Should Energy Taxation "Go Dutch"?

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One particular area for green tax reform has been the use of the tax system to provide proper incentives to reduce climate change emissions, in particular carbon-dioxide (CO2). Indeed, the burning of fossil-fuel-based energy products contributes significantly to climate-change-related emissions. Therefore also the European Commission commissioned a new Directive (see COM(2003) 96 final) for raising and harmonizing energy taxes across the European Union (EU). In fact, this EU Directive is the culmination of a long-lasting effort to introduce a broader (implicit) tax on the use of fossil fuels and its associated climate change emissions (Ekins and Speck 1999).

Interestingly, the Netherlands, like the Scandinavian countries and Austria, introduced similar energy taxes long ago. This led to an energy tax structure that is in line with the recent EU Directive on energy taxes and therefore did not require any serious reform when the Directive became effective at the beginning of 2004. This suggests that the Dutch experience with energy taxation could be seen as a prototype model for other countries to follow when implementing the EU Directive. Up to some point this is certainly true. It is interesting to see what experience a small, open as well as energy-intensive economy like the Netherlands has had with energy taxation.

As usual, however, the devil is in the details, and several caveats lurk around the corner. One serious caveat is that at some point revenue considerations start to dominate energy tax design. This might lead to suboptimal tax structures from both a revenue raising as well as a corrective tax perspective. Some recent reforms in the Netherlands – although in line with the EU Directive – are a case in point as this article will illustrate. In fact, the recent EU Directive provides interesting opportunities to exploit international coordination to avoid at least some of these drawbacks provided that the focus is on regulation, not on revenue raising energy taxes.

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Energy taxation in the Netherlands

In the last two decades, several tax policy initiatives have caused a major shift in the way in which energy products were treated in the Netherlands. Taxation as a means of creating direct incentives to reduce the climate change impacts of energy products has already had a long history, albeit its revenue-raising impact has always been modest. Clearly, taxes on energy use other than motor fuels, e.g. for heating or power generation, have always had a very limited role in the overall tax and excise structure from a revenue perspective. As in most European countries today, excises on mineral oils (MOE) were also the only relevant energy taxes before the introduction of an explicit tax on energy use in the Netherlands, the so-called Fuel Tax (FT) implemented in 1988. Still, together both taxes were responsible only for 4 percent of total tax revenue in that year.

Since 1988, however, this picture has changed remarkably in the Netherlands (Vermeend and Van der Vaart 1997; Heineken 2003). First, the FT became gradually more important as a revenue-raising instrument. This tax replaced a set of small charges with a rather complicated tax base (including air pollution and noise) for financing purposes. After these charges were transformed into a transparent tax on fuels in 1988, their rates were raised substantially at the beginning of the 1990s. Second, the Dutch government introduced a completely new tax in 1996 to regulate energy consumption and to reduce CO_2 emissions. This tax, the regulatory energy tax (RET), was introduced despite the failure of the European Commission to introduce an EU-wide carbon tax in 1995 (see COM(95) 172). All energy taxes together accounted for almost 9 percent of total tax revenue in 2002 and the role of the MOE declined from almost 100 percent of overall energy tax revenue in 1988 to only 66 percent in 2002 (see Table 1). Both the major tax reform in the Netherlands in 2001 and recent tax initiatives of the Dutch government continued to reinforce this trend.

The shift in the tax treatment of energy products underlying the rise in revenue is further illustrated in Table 1. The table not only reveals large differ-

Table 1

Total excise rates on specific energy products in the Netherlands in 2002 and for the EU Directive COM(03) 96 (in Euro)

Energy product	Unit (thousands)	Mineral oil Excise	Fuel tax	Regulatory energy tax	Total energy excise tax	EU Directive
Mineral oils: motor fuels						
– Leaded gasoline	Liter	685[a)]	12		698	421
– Unleaded gasoline	Liter	615[a)]	12		627	359
– Diesel/light fuel oil – low S[b)]	Liter	332[a)]	14		345	302
– Diesel/light fuel oil	Liter	346[a)]	14		359	302
– LPG	Kg	104	16		120	125
Mineral oils: other use						
– Diesel	Liter	53[a)]	14	131	197	21
– Light fuel oil	Liter	53[a)]	14	132	198	21
– Heavy fuel oil	Kg	16	16		32	15
– LPG	Kg		16	156	172	0
Coal						
– Coal	Kg		12[c)]		12	4.05/9.1[e)]
– Blast-furnace, coke-oven,						
– Coal and refinery gas	GJ		117[d)]		117	n.a.
– Coal gasification gas	GJ		462		462	n.a.
Natural gas						
– Gas (0–5,000)	m^3		11	124	135	4.75/9.5[e)]
– Gas (5,000–170,000)	m^3		11	58	69	4.75/9.5[e)]
– Gas (170,000–1mn)	m^3		11	11	21	4.75/9.5[e)]
– Gas (1mn–10mn)	m^3		11		11	4.75/9.5[e)]
– Gas (> 10mn)	m^3		7		7	4.75/9.5[e)]
Electricity						
– Electricity (0–10,000)	KWh			60	60	0.5/1[e)]
– Electricity (10,000–50,000)	KWh			20	20	0.5/1[e)]
– Electricity (50,000–10mn)	KWh			6	6	0.5/1[e)]
– Electricity (> 10mn)	KWh					0.5/1[e)]
Energy tax revenue	million Euro	5.8	0.6	2.4	8.8	
Percentage energy tax revenue	%	66	7	27	100	

[a)] Includes strategic storage tax of EUR 6 per unit. – [b)] Sulfur content below 50 ppm. – [c)] Taxpayer may opt for GJ and carbon content as a tax base, with a rate of EUR 0.198 per GJ or EUR 2.4493 per 1,000kg CO_2. – [d)] If traded; the rate is zero if these gases are produced and used in the same plant. – [e)] Low (high) tax rate applies to (non)commercial use .

Source: Statistics Netherlands; Dutch Ministry of Finance; COM (03) 96.

ences in the current treatment of energy products resulting from the different energy taxes, but also shows how the newly introduced taxes, in particular the FT and the RET, broadened the tax base and how they together relate to the minimum tax rates set by the EU Directive. These taxes are responsible for the inclusion of energy products such as coal, natural gas and (small-scale consumption of) electricity as well as mineral oils used for heating purposes. In particular, the RET is responsible for from over 50 to 100 percent of the excise burden of some products. Note also that large differences exist between tax rates on energy products used as motor fuels, heating fuel, feedstock or for other applications. In general, MOE tax rates are highest for gasoline and lowest for mineral oils used for heating purposes. All excises are specific per unit of energy volume. The FT has had a hybrid tax base since 1990. Initially, a fixed CO_2 component was added to the initial tax base by energy content. Since 1992, the different fuels have been (more or less) taxed according to their relative energy and carbon content, each counting for 50 percent of the overall tax base.

The RET started as a tax on energy products used for heating purposes (mainly gas in the Netherlands) or power generation (electricity) by small-scale consumers, such as households and small firms. Since the RET's introduction in 1996 its tax base has been broadened and now also includes consumption by intermediate firms. Tax rates are regressive with the level of consumption for each connection to the grid, and very large electricity consumption levels faced a zero rate in 2002. Recently the electricity tax base was brought further

in line with the requirements of the EU Directive and now also applies to large scale energy consumers (although with some allowed exemptions). In fact, both the FT and RET were brought into one legal framework – called the Energy Tax – at the beginning of 2004.

Together, the FT and RET created the incentive structure on energy products used for heating or power generation. Note, first of all, that *mineral oils* not used as motor fuels are subject to all the taxes. The much lower MOE on mineral oils used as heating fuel is compensated partly by the RET. Crude oil is only taxed indirectly, i.e. downstream *after* the refinery process, by the taxation of refined mineral oils (gasoline, etc.). Accordingly, the energy consumed (and emissions caused) by refining is excluded from the tax base, as are particular refinery products, such as petrocokes and liquid and gaseous residuals, which are often recycled in the same plant.

The Netherlands is one of the few countries that taxed but did not subsidize coal, although at a low rate (coal mines were closed at the end of the 1960s). Special provisions exist for typical energy products produced and recycled in production processes based on coal, such as steel production. For instance, there are exemptions for blast-furnace and coke-oven gas, if recycled within a particular (large) plant. Only if these products are traded does the tax apply. Note also that the EU Directive does not apply to these products either.
Consumption of *natural gas* (NG) is taxed through the FT, although the tax rate for large-scale consumption is very low. The regressive tax rates of the RET, however, are much stronger, with even no tax applying to large-scale NG consumption. Also, an exemption existed for consumption up to 800m^3 between 1996 and 2001, but this has recently been changed into a tax credit with equal value in terms of income loss (Euro 142). Finally, reduced tax rates apply to gas consumed for horticulture.

The consumption of *electricity* is, like the consumption of NG, taxed through the RET, including also a regressive rate structure and an exemption for very large consumers. Note that NG input for *electricity production* is exempted from the RET, and all inputs have been exempted from the FT since 2001. Originally electricity producers also had to pay FT for the use of fuels, such as coal and NG, and a uranium tax was due for nuclear power generation between 1997 and 2001. In 2001, this regime was changed in favor of what is called an 'output' tax. Now, all fuels used for electricity generation are exempted, including the fuels used in combined heat and power (CHP) plants (with electric efficiency over 30 percent). Simultaneously, the tax rates on electricity were raised under the RET regime.

Note, finally, that several energy products were originally exempted from these energy taxes, like consumption and production of electricity from *biomass, wind and solar power*. However, these products have been taxed at a reduced rate since 2003.

Characterising the Dutch energy tax structure

Tax policy design of an energy tax to lower the levels of CO_2 emissions is rather straightforward in a world of only one distortion, i.e. a competitive economy with a negative externality from climate change which is directly linked to CO_2 emissions. In this case a corrective Pigovian tax would correct this externality simply by using the carbon content of energy products, by allowing for exemptions of energy products that are free of carbon content, by including tax rebates for carbon abatement, and by setting the tax rate equal to the level of the (expected) environmental damage involved (see Cnossen and Vollebergh 1992). In practice, however, governments refrain from the implications of such a tax for various reasons. One important reason is that they may also have a keen interest in the revenues of such a tax. Even an optimal corrective tax raises revenue in the optimum and this revenue is never redistributed lump-sum in practice as is assumed in a Pigovian world. For instance, governments may like to signal that they care about green tax reform, and one measure to illustrate this signal is, paradoxically, a higher share of green tax revenue. However, a high share of tax revenue from an energy tax base might also reflect a highly inefficient tax from the Pigovian perspective if this tax is not designed properly.[1]

The choice and development of the energy tax structure of both the FT and the RET in the Netherlands reveals this interesting paradox.

[1] To find a proper balance between corrective and revenue raising goals of government, in particular with the use of an indirect corrective tax like an energy tax, requires a balancing act which is far from straightforward (see for instance Bovenberg and Goulder, 2002 and Cremer and Gahvari, 2002).

Whereas the FT was designed for revenue-raising reasons, its tax rate is rather low and its tax base is remarkably broad including (relatively) elastic fuel consumption from (very) large consumers of coal and natural gas. The newly introduced RET with its regulatory focus, however, raises much more tax revenue than the FT applying much higher tax rates on a (relatively) less elastic tax base, i.e. consumption of energy for heating by households! I summarize the main characteristics of both the FT and the RET in 2002 as a point of reference in Table 2.

A first observation is that the FT, not the RET, is mainly responsible for the remarkable comprehensiveness of the Dutch energy *tax base* from a climate change perspective (see also Table 1). The FT taxes coal and NG upstream (if produced or used as 'raw' fuel or if distributed to others for domestic use) and oil through a tax on refined oil products. In contrast, the RET mainly focuses on downstream consumption of the major energy products consumed at the household and small-firm level in the Netherlands, i.e. NG and electricity. Only the direct taxation of electricity has been added to the energy tax base by the RET, while NG is now also being taxed at the household level.

Second, as far as *linkage* between energy use and emissions is concerned, which is the main issue from a regulatory perspective (see Smulders and Vollebergh 2001), the paradox is even more clear. First of all, upstream taxation of energy products is considered particularly distortive from the revenue perspective (Bovenberg and Goulder 2002), but downstream taxation of energy products implicitly exempts upstream emissions (Pearson and Smith 1992). Thus, the choice of tax base is precisely opposite to the main purpose of both taxes. One wonders why a *specific* excise, like the FT, was introduced for revenue reasons because energy consumption is already taxed through VAT. The explanation for this 'anomaly' is that the FT replaces a system of small environmental charges. Therefore its tax base had to be linked to 'the environment' (even though its revenue no longer has to be used for environmental expenditures). In contrast the RET has always been regarded as a unilateral environmental tax which should exempt exposed energy consumption, i.e. upstream energy use by energy-intensive industries and electricity producers (see also Bovenberg 1993). Interestingly, the original (as well as current) design for a European carbon tax was hardly different in this respect (Ekins and Speck 1999).

Third, the *exemptions* as related to specific characteristics of production processes, like steel production and refineries, provide further evidence for the paradox mentioned above. The heterogeneity of energy use involved here, in particular due to complex joint production, justifies special treatment (e.g. Poterba and Rotemberg 1995). Much of the current rationale of the Dutch energy tax structure follows from a sometimes even accidental recognition of this heterogeneity. For instance, the current FT does exempt residual gases, which is clearly optimal from the regulatory perspective. The taxation of residuals favors substitution towards untaxed elements in the steel making or refinery process, in particular towards flaring. Although taxation of residual fuels would certainly be favorable from a revenue-raising perspective, it is very likely to result in *more*, instead of less CO_2-emissions. The current exemption of residual fuel use clearly benefits the environment, but its existence is only due to a ruling of the Dutch Supreme Court on completely different grounds.[2]

Table 2

Comparison of fuel tax and regulatory energy tax in the Netherlands in 2002

	Fuel Tax (FT)	Regulatory Energy Tax (RET)
Main purpose	– Revenue raising	– Regulation (climate change emissions)
Tax base	– All energy products except electricity	– Only small-scale consumption of natural gas and electricity
Linkage	– Upstream coal and natural gas – Downstream oil	– Downstream
Exemptions	– Residual energy products – Fuels used for electricity production	– Large energy-intensive industries – Horticulture
Abatement incentives	– No	– Carbon sequestration – Subsidies for non-fossil-fuel products
Tax rate structure	– Specific (hybrid)	– Specific (hybrid)
Level	– Low	– High, but decreasing with higher levels of consumption

Source: author.

[2] See Vollebergh (2004), for an extensive discussion of the justification of this exemption.

The recent tax reform with respect to *electricity* is another example of the paradox that the revenue-raising FT serves regulatory incentives better than its explicit regulatory alternative. Electricity is taxed directly under a so called 'output-based' RET regime, which exempts carbon emissions during electricity production. Until 2001, however, the FT also applied to the main inputs for electricity production in the Netherlands – NG and coal. Since 2001, the energy products used for electricity production, including CHP installations, have been exempted from the FT in favor of higher rates of the output-based RET. Accordingly, input substitution by electricity producers to reduce CO_2 emissions is no longer directly addressed by the energy excise structure now.

The main reason behind this remarkable tax shift is a compensation for CO_2 abatement measures as promised by electricity producers according to the so-called 'coal covenant'. Moreover, the measure sustains the promotion of (NG-based) CHP generation in the Netherlands. After the termination of a generous subsidy to any (potential) producer of CHP several years ago, the booming CHP business came to a sudden standstill and even existing installations were threatened.[3] Broadening the NG tax base to include firms of medium size under the RET would impose a further disincentive to CHP. Shifting the tax burden from the FT to a tax on 'output', i.e. the RET on electricity, would lower the tax burden on the generation of electricity. Because the different modes of power generation are treated similarly under this reform, large-scale power plants no longer face input and abatement incentives to reduce climate change emissions.

Finally, *carbon abatement incentives* are particularly small for both taxes. Even the incentives that applied in 2002 have recently been reconsidered and will be abolished. Apart from stimulating CHP generation, the FT has no provisions for 'carbon' rebates, which is in line with the revenue-raising purpose of the tax. Their absence in the RET, however, is remarkable. Also proposals to favor carbon sequestration through afforestation by providing offsets in the RET have never been put into practice.[4] Yet the RET used to have incentives for nonfossil-fuel-based energy production, but now even taxes renewable resources, though at a reduced rate.

As far as the *tax rates* are concerned, both taxes are specific with a hybrid structure, while FT rates are much lower than RET rates. With its upstream orientation, the FT also taxes energy-intensive consumers but only at low rates, while the RET taxes mainly the consumption by small firms and households of NG and electricity, the main energy products consumed by these agents, at high rates. Even though all agents are due to pay RET over their inframarginal consumption of energy, energy-intensive industries face no tax at the margin at all.

Again, tax rates on the different energy products hardly follow the logic as implied by the purpose of both taxes. The much lower tax burden for energy products consumed by industry reflects the Ramsey perspective.[5] In general, (energy-intensive) industry is more sensitive to the energy tax base, and distortions are more likely for intermediate inputs, such as heavy fuel oil, coal, (large-scale consumption of) NG and electricity. Thus to tax energy substitutes for households and small firms at a much higher level through the RET primarily makes sense from a revenue perspective (ceteris paribus). Again the Pigovian element is exactly opposite to what one would expect. The FT clearly favors NG over oil and coal for the relevant substitutes at the industry level (for details see Vollebergh 2004). Coal faces a total tax burden almost twice as high as the tax burden on NG which closely follows the Pigovian logic of indirect taxation according to the (relative) pollution intensity of these products. In contrast, the relative (normalized) total tax burden of heating products for households and small firms, such as NG, light fuel oil and electricity, is similar. Clearly, this burden, which is mainly caused by the RET, appears not to follow the Pigovian logic.

[3] CHP was subsidized in the Netherlands through a fixed price per kWh delivered to the national grid. This price was considerably above the market price for electricity and therefore stimulated a fast expansion of CHP in the Netherlands. Note that CHP is still subsidized by a reduction of the RET on electricity produced from these plants (not larger than 200 GWh).

[4] Firms distributing NG and electricity would have received tax rebates for certified afforestation (under the Carbon Offset Verification System), but not for other carbon abatement investments.

[5] A more appropriate comparison requires standardization of tax rates in relation to energy and/or carbon content of the fuels, however. The problem with the (common) representation of the energy tax structure (like Table 1) is its poor informative content with respect to its (regulatory) incentives. The volume of fuels is a poor indicator of the relative performance of energy products for heating purposes. Although an increase in the tax rate per unit of volume always induces agents to look for cheaper alternatives, the impact of a similar rise in tax differs across products due to differences in, for instance, heating potential. Using several tax ratios that account for this standardization, Vollebergh (2004) provides a much more detailed description and analysis of the energy tax structure in the Netherlands.

Some tax policy lessons

What can we learn from the Dutch experience with energy taxation? The most challenging lessons are:

- Higher tax revenues from an environmental tax base, like 'energy' or even 'fossil fuels' need not signal optimal green tax reform. Higher tax revenues on some energy inputs may even exacerbate emissions (residual fuels), whereas alternative tax bases may raise revenue at lower (distortionary) costs (e.g. broad based consumption tax, like VAT). Indeed, the newly introduced regulatory energy tax (RET) in 1996 signals green tax reform because of its high amount of revenue raised on a 'green' tax base, i.e. energy use by households and small firms. However, although the RET might be (relatively) efficient from a Ramsey perspective, a simple increase in the tax rates of the existing tax on fuels would probably have been much better from a regulatory perspective. Thus the revenue-raising tax on energy accommodates important exemptions from the regulatory perspective, whereas the regulatory tax mainly taxes relatively inelastic uses of (fossil-fuel) energy. This just illustrates that higher tax revenues from energy tax bases do not always signal Pareto improvements, even if one restricts the evaluation to the environmental dividend alone.
- In line with the previous remark, an *uniform* corrective taxation is not always the best solution to 'repair' an externality. Specific sectors or production processes might be optimally exempted from indirect environmental taxes, for instance if emissions and inputs are substitutes, or if administrative cost are prohibitive (relative to the abatement potential). Although the fundamental idea that more direct instruments are beneficial to society still remains valid, these benefits should be weighed against efficiency losses due to other second-best elements, such as heterogeneity in informational or abatement costs. A clear example is the choice of the EU not to tax residuals recycled in refineries and steel making plants.
- The Dutch energy tax as well as the EU Directive for a coordinated EU-wide energy tax account for comprehensive taxation of energy products. All upstream and downstream fossil-fuel products, except crude oil, are subject to some tax. However, the energy tax structure in terms of the composition of the tax base, its choice of the tax base (energy-content), options for tax rebates for carbon abatement and its rate structure leaves room for improvement. Upstream taxes with their strong linkage, the limited (cheap) options for direct emission abatement and their low transaction costs seem to provide an interesting alternative for the relatively high energy tax burden for households. Even low tax rates would already trigger large energy-intensive firms to invest in carbon abatement options, in particular if a tax would allow for (self-enforcing) tax rebates, whereas such options do not exist at the household level. Higher 'output' tax rates on refined oil and electricity never compensate for the loss of abatement potential from these plants, in particular because they are usually large and energy-intensive. Other ways to improve the effectiveness of the existing taxes would be to introduce at least a hybrid *carbon* tax base, allow for tax rebates for abatement and to relate the tax rates even more explicitly to product characteristics.
- Finally, the recent EU Directive is a useful step forward and provides interesting opportunities to exploit international coordination to avoid at least some of the drawbacks mentioned before provided that the focus is on regulation, not on revenue raising energy taxes. For instance, the recent shift from an input to an output electricity tax in the Netherlands could be reconsidered if all countries would commit to at least taxing their electricity production energy inputs at some minimum rate. However, the many exemptions allowed in the current Directive render this rather unlikely, which makes Member States reluctant to implement this type of energy tax. Also the lower tax rates for commercial use do not fully exploit the regulatory potential of a European wide energy tax. It would be much more efficient to apply (at least) similar tax rates to commercial rates together with proper carbon abatement rebates. Indeed, these as well as other examples demonstrate that the opportunities for regulation are not fully exploited yet. If there is a reason for the taxation of energy it is regulation, since an energy tax base does not seem to be the best choice as a revenue raising source.

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