firm's marginal abatement costs are less than the carbon tax, it can reduce its tax expenditure by cutting its emissions further. If its marginal costs are higher, it will pay the tax rather than pursue further emission cuts.

place for the Energy Tax[4]. With a low marginal energy price, these sectors in particular have little if any incentive to reduce their energy consumption. To make an efficacious as well as cost-effective contribution to securing climate targets and encourage these industries to attend more to their consumption at the margin, it is essential to abolish the reduced Energy Tax rates currently in force for agriculture and industry, without affecting their competitiveness.

For the built environment and transportation sectors (the latter comprising road passenger transport only) the current situation is that energy-based charges are *higher* than the CO_2 costs, while price elasticities are modest. In other words, to render transport and the built environment more sustainable means that higher tax rates are required than the current social costs of CO_2 emissions if behaviour is to be effectively influenced[5]. This is also in line with the observation that many consumers and entrepreneurs do not switch to a sustainable alternative while costs or profits remain unchanged. A serious transition will only occur if there are additional financial gains compared with pursuing an 'economically equivalent' alternative.

Lock-in

One important argument for creating stronger incentives is that the decisions of both producers and consumers are currently locked into the existing technological system. While this system may originally have been desirable, today it is no longer optimal. This means that a one-off increase in energy prices by way of an additional charge will not simply remedy the situation overnight. For a successful transition to sustainability, it is not enough to set a level playing field for sustainable alternatives. To turn the tide, it is essential that a stable market be created that is embedded in some form of international coalition under which energy and resource prices will have to steadily rise and new technological advances be suitably incentivised.

Lock-in: the QWERTY keyboard and the combustion engine

Examples of infrastructure that suffers from 'lock-in' are to be found in various areas, including road and rail systems, electrical power grids and motor fuel distribution systems. Unless the dominant technology is superior to other conceivable variants, we have a suboptimal situation. The classic example here is the QWERTY keyboard, which may be the uncontended standard, but is not deemed superior. Important evolutionary insights have been presented by the Council for Housing, Spatial Planning and the Environment (VROM-Raad, 2004) and RFF (2004). Today's production and transportation system is highly dependent on cheap fossil fuels, the 'head start' gained by the internal combustion engine (due to initial conditions). The combustion engine was once an efficient system, but as the downside of burning fossil fuels becomes ever more apparent, this may no longer be the case. Because our transport infrastructure, filling stations and so on are all intimately geared to the existing production and transport system, the switch to alternative fuels, production technologies and transport systems will be hugely expensive.

---

4 In general the tax rates for large-scale energy consumers (i.e. heavy industry) are far lower than those for small-scale consumers like households. The tax rates for industry are kept relatively low so as not to affect competitiveness in international markets. Based on the rates for 2002, Van Beers *et al*. (2002) calculate that such treatment amounts to these large-scale energy users receiving energy subsidies to the tune of €1.6 billion a year (with a uniform tariff starting at the second tier) to €5.2 billion (uniform tariff starting at the first tier). Dutch Energy Tax rates are reviewed on page 45 of this report.

5 It should be borne in mind that current external costs are not constant, either, but on the rise, simply as a result of ever tougher climate targets and rising marginal abatement costs.

2.3 A sustainable tax system: climate-proof taxes

Climate change will mean an increase in government expenditure and declining revenues. The combination of climate change and demographic trends will put government finance under double pressure. Traditional tax revenue will become less guaranteed, while green taxes broaden the tax base and depend less on economic growth.

Climate change is now unavoidable and adaptation is essential if we are to alleviate the consequences. For the Netherlands it will mean higher average temperatures, changes in precipitation patterns, more extreme weather events and rising sea levels.

The current economic crisis has left the tax-payer with a deficit of € 34 billion, a figure necessitating drastic adjustments to the National Budget. This deficit is the result of the credit crisis and the subsequent recession, which has hit the Dutch economy hard. At the same time there are a number of commentators (among others, Al Gore) who are pointing to linkage between the current crisis and climate change, charging the global economy with taking too little account of the ongoing depletion of natural resources and degradation of the biosphere.

Whatever the case, in the coming decades public finance will become increasingly dependent on the direct and indirect impacts of climate change, in the form of extra expenditure and declining revenue, respectively. To make matters worse, climate change is occurring against a backdrop of a steadily aging population. The 'double whammy' of climate change and demographic trends will put major pressure on the sustainability of government finance, on both the income and expenditure side (see box).

Climate change: the impact on public finance in a nutshell

The consequences of climate change for government finance depend very much on the climate scenarios that play out. In 2007 the Dutch DNB bank did not expect government outlay on dike reinforcement (data that were later updated) to rise any faster than growth of GDP. The impact on public finances would be only modest. It is to be queried, though, whether the bank made sufficient allowance for the indirect impacts on the revenue side resulting from a decline in economic growth. At the request of the German Finance ministry, Ecologic and INFRAS came to the conclusion that both effects will become very apparent from about 2050 onwards. It cannot be ruled out that the consequences of climate change in terms of both the cost of adaptation measures and impacts on GDP will very much coincide and be highly correlated.

Climate change will also make the economy, and thus tax revenue, vulnerable to fluctuations and economic recession. Traditional tax bases like income, capital, consumption and perhaps also property and other forms of private wealth will thus lose some of their present stability.

According to the Stern Review (Stern, 2006) the economic consequences of non-intervention ("the cost of inaction") could be as much as 5-20% of global GDP in 2050. This will be due above all to the impact of floods, droughts and storms. If, instead, we intervene with appropriate urgency and give carbon emissions their proper price via international coalitions to prevent these climate change impacts occurring, the aggregate costs of such intervention will amount to about 1% (to 2%) of global GDP in 2050.

At present, tax revenue keeps apace with the trend in GDP, reflected in a value of 1 for the so-called macro-economic progression factor (MEP)[6]. If the Dutch economy weakens, traditional tax revenue from VAT, income tax and corporation tax also become uncertain. This may make a further broadening of the tax base an attractive proposition, to reduce the dependency of tax revenue on economic growth. At the same time, consumption of energy and resources are likewise dependent on economic growth. As tax bases, however, these probably have an elasticity *lower* than that of labour. For this reason, a shift of the tax base from labour to energy, resources and the environment could potentially help stabilise government finance.

2.4 Conclusion

Proper price incentives with full incorporation of environmental costs are an important precondition for creating a sustainable economy. Besides internalising costs, green taxes also need to induce sustainable behavioural change, especially in situations of low price elasticity and absence of international competition (built environment and transportation).

In the absence of appropriate government intervention, the economy makes insufficient allowance for a wide range of environmental values. This is because the costs of pollution and environmental damage are not borne by the parties causing them but passed onto others. With environmental taxes in place, environmental costs become internalised in prices, inducing both consumers and producers to make greater allowance for the external costs they cause in the decisions they make. Such action constitutes a first, efficient step towards a sustainable economy.

This first step is especially important in agriculture and industry, where there is currently a substantial 'deficit' in the share of environmental costs actually paid. Further greening of the tax system has much to gain from the removal of 'perverse' subsidies and harmonisation of the Energy Tax rates paid by households and industry (i.e. the segment not covered by the EU Emissions Trading Scheme). This would permit equitable and cost-effective distribution of efforts across the various sectors concerned.

The question, though, is whether this principle of *efficient prices* is enough. In sectors like transportation and the built environment additional action will be needed to induce behavioural change and create a sustainable society. If tax reform is to make a major contribution to sustainability policy, the setting of tax rates needs to be based on a different principle: regulation of behaviour. This principle of target-based pricing – using prices to achieve a particular policy goal – is becoming an increasingly common feature of European climate policy. Timely disclosure of future tax rates will create the transparent investment climate that is indispensable for creating a sustainable economy.

6 This index indicates the percentage growth in tax revenues for every 1% growth in GDP.

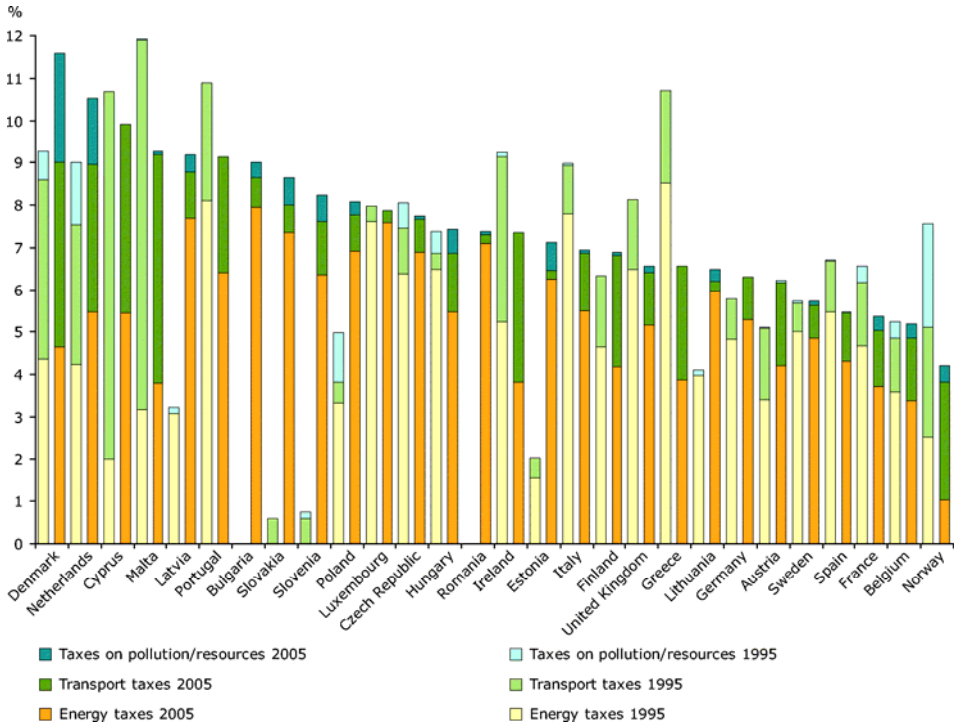
3 How green are our taxes?

3.1 Where do we stand today?

With its 14% of green taxes the Netherlands is still up with the front-runners, but precisely for this reason is a victim of the 'dialectics of progress'. In the EU as a whole the share of green taxes has even declined and at 2.6% of GDP is now at the lowest mark in ten years ('degreening').

In this section we provide a brief synopsis of how the Netherlands is doing in terms of greening its tax system compared with other EU member states. Within the EU the Netherlands is still up with the front-runners (Figure 2), but at the same time there are clear signs that its pioneering role is now holding it back: it is a victim of the 'dialectics of progress'. Although the share of green taxes in aggregate national tax revenue continued to grow between 1995 and 2005, that growth (from 9 to 10.5%) was no longer as spectacular as it had been in the early years.

Figure 2 Share of green taxes in EU member states, 1995 and 2005

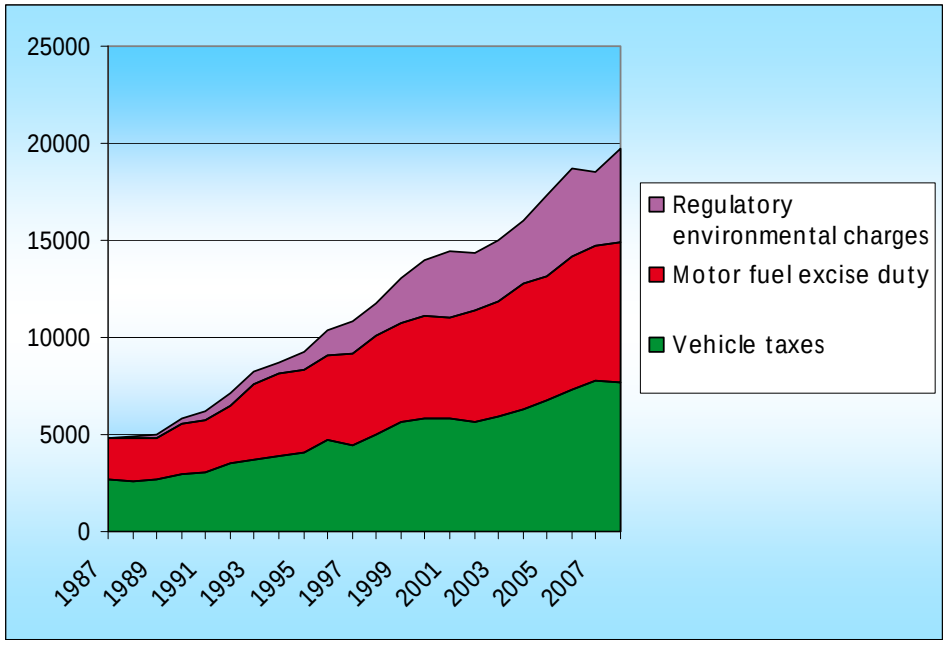


Note: Note that the share of green taxes reflects not only the rates at which these taxes are levied, but also various structural characteristics of the economy (providing the tax base) such as national fuel consumption and ditto energy consumption (low or high energy intensity of the economy). A high percentage of green taxes is therefore not necessarily a positive thing.

Source: EEA.

The picture for the Netherlands is depicted in Figure 3. Between 1990 and 2006 tax revenue from green taxes[7] rose from almost € 9 billion to 19 billion. Since 1995 this share has risen steadily in proportion to the country's total tax revenue. As a result, the share has remained virtually unchanged at around 14% in recent years. As aggregate tax revenue has in turn kept apace with growth of GDP, the share of green taxes relative to GDP has also remained unchanged.

Figure 3 Green tax revenue (Millions of Euros) in the Netherlands, 1987-2008

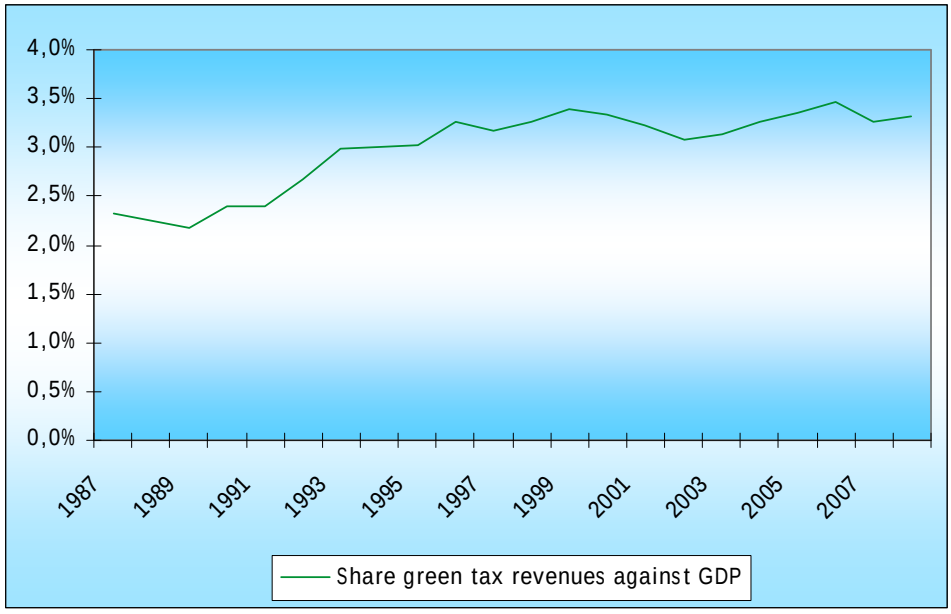


Source: CBS, Statline.

Within Europe, following an initial rise in the share of green tax revenue we see stabilisation setting in in the 'old' member states. In the past few years there has even been a slight decline: since 1999 the share of green tax revenue in the EU-27 has fallen to its lowest mark in ten years: 2.6% of GDP. This decrease is due above all to implementation of lower energy taxes (in the larger member states and Greece), while revenue from the other environmental taxes has remained more or less stable. In the rest of this chapter we discuss the possible reasons behind these developments.

7 The term 'green taxes' is taken to encompass (the revenue from) pure 'environmental taxes', excise duty on mineral oils, and vehicle taxes (Vehicle Circulation Tax and Vehicle Purchase Tax).

Figure 4 **Green tax revenue as a proportion of GDP in the Netherlands**



Source: CBS, Statline.

Differentiation

The regulatory function of green taxes can be increased by employing differentiated tax rates, a strategy that is particularly effective if there is little difference between the various alternative options available. Without any rise in the overall tax burden, in the Netherlands numerous taxes have been environmentally differentiated. One example of effective differentiation of fuel excise duty with respect to fuel sulphur content: within just a few months the entire market had switched to low-sulphur fuel. The differentiations in vehicle taxes (Vehicle Circulation Tax, Vehicle Purchase Tax and the company car tax charge) are also good examples. In the past few years the environmentally motivated grading of existing taxes and a number of dedicated tax incentive schemes[8] have led to market introduction of a range of environmentally benign products, technologies and fuels. As stated, differentiated tax rates are particularly effective if there is little difference between the various alternatives available, as it temporarily bridges the price differential between more benign and traditional options.

3.2 'Contamination' of green taxation

Over and against green taxes stand unsustainable, 'perverse' subsidies that encourage consumption of fossil fuels. In the Netherlands we are talking about € 7.5 *billion* support annually, leading to emissions of 6 Mt of GHG.

At first sight, a 14% share in national tax revenue for green taxes may sound like a lot. However, this simple indicator ignores a whole range of unsustainable 'fiscal subsidies'. On top of this, today's tax system also embraces numerous subsidies that unintentionally have an adverse environmental impact. Without any attempt at completeness, the prime examples include the following: Energy Tax reductions for industry and greenhouse horticulture; exemptions and reduced rates on fuel excise duty (including those in force for aviation, shipping, 'red diesel' and LPG); the low

8 The Energy Investment Deduction (EIA), Environmental Investment Allowance (MIA), Accelerated Depreciation of Investment in Environmental Equipment (VAMIL) and Green Investment schemes.

VAT rate for meat and for flowers and ornamental plants; and the fiscal treatment of business travel.

The importance of pruning back perverse subsidies

According to one recent estimate (Beers & Van den Bergh, 2009), the Netherlands currently has 41 off-budget schemes that encourage consumption of fossil fuels, with all the adverse impacts on environment and climate this implies. All told, approximately € 7.5 *billion* government support is provided in this way annually, a subsidy associated with 6 Mt greenhouse gas emissions. This estimate depends very much on the definition employed and inclusion of the reduced Energy Tax rates for industry and greenhouse horticulture under the heading *fiscal subsidy*.

The IEA (IEA, 2008; IEA, 2002) have estimated that if all the world's subsidies on fossil energy resources were removed it would lead to a 10-12% reduction in greenhouse gas emissions by the year 2050. In the 20 largest OECD countries the funds involved totalled € 318 billion in 2007, equivalent to around 1.2% of these countries' GDP. The G20 has reached agreement on gradually phasing out all such subsidies on fossil fuels, although the legal status of the plan is as yet unclear.

Although there were once good reasons for these unsustainable subsidies, in an era of shrinking energy resources and climate change there are solid reasons for abolishing them. Such reforms are an indispensable part of any effort to green the tax system and create concrete incentives for sustainable development. Removing these subsidies also reduces administrative expenditure and the potential fraud that inevitably accompanies such schemes and helps simplify the tax system, moreover. Finally, it leads to greater national economic efficiency and consequently boosts economic growth.

3.3 Results to date

It is hard to isolate the effects of environmental taxation from other impacts, such as those associated with GDP growth and long-term societal trends. It is above all in the longer term that price changes have a real impact on car use and ownership and loft insulation, for example.

In practice, green taxation is almost always rooted in a combination of motives: the regulatory motive to induce behavioural change and the motive of earning government revenue, with sometimes one predominating, sometimes the other. In this section we focus on the results achieved to date.

Environmental impacts

It is no simple matter to evaluate the environmental impact of green taxes. There is often a broad array of policies in place and there are also other factors at work (in particular, growth of GDP), making it difficult to isolate the 'pure' effects of environmental taxes. Nonetheless, there is growing insight into these impacts. A study by the OECD (*The political economy of environmentally related taxes*, 2006) reviews the results then available from various OECD countries. The conclusion is that environmental taxes do help improve environmental quality. Although in economic terms demand for many of the tax bases in question is technically inelastic[9], the price elasticity does generally differ significantly from zero. This means that demand for the product in question will indeed fall as its price rises. This is borne out by a variety of studies that found, for both energy and motor fuels, relatively low price elasticities for the short term and higher elasticities for the longer term. This can be explained by the fact that decisions on issues like investments,

9 A tax base is said to be inelastic with respect to demand if the price elasticity is between 0 and 1 (in absolute terms). An elasticity of – 0.2, for example, means that a 10% price rise leads to a 2% decline in demand.

private vehicle purchase and loft insulation often take time. Long-term price elasticities with respect to traffic volume, fuel consumption and vehicle ownership are a factor 2 to 3 higher than short-term elasticities, for example. Even when the product has a positive income elasticity in excess of 1 (as in the case of transport), the tax base can be increased as long as there is positive economic growth and the price elasticity is negative (fiscal function).

The Netherlands Bureau for Economic Policy Analysis (CPB) and Ecofys have also concluded that the Dutch Energy Tax has contributed significantly to the effectiveness of climate policy, particularly in the built environment. A study by Ecofys (2005) comparing policies aimed at the built environment concludes that the Energy Tax is the most efficacious as well as cost-effective policy in place. In other words, an energy tax gives the greatest CO_2 emission cuts at least cost. This is above all because the Regulatory Energy Tax, to give it its full name, impinges on all forms of energy consumption, while other policies are more selective in scope. Combination with other policies is also pivotal (see box).

Green taxes and flanking policy

In assessing the environmental impact of green taxes it is important to consider their relationship with other policies, as these may sometimes play a crucial role. A case in point are the Dutch energy performance standards for new housing. The way for these 'EPC standards' was paved by first of all subsidising low-energy heating systems and loft insulation (via the now defunct MAP and EPR schemes). This facilitated acceptance of the standards by developers, as they were able to fall back on a mature market for low-energy heating appliances. At the same time the standards also appealed to house-buyers, who could recuperate the higher initial outlay through savings on their energy bill (now with a higher Energy Tax surcharge). In this way a combination of standards and the Regulatory Energy Tax has helped create a structural market for efficient heating appliances, sustainable home-based energy generation technologies and insulation materials in the Dutch construction industry.

Recent calculations by CE Delft indicate, for example, that simultaneously increasing the duty on petrol, diesel and LPG by 14, 20 and 12 Euro cents, respectively, would cut CO_2 emissions by at least 1.8 Mt annually (CE, 2009). As a comparison, the government's 'New Driving' campaign to promote efficient driving habits will achieve a reduction of around 0.6 Mt (CE, 2008). Once again, the anticipated effectiveness of a carbon tax is due to this measure leveraging fuel consumption across the board (driving style, number of journeys/volume reduction, purchase of fuel-efficient vehicles), while other instruments only impinge on particular elements ('New Driving' only on driving style, for instance).

Green taxes encourage innovation and ecological efficiency and can create competitive advantages. It is then essential, however, that investors can rely on coherent and consistent government policy for the longer term.

Innovation dynamics

Green taxes create a permanent incentive for innovation – to improve the 'eco-efficiency' of production processes and consumption patterns and thereby achieve cost savings. This will also create new opportunities in the global marketplace and, importantly, eco-efficient innovations may also give companies a competitive edge. Thus, the robust water pollution charges that have long been levied in the Netherlands have not only led an improvement in surface water quality, but also to innovative water treatment industries with a strong position in foreign markets (the 'first-mover effect'). Another example is provided by innovation dynamics in the built environment, where a range of new technologies (high-efficiency boilers, home insulation techniques, solar photovoltaics, solar boilers) have found their way into both new and existing dwellings, through a combination of energy standards and the Energy Tax. As

eco-efficient innovations often relate to decisions with a long-term horizon, for the investor bearing the risk it is often also very important that relevant government policy is transparent, coherent and consistent over the longer term. Promoting innovation is a key issue, in terms of securing national environmental targets as well as from a purely economic perspective. Green taxes are one way of achieving this aim.

There is no cut-and-dried picture of the impacts of greening on employment. The OECD projects a neutral to slightly positive effect on employment if the tax burden shifts from labour and capital to the environment.

Employment

The potential employment gains of ETR are as yet unclear. On the face of it, a shift in the tax base from labour and corporate gains to the environment would appear to have a positive impact on both environmental quality and employment: the so-called 'double dividend'. By increasing the price of energy, for example, energy consumption should fall, and by lowering the price of labour, employment should rise (the 'substitution effect'). Among analysts the additional welfare impacts of removing this distortion are the subject of considerable debate (see box). The OECD anticipates a neutral to slightly positive impact on employment if the tax burden is shifted from the production factors labour and capital to the factor environment (OECD, 2004a).

Employment effects of ETR

In the 1980s it was claimed that shifting the tax base from labour to the environment could well lead to additional welfare gains because it would reduce the distortionary action of taxation (the so-called 'excess burden'). By engendering a rise in employment along with a reduction in environmental burden, it was claimed, such a shift could yield a 'double dividend' (Pearce, 1991). This vision had been questioned, though, among others by Bovenberg & de Mooij (1994), who argue that in well-functioning labour markets the total excess burden does not decrease, because higher prices due to environmental taxes are passed on to employers. Because green taxes have a narrower tax base than taxes on labour, there may even be a negative impact on economic welfare. This finding – which may have had a significant impact on the (stagnating) development of green taxes in the Netherlands – was elaborated in greater nuance in later, more refined models. Under certain assumptions it may well be feasible to reduce unemployment through a tax shift from labour to the environment (Schöb, 2003). Particularly in countries with involuntary unemployment, this kind of shift can have a positive effect. Environmental taxes may also bring dynamic benefits, such as greater innovation in environment-saving rather than labour-saving technologies (den Butter *et al*., 1995).

3.4 Tax greening and fuel prices

Trusting high oil and gas prices to come to the rescue in addressing climate change is wishful thinking. High fuel prices are no substitute for climate policy and greening the tax system.

There are a number of trends emerging that may put increasingly structural pressure on fossil fuel markets, such as sharply rising demand in countries like China and the growing scarcity of easily exploitable reserves. It was these trends that Shell's former CEO Jeroen van der Veer had in mind in his much-publicised quote that "the era of cheap oil and gas is over", in reference to a future in which the trend in oil prices will be persistently upward and oil stocks will be ever harder to recover. High fuel prices act as an incentive to speed up conservation measures, causing a decline in energy consumption and carbon emissions. The question, then, is whether we can count on high oil and gas prices securing international and national climate targets for us automatically. This line of thinking is illustrated by the following quote, which has been cited approvingly time and time again: "So the market has achieved what international bureaucrats – hampered by resistance from key consumer

countries like the United States, China, Australia and India – have struggled to obtain in a decade"[10].

In an article in *Energy Policy* (Veille & Viguier, 2007) this kind of reasoning has been critically reviewed. As a result of the high oil prices during the 1973 oil crisis, substantial energy savings were indeed achieved. However, the oil price argument ignores the occurrence of income effects (reduced demand) and substitution effects (from gas and oil to coal). This can be illustrated by the major rise and similarly substantial fall in oil prices in 2008 owing to reduced demand as the financial crisis started to take hold. Although in itself that crisis is to be deemed a factor external to oil price trends, high oil prices clearly put a brake on global economic growth, thus depressing demand for fuel. High oil and gas prices cannot therefore be regarded as a reliable substitute for climate policy.

Placing too much faith in an upward trend in fossil fuel prices is wishful thinking for another reason: the interaction between oil prices and effective climate policy. Global climate policy, if effective, will lead to a structural decline in oil demand, causing the price of this commodity to fall. In a situation of effective global climate policy, with prices for carbon emissions projected to rise, oil producers have a strong interest in depleting today's fossil reserves as rapidly as possible (before 2025) to minimise future losses of revenue. In this context, massive 'dumping' of crude oil is even conceivable, given that the value of oil company assets will show a sharp decline as climate policy grows steadily more stringent.

Finally, the welfare costs associated with a (global) increase in oil prices are many times greater than those accompanying a global carbon emission tax. For oil-dependent nations, high oil prices can be regarded as a kind of tax on consumption, the revenues of which do not accrue to the government but to oil-producing nations (i.e. in addition to the 'deadweight' loss, a negative transfer, too). In contrast, the welfare costs of international CO_2 pricing are generally only modest, as long as arrangements are efficiently designed via global emissions trading or an internationally coordinated tax.

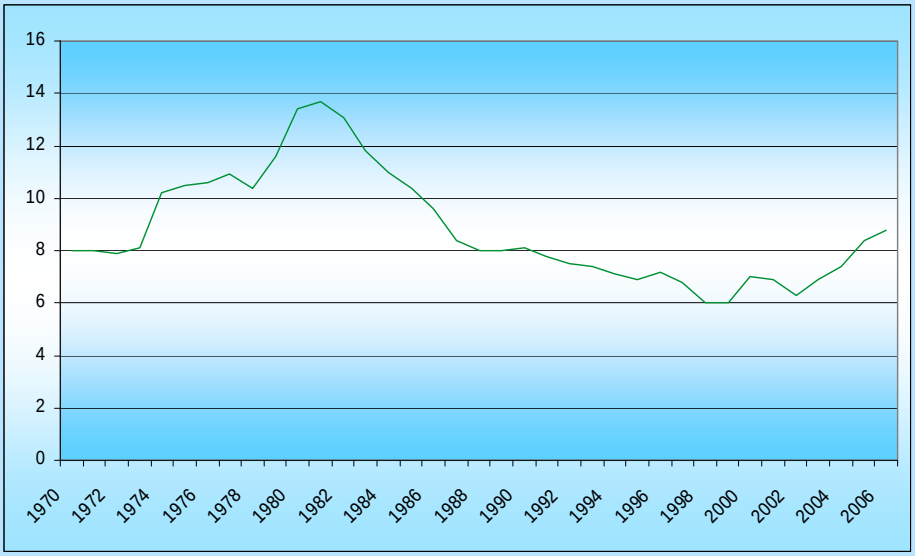
Practical experience with energy taxes thus tells a different story. In the Netherlands and elsewhere, high fuel prices have been an important motive for postponing or cancelling scheduled green taxation measures. Since 2005 there has even been a measure of 'degreening' within Europe, with the average EU share of green tax revenue as a percentage of GDP declining somewhat. This is probably due to the high energy prices we have seen since the turn of the century, with a further marked increase starting in 2005. This points to a strong tendency to lower the tax burden as energy prices rise. In the Netherlands, too, the high fuel prices in 2005-2008 were accompanied by repeated calls for government intervention. In 2008 the scheduled increase in the Energy Tax (from 20%) floundered for lack of political support, with strong opposition from both industry and consumers. Paradoxically enough, by the end of 2008 prices were again back at their old level, thanks to the initial economic effects of the financial crisis. As an illustration: when the government brought out its May 2008 'Communication on green tax reform', the oil price stood at USD 115 a barrel, rising to USD 145 when the communication was discussed at the end of June, only to drop back to USD 75 per barrel at the end of 2008.

---

[10] E. Rhein of the European Policy Center in the International Herald Tribune of 31-12-2005, cited in Veille & Viguier, 2007.

In Western countries direct energy costs generally make up a relatively low fraction of household expenditure. In European OECD nations energy costs stood at around 9% of GDP in the year 2000. Despite energy prices continuing to rise, in historical terms the share of energy costs in GDP had long been declining. In 2000 the average Dutch family spent about 3.6% of its disposable income directly on energy (excluding transport fuels), compared with around 5% in 1950. Unsurprisingly, though, from around 2000 onwards the share of energy costs in GDP started to rise, as shown in Figure 5. Although this figure is for the US economy (for lack of Dutch and European data), with energy tax rates differing from those in Europe, we see approximately the same trend on both sides of the Atlantic.

Figure 5 Trend in energy costs as a percentage of GDP, US Economy



Source: Energy Information Administration (EIA). US Government.

3.5 Lessons learned

Within the EU there is growing support for a carbon tax for sectors like agriculture, transportation and the built environment, with tax rates geared to environmental targets.

How green is the grass on the other side, that is, in other countries? As discussed above, the Netherlands is no longer leading the pack when it comes to ETR and so we can learn from developments elsewhere. Increasingly, European member states are introducing environmental charges indexed ever more strongly to specific environmental problems. Examples include tax differentiation with respect to fuel sulphur content, road infrastructure usage (Austria, Germany, the UK), pesticide use (Norway, with tariffs differentiated according to environmental and health risks) and household refuse charges (indexed to the volume of kerbside waste).

One trend that is clearly emerging is introduction of CO_2-differentiated energy taxes for non-ETS sectors like agriculture, transportation and the built environment. The European Commission is considering making it mandatory for EU member states to levy a tax on energy use and CO_2 emissions in the agriculture and transportation sectors. Countries like Sweden and Denmark have already introduced a carbon tax and in France negotiations are at an advanced stage (see box on next page). In the case of transportation and the built environment, there is no competition from outside the EU. Compared with the current Dutch Energy Tax this means indexing the tax to the carbon content of the fuel or energy carrier (with separate rates for waste heat and district heating) and mode of generation (based on suppliers' fuel mix, for example). A carbon tax will thus encourage behavioural change, encourage

increased investment in sustainable energy systems and alter the power generation fuel mix. For households, this will make it more appealing to opt for green electricity or low-carbon energy carriers like waste heat and district heating.

France: the 'Tax Carbone'
In France a proposal had been launched to introduce a new tax on oil, gas and coal consumption, amounting to € 17 per tonne of CO_2. The tax would be collected at the petrol pump and via domestic energy bills. There will be no increase in electricity prices; 80% of French electricity is nuclear-generated.

A committee of experts has suggested the tax should be even higher: € 32/tCO_2 (in 2010), with this figure rising annually by 5% to € 100 in 2030. If the plans go ahead it would in principle cost households between € 78 and € 344 a year, with petrol likely becoming 7-8 cents a litre dearer and diesel 9 cents. In principle, receipts from the tax are to be redistributed in such a way as to offset any increase in overall tax burden for the average household.

At the end of 2009, however, France's Constitutional Court declared there were too many exemptions from the tax, creating inequalities between various categories of energy consumers. According to the Court, 93% of industrial emissions are exempt from the new tax, with over 1000 heavy industrial polluters not having to pay the € 17/t carbon tax. It is by no means clear, however, whether a simple change to the law will induce the Court to rule positively on the proposals.

One of the key issues in this context is whether this kind of energy or carbon tax should also apply to industry. As the ruling by the French Constitutional Court shows (see box), there are legal grounds for objecting to the large number of exemptions from the 'Tax Carbone', which has been shown *de facto* to exclude 93% of industrial emissions. Note that a degressive tax structure (as in the case of the Dutch Energy Tax) does not breach the principles of equality and non-discrimination. Although the full implications of the French Constitutional Court's ruling are as yet unclear, it may signify that new carbon taxes may not make too many major exemptions for particular (industrial) sectors.

In many EU member states, however, the tax burden of carbon/energy taxes is currently very unevenly distributed (as in Finland, Denmark and the UK, for example), with households responsible for 20% of energy consumption shouldering up to 60% of all energy taxes. This is all the more surprising as truly cost-effective abatement measures are to be found precisely in industry. Other critics point to the high carbon content of the fuels generally burned by industry: oil and coal. If it can be demonstrated that these industrial users will suffer competitively, then European coordination will be required. At the same time, though, such impacts can be softened by means of suitably designed redistribution schemes, as the case of Denmark shows.

In the transportation sector, too, pricing instruments will have to be aligned to a far greater extent with CO_2 emissions. The relatively high taxes on fuels and vehicles in place in Europe have led to cars being far more fuel-efficient on this continent than in the US, for example. Fiscal policy, and pricing policy in general, can therefore certainly be effective. In the European context, a growing number of EU countries are taking recourse to CO_2 differentiation of vehicle purchase tax, as is the case in the Netherlands. An important argument for such differentiation in VPT is that the benefits of efficient vehicles accrue mainly to consumers, the costs and risks to producers. Consumers generally

give less consideration to savings arising during the usage phase, a market failure amenable to correction by introducing incentives at the point and time of vehicle purchase.

3.6 Conclusion

In the Netherlands 14% of tax revenue can be characterised as green, although this figure is somewhat contaminated due to the existence of unsustainable, 'perverse' subsidies. Green taxes have been effective in boosting energy efficiency, particularly in the built environment and transportation sectors. Because of their generic, economy-wide nature, their impact on fuel and energy efficiency has often been greater than that of the other policies that have been rolled out, despite the relatively modest price elasticities involved.

On their own, high oil prices are not enough to spur the transition to a sustainable energy supply; for that challenge, far more is required. What the oil price argument fails to recognise is that there will be income effects (reduced demand) and substitution effects (from gas and oil to coal). In addition, the welfare costs of a given reduction in carbon emissions will be many times lower if it is achieved by efficiently pricing those emissions (whether via taxes or trading) rather than by way of high oil prices.

As recent experience shows, however, theory and practice may be two very different things. Thus, high oil prices have served as a political motive for calling off further environmental tax reform, given the strong opposition to continued rises in energy prices. While carbon and energy prices remain so volatile, however, policy-makers and politicians would do well not to succumb to the temptation of letting decisions on further greening hinge on such 'whims of the day'.

This volatility of energy prices and the desire for more robust regulation of carbon emissions are important reasons for seeking tax bases more closely aligned with those emissions. This is in line with the European trend of basing energy taxes to an increasing extent on CO_2 emissions. The key issue, then, is the sustainability of carbon as a tax basis, which will now be discussed in the following chapter.

4 Constraints on green tax reform

4.1 Introduction

At the time of writing in 2009, the Dutch tax system can be said to have a solid green fringe, with 14% of tax revenue deriving from green taxes in one form or another. Is there scope for further environmental tax reform in the future, or are we already approaching the 'limits to green'? In the Netherlands we may indeed possibly be running up against a number of limits, in terms of:

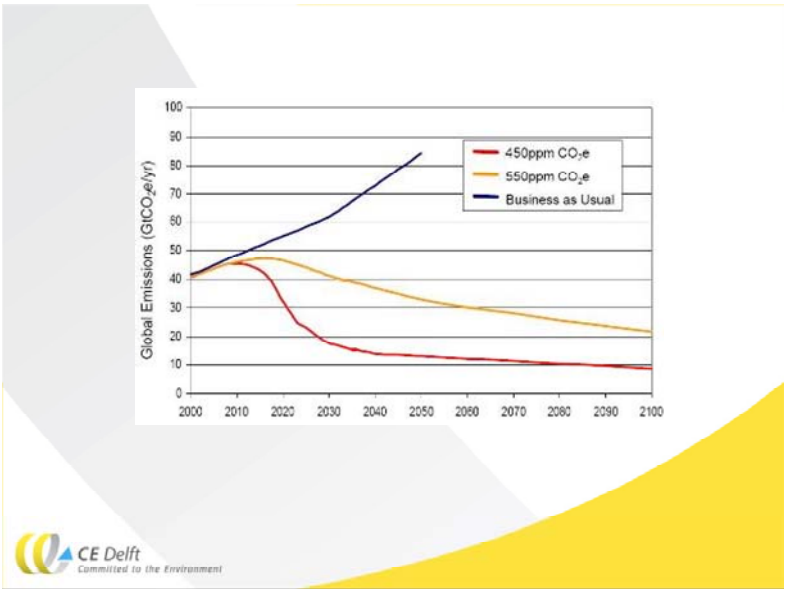
- Fiscal feasibility.
- Public acceptability.
- Socio-economic feasibility.
- Policy feasibility (relation with emissions trading).

4.2 Fiscal feasibility

Environmental taxes should not be seen as a guaranteed source of government revenue. When the environmental target is achieved, the pollution will have been halted, but so too will the revenue flow. In this sense an environmental tax is anything but 'sustainable'.

The emissions stabilisation path required to secure the target of 2°C warming means we must reduce global CO_2 emissions very substantially within a relatively short period of time. This is illustrated in Figure 6, a graph taken from the Stern Review showing the required cuts in global greenhouse emissions if we are to stabilise atmospheric GHG levels (measured as CO_2-equivalents) at 450 parts per million[11]. 'Stabilising' concentration levels means reducing emissions by 20-30% by the year 2020 and by over 80% by 2050 relative to 1990 levels. Employing a carbon tax to steer the country down this kind of stabilisation path will mean the tax base will gradually decline to around 20% in 2050.

Figure 6 Emission stabilisation paths required for selected atmospheric CO_2 concentrations (ppm)



Source: Stern Review.

[11] The target of 2°C warming can only be secured (with 50% confidence) if the concentration in 2050 can be kept to around 450 parts per million, falling to around 400 by 2080.

In contrast to traditional tax bases (labour, corporate profit, consumption), whereby tax receipts gradually rise as long as there is economic growth, CO_2 is not sustainable as a tax base in the longer term[12]. The future decline in carbon emissions will lead to a decline in the revenues accruing from this tax base and its differentiations. To guarantee stable revenues under such circumstances, tax rates will have to be adjusted upwards from time to time. In this respect two aspects are important:

1. Autonomous improvements in carbon efficiency.
2. The regulatory impact of the carbon-motivated tax itself.

In both cases, current assessment methods provide an sufficiently reliable framework for arriving at a good estimate.

Autonomous carbon efficiency improvements

For dwellings and motorised transport, CO_2 reduction trends can be reasonably well projected into the medium term. For example, EU legislation on the CO_2 emissions of new cars[13] will mean a projected 2-3% annual improvement in the efficiency of newly sold vehicles over the coming years. In the case of newbuild housing, CO_2 performance standards look set to induce an efficiency improvement of around 20% by the year 2012[14].

With this knowledge, it is very well feasible to establish future tax rates that are robust to autonomous declines in CO_2 emissions. It may be added, though, that success in this respect will depend largely on the credibility of national and European climate policy.

Regulatory effects

It is equally feasible, moreover, to make a reliable estimate of the required behavioural effects themselves. For numerous segments of the economy we today dispose over state-of-the-art models for calculating the ins and outs of different tax measure. With this knowledge, it should be possible to make due allowance for behavioural effects in the precise level of tax rates, in order to achieve (ex-post) budget neutrality. The question, though, is to what extent this will be deemed socially acceptable. The fact that exhibiting the desired behaviour will, on average, be taxed may lead to public opposition.

For many green tax measures, then, the required periodic rises in rates are fairly easy to predict. By fixing these for many years in advance, a stable climate for sustainable investments can be guaranteed. This could be achieved, for example, by means of framework legislation or a clause in the Tax Act stating that rates will be adjusted to allow for autonomous CO_2 efficiency improvements.

Not only will this provide a reliable early synopsis of future environmental tax rates. It will also avoid intense political and/or public debate with every new proposal to adjust those rates. A periodic review by an independent body (such as the Netherlands Environmental Assessment Agency or the Netherlands Bureau for Economic Policy Analysis) as to whether the rates are still in step with the autonomous trend in carbon emissions would provide guarantees vis-à-vis tax returns and bolster social acceptance.

---

12 Note that the growing vulnerability of the economy to climate change also means that tax revenues will come to depend increasingly on such change.

13 The European Commission has made it mandatory for the CO_2 emissions of new cars to be below 130 g/km, on average, by 2015.

14 This is based on the EPC index being tightened from 0.8 tot 0.6 in 2012.

A good example of a tax measure for which the future rates are already laid down by law is the CO_2 differentiation of the Dutch vehicle purchase tax. In this case it has been set out in legislation (see Ministry of Finance, 2009) that the pertinent rates will be raised by a certain percentage each year to correct for the autonomous decline in the CO_2 emissions of new cars (an estimated 2.8% per annum, as mentioned above).

'Shelf life' post-2025

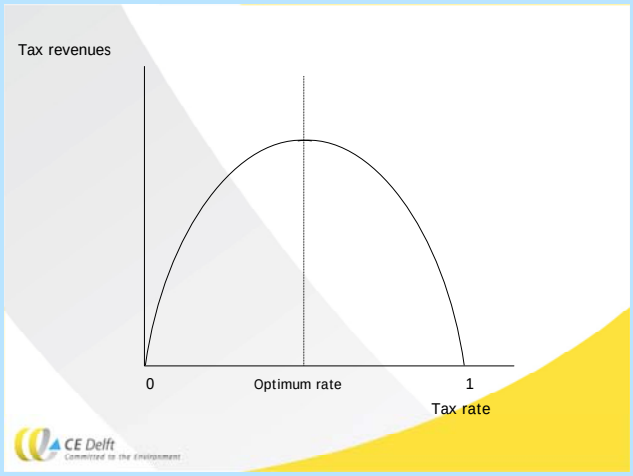
The narrower the tax base becomes, the higher the adjusted tax rate needs to be to keep receipts at a stable level. Incremental rises cannot go on indefinitely, though. In these terms, further ETR would appear fiscally feasible up to about 2025, provided tax rates are duly adjusted for autonomous improvements in carbon efficiency. This principle is illustrated by the so-called Laffer curve (see box on next page).

Beyond the horizon of 2025, however, a 'tipping point' may well come into the picture, combined with an already autonomously shrinking carbon tax base. After all, as the tax rate corrections associated with behavioural change pertain to an increasingly narrow tax base, the overall rate will rise ever more steeply, leading in turn to a magnified behavioural effect, and so on. As this process gains momentum, at some point the 'shelf life' of CO_2 as a tax base will grind to a halt. However this pans out exactly, the implications of carbon taxes for tax revenue stability will need to be carefully monitored and evaluated.

The green Laffer curve

In the early 1980s the economist Arthur Laffer gained fame with a figure he drew on a napkin in a Washington restaurant. What he sketched was a graph showing the relationship between the rate at which labour is taxed and the ensuing tax receipts, indicating the existence of an optimum tax rate in terms of revenue (see figure). The idea behind the Laffer curve is that taxation distorts the operation of the labour market: if the tax rate rises too far compared with (marginal) wages, a major part of the working population will withdraw (partly) from the labour market.

The Laffer curve is thus a plot of tax rate against tax revenue. Two points on the curve are fixed. The first is for a tax rate of 0%. In this situation, tax receipts are obviously also zero. The second point is for a tax rate that just exceeds the marginal utility that people derive from the good on which the tax is levied. In this situation, too, receipts are zero[15]. The optimum lies somewhere between the two.



Today's environmental taxes are largely on the left of the Laffer curve. This can be derived from the relatively low price elasticities of less than 1 holding for energy consumption, for example. A slight increase in the optimum rate according to the Laffer curve thus leads on the one hand to a small decline in tax revenue, but on the other to an increase in environmental impact. From the point of view of society as a whole, the optimum rate for environmental taxes is probably to the right of the optimum indicated by the Laffer curve. As one moves to the right, the scope for revenue losses by the government become ever greater.

4.3 Public acceptability

To bolster support for green taxes, the additional tax revenue can be recycled back to consumers and producers, perhaps giving extra compensation to particular sectors.

The conclusion of the previous section is that the rates of environmental taxes goods need to be periodically raised to offset the dwindling tax base. The question then arises, though, whether such periodical increases are also acceptable to the various parties in society. How likely is it that a steadily rising carbon tax will be embraced with open arms? Particularly when market energy prices start to rise again in the future, we can expect the kind of social reflexes we have seen in the past. Here we are confronted with a major

15 An example may clarify the situation. Suppose the Energy Tax is raised to such a degree that it holds for all consumers that the welfare derived from using 1 kWh of electricity is less than the tax they must pay on that kWh. In this situation, no more electricity will be used and tax receipts will therefore drop to zero.

obstacle for which there are no straightforward solutions. Numerous opinion polls among the Dutch population have shown there is broad public support for climate policy and a serious willingness to pay for additional action. A public debate on the need for progressively rising green taxes is very much required.

Without wishing to suggest we have a cut-and-dried answer to this issue, there seem to be three possible lines of thought:

- It is important that ETR conveys a clear message: large-scale emission of pollutants like CO_2 is undesirable, exposes society to major risks and will be strongly discouraged by the government. Such taxes will have to send out a single unambiguous message, of vital importance, not twenty little reminders. It must therefore be demonstrated that the individual tax measures being rolled out will make a major contribution to securing policy targets on climate change and sustainable development, independently of how the revenues are used.
- For the sake of public support, it is desirable that the additional government revenues are recycled in their entirety in such a way that both consumers and industry benefit and are compensated for their rising costs. From an economic perspective it then makes sense to state a clear linkage with the lowering of distortionary taxes like those on labour and corporate profits. To increase public acceptance of the new taxes it may sometimes be wiser to earmark (some of the) incoming receipts for specific purposes, however, preferably for the same purpose as that for which the tax has been introduced. Examples might include 'high-profile' measures such as free LED lighting, free advice on energy conservation, etc. Under the present 'integrated framework' for budget assessment this is not permitted. Exemptions to this rule may be needed if certain essential green taxes are indeed to become feasible. Thus, the guarantee that all the revenue from the proposed road-pricing kilometre charge would accrue to the Infrastructure Fund has been an important factor in the generally widespread public support for the scheme.
- One option for ETR that generally meets with little public opposition is green differentiation of existing taxes, especially if 'penalties' for environmentally harmful activities are offset by 'rewards' for eco-friendly behaviour. One successful example of this kind of green differentiation is the reduced company car tax charge in force for fuel-efficient lease vehicles.

4.4 Socio-economic feasibility

ETR may have significant and unwanted effects on income distribution. These can be avoided by adjusting the tax-free allowance or lowering other taxes.

Income effects

In the absence of additional, flanking fiscal policy, continued ETR will have a major impact on income distribution. Thus, low income groups may be disproportionately hit by a road pricing, a high Energy Tax and taxes on inefficient vehicles and dwellings[16]. As a result they may become drastically limited in their consumption potential. Environmental economists may well reply that this is exactly what they seek to achieve: the tax 'hurts' economically and elicits behavioural change in order to avoid the high costs of the tax in question. From the perspective of overall societal welfare, however, it is important that those with higher incomes (who by definition attach less utility value to additional income) continue to contribute most. The declining perceived utility value of income is a key motive for the progressive nature of

[16] Those on a low income are more likely to own relatively old and inefficient vehicles and also live in less well-insulated homes with a below-average energy label.

the Dutch tax system, with the strongest shoulders bearing the heaviest burden. This principle may be at odds with further ETR. In other cases, extra taxes on electricity and motor fuels will lead precisely to smaller income differences (for a brief discussion, see box).

Income effects of green taxes

Green taxes may sometimes work to level income differences, sometimes to accentuate them. On this issue there is no simple answer that is valid across the board. In the case of the tax on natural gas, the impact will be non-levelling (EEA, 2006). Because consumption of these goods is governed little by income, taxation thereof hits low-income groups harder than those better off. With vehicle and road-use taxes, on the other hand, the opposite is true. Thus, excise duty on motor fuels or a progressive, CO_2-indexed vehicle purchase tax (VPT) on new cars will hit the richer relatively harder, as they generally drive bigger and thus less fuel-efficient vehicles. Note that it always depends on the precise design of the tax: the scheduled replacement of the VPT (which is highly non-levelling) by a per-kilometre charge may, on balance, also be non-levelling, with all the hard political debate this implies. Despite the fact that a large proportion of motorists will gain in *absolute* terms from a per-kilometre charge, the *relative* differences between groups may become more pronounced.

Through judicious design of recycling arrangements, undesirable income effects can be adequately addressed (OECD, 1996). One option is to have a tax-free allowance (leaving marginal usage still taxable) and limit recycling to certain tax bands. As income effects need to be corrected via revenue recycling, there is a political tension because the two dossiers (the tax itself and the recycling of its revenues) need somehow to be dovetailed together (see also above).

Competition effects

Any increase in the Energy Tax also needs to be 'economically feasible'. In other words it may have no, or only minimal, impact on the competitiveness of Dutch industry, nor on consumer spending power.

Broadening the scope of the Energy Tax will lead to minor gains for the many and major losses for the few. The losers will be in the energy-intensive industries, a sector that is relatively well represented and disposes over an efficient lobbying network. The winners – new industries and taxpayers - are less well-organised, however, and may in some cases not even yet exist. With time, though, there are many industries that stand to gain from ETR if they strike out ahead of the pack and build up a competitive edge. In certain sectors this may even give the Netherlands a major advantage over other countries, with innovative companies here getting an earlier opportunity to develop operations in a more sustainable direction: the so-called *first-mover benefits*. At the level of industrial sectors, however, losses cannot be ruled out. Besides the adverse consequences of this for the Dutch economy as a whole, there will be no net environmental gains either. This is because of *carbon leakage*, with the resultant CO_2 emission cuts in the Netherlands being offset by a virtually identical rise in CO_2 emissions somewhere abroad. The macro-economic picture to emerge from numerous studies (for example, CPB, 1997; CPB, 2001) is that under a modest greening strategy winners and losers will be reasonably well balanced[17].

[17] Calculations made for the '2nd Taskforce on Greening' indicate that in the medium term in all variants the costs of adjustment are less than 0.1% of GDP (expressed as factor costs).

This begs the question of how unwanted micro-level impacts can best be compensated. Through judicious recycling of green tax revenues, impacts on competitiveness can be alleviated. In Denmark, annual increases in a carbon tax for trade and industry are redistributed in the form of subsidies for energy-saving and reductions in the employer's share of payroll tax.

In addition, many countries that have introduced a carbon tax have opted to exempt the most energy-intensive sectors of the economy. In the United Kingdom, for instance, companies in 45 energy-intensive sectors are eligible for an 80% reduction on the Climate Change Levy (IFS, 2008). In exchange, these firms have made legally binding pledges to the government to cut their carbon emissions. Finally, when it comes to green tax measures having a marked impact on competitiveness, it is important that European coordination be sought.

4.5 Feasibility vis-à-vis climate policy (ETS)

In general, a carbon tax will distort prices on the ETS (carbon-trading) market and with an emissions cap in place will not lead to any additional CO_2 emission cuts. A carbon tax can create a price floor in the ETS and break open 'lock-in' situations.

Energy suppliers and energy-intensive industries are party to the EU Emissions Trading Scheme (ETS). For these sectors, where carbon emissions already have a market price, the question is then whether additional pricing policy is either required or desirable.

In a properly-functioning ETS market for emission allowances, introduction of a national carbon tax will lead to market distortion. Since the overall emission cap for the participating countries remains unchanged, a nationally levied carbon tax will lead to no additional environmental gains: the extra emission cuts achieved in the Netherlands will be offset entirely by extra emissions elsewhere. On top of this, these Dutch emission cuts could have been secured at lower cost in some other country. From the economic angle, then, the overall effectiveness of the system is thus reduced.

This said, though, situations are conceivable in which a carbon tax for sectors participating in the ETS is nevertheless still desirable. Such is the case, for example, when a sector has manoeuvred itself into a *lock-in* situation, with the ETS creating insufficient motive to break out of the existing mould. Some time in the past, for instance, a sector may have opted for an energy-intensive production process that at today's energy prices is no longer economically optimal. The costs of replacing the entire production process are so high, however, that the price incentive given by the ETS is not enough to induce firms in the sector in question to adopt an alternative process. In such cases a dedicated tax measure may provide support in escaping from lock-in. As this will often concern multinationally operating industries, international coordination will here be required.

A carbon tax can serve as a price floor in the ETS. This kind of floor may be needed to give firms an unrelenting incentive for further emissions reduction, thus mitigating price volatility. In this way, any deleterious impacts of corporate short-sightedness can to a certain extent be mitigated. Once again, international consensus will be needed for any such use of carbon taxes as an ETS price floor.

5 The way forward

5.1 Introduction

In designing a greener tax system that provides maximum support for the government's long-term environmental objectives, several key choices need to be made. Among these, three stand out:

- What (new) tax bases are to be adopted?
- What tax rates should apply?
- What further design parameters are to be taken?

This chapter does not seek to present a comprehensive proposal for environmental tax reform, merely to outline the principal elements of an agenda for the future.

5.2 What tax bases?

Two reforms can make a major contribution to effective climate policy: a) taxation based systematically on the carbon content of energy supplied and used, and b) broadening the scope of the present Energy Tax. To promote sustainable supply chains, depletion of natural resources can also be taxed.

If green taxes are to be effectively deployed in the context of climate policy, we cannot simply fall back on historical successes in the Netherlands or elsewhere. This holds all the more because there is absolutely no fiscal experience with reducing pressure on natural resources. The first question that arises is whether new tax bases can be used in the Netherlands to reduce this kind of 'ecological footprint'. Can the country go it alone in this area, or is a European coalition required? Today's consumption of natural resources by the Dutch economy is unsustainable and is causing very significant environmental damage. The issue of whether Dutch consumption of these resources should be taxed hinges very much on the question of whether it is economically efficient and wise to levy a tax on economic inputs rather than outputs (see box).

Which to tax: inputs or outputs?

When it comes to internalising externalities in the economy, one key question is whether it is inputs (i.e. resources and energy) or outputs (i.e. products and emissions) that should be taxed. In a stylised economic model of reality the answer is straightforward: the tax should be levied on the undesirable outputs (i.e. emissions). If inputs were taxed, the only way a firm could elaborate solutions to reduce its pollution would be to cut back on those inputs (or use alternative raw materials). By taxing the output, in contrast, it is up to the company to decide how best to reduce emissions. It will then opt for the most cost-effective strategy: pay the tax, implement abatement measures or change/reduce its inputs. The overall costs of the environmental policy will thus be reduced, because there is a greater range of options for achieving the environmental targets.

There are several reasons why this is a stylised analysis. Three reasons can be cited why a tax on economic inputs may in fact be more efficient than a tax on outputs like emissions. In the first place, not all environmental taxation takes place in the Netherlands. A company's inputs (livestock feed, for example) may thus be subject to an environmental tax in other countries or regions. By imposing an input tax on soybeans (or feed consumed) it can be endeavoured to reduce adverse environmental impacts down the entire (animal) protein chain.

A second reason is that taxation of outputs involves considerable transaction costs. This will be particularly true in the case of products sourced from diffuse markets. In the built environment and transportation sectors, an input tax (indexed to the carbon content of the fuel consumed) is preferable because individual monitoring of emissions would involve excessively high implementation costs.

Thirdly, an input tax may help internalise certain market inefficiencies. It has been known for a long time that companies rarely implement all the cost-efficient measures available for conserving energy and natural resources. There are a string of reasons for this, including an information deficit and the 'risk premiums' associated with volatile energy and resource markets. Together these factors result in market failures which could be corrected, to an extent, by introducing an input tax on energy and natural resources.

These arguments (overseas environmental impacts, diffuse emissions and facilitation of profitable investments) may mean that a tax on economic inputs is more efficient than a tax on emissions[18]. Input taxes may become important because of the environmental impacts occurring outside the Netherlands. Analyses by the Wuppertal Institute in Germany and CE Delft in the Netherlands indicate that our now declining environmental burden is due partly to our having settled for an increase in the 'ecological rucksack' embodied by the impacts of our consumption in other countries. This is regrettable, and particularly so when it comes to global environmental problems like biodiversity loss and climate change. While the impression is created that things are looking up for the environment here (at substantial cost, it may be added), on a global scale environmental problems continue to worsen all the time.

From the angle of effective climate policy it is essential that taxes on energy be indexed to the CO_2 emissions associated with the fuels consumed. The taxes currently in place (fuel duty, Energy Tax) are based on the end user's energy consumption, with neither distinguishing between the carbon emissions of the actual fuel consumed. In the near future, though, a broad spectrum of alternative fuels and energy carriers will be coming onto the market (including first and second generation biofuels), with a considerable revolution – and challenge – in the realm of sustainable energy systems awaiting us.

In the medium term, opting for a single, standard carbon tax for transport and small-scale energy users creates a tension between carbon emissions and fiscal 'shelf life' (as time progresses, the tax base becomes prey to its own success as a climate change policy, with revenue declining to 20% in 2050; see Chapter 4). In terms of the resultant tax revenue this is unsustainable. For this reason a tax indexed to both energy and CO_2 is perhaps the wisest strategy. This would mean an energy tax with two components, indexed to total energy consumption and the carbon content of the fuels consumed. To flesh this out in practice will require a *second* charge point: the carbon content of the energy embodied in the fuels. This is also a good strategy from the perspective of the two main aims of energy policy: to reduce dependence on (fossil) fuel imports and cut emissions of greenhouse gases and air pollutants.

One constraint here is that green taxes need to be compatible with current fiscal practice. The system must be of relatively simple design, that is, geared in principle to substantial flows and accompanied by an acceptable administrative burden. In this context we refer back to the abolition of various 'fiscal subsidies' and the reduced Energy Tax rates currently in force (by

[18] In this context it should always be assessed whether a tax or charge impinges on the specific market failure one is seeking to address. A tax will have little impact on improving the availability of information on energy-saving options, for example, an issue that can be more effectively addressed by other kinds of policy.

introducing a flat rate up to the third tier), which can be seen as a major simplification of the tax system. Abolishing the reduced duty rates for 'red diesel' and LPG will also lead to a reduction in implementation costs, administrative burden and fraud. Reforming the Energy Tax and fuel duty system to index them to carbon emissions will involve an extra administrative burden. This can be kept within reasonable bounds, though, if maximum upstream linkage is sought, levying the tax on consumption of the various fuels in the producer segment of the national or European economy.

5.3 Raw materials and natural resources

Today's use of natural resources and raw materials in the Dutch economy is unsustainable and leads to major externalities, many of them in other parts of the world. Taxes can be levied either at the beginning or end of the supply chain, on industrial use of unsustainable resources or on consumption of meat, say.

In no way can current use of natural resources and other raw materials be said to be sustainable. There is a wealth of evidence that the Earth's renewable resources are under serious threat[19]. Among the key examples are timber, animal feed and fish. The depletion of non-renewable resources like copper, steel and aluminium should be a less urgent problem, provided the price mechanism does its job in resource markets, although outside the Netherlands grappling with it may have substantial environmental impacts. As yet, international policy to internalise such impacts has scarcely got off the ground.

From national and European perspective there are sound reasons for taxing imports (and production) of resources associated with a risk of depletion (see previous box) or production of which is accompanied by major environmental impacts. A number of analyses (e.g. CE/CML, 2004) have shown that a variety of resources, in particular animal protein (meat and fish) and timber, are eligible for this approach. The idea here is that efficient use of natural resources will help reduce environmental burdens at the 'back end' of production chains (i.e. overseas), with a concomitant impact all the way down the chain, including transportation and energy consumption. The other side of the coin may be that the knock-on effect on end product prices is so marginal that volume effects will fail to materialise.

Introducing a broad tax based on kilogram resource consumption in the Dutch economy would only appear to be interesting from a fiscal angle, providing a potentially substantial source of revenue. However, in these resource chains there is absolutely no relationship between weight and environmental emissions, making such a move untargeted and inefficient, over and above the potential production losses that would ensue from such a tax. Any tax on material and resource consumption will have to properly distinguish the environmental characteristics associated with that consumption. At first, a tax on unsustainable resources will therefore have to focus on a small selection of resources characterised by substantial environmental impacts and external costs. Other considerations involved in making a first selection include whether or not the material is difficult to replace (whether substitutes are available) and whether it can be recycled at reasonable cost. Because it is above all the animal produce of the agricultural sector that is associated with major environmental impacts, this would seem the obvious place to start. Without any pretence to completeness, we would in principle suggest taxing

[19] Strictly speaking this is not an environmental but a sustainability problem, since overexploitation of renewable resources denies future generations the possibility of using these resources to create economic prosperity. Both the extraction and processing of non-renewable resources and the exploitation of renewable resources cause environmental damage, however.

meat, livestock feed and fish. As an illustration, let us consider the case of meat.

Protein and livestock feed

Given the major external costs of climate change and biodiversity loss (see box 'Meat and dairy chains'), a tax on meat and/or livestock feed (including concentrates) would appear a sensible move, because in the absence of a global price instrument or trade arrangements the costs of greenhouse gas emissions and biodiversity loss are today often passed on to others.

The first route would be to tax imports of unsustainably sourced livestock feed[20]. The advantage of this approach is that there are considerable environmental gains to be achieved at the 'back end' of the chain by a coordinated switch to sustainably certified feed of balanced composition[21]. At the same time, reducing the amount of concentrate fed to livestock may also reduce greenhouse gas emissions in the Netherlands (due to less methane production). One drawback, however, is that the volume effect on animal protein consumption will be limited, since part of the price effect will 'evaporate' down the chain because of substitution by alternative kinds of feed (as a means of evading the tax).

The second charge route could therefore serve a complementary purpose, targeting final consumption in the Netherlands. The simplest strategy would be to abolish the 6% VAT rate for meat, dairy and fish and reinstate it as 19%. It is because of the essential role of foodstuffs that it was decided in the past within the EU to opt for a reduced VAT rate of 6% for these product categories (as well as for cut flowers and ornamental plants). There are certain foodstuffs that do not necessarily qualify as being essential for a healthy diet, while at the same time having a substantial ecological footprint, as in the case of meat, fish and dairy produce. Annex H of the VAT directive cites the categories of goods and services that are eligible for a reduced rate. This is not mandatory, however, and member states are thus at liberty to levy the 'standard' VAT rate (in the Netherlands 19%) on polluting foodstuffs (plus cut flowers and ornamental plants). This route is targeted purely at cutting consumption of animal protein, without differentiating between more and less polluting protein chains.

In implementing such a measure the Netherlands can decide to go it alone, moreover, since Dutch livestock farmers and imports of meat will both be hit equally hard by abolishing the reduced VAT rate (level playing field). A very substantial percentage of Dutch meat production is destined for the export market. Raising the VAT rate in the Netherlands is of no relevance for addressing the environmental impacts of this export, however. At the same time, neither will these exports be affected by the VAT increase, because of the 0% tariff in force for exported goods. For the second option, collaboration at the EU level would seem advisable.

---

20 The scope is in fact wider, encompassing unsustainable protein sources (soya) used in the food industry as well as the livestock sector. However, 90% of Dutch soya imports are destined for use as animal feed.

21 It is debatable whether certified feed sourced in Europe has a more favourable climate impact.

Meat and dairy chains
According to the report 'Livestock's Long Shadow' (FAO, 2006), worldwide meat and dairy production are responsible for around 18% of global warming and 8% of water consumption. Because of unsustainable production methods and rapidly rising global demand for animal products, livestock production chains are threatening biodiversity in many parts of the world. Given the inferior ecological value of much farmland as well as mineral losses, agricultural land use can be characterised as unsustainable. There is plenty of potential for reducing these environmental impacts, through a change in the pattern of protein consumption, technical innovation and a shift from concentrates to sustainable feed.

5.4 Agriculture

The agricultural sector currently enjoys both fiscal subsidies and reduced tax rates. Abolishing these forms an essential part of ETR. In the case of greenhouse horticulture, uniform energy tariffs help make climate-neutral technologies profitable.

As the above analysis shows, agriculture is a sector in which policies to internalise the costs of greenhouse gas emissions and biodiversity loss have scarcely got off the ground at all. The situation is in fact even worse, as an array of tax breaks mean that agricultural activities are not faced with a marginal energy price incorporating the full environmental costs. Key examples include the reduced Energy Tax rate for greenhouse horticulture (totalling an estimated € 150 million a year) and the reduced duty on 'red diesel' (around € 125 million). The biodiversity impacts of many foodstuff and protein supply chains are likewise unpriced for lack of a global price or trade instrument.

Within the agricultural sector, Dutch greenhouse horticulture is currently still very energy-intensive, with substantial CO_2 emissions of around 6.5 Mt a year, some 3% of the national total. Although the sector has made considerable progress, its energy consumption and CO_2 emissions can be reduced even further, by making greenhouses climate-neutral or even net providers of energy. The required technologies are already available (the so-called 'greenhouse of the future'), but not yet fully mature.

Table 2 **Energy tax rates for greenhouse horticulture, € per tCO_2 (excl. VAT)**

	Gas tariff	Reduction compared with normal tariff
Tier 1	8	81
Tier 2	13	65
Tier 3	11	11
Tier 4	7	0
Tier 5	-	-
Tier 6	5	0

Emission factor of gas = 1.7750 kg CO_2/m^3.

Further greening of the agricultural sector can be achieved by phasing out today's tax reductions on energy use. This will have to be done very carefully, as the risk of 'cold turkey' restructuring is by no means hypothetical. Given its energy dependency, greenhouse horticulture is exceptionally sensitive to energy taxes and fluctuations in gas prices. Given the relatively small size of the firms involved, the share of energy in total operating costs is probably far higher than in other sectors.

Internationally, greenhouse horticulture is a highly competitive industry, with prices very much governed by (export) demand, and it would therefore make

sense to implement suitable (fiscal) flanking policy when phasing out the reduced Energy Tax rates. One option would be to provide a certain compensation to horticulturalists investing in low-energy or net-output greenhouses. Flanking policy would also be desirable for a while when phasing out the reduced duty on 'red diesel'. This kind of 'stick and carrot' policy generally proves effective.

5.5 Industry

The tempo of energy conservation in industry has fallen to 1% per annum, while 2% was targeted. This underscores the need to extend the first tier of the Energy Tax to include medium-sized and large-scale consumers, within constraints of competitiveness.

Industry is responsible for a substantial share of Dutch CO_2 emissions: around 25%. Because of the exceptionally low Energy Tax rates in force for industry (i.e. medium-sized and large-scale energy consumers), marginal energy prices for such firms are currently very low. For these industries (in tiers two, three and especially four and five) this means there is not enough financial motive for energy-saving. The maximum feasible improvement in industrial energy efficiency is estimated to be 2% per annum, but by 2006 this rate had fallen to 1% (ECN, 2008).

One key tax greening measure would be a uniform extension of the rates of the first tier to the second and third. This would be a very cost-effective contribution to climate policy and allocate efforts across households and industry in a balanced way. We do not anticipate such a measure having any significant impact on competitiveness, as most of the industries involved operate on the domestic market, with energy comprising only a fraction of overall production costs, moreover. Table 3 reviews the Energy Tax rates in force in the Netherlands, expressed in € per tonne of avoided emissions.

Table 3 **Energy Tax rates in the Netherlands, € per tCO_2 (excl. VAT)**

	Gas	Electricity	Typical users
Tier 1	89	192	Households
Tier 2	78	70	SME*, commercial services
Tier 3	22	19	SME*, government
Tier 4	7	2	Industry (probably partly ETS)
Tier 5 (non-commercial)	6	1	Non-commercial
Tier 6 (commercial)	5	-	Energy companies, steel, aluminium (ETS)

* Small and Medium-sized Enterprises.

Emission factor for gas = 1.7750 kg CO_2/m^3.

Emission factor for electricity = 0.566 kg CO_2/m^3 (note that results depend very much on the emission factor adopted).

When it comes to extending a uniform tariff to tiers 4 and 5, tax reformers will probably be faced with two important constraints. One is that large-scale industrial energy users and energy companies have been trading their CO_2 emissions on the ETS market since 2005. Because of the emission cap in force here, at first sight it would not seem effective to broaden the Energy Tax to encompass this group. However, the British Mirrlees review sees scope for this creating a CO_2 price floor in a market that has proved extremely volatile (cf. Section 4.5). This would then have to be coordinated at a European level to arrive at an appropriate price floor. The second constraint looming on the horizon is that there may be impacts on competitiveness for certain firms

whose energy consumption is substantial and that operate in international markets.

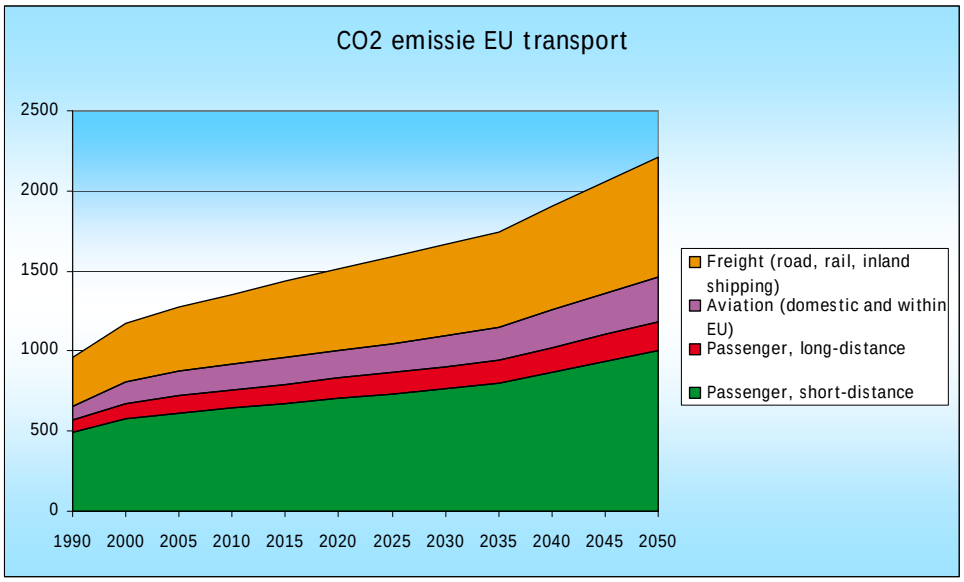
The CPB studies cited earlier indicate that if there is judicious recycling of revenues to firms, macro-economic impacts can be rendered virtually negligible. However, there is no denying that it will be difficult to design recycling arrangements in such a way as to avoid excessive shifts within certain specific branches of industry. In this context we would again recall the successful redistribution arrangements of the Danish carbon tax.

5.6 Transportation

Without additional policy, transport volumes and the associated carbon emissions are set to soar in the coming decades. To satisfactorily address this trend requires higher fuel duties and abolition of the reduced rates for diesel, 'red diesel' and LPG. Differentiation is also required in terms of fuel carbon content, giving a competitive edge to carbon-neutral fuels.

Over the past few decades many sectors have made a certain amount of progress in reducing emissions of CO_2 and other greenhouse gases. This does not hold for transportation, though. Because of the cuts achieved in other sectors and the continued growth of transport movements (particularly freight), the share of transportation in aggregate emissions is set to rise further. Since 1990 there has been 38% growth in transport CO_2 emissions in the EU. In the absence of additional policy, this growth is set to continue in the coming decades (Figure 7). The strongest growth in CO_2 emissions is expected in aviation, shipping and road haulage, despite all the ongoing improvements in energy-efficiency (which are slow to diffuse through fleets, however).

Figure 7 CO_2 emissions of different modes of transport in the EU, Mt



Source: PBL, 2009.

For most modes of transport (except modern petrol-fuelled cars) there is at present an often substantial gap between the external costs of vehicle usage and charges paid. This gap is biggest for those modes where projected growth in carbon emissions is greatest. When it comes to road transport, the gap is particularly marked for light and heavy goods vehicles. In other words, these vehicle categories do not pay for the social costs to which they give rise. Particularly with HGVs, infrastructure costs are very substantial. With the non-road modes, it is above all aviation and maritime shipping where there is a

major gap between current charges and costs, due above all to the high price tag on their contributions to climate change and air pollution.

The excise duty currently levied on motor fuels bears no relationship to their carbon content (Table 4). Compared with petrol, there are substantially reduced fuel duty rates for diesel and LPG and a zero rate for kerosene (jet fuel). Several remarks are in order here:

- In the first place, these taxes are primarily fiscal in nature and should not therefore be legitimised solely in terms of environmental targets.
- Secondly, these taxes cannot be associated exclusively with CO_2 emissions, but also relate to other transport externalities like air pollution and noise.

This said, though, from the angle of climate policy current fiscal arrangements are far from optimal. One thing that particularly stands out is the very favourable fiscal treatment of LPG (equivalent to a bonus of over € 200/tCO_2 compared with petrol) and the unfavourable treatment of ethanol (a 'penalty' of € 210).

Table 4 **Excise duty rates, expressed in €/litre and €/tCO_2 down the entire chain, excluding VAT**

	Fuel duty, € per litre (2009)	€ per tCO_2
Diesel	0,40	125
Red diesel	0,25	80
Petrol	0,70	250
LPG	0,07	40
Biodiesel**	0,40	160
Ethanol	0,70	460
Kerosene (international)	0	0

This table is based on 'well-to-wheel' emission factors calculated from a combination of sources: TNO, 2003; www.tremove.org; IFEU, Heidelberg, 2008 (www.ecotransit.org). The emission factors for ethanol and biodiesel are from http://ies.jrc.ec.Europe.eu/WTW.html.

For international shipping, inland shipping and aviation there are a variety of tax reductions and exemptions in place, with the overall result that the external costs of CO_2 emissions are still scarcely borne by the parties responsible. Van Beers *et al*. (2002) focusing on the tax exemption for jet fuel, conclude that this should be classed as a subsidy, as it leads to lower costs for the aviation industry[22]. This applies equally to shipping. For kerosene it can be estimated that this subsidy is equivalent to around € 0.70/litre, compared with the duty levied on petrol. Cheap fuel encourages greater transport volumes, higher energy consumption and consequently greater emissions.

Non-road transport

When it comes to future ETR in the transportation sector, a pivotal role must be played by removing the various reduced rates and exemptions in force today. For inland and maritime shipping as well as aviation this means seeking international agreement, for in practice it makes far greater sense to adopt such measures at least at the European level, and preferably internationally.

[22] For a variety of reasons, several categories of fuel are exempt from excise duty or are eligible for a reduced rate. Thus, the kerosene burned on international air flights has long been exempted under several arrangements (the Chicago Treaty, 1944 and European directive 92/81), while a reduced tariff is levied on 'red diesel' and LPG. Introduction of a fuel tax for inland shipping is currently impeded by the Mannheim Convention.

Road transport

With respect to road transport, the main aim of any greening strategy must be to achieve further internalisation of external costs. This means that road pricing rates need to be brought more in line with the true external costs associated with a vehicle-kilometre. For road haulage, in particular, this means that kilometre charges need to be substantially higher than currently proposed in the new road-pricing scheme[23] (above all because of the relatively large contribution of HGVs to infrastructure costs), to bring them more in line with the rates of the 'MAUT' toll for this vehicle category in Germany. When it comes to infrastructure costs, at any rate, there are no European barriers to full-cost accounting.

In the second place, fuel duty needs to be indexed more to the actual emissions associated with burning a litre of the fuel. As current duty rates are higher than the social costs of CO_2 emissions, there must remain a base rate dependent on the volume or energy content. Justification for this can be derived from the wish to reduce dependency on oil and gas imports. Tax rates can be based on the principle of target-based CO_2 pricing, i.e. a progressively rising CO_2 component in the duty rate, a *sine qua non* for halting future growth in carbon emissions. The other side of the coin is that this may be associated with welfare costs, certainly if it means a reduction in mobility. In our greening package we have taken an average increase of 20% relative to the current duty rates.

One advantage of target-based pricing is that it creates a structural market for sustainable motor fuels[24]. Oil companies will also be given an incentive to hasten market introduction of second-generation biofuels. Relative to traditional fuels, a price differential may emerge based on superior CO_2 efficiency down the supply chain. At the same time, additional criteria can be set for being eligible for an exceptional charge rate. Finally, additional incentives may prove necessary (see box).

Incentives for private vehicle purchase and company cars

In an optimal economy comprising well-informed and rational consumers, fuel duty is the best possible instrument from the perspective of climate policy. High fuel costs form an automatic incentive for consumers to buy fuel-efficient vehicles with more expensive engine technologies (transmission, hybrid, etc.), recovering their extra initial outlay via lower operating costs. As a number of studies have demonstrated, however, only little allowance is made for energy costs at the time of vehicle purchase. Retaining (some portion of) a CO_2-differentiated vehicle purchase tax therefore provides an important mechanism for encouraging purchase of an efficient car. This is in line with the Europe-wide trend of VPT being converted into a carbon tax.

One group of road users for whom a carbon tax does not provide a direct incentive are drivers of leased vehicle, whose fuel costs are often borne entirely by employers (also for private usage). To give leasing companies an incentive to purchase more efficient cars nonetheless, the fiscal arrangements in place for company cars could be indexed even more to vehicle CO_2 emissions (as in the British system). In the spirit of the plans for the proposed Dutch road pricing scheme, and with the aid of the technologies set out there, the tax on ownership of a lease vehicle could with time be (partly) superseded by a tax on vehicle usage, to ensure that unrestricted private use of leased vehicles is also appropriately priced.

23 *Anders Betalen voor Mobiliteit* ('A new charge scheme for mobility').

24 As there is essentially little difference in the carbon content of traditional motor fuels, this will mean far less difference between the duty levied on LPG, petrol and diesel.

5.7 The built environment and land use

To save energy in the built environment requires a further increase in the Energy Tax. This will also mean faster returns on investments in energy conservation. A charge on land use is interesting from a fiscal, economic and environmental perspective. Land use is one of the least distortionary tax bases available.

Over the past few decades, per-household energy consumption in the built environment has fallen when it comes to (gas) heating and risen with respect to electricity. Because of the growth of the housing stock, aggregate gas consumption for heating has remained approximately unchanged, while demand for electricity has risen substantially despite improvements in the efficiency of equipment and appliances. In Dutch private and commercial building stock there is a considerable efficiency gap between actual energy efficiency and the theoretical optimum[25]. For many conservation measures it can be calculated that investments can be recuperated within five to eight years via the savings on energy costs. To realise this conservation potential in the existing building stock requires higher energy prices. Incrementally increasing the Energy Tax is an effective way to shorten pay-back on investments and increase the perceived urgency of energy conservation.

Besides the incentive for energy-saving, the built environment can contribute to making the power supply more sustainable and opting for CO_2-neutral energy carriers (e.g. use of waste heat). To this end, a new CO_2 component in the Energy Tax is required, at levels indexed to the fuel in question. These rates should be target-based, rising from 25 €/tCO_2 in 2012 to 100 €/tCO_2 in 2030, analogous to the proposals of the French committee of experts (see earlier box). An additional policy track may be needed if it transpires, after the energy price rises, that property-owners are still making too little allowance for energy costs when renovating and buying property (see box).

Incentives for energy-efficient property purchase and renovation

When buying or renovating a property, at the moment consumers scarcely give a thought to future energy costs, if they do at all, even though these costs make up a steadily rising share of overall living expenses. In this respect there are clear parallels with the transport sector: it is not only energy (or motor fuel) consumption itself that can provide the required fiscal leverage, but also property (or vehicle) acquisition and ownership. There are several options available for this purpose: differentiation of property taxes (via the 'notional rental value' used for income tax purposes and/or 'council rates', known in the Netherlands as OZB), on the basis of the energy label or energy index for existing dwellings or, alternatively, the property transfer tax. Under a greened tax system, consideration could be given to a new kind of property tax based on the energy efficiency of the dwelling. Under the current system, the property transfer tax is interesting because its levying coincides with a natural opportunity for energy-efficient renovation and provides the most direct incentive for investment.

Land use

In the Netherlands, land use is currently untaxed. The justification for introducing such a tax derives from the welfare-economic consideration that numerous people suffer from the loss of undeveloped land, while it is only the (future) owner of the land who benefits. Loss of 'open space' thus constitutes a classic example of an externality. In welfare-economic terms this situation can be remedied by levying a tax on the development of undeveloped land, with the tariff being determined by the social value of the space lost. Such a tax could be imposed with multiple aims in mind, however, including recovery of the 'windfall' profits accruing to land-owners following certain changes in zoning. Another option would be a more regulatory type of land use tax, at a

[25] The difference is even greater if current investments are compared with the optimum in terms of overall social welfare.

level sufficient to encourage developers to invest more in inner-city development and restructuring.

Adopting land use as a new tax base is above all interesting from a fiscal-economic perspective. Land use is one of the least distortionary tax bases available in the economy, as reflected in its extremely low elasticity (land use does not relocate abroad…). It thus provides a broad and stable tax base. It is also potentially interesting from the angle of landscape quality, moreover, especially relevant in the Netherlands, where optimal use of the available land and halting 'landscape cluttering' is today a policy priority.

The overarching consideration here is to help safeguard the open space that still remains. In this context, three lines of thought can be distinguished:

1. A (one-off) tax on development of public or undeveloped space.
2. A (one-off) tax on transforming high-quality land (i.e. nature) into low-quality land.
3. An (annual) tax on land use, based on the actual purpose for which the land (i.e. the buildings on it) is being used.

In the last case, the new tax might replace today's 'council rates' (Dutch: OZB).

5.8 What tax rates?

If successful, a regulatory tax leads to falling consumption of the taxed good and consequently to declining tax revenues. To maintain an incentive for further conservation and retain the same tax receipts, rates will need to be gradually raised.

The government's long-term climate and environmental targets are ambitious. If they are to be secured, we need to have the courage to go beyond merely maintaining today's tax bases and tariffs, even though these indeed already provide a broad and solid foundation for current climate policy. At the same time, though, there is very little or no experience with taxes that come anywhere close to what is required for achieving robust emission reductions in terms of the required tax rate.

This leads to the following dilemma (TME, 1999):

- On the one hand, one needs to substantially broaden the scope of environmental taxes as well as raise charge rates in order (theoretically) to come anywhere close to one's policy targets (and experience with energy-saving shows there is still a wide gap in this respect, with less being done than what at first sight appears economically rational).
- On the other hand, people are already protesting about environmental taxes and price measures (witness the opposition to increases in fuel duty and successful action against the tax surcharge on air tickets), providing possible arguments for not letting tax rates rise too high or rejecting certain tax bases altogether.

The basic starting point for any further ETR must be that tax rates successfully internalise environmental damage and other kinds of externalities. In many sectors (particularly greenhouse horticulture and heavy industry) this makes an increase in tax rates virtually inevitable.

For the built environment and passenger transport, charge rates need to be based more on the behavioural changes required in pursuit of environmental targets. For those sectors not exposed to international competition, there is absolutely no reason this principle of target-based pricing should not be adopted. From both an environmental and a fiscal perspective, periodic increases in charge rates is desirable: environmentally to ensure that once the

'low-hanging fruit' has been picked the higher fruit comes within reach, and fiscally to ensure the tariffs are corrected for autonomously declining carbon emissions. In the next ten to fifteen years there is likely to be sufficient scope for guaranteeing stable tax revenues via this kind of tariff adjustment. By establishing successive tariff increases well in advance (through appropriate legislation) a stable climate can be created for sustainable investment, one of the key pillars for building a green economy. Besides the autonomous decline in carbon emissions, such legislation on incremental tariff corrections might also include reference to the behavioural effects of the tax. This would help stabilise tax revenues further.

5.9 Design parameters

Without flanking policy, ambitious greening of the tax system is virtually inconceivable. As a fiscal strategy, the carrot-and-stick model has proved its worth.

Environmental taxes are highly effective when there are high-quality eco-friendly alternatives available on which no or less tax is levied. In this context consideration can be given to combination of the 'stick' of taxes and the 'carrot' of positive incentives (subsidies). This combination may promote earlier adoption of green tax measures, as evidenced by the Danish carbon tax. Besides political advantages, a carrot-and-stick strategy also brings economic benefits. One of the economic benefits of using positive incentives has to do with the possibly positive external effects associated with the development and use of new environmental technologies. Introduction of such technologies is characterised by a steep learning curve, with 'followers' benefiting from the experience of 'first-movers'. By employing positive incentives to reward these pioneers, the positive external effects they generate are internalised.

Besides charge rate differentiation and exemptions, flanking policy also has a role to play. Over the past few years an important step has been taken towards differentiated vehicle taxes in the transport sector. In this respect, tax developments in the housing sector are lagging behind. Successful differentiation of rates requires objective and undisputed knowledge of environmental parameters and accurate registration thereof (see box).

What can the built environment learn from transportation?

In recent years there has been successful greening of a number of taxes in the transport sector. Particularly important in this respect will be the proposed introduction of the Dutch road pricing scheme. The question arises of what the built environment can learn from this experience. The first consideration is that, as a 'product category', a dwelling is far less homogenous than a car: property relationships differ and there is far greater diversity of dwellings in terms of both 'model' and size. Secondly, the penetration of new cars in the vehicle fleet proceeds a whole lot faster than in the case of dwellings in the housing stock (with a far longer life span as well). Thirdly, the transport sector has already built up years of experience with emissions registration and European vehicle 'type approval'. In this respect there is certainly room for improvement when it comes to dwellings and it also indicates that reliable allocation of energy labels to homes will be crucial in the years ahead. As long as any uncertainties remain in this area and the housing stock has not yet been fully registered, any greening of property taxes will be extraordinarily difficult.

5.10 Revenues

Altogether, the Dutch policy package reviewed yields a total of € 8 billion revenue on top of the current € 19 billion, boosting the share of green taxes from today's figure of 14 to 20%.

It is estimated that the overall package of green tax measures outlined here will generate around € 8 billion of green tax revenue, after allowing for the regulatory effect of the taxes. This € 8 billion is additional to the current figure of € 19 billion green tax revenue. These revenues may in fact turn out to be greater, as no allowance has been made for the revenues accruing from any resource taxes. Together, this additional € 8 billion from green taxes increases the share of such taxes in total national tax revenue from 14 to almost 20%. Aggregate green tax revenue relative to GDP thus rises from 3 to almost 5%. There seems to be no need for the Netherlands to wait for concerted European action before implementing this policy package. In Chapter 6 we discuss the European agenda in this area.

Table 5 Synopsis of revenues from potential green tax measures

Sector	Green tax	Revenue (€ bln.)*
Transport	A 20% increase in excise duty on all transport fuels (including a CO_2 component).	0.8
	An increase in the kilometre charge for freight vehicles from € 0.024 to € 0.15.	1.0
Industry	Broadening the Energy Tax, with the rate for the 2nd and 3rd tiers being set equal to the (current) rate for the 1st tier.	2.7
Built environment	Additional to the broadening of the Energy Tax, a 50% increase in the tariff for the 1st tier (including a CO_2 component).	2.4
	A tax of € 16 per m^2 on developing undeveloped land.	0.7
Agriculture	Abolition of the Energy Tax reduction.	- **
	Abolition of reduced duty on 'red diesel'.	0.1
Raw materials and natural resources	A tax of € 0.25 per kg on livestock feed.	(pending) ***
	Abolition of the lower VAT rate for meat, dairy and fish (an increase from 6 to 19%).	0.7
Existing green taxes		**19**
Total	**Total revenues**	**27.3**
	Total revenues, as % of total taxes	**20.1%**
	Total revenues, as % of GDP	**4.8%**

* Estimated tax revenue makes due allowance for the (intended) behavioural impact.

** Included under broadening of the Energy Tax.

*** Not included because of need for EU coordination.

6 The European agenda

6.1 Environmental tax reform in the European context

An EU agenda on green tax reform can focus on harmonisation of *national* environmental taxes or introduction of a *European* green tax, or both. While neither of these are without their problems, they are absolutely essential for moving towards abolition of subsidies for internationally operating industries, including freight transport.

For the Dutch tax system to be effectively and viably greened, some form of European harmonisation is essential, primarily to ensure that such a move does not impact too much on competitiveness. Not only are negative economic impacts of this kind in themselves undesirable; they would also reduce support for the new tax measures. Pronounced effects on competitiveness undermine the environmental effectiveness of tax reform, moreover. In the context of climate policy there is likely to be 'carbon leakage', i.e. relocation of large, energy-intensive industries to countries with less stringent environmental policies, with the upshot that global CO_2 emissions fail to decline.

European coordination is also desirable in areas where further greening of the tax system is thwarted by (European) treaties. A case in point is the Mannheim Convention, which prohibits the Netherlands from taxing inland shipping anywhere in the Rhine basin.

In the remainder of this chapter we consider two ways in which European coordination in the realm of green taxation might be elaborated:
1. European and international agreement (harmonisation).
2. European implementation of green taxes.

6.2 European and international harmonisation

International agreement is required to achieve:
- A phase-our of 'perverse' energy subsidies.
- A review of international treaties for aviation and shipping.
- Harmonisation of minimum tax rates.

There are various ways to achieve European harmonisation of green taxes. One route that is frequently adopted in this context is for the European Commission to set a minimum tax rate, with Member States then under an obligation to levy the tax at least this level. In recent years minimum tax rates have been laid down in various areas, such as energy products (incl. vehicle fuels), electricity and the vehicle registration tax for heavy goods vehicles. The European Commission is also considering setting minimum tax rates specifically for a carbon tax on energy products (incl. vehicle fuels) and electricity (EC, 2009a).

Another route towards European harmonisation is to enter into bilateral or multilateral agreements on fiscal policy. As an example: the European Commission has given its fiat to the Netherlands entering into bilateral agreements with other EU member states so that duty can be levied on aviation fuel used on flights from and to the Netherlands.

International agreement will also be needed to achieve a phase-out of many of the energy subsidies currently in existence (see box on p. 25). Within the G20 the first signals seem to be emerging of a willingness to start phasing out energy subsidies worldwide, although it remain to be seen how solid these pledges are. This is one of the issues might be discussed at the next round of international climate negotiations.

In some cases introduction of new green taxes may be thwarted by standing international agreements, as with the Mannheim Convention cited above. International consensus on more flexible interpretation or repeal of such

conventions and agreements increases the scope for national green tax reform. This also holds for the kerosene fuel burned on international air flights, taxation of which will require renegotiation of the Chicago Treaty (1944) and European directive 92/81, among other things.

Where is European harmonisation required?

European harmonisation is required mainly for those green tax measures with a potentially major impact on competitiveness:

- *Broadening of the Energy Tax:* abolishing the reduced tax rate in place for the second and third tiers of the Energy Tax is not anticipated to have any marked impact on competitiveness. These tiers comprise mainly small and medium-sized enterprises, which are usually nationally oriented and/or energy-extensive. The situation is different, though, when it comes to abolishing the reduced tariffs for the fourth and fifth tiers of the tax. Especially in the fifth tier, there are numerous internationally operating, energy-intensive companies whose competitiveness will be affected if rates are increased to any substantial extent. To what extent this also holds for the fourth tier is as yet unclear. Whatever the case, creating a *CO_2 price floor via (the fifth tier of) the Energy Tax* will require European coordination if this principle is to be effectively employed. Before anything definite can be said about the best design for broadening the Energy Tax, further study is required on how energy consumers are divided across the various tiers.

- *A carbon tax on vehicle fuels:* a major share of freight transport as well as passenger air transport is international. Any increase in taxes on the fuels involved will consequently damage the international competitiveness of businesses in these sectors. With respect to freight transport, though, it should be borne in mind that transport costs are often only a small fraction of total production costs, implying that negative impacts will be limited. In the case of road vehicle fuels, the cross-border effects of a carbon tax will be a more compelling reason for seeking international harmonisation: a steep rise in Dutch fuel prices will induce many motorists to fill up in Belgium or Germany, causing substantial losses of income for Dutch filling stations in border areas.

  In the case of international and inland shipping as well as aviation, there are international treaties in place that will make it impossible to impose a tax on the respective fuels, at least not across the board. In this area far-reaching European coordination is therefore required.

- *A tax on animal feed:* agriculture is very much a sector competing on international markets and the higher production costs for Dutch farmers resulting from national implementation of a tax on animal feed might have a serious impact on competitiveness. Certainly given the low margins holding in this sector, international agreement is a precondition for this kind of environmental tax. If a product tax rather than input tax were introduced (in the form of a meat tax), there would be no impact on competitiveness.

- *A resource tax:* like agricultural markets, resource markets are also highly international, so that introduction of a national resource tax might have major impacts on competitiveness. This green tax will therefore also require European consensus.

Implementation in the Netherlands

For green tax measures relating to households, in contrast, no such European consensus is required. Cases in point include raising the level of the first tier of the Energy Tax, differentiated property taxes and green tax measures for leased company cars. Similarly, abolishing the reduced VAT rate on meat, for example, is something that can be rolled out immediately. All these measures could thus be implemented 'unilaterally' by the Dutch government without any problem.

Table 6 **Status of green taxes with respect to need for European harmonisation**

No European harmonisation required	Further study required on need for European harmonisation	European harmonisation required
Raising the Energy Tax	Broadening the 4th band of the Energy Tax	Broadening the 5th band of the Energy Tax
Broadening the 2nd and 3rd tiers of the Energy Tax	A carbon tax as part of the Energy Tax	A carbon tax on vehicle fuels
A carbon tax on energy use		A tax on livestock feed
A CO_2-differentiated purchase tax for cars		A resource tax
Fiscal inclusion of leased company cars		
Differentiation of property taxes		
Increasing the VAT rate on meat to 19%		

6.3 Scope for European green taxes?

Although a single European green tax could serve as a key element of EU climate policy, its implementation would be wrought with difficulty.

One step beyond Europe-wide harmonisation of national green taxes would be to introduce green taxes at the European level. Among European government leaders the idea of a European tax on environmentally harmful activities is starting to take hold. Besides its regulatory impact, this kind of European green tax would also create an opportunity for reducing member states' payments to the European Union, creating new scope for pruning back national budget deficits.

Introduction of a European green tax is still an issue wrought with difficulty and controversy, however, mainly for political reasons. For a number of European countries, surrendering national sovereignty on taxation has until now proved a non-starter. Among the European populace, too, there is probably little support for any further European taxation. In this context an appeal could well be made to the principle of *no taxation without representation*. What would happen in such an event is that a new, *visible* tax would take the place of (a reduction in) existing, *invisible* payments to the European Union

One important advantage of European green taxes is that they would have substantially less impact on competitiveness than national tax measures. In addition, taxes at this level are more in keeping with the scale of today's environmental problems, which are often international in nature. This argues for focusing particularly on cross-border effects and international product flows, as exemplified by the cases of meat, animal feed/protein, European air travel, shipping and so on.

7 Conclusions and final remarks

The key question addressed in this report is whether there is scope for increasing the current share of green taxes in the Netherlands. Given that this share has remained stable at 14% for a number of years, the question arises whether we have run up against 'limits to growth' as far as environmental taxes are concerned, implying no scope for any further increase in green tax revenues relative to GDP. Such limits may be fiscal, social of socio-economic in nature.

With an ambitious package of greening measures, the Netherlands can boost the share of green tax revenue to 20%, equivalent to 5% of Gross Domestic Product. This figure of 5% is in line with what international studies anticipate are the fiscal limits of a greened tax system. For this level of environmental tax reform, European coordination is not required. In calculating estimated revenues, due allowance has been made for the fact that reduced pollution will lead to declining tax revenues. Expectations are that this package will make a major contribution to the government's environmental and climate targets, particularly the latter.

One strategy for further ETR could comprise the following four key elements:
1. Introduction of a new carbon tax, to be incorporated in the Energy Tax and in fuel duty.
2. A broadening of the scope of the Energy Tax and removal of other fiscal subsidies and reduced tariffs.
3. Extension of the tax system to include new tax bases: import/production of natural resources (timber, fish, meat) and land use.
4. A European agenda on green tax reform.

Track 1: A carbon tax

A new carbon tax on CO_2 emissions is essential because today's fuel duty and Energy Tax have insufficient leverage on the wide range of biofuels currently being developed and on sustainable forms of energy with very diverse lifecycle carbon efficiencies. Fiscal treatment of today's vehicle fuels is far from optimal from a climate perspective, moreover. The reduced duty on LPG and 'red diesel' is no longer justifiable simply with reference to air quality, for example. A new carbon tax will have to come on top of the fuel duty and energy tax rate. This combined strategy also has a two clear policy motives: the desire to reduce dependence on energy imports (the energy component) and the government's ambitious climate targets (the CO_2 component).

Track 2: Broadening the Energy Tax

Broadening the scope of the Energy Tax is essential because of the lop-sided development embodied in restricting the incremental increase in this tax to households and small-scale consumers only. On this path, the Netherlands is structurally neglecting the scope for cost-effective energy-saving at medium-sized and large-scale firms, thereby reducing the energy efficiency of the country's industrial base. On top of this come the numerous fiscal subsidies in place today, particularly for agriculture (lower Energy Tax rates for greenhouse horticulture and reduced duty on 'red diesel'), which are encouraging wasteful energy use and are incompatible with effective climate policy. Phasing out these unsustainable subsidies is an indispensable part of

any serious strategy for further ETR. This would also contribute to further fiscal simplification, as would a flat Energy Tax for the first three tiers.

Track 3: New tax bases

The environmental burden embodied in certain resource supply chains may imply a need for new fiscal measures, at either the European or Dutch level. Today, energy resources are the only natural resources taxed. The simplest policy measure would be to transfer meat from the reduced VAT rate (currently 6%) to the high rate (19% in the Netherlands), which would be in line with the overall desirability of moving towards a diet comprising less (animal) protein. This measure would have a neutral effect on the competitiveness of the Dutch livestock sector (level playing field). Upstream, there is probably even more scope for environmental improvements in animal product chains. This might argue for levying a tax as early as possible in the relevant protein supply chains. It should be borne in mind that this kind of tax would require very careful planning, given WTO trade rules and the issue of how to treat alternative (plant-based) protein chains in the food supply, which often have a similarly high environmental impact. Whatever the case, European coordination will be essential, while this is not the case for abolishing the lower VAT rate for meat and so on. In this study the precise design of a tax on livestock feed has not been investigated.

Besides natural resources, land use might also provide an important base for a further ETR. In this area there appears to be greater policy manoeuvring space than for natural resources, which often involve a combination of remote, cross-border impacts and convoluted international product chains. Particularly in the Netherlands, the negative externalities of land use may well become increasingly important in the future because of growing claims on the available space and a desire for more 'compact' development. Land use and housing construction are becoming more and more intertwined with energy and mobility issues and the growing externalities of land use provide a very strong case for introducing a tax on 'green-field' land development.

Track 4: The European agenda

European climate policy needs to be accompanied by a parallel Europe-wide strategy in the realm of taxation. In particular, harmonisation is required in the following areas:

- European harmonisation is needed to avoid unwanted impacts on the competitiveness of (certain sections of) industry, but also as an essential first step towards reviewing international agreements and treaties that prohibit abolition of environmentally harmful subsidies and those on fuels and energy (clearing the way for a tax on jet fuel and VAT on air tickets, for example).
- Via the Energy Tax for large-scale energy users, a CO_2 price floor can be created under the European Emissions Trading Scheme (ETS) to address the issue of highly volatile and generally low carbon prices. Reducing uncertainty is very important for investments in CO_2 abatement, among other things.
- Another option is a carbon tax on road vehicle fuels. To avoid border effects, some form of EU harmonisation is required.
- Likewise, a resource tax (on animal feed) is likely to require European harmonisation.

Constraints

Against this background, a strategy for green tax reform will therefore need to make due allowance for the following constraints:

- **Fiscal feasibility**: In elaborating new green taxes, account needs to be made for declining tax revenues as CO_2 emissions fall (as intended). Up to 2020/2025 these declining revenues can be reasonably well forecast. One option until then is to compensate the falling revenues by progressively raising the rate at which the carbon tax is levied. In the longer term (post-2025) the question becomes relevant whether reform towards new tax bases is once again required in the light of the then substantially narrower tax base.
- **Public acceptance**: One crucial issue is how to ensure that private citizens and businesses accept the steady incremental rises in carbon tax rates. This is a political choice. The tangible observability of rising environmental tax rates that are not linked to economic growth will be one of the thorniest issues to tackle. The answer to this is by no means straightforward, but one possible strategy may be to develop a fiscal-legislative framework in which tariffs are laid down for a number of years in advance. In addition, public acceptance will gain from visible redistribution of revenues (balancing the sweet with the sour..), for example by subsidising energy conservation or by lowering tax on labour.
- **Socio-economic feasibility**: To prevent low-income groups being disproportionately hit, the green taxes can be straightforwardly compensated, by increasing the tax-free allowance (which for these groups is relatively more important). There also needs to be particular focus on energy-intensive industries competing in global markets. With judiciously designed flanking fiscal policy, higher energy prices need not necessarily lead to higher costs, as has already been demonstrated in other countries.
- **Policy feasibility**: the question arises whether there is scope for introducing an additional carbon tax alongside the existing EU emissions trading scheme. The combination of the two would appear to be well feasible as well as sensible, because the new tax would create a price floor in the ETS. This is again an issue requiring European agreement.

Price strategy

The basic starting point for any further ETR must be that the tax rates achieve internalisation of external costs and environmental damage ('getting the prices right'). In many sectors (particularly greenhouse horticulture and heavy industry) this makes an increase in tax rates (removal of reduced tariffs) all but inevitable. For the built environment and passenger transport, tariffs will need to be geared more to the kinds of behavioural change required to secure standing policy targets (*target-based pricing)*. If successful, a regulatory tax such as that on carbon emissions will lead to emission cuts and consequently to dwindling tax revenue. To maintain an incentive for further reductions as well as the same level of tax receipts, tax rates will have to be steadily increased. Clarity about these increases over the years will give investors a stable business climate. To marry two objectives in one and the same policy measure is simply unfeasible, as the economist Jan Tinbergen demonstrated. This makes an additional measure essential: a legislatively grounded 'climate price correction' with which to reconcile the intended environmental outcome with stability of government revenue.

References

Van Beers & van den Bergh, 2009
Cees van Beers & Jeroen van den Bergh
Environmental Harm of Hidden Subsidies: Global Warming and Acidification
In : Ambio Vol. 38, No. 6, (2009); p.399-341

Van Beers e.a., 2002
van Beers, C., van den Bergh, J.C.J.M., de Moor, A. and Oosterhuis, F. 2002. Environmental Impact of Indirect Subsidies. Development and Application of a Policy Oriented Method.
The Hague : Dutch Ministry of Housing, Spatial Planning and Environment, 2002.

Bovenberg & Mooij, 1994
A.L. Bovenberg & R.A. Mooij
Environmental Levies and Distortionary Taxation
In : American Economic Review Vol. 94 (1994); p.1085-1089

CE/CML, 2004
S.M. de Bruyn, M.N. Sevenster, G.E.A. Warringa, E. van der Voet & L. van Oers
Materiaalstromen door de economie en milieubeleid : een analyse naar indicatoren en beleidstoepassingen van economiebreed materialenbeleid
Delft : CE Delft, 2004

CE/CML, 2006
S.M. de Bruyn, M.N. Sevenster, E. van der Voet & L. van Oers
Materiaalverbruik en milieu-impact: data 1990-2004
Delft : CE Delft, 2006

CE, 2008a
B.E. Kampman, L.C. den Boer & M.B.J. Otten
Kosten en effecten van beleidsmaatregelen
Delft : CE Delft, 2008

CE, 2008b
Martijn Blom, Sander de Bruyn & Jasper Faber
Fiscale vergroening: effecten en beoordeling van opties ten behoeve van het belastingplan 2009
Delft : CE Delft, 2008

CE, 2009
Eelco den Boer, Arno Schroten & Gijs Verbraak
Opties voor Schoon & Zuinig verkeer
Effecten op klimaatverandering en verzuring
Delft : CE Delft, 2009

CPB, 1997
Vergroening en Energie: Effecten van verhoogde energieheffingen en gerichte vrijstellingen
The Hague : Netherlands Bureau for Economic Policy Analysis (CPB), 1997

CPB, 2001
Mark Lijesen, Machiel Mulder en Martin Vromans
Fiscale vergroening en energie II: Economische effecten van verhoging en verbreding van de Regulerende Energiebelasting
The Hague : Netherlands Bureau for Economic Policy Analysis (CPB), 2001

ECN, 2008
P.G.M. Boonekamp & J. Gerdes, in collaboration with SenterNovem, PBL and CBS
Energiebesparing in Nederland 1995-2006 : Update op basis van het Protocol Monitoring Energiebesparing
Petten : Energy Research Centre of the Netherlands (ECN), 2008

Ecofys, 2004
Evaluatie van het klimaatbeleid in de gebouwde omgeving 1995-2002
Utrecht : Ecofys, 2004

EEA, 2006
European Environment Agency (EEA)
Using the market for cost-effective environmental policy : Market-based instruments in Europe
Luxembourg : Office for Official Publications of the European Communities, 2005

EC, 1992
Council Directive 92/81/EEC of 19 October 1992 concerning the harmonization of the structure of excise duties on mineral oils
Brussels : European Commission (EC), 1992

EC, 2009a
Proposal for a Council Directive amending Directive 2003/96 restructuring the Community framework for the taxation of energy products and electricity
Brussels : European Commission (EC), 2009

EC, 2009b
Regulation (EC) no. 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles
Brussels : European Commission (EC), 2009

FAO, 2006
H. Steinfeld, H. Gerber, T. Wassenaar, V. Castel, M. Rosales & C. de Haan (eds)
Livestock's long shadow: environmental issues and options
Rome : Food and Agricultural Organisation (FAO), 2006

ICAO, 1944
International Civil Aviation Conference : Chicago, Illinois, 1 November to 7 December 1944
Chicago : ICAO, 1944

IEA, 2008
World Energy Outlook, 2008
Paris : International Energy Agency (IEA), 2008

IEA/UNEP, 2002
Reforming Energy Subsidies Brochure
Paris : IEA/UNEP, 2002

IFEU Heidelberg, 2008.
EcoTransIT: Ecological Transport Information Tool, Environmental Methodology and Data
The tool can be found at www.ecotransit.org, along with the manual
Heidelberg : IFEU Heidelberg, 2008

IFS, 2008
Environmental taxes : Reforming the Tax System for the 21st Century, the Mirrlees review
London : Institute for Fiscal Studies (IFS), 2008

Ministerie van Financiën, 2009
Wijziging van enkele belastingwetten en enige andere wetten (Belastingplan 2010)
The Hague : Netherlands Ministry of Finance, 2009

Musgrave & Musgrave, 1984
R.A. Musgrave & P.B. Musgrave
Public Finance in Theory and Practice. Fourth Edition
S.l. : McGraw-Hill Book, 1984

OECD, 2004a
Environment and employment : an assessment
Paris : Organisation for Economic Co-operation and Development (OECD), 2004

OECD, 2004b
Environmental performance review of Sweden
Paris : Organisation for Economic Co-operation and Development (OECD), 2004

OECD, 2006
The political economy of environmentally related taxes
Paris : Organisation for Economic Co-operation and Development (OECD), 2006

PBL, 2009
Getting into the Right Lane for 2050: A primer for EU debate
Bilthoven : Netherlands Environmental Assessment Agency (PBL), 2009

Pearce, 1991
D.W. Pearce
The Role of Carbon Taxes in Adjusting to Global Warming
In : Economic Journal, Vol. 101 (1991); p.938-948

RFF, 2004
J.C.M. van den Bergh
Evolutionary Analysis of Economic Growth, Environmental Quality and Resource Scarcity
In : Ayres R.U., D. Simpson & M. Toman (eds.), Scarcity and Growth in the New Millennium, Washington DC : Resources for the Future (RFF), 2004

Schöb, 2003
Ronnie Schöb
The Double Dividend Hypothesis of Environmental Taxes: A Survey
Munich : CESifo Group Munich

Stern, 2006
N. Stern, (eds.) (2006)
Stern Review: The economics of climate change
Cambridge : Cambridge University Press, 2006

TME, 1999
Jochem Jantzen
Op zoek naar het groene belastingparadijs: zijn milieudoelen haalbaar met milieuheffingen
The Hague : Institute for Applied Environmental Economics (TME)

TNO, 2003
P. Hendriksen *et al*.
Evaluation of the environmental impact of modern passenger cars on petrol, diesel, automotive LPG, CNG
S.l. : TNO, 2003

Vellinga *et al*., 2006
P. Vellinga, M.J.F. Stive, J.K. Vrijling, P.B. Boorsma, J.M. Verschuuren & E.C. van Ierland
Tussensprint naar 2015 : Advies over de financiering van de primaire waterkeringen voor de bescherming van Nederland tegen overstroming
S.l. : Advisory Committee for Primary Dyke Funding, 2006

VROM-Raad, 2004
Energietransitie: klimaat voor nieuwe kansen : Gezamenlijk advies van de VROM-Raad en de Algemene Energieraad
The Hague : Council for Housing, Spatial Planning and the Environment, 2004

Vielle & Viguier, 2007
M. Vielle & L. Viguier
On the climate change effects of high oil prices
In : Energy Policy, Vol. 35 (2007), p.844-849