Successful environmental taxes in Denmark

This note is a presentation of some of the most successful environmental taxes. We have chosen a mix of different kind of taxes: water taxes, one of the energy taxes (carbon tax), taxes on PVC with phthalates, waste taxation, car taxes, etc.

**Water tax**

The tax on piped water was introduced in 1994 in Denmark by the Social Democratic lead government in order to reduce the water consumption. There was no shortage of water. The purpose was to reduce the amount of wastewater.

In 1994, the water tax was 1.0 DKK per m³ water (0.75 euro). The water tax had an immediate effect on the water consumption. The delivery of drinking water was reduced from 513 to 480 million cubic meters from 1993 to 1995.

The water tax is slowly increased to 6.1 DKK per m³ (0.8 euro) in 2014 and 6.5 DKK per m³ (0.9 euro) in 2015, including a supplementary drinking water tax. The tax on piped water is reimbursed for enterprises.

Together with the wastewater tax, the water tax has continuously reduced the water consumption in the households.

Waterworks also pay water tax on water waste due to leakages in the pipes system, if the waste is more than 10% of the total water production. This system lead to a remarkable reduction of water leakages from the water pipes.

The figure below illustrates the development in the water consumption per person and per company from 1997 to 2009. The development in water consumption in households water consumption is marked as dark grey, the industry as green, the public sector as blue and the waterloss as light grey.
The dark grey is households, the blue is public institutions and the light green is the business sector.
The table below shows the revenue from the pipe water in million DKK. 1 euro=7.5 DKK

### Revenue from the tax on piped water in million DKK

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<tr>
<th>Year</th>
<th>2007</th>
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<th>2013</th>
<th>2014</th>
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<tbody>
<tr>
<td></td>
<td>1380</td>
<td>1385</td>
<td>1372</td>
<td>1364</td>
<td>1400</td>
<td>1503</td>
<td>1584</td>
<td>1600</td>
</tr>
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</table>

Though the use of water has declined, the revenues from the tax on piped water has increased because of increased tax rates. The revenue from the water tax will be around 1700 million DKK (227 million euro) in 2015.

**Pesticide tax**

We just sent you a separate note about the pesticide tax.

**Tax on PVC and phthalates**

The tax on PVC and phthalates was introduced in 2000. The purpose was to increase the economic incentive to use other softener than phthalates and to reduce the quantity of PVC to be burnt in combined heat and power plants.

There are different tax rates per kg PVC with phthalate depending on the product, for instance flexible pipes (3.5 DKK per kg), gloves and rainwear (3.6 DKK per kg) and cables (2.48 DKK per kg). The tax rate for the same products produced without phthalate is 1.4, 1.08 and 0.91 DKK per kg.
The tax on PVC and phthalate has been a great success because it has considerably reduced the use of phthalate. The use of phthalates is reduced to more than one third. Research indicates, that classified phthalates, for instance DEHP, has been substituted by non-classified phthalates, as for instance DINP and DIDP.

The table below shows the total revenue from the tax on PVC and phthalate (1 euro=7.5 DKK).

**Revenue from the tax on PVC and phthalates (in million DKK)**

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</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>67</td>
<td>60</td>
<td>51</td>
<td>43</td>
<td>44</td>
<td>37</td>
<td>26</td>
<td>23</td>
<td>22</td>
<td>20</td>
<td>18</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>

The tax on PVC and phthalates is of great importance to the environment and health, because it has reduced the use of classified phthalates. The contribution to total tax revenue is negligible.

The substitution from classified phthalates to other softener was most dramatic in the first 10 years after the introduction of the tax on PVC and phthalates. The tax is not high enough to get phthalates out of medical equipment.

**Carbon tax**

Denmark was one of the few countries, introducing a Carbon Tax in the early 1990’s. The step one was a carbon tax on households in 1992.

The business sector did not pay energy taxes at that time. However, the socialist government proposed a carbon tax on business sector to make sure, that Denmark in 2005 succeeded in reducing the CO2 emissions by 20 % compared to 1988. The carbon tax on the business sector was prepared from 1993 and was in force from 1996.

The carbon tax payment in the business sector was highest on energy for room heating and room cooling. It was lower for so-called “light processes”, including light industrial processes and including electricity used for lighting and office equipment in the business sector. The carbon tax payment was lowest for energy-intensive industrial processes because a bigger part of the tax payment is reimbursed and because of a basic allowance. The energy-intensive processes, including industrial processes and horticulture, were specified in the regulation. The energy-intensive industries had a further reimbursement option, if they signed an energy efficiency agreement with the Danish Energy Agency and invested in energy saving equipment.

It was calculated ex-ante, that the carbon tax in the business sector should reduce the CO2 emissions by 4.6 %. 1.8 % should come from the energy efficiency agreements and investment grants.

Two inter departmental evaluations concluded later, that the carbon tax influenced the CO2 emissions as predicted, and that macro-economic negative effects of the carbon taxation other green taxes were extremely limited.

The rising energy taxes (in household sector) and the carbon taxation reduced the overall energy consumption per square meter immediately.
Total energy consumption per m² for heating (black) and electricity (hatched)

Source: Danish Energy Agency.

Since the business sector until recently have had the energy taxes fully reimbursed, the carbon taxation (and the Emission Trading System) are the main reasons for the energy efficiency development in the Danish industrial sector. The figure below illustrates, that Danish Industry is extremely energy efficient compared to other industrial countries.

Energy intensity per unit produced in industrial countries

When looking at the overall development, the economic growth has been considerable since the 1990’s, while the energy consumption has remained rather stable. It is due to the energy- and carbon taxation.
The development in GDP (black) and energy consumption (red)

![Graph showing the development in GDP and energy consumption](image)

Source: Danish Energy Agency and Danish Statistical Department

In 2013, the Socialist government and the Parliament decided to remove the carbon tax on the business sector and introduce a payment of energy taxes on the EU minimum level. Now, the business sector only pay CO2 tax on energy for room heating and cooling.

The table below shows the revenue from the CO2 tax in DKK (1 euro=7.5 DKK).

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue (million DKK)</th>
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<tbody>
<tr>
<td>2007</td>
<td>5091</td>
</tr>
<tr>
<td>2008</td>
<td>5076</td>
</tr>
<tr>
<td>2009</td>
<td>5019</td>
</tr>
<tr>
<td>2010</td>
<td>5757</td>
</tr>
<tr>
<td>2011</td>
<td>5897</td>
</tr>
<tr>
<td>2012</td>
<td>5676</td>
</tr>
<tr>
<td>2013</td>
<td>5866</td>
</tr>
<tr>
<td>2014</td>
<td>3998</td>
</tr>
</tbody>
</table>

Taxation of waste and waste based heating

The aim of the waste taxes is to reduce the production of waste and to influence the handling of the waste.

The tax on landfill waste was introduced in 1987 to avoid unnecessary landfill. From 1997, landfilling of combustible waste was banned. In the late 1990’ies, Denmark had a much smaller proportion of landfill waste than other industrial countries. The tax on landfill waste was 475 DKK per ton waste in 2014 (63.3 euro per ton).

In Denmark, combustible has been considered a fuel since 2010, which is taxed more and less like other fossil fuels. Taxation of combustible is divided in two parts. There is a tax on the heat, which is produced, when the waste is burned. This tax is 51.3 DKK per GJ in 2014. There is also a so-called additional tax on waste, which is calculated from the energy content in the waste – used or not used. In 2014 the additional tax is 31.8 DKK per GJ. The Additional Tax on Waste replaced the previous weight-based tax on waste. The new system gives an increased incentive to recycling the most energy intensive part of the waste, for instance PVC.
Waste from biomass and processing of meat waste are exempted from the tax. Because waste is considered a fuel, incinerators pay carbon tax or are part of the European Emissions Trading System. Incinerators pay NOx tax and sometimes SO2 tax, when burning the waste. Despite packaging tax and tax on printed advertisements, Denmark generates much waste per capita. But more than half of the waste is burned as part of district heating supply - around 20% of the district heating is based on combustible. This is illustrated in the figure below.

The waste taxation has had an important impact on waste handling. The figure below shows how recycling of waste has increased dramatically since 1985 (the blue in the figure), while landfilling has been reduced (the yellow-brown part of the bars). The part of waste used in production of heat, mainly district heating, has increased a little.
Communicating the benefits of green fiscal reform

Green Budget Europe and the Danish Ecological Council

The table below shows the revenue from the landfill tax, the former waste tax and the new additional tax on waste. 1 euro=7.5 DKK. Please notice, that axation of waste based heat is included in the energy taxes since 2010.

Revenue from the waste taxes (million DKK)

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue</th>
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<tbody>
<tr>
<td>2007</td>
<td>1239</td>
</tr>
<tr>
<td>2008</td>
<td>1127</td>
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<tr>
<td>2009</td>
<td>1024</td>
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</tr>
</tbody>
</table>

Car taxes

Since 2007 the energy efficiency of the car has influenced both the purchase tax (called registration tax) and the annual taxation (green owner tax). The purchase tax is small, when the car is highly energy efficient, while it is high, when the car is big and using a lot of petrol or diesel.

For ordinary cars, the purchase tax is reduced by 4,000 DKK (533 euro) for each kilometer car drive per liter petrol or diesel further than 16 kilometers per liter gasoline and 18 kilometers per liter diesel. Similarly, the purchase tax is increased by 1,000 DKK (133 euro) for each kilometer car drive less than 16 kilometers per liter gasoline and 18 kilometers per liter diesel.

This regulation has been highly effective, since it created a large sale of small and energy efficient cars. The figure below illustrates, that the average new car in Denmark is more and more energy efficient and this development is enhanced by the new regulation from 2007. The red line shows...
the development for diesel cars and the green line for gasoline cars. The blue line shows the average for all cars sold.

**The average energy efficiency of new cars sold in Denmark**

![Energy Efficiency Chart]

In the figure below you find the average CO2 emissions per kilometer from all the cars in Denmark, which is reduced, calculated in grams per kilometer.

**Average CO2 emission in grams per kilometer in the Danish car fleet**

![CO2 Emission Chart]
The role of the purchase tax should ensure that most energy efficient cars and new technologies became attractive to the consumers. Therefore, it is not appropriate with a static breakpoint. Today the most energy efficient cars run longer than 16 kilometers per liter petrol and 18 kilometers per liter diesel due to the technological development and EU requirements for CO2 emissions from new cars. With a static breakpoint more and more cars qualify for the low purchase tax.

As a consequence, the revenue from the purchase tax is declining per car as shown in the figure below.

**Revenue from the purchase tax per new car, sold in Denmark**

It is also inconvenient, that the lower purchase tax has increased care sales in Denmark since 2008. The figure below illustrates, how the total fleet of cars is growing in Denmark.
Development in the number of cars in the Danish car fleet

Though the number of cars sold are increasing, the total revenue from the purchase tax and the annual fee (annual owner tax) is reduced, see the table below.

Revenue from purchase tax on vehicles sold (in million DKK)

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
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<tr>
<td></td>
<td>24,321</td>
<td>20,031</td>
<td>12,001</td>
<td>13,390</td>
<td>13,760</td>
<td>13,125</td>
<td>14,914</td>
<td>15,740</td>
</tr>
</tbody>
</table>

To avoid a continuously increase of the car fleet, the purchase tax must be continously adjusted, reflecting the technological development and CO2 emissions from best vehicle on the market.

The annual owner tax (the green owner tax) is price inelastic and should be used to adjust the tax revenue.

Revenue from the annual owner tax on all vehicles (in million DKK)

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
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<th>2014</th>
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<tbody>
<tr>
<td></td>
<td>8,712</td>
<td>10,544</td>
<td>9,827</td>
<td>10,019</td>
<td>9,873</td>
<td>10,042</td>
<td>10,886</td>
<td>10,620</td>
</tr>
</tbody>
</table>

It would be an advantage, if the Danish regulation was changed and the breaking point was calculated as CO2 emissions per kilometer car drive instead of in kilometers car drive per liter gasoline or diesel.
Communicating the benefits of green fiscal reform

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