



Environmental taxation without damaging competitiveness

Environmental taxes raise tax revenues, increase energy efficiency and reduce emissions and environmental damage. However, many countries are reluctant to implement them, fearing negative impacts on competitiveness. Here we present the lessons learned from Denmark.

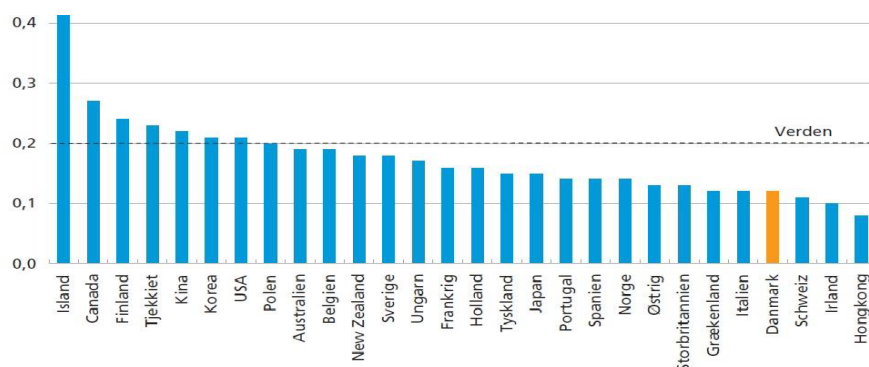
Denmark is one of the most energy efficient economies in the world. In 1996, it became one of the first countries in Europe to introduce a CO₂-tax on top of existing energy taxes and to subject the business sector to a reduced rate of CO₂-tax.

I Competitiveness effects

Two in-depth governmental reviews conducted in 1999 and 2011 concluded that **the Danish CO₂-tax reduced CO₂-emissions substantially, and that energy intensity decreased 22% from 1990 to 2008** (Danish Ministry of Taxation and Competitiveness, 2011). They also concluded that

The CO₂ tax has helped to make Denmark one of the most energy efficient economies in the world, as shown in the table below.

Energy intensity per unit produced in industrial countries



Both reviews concluded that the widespread use of green taxes does not have a negative impact on overall competitiveness. Indeed, they highlighted the possibility of increasing tax rates substantially without impacting on general competitiveness or employment, if tax-rates escalate slowly over a longer period so that enterprises have time to adapt and maintain their competitiveness.

Only a limited number of energy-intensive enterprises were not able to maintain their competitiveness – and this is why special rules for energy-intensive industries are necessary.

II Special rules for energy-intensive industries

Until recently, all enterprises in Denmark were required by law to report how much energy they used for room heating and air conditioning, for energy intensive processes, and the remainder of their energy use. This energy use was then taxed at different rates, as shown below:

	Energy tax	CO2 tax
Energy for heating and cooling	YES	YES
Energy used in light processes	NO	YES
Energy used in energy-intensive processes	NO	REDUCED RATE

Companies with energy-intensive processes were offered contracts to facilitate increased investments in energy-efficient technologies, secure reduced CO₂-tax rates, and offered financial support for large investment projects. Agricultural and horticultural sectors were reimbursed nearly all taxes due.

Intelligent policy mitigated possible negative effects on competitiveness and had a positive effect on investments in energy-efficient technologies, especially in the 1990s.

III Revenue recycling

To avoid negative impacts on competitiveness, it is crucial to recycle net revenue from environmental taxes to the business sector in general and to the manufacturing industries in particular.

When tax-rates increased in 1996, tax revenues were recycled to companies to reduce ancillary wage costs, or public fees, or revenues were used to fund support schemes for energy efficient investments.

Reimbursement of revenues boosted the market share of energy-efficient industries, while less energy-efficient companies were negatively affected – leaving international competitiveness unchanged overall.

IV Latest developments in Denmark

In 2013, the Danish parliament reduced energy-taxes on energy used for all purposes other than room heating and air conditioning for business to a level corresponding to the European minimum and removed the CO₂-tax on electricity. The new low tax rates will even apply to electricity for lighting and office equipment in trade and services – even though these sectors are not exposed to international competition. The Danish business sector continues to pay full energy and CO₂ taxes on energy for space heating and cooling.

These changes were in response to Denmark having lost almost 30% of its global market share since 1995, according to a study conducted by Denmark's National Bank in 2012 – but this was due to increasing labour costs and slow growth in productivity, not green taxes. **The move is regrettable, has been strongly criticised and goes against Denmark's target of covering its entire energy supply, including transport, with renewable energy by 2050.**

The FRE-COMMUNICATE! project is funded by the Velux Foundations. VILLUM FONDEN and VELUX FONDEN are non-profit foundations, founded by VILLUM KANN RASMUSSEN – founder of VELUX and other companies in the VCR group, with the purpose of bringing daylight, fresh air, and a better environment into people's everyday lives.



Environmental fiscal reform and social equity

Environmental taxes can raise tax revenues, boost energy efficiency and reduce emissions and pollution. For countries short of revenues with ambitious environmental policies, environmental taxes are a logical choice.

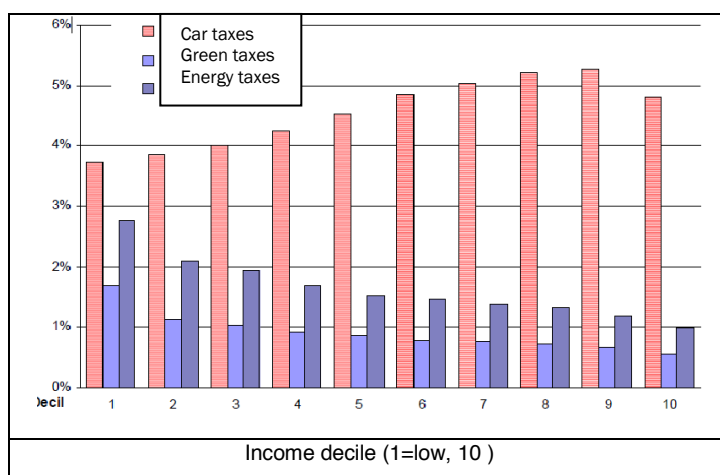
Some critics argue that environmental taxes hit the poor hardest. Is this true ? – and if it is, what can we do about it? We base our answers on lessons learned from 25 years of environmental taxation in Denmark.

Environmental taxes are not regressive overall

In Denmark, the amount of environmental taxes paid increases with income, amounting to about the same percentage of personal income across the board.

However, environmental taxes have different effects on income. For example, high-income families spend a greater share of their income on car taxes compared to low-income families. Energy taxes are different. Each adult uses more and less the same amount of electricity and nearly the same amount of heating fuel, meaning that electricity taxes represent a much larger share of the low-income budget – as you can clearly see in table 1.

Table 1: Share of environmental taxes by income decile (% of total income)



Source: Risø, *Fordelingsvirkninger af miljø og energifgifter*, 2001.

Thus, when the government increases energy taxes, low-income families will be the most affected unless additional measures are introduced to protect them. Some best practice examples are listed below.

II Possible solutions

The right mix of environmental taxes

As environmental taxes have different impacts, it is important to choose the right mix of environmental taxes to make sure everyone pays their fair share. To get the balance right, it is important to include progressive taxes, such as higher taxes on big, less efficient cars, or air passenger duty.

Compensation via the tax system

The Danish government has used several strategies to prevent environmental taxes hitting the poorest hardest. One possibility is to reduce the lowest rate of tax, or reduce some of the tax elements paid by all taxpayers. **Every taxpayer will benefit from this tax reduction – but increased net income will constitute a bigger share of the total income in low income deciles.** To give a practical example: In Denmark in 2009, energy taxes increased considerably, while healthcare payments and the lowest tax rate were reduced.

Another possibility is to increase the personal tax allowance, as the Danish government did in 2012, when single mothers were given an additional allowance. Many countries make deductions from income before calculating tax. These can be reformed to make sure that the overall impacts of taxes are fair and equitable.

Green cheques

Handing out green cheques is also a way of avoiding regressive effects. In Denmark, the green cheque is in fact a deduction from income which decreases as income increases. The maximum green check is worth €173 per adult per year, and €40 per child. This tax deduction is part of the compensation for increased energy tax rates from 2009 introduced to prevent any possible regressive effects.

Tax rates for residential customers in 2014 in Denmark

Electricity: Electric heating 0,05 euro/kWh Electricity 0,11 euro/kWh Natural gas Energy tax: 0,38 euro/m ² CO ₂ -tax: 0,05 euro/ m ² NO _x -tax: 0,006 euro/ m ²	Oil for heating: Energy tax: 0,34 euro/l CO ₂ -tax: 0,06 euro/l NO _x -tax: 0,007 euro/l
---	---

Due to the compensatory measures introduced by the Danish government, these tax rates are broadly accepted by the electorate in Denmark.

The FRE-COMMUNICATE! project is funded by the Velux Foundations. VILLUM FONDEN and VELUX FONDEN are non-profit foundations, founded by VILLUM KANN RASMUSSEN – founder of VELUX and other companies in the VCR group, with the purpose of bringing daylight, fresh air, and a better environment into people's everyday lives.



Fact Sheet: The Swedish NO_x emissions tax

Purpose of the tax

Soil acidification and water eutrophication caused partly by emissions of NO_x from combustion processes in transport, industry and power plants has been a major problem in Sweden since the 1980s. The NO_x tax and reimbursement system were introduced in 1992 with the intent of reducing emissions of NO_x from energy generation in combustion plants and combined heat and power plants. The NO_x tax is an economic instrument that aims to give incentive for operators to reduce emissions and invest in advanced combustion and pollution abatement technologies. The overall purpose is to achieve environmental objectives for acidification, eutrophication and fresh air. From the time the tax was introduced in 1992, NO_x emissions from such plants was continuously reduced proportional to the energy produced (see figure 1.1). Since 1991, emissions per unit of energy produced have decreased from 0,4 kg/GWh to 0,18 kg/GWh.

How the tax works today

According to the NO_x Act the charge of 50 SEK is to be paid per kg emissions of NO_x from boilers, stationary combustion engines and gas turbines with a useful energy¹ production of at least 25 gigawatt hours (GWh) per year. The system is designed so that a refund amounting to the revenue raised except administrative costs is returned to the participating plants, in proportion to their production of useful energy. Facilities emitting low volumes of NO_x per unit of energy produced are, by this, net beneficiaries of the scheme (see box 1.1).

It is established by the law (1990:613) on environmental taxes on nitrogen oxide emissions in energy production, which facilities are covered by the tax and which are exempted from the tax. Among others, the pulp industry's recovery boilers are not affected by the tax. In 2013, the tax revenue from the NO_x tax

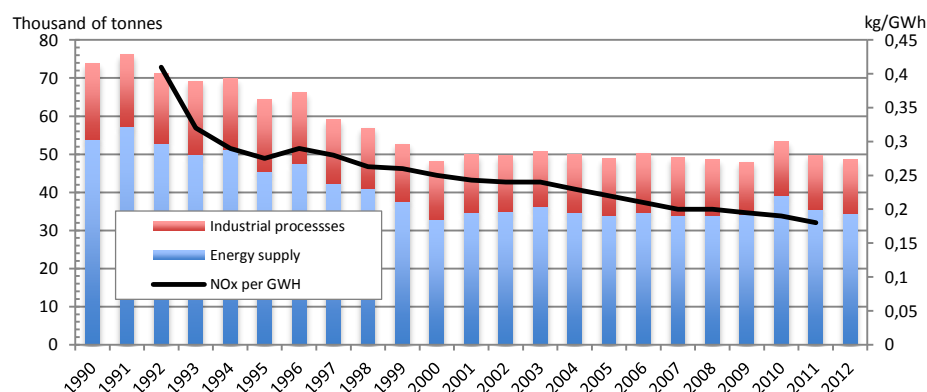
Box 1.1: Calculating the tax refund

Each year, plants affected by the tax assess how high their NO_x emissions have been and how much energy they have produced during the year. From total NO_x emissions, the total NO_x tax is calculated. In addition, the total amount of energy produced and the refund (on amount of energy produced) is calculated. The refund is calculated by dividing the remaining tax revenue with the energy produced. It provides a refund expressed as SEK/MWh. Thereafter every plant's net refund amount is calculated as: (produced MWh energy x refund SEK/MWh) – (kg of nitrogen emitted x 50 SEK). When the tax is paid, a refund is given to those who have low emissions relative to their energy production. In this way some plants will make a net profit while the rest will make a net payment.

Example:

A combustion plant produces 135.790 MWh of energy and emits 24.680 kg of NO_x in 2006. The tax rate is 50 SEK/kg NO_x and the refund was 8,50 SEK/MWh that year. The net amount is calculated: 135.790 MWh x 8,50 SEK/MWh - 24.680 x 50 SEK/kg = -79.785 SEK. This means the combustion plant has to pay 79.785 SEK (Swedish Environmental Protection Agency, 2014).

Figure 1: NO_x emissions in total (tonnes) and per produced energy unit (kg/GWh), 1990 - 2012.



Note: From figure 1.1 it is seen that while the NO_x emissions per produced energy unit is declining, total NO_x emissions stagnate or even increase after 2008. Source: Based on data from The Swedish Environmental Protection Agency. Available at: <http://www.naturvardsverket.se/Sa-mar-miljon/Statistik-A-O/Kvaveoxid-till-luft/>

¹ Useful energy is a term used to compare energy production at different production units. In some industries useful energy is the same as the energy sales (often in power and heating industry). For other industries that do not sell energy it is defined as hot water, steam or electricity produced in the boiler and used in production processes or for e.g. the heating of factory buildings (Naturvårdsverket 2012).



was 671 million SEK². The tax revenue equals the total payments from plants emitting more than the average, which is then refunded to the industry to plants that are cleaner than the average (cf. box 1.1).

The implementation process

Emissions of NO_x from combustion are a global environmental problem, because it causes acid rain and contributes to eutrophication in lakes, rivers and oceans even distances away from the polluting source. Sweden has under international conventions committed to reduce Swedish emissions. Even the Swedish environmental quality objectives mean that the Swedish emissions of NO_x must be reduced. As acidification was the major environmental problem in Sweden in the 1980's, NO_x emission's effects on the environment got a strong political attention. The Swedish Government decided to adopt a strategy in 1985 to reduce overall domestic NO_x emissions by 30% by 1995, compared to 1980 levels. With the Swedish Environmental Charges Commission proposal in 1990, a charge of 40 SEK per kg of NO_x emitted by combustion plants producing at least 50 GWh was introduced on 1 January 1992. In 1996, the charge system was expanded to include plants producing at least 40 and further in 1997 to plants with a production of at least 25 GWh. In 2008 the NO_x tax was increased to 50 SEK / kg of NO_x emissions.

Challenges

The 2008 increase in the NO_x tax of 10 SEK/kg of NO_x emissions has been investigated through a statistical analysis and an interview study by the Swedish Environmental Protection Agency (*Naturvårdsverket*) in 2012. The results of the assessment show that emissions of NO_x per unit of energy produced has continued to decrease, since the introduction of the charge in 1992. Although increasing the charge was expected to accelerate this decrease, no such acceleration has been observed since 2008. This would indicate that the effect of the increase has been limited. In fact, it is seen that *total emissions* after 2008 have increased (see figure 1.1), which could be explained by reasons given below.

One explanation is that energy production, which is the main activity for about 50% of the plants (combined power and heating plants and the waste incineration industry), has increased in line with the Swedish economy. Another explanation is that the NO_x charge and refund system, not only stimulates firms to take NO_x-reducing measures, but also stimulates the production of energy in the plants, which in turn increases total NO_x emissions. A solution would be to return the revenue lump sum to the industry. The refund should not depend on energy produced, as this gives incentives to produce and emit more. If the tax is refunded in a way firms cannot influence, i.e. lump sum, no such incentives are given.

The inefficiency of the higher charge could be explained by the charge not continuously increasing according to inflation. This means that the real charge was declining from 1992 to 2008. Since SEK 50/kg in 2011 corresponds to SEK 37.3/kg in 1992 prices, the charge was in 2008 brought back to approximately the 1992-level. Thus, the increased charge can be viewed as a way to undermine the effect of inflation, and not an increase in the real value of the charge. However, one should take account of external factors, such as weather conditions, affecting energy production (and thereby NO_x emissions) when assessing the effect of the charge on total emissions. Thus, it is difficult to draw conclusions on the effectiveness of the *increased* charge by looking at the total NO_x emission level.

Further information

OECD (2013), "The Swedish Tax on Nitrogen Oxide Emissions: Lessons in Environmental Policy Reform", OECD Environment Policy Papers, No. 2, OECD Publishing.

Notisum web page: Law on environmental tax on emissions of nitrogen oxides by energy production (In Swedish). Online at [<http://www.notisum.se/rnp/sls/lag/19900613.htm>].

The Swedish Environmental Protection Agency (2012). Utvärdering av 2008 års höjning av kväveoxidavgiften (Evaluation of the 2008 increase in nitric oxide charges). Rapport 6528. November 2012 (Summary in English). Online at:

[<http://www.naturvardsverket.se/Nerladdningssida/?fileType=pdf&pid=4570&downloadUrl=/Documents/publikationer/6400/978-91-620-6528-7.pdf>]

² Skatteverket: Taxes in Sweden, Tax Statistical Yearbook of Sweden 2014, p. 26. Available at: <http://www.skatteverket.se/download/18.3f4496fd14864cc5ac9cf58/1418913620973/skatter-i-sverige-skattestatistisk-arsbok-skv152-utgava17.pdf>