# The role of market-based instruments in achieving a resource efficient economy

Under framework contract: ENV.G.1/FRA/2006/0073

Client: European Commission: DG Environment

Rotterdam, October 2011

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Final Report

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ECORYS

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# Executive Summary

## Why look at market-based instruments for resource efficiency?

Our economies depend on natural resources, as an essential input. Resource extraction and use places pressure on the environment, the scale and rate of this pressure is important in terms of our quality of life. Improving the process by which we use resources, by making them less polluting and more efficient, has been an important way of managing their impact. Economic growth and industrialisation in the developing world has significantly increased demand for resources. This has ratcheted up the pressure on many natural resources, raising questions of sustainability and availability, and increased prices for some resources.

The challenge this presents to European industry and society is significant and the response to it is crucial to future economic competitiveness and quality of life.

## Summary of key findings

### On the current use of market based instruments globally

1. Most environmentally related market based instruments in use globally are fiscal (tax) instruments.
2. MBIs are applied relatively rarely to resources: waste and emissions are the major focus of existing instruments.

### On environmental taxation in the EU

1. Across the EU environmental taxation varies in importance:
   a. Pollution and resource taxation make up only a very small share of environmental tax revenue…
   b. …but Denmark and the Netherlands show that this can be successfully increased.

### Lessons from looking at MBIs in practice

1. To introduce an effective instrument, you need support for it.
2. Education and awareness raising can be powerful supporting tools.
3. Substitution effects can have unintended consequences…sometimes leading to lower resource efficiency.
4. Administrative burdens vary considerably, but for container deposit schemes are high.
5. The type and objectives of an instrument tax can be crucial to its impact on resource efficiency.
   - Setting the tax at the ‘right’ level is central to its impact.
   - The impact of tax measures will erode over time, but revenues typically continue to increase.

6. Market based instruments are part of a wider system of instruments that they need to work with to be successful.
7. Monitoring and data relating to market based instruments is typically weak.
8. Fully understanding impacts would require more detailed econometric analysis.

9. Economic impacts of the studied MBIs were estimated to be slightly negative, which could in many cases be offset by the revenues raised.
    - A double-dividend from environmental taxation was achieved, but only in the UK.
    - Distributional impacts were typically slightly regressive.
10. Competitive impacts of the studied resource efficiency MBIs were estimated to be low.
11. Signals deployment of MBIs at EU level are mixed.

### Therefore we recommend to the European Commission and Member States

1. That there is strong potential for wider use of MBIs for resource efficiency.
2. To consider a broader range of market based instruments.
3. To remember to design instruments as part of a full package – MBIs are not a 'silver bullet'.
4. MBIs for resource efficiency should have resource efficiency as a primary objective.
5. Price based measures should be set at a level that actually incentivises change.
6. To Consider how resource taxes can incentivise efficient behaviour and expand the environmental tax base.
7. Tax measures should always consider if revenues can be recycled to companies or consumers to achieve a double-dividend.
8. Tax measures need to be dynamic or regularly reviewed.
9. Take consumer behaviour and perceptions into account in instrument design.
10. Investigate how targeted education and awareness raising can be expanded.
11. Carefully consider the cost-effectiveness of container deposit schemes.
12. MBIs should link resource quantity and impact.
13. Distributional effects of MBIs are typically not large, but should be considered.
14. MBIs should be based on a sound life-cycle basis to support real resource efficiency.
15. Use consistent definitions and methodologies and improve monitoring and evaluation.

These findings are further expanded and our full recommendations presented later in this executive summary.

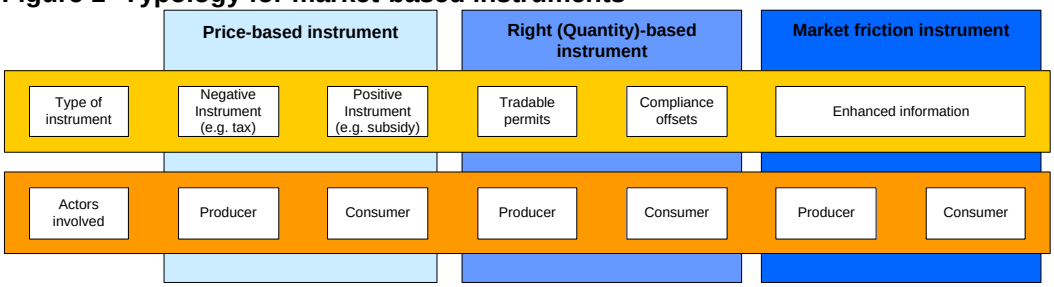
## Purpose of this study

This study investigated how market based instruments (MBIs), can support and drive the move towards resource efficiency. These tools are designed to 'get the prices right', meaning that markets better reflect environmental impacts (externalities) and resource scarcity in prices so that producers and consumers can respond appropriately. This is widely understood to be more economically efficient than directly legislating or regulating for similar goals. The **objective of this study was to identify the market based instruments being used**, particularly those that demonstrate best practice in promoting resource efficiency, and **examine how they can be improved**, **what lessons can be drawn and the recommendations for the future**, taking into account the cost, competitiveness and other impacts.

## How we looked at this: methodology

The research method for this study was based around a few key elements. Firstly, the scope was clarified, excluding energy, carbon emissions and other air pollution emissions, where considerable work already existed. The focus was to be on other resources, products and services. A typology of market based instruments was then defined; see Figure 1, with 3 main types of instruments identified.

**Figure 1 Typology for market-based instruments**




Source: Figure is adapted from Whitten et al, An Overview of Market-Based Instruments and Environmental Policy in Australia

1. ***Price-based instruments*** alter the prices of goods and services to reflect their relative impact. Examples are the introduction of *taxes* on water use or *subsidies* for environmentally friendly bio fuels;
2. ***Rights- or Quantity-based instruments*** are designed to control the quantity of the resource, environmental good or service to the socially desired level. Right- or quantity- based instruments are for example the *European Emissions Trading System* or a *Carbon Offset Scheme*;
3. ***Market friction instruments*** are policy mechanisms which pursue the goal of stimulating a market to produce a desired resource efficient our environmental outcome by improving information flows. An example for a market friction instrument is *eco-labeling*.

Market friction instruments are not discussed further as these are not inline with the study objectives.

The research began with a desk-based search into the MBIs used globally resource efficiency to identify the range of different instruments being used. Eight MBIs used in the EU were taken forward as case studies, with

the case studies investigating the application of similar instruments in two different Member States to compare and contrast approaches and maximise learning. The analysis was supported with economic modelling of the case study instruments using the E3ME model.

The eight case studies we prepared are:

1. Water consumption – NL & CY
2. Pesticide taxes – SE & DK
3. Aggregates levies - UK &SE
4. Tree protection charges – AT & LT
5. Drinks container deposit schemes – DE & DK
6. Plastic bag taxation – IE & DK
7. Effluent charging – DE & FR
8. Natural resource taxation – LV & FI

Short summaries of these cases are provided in the next sections.

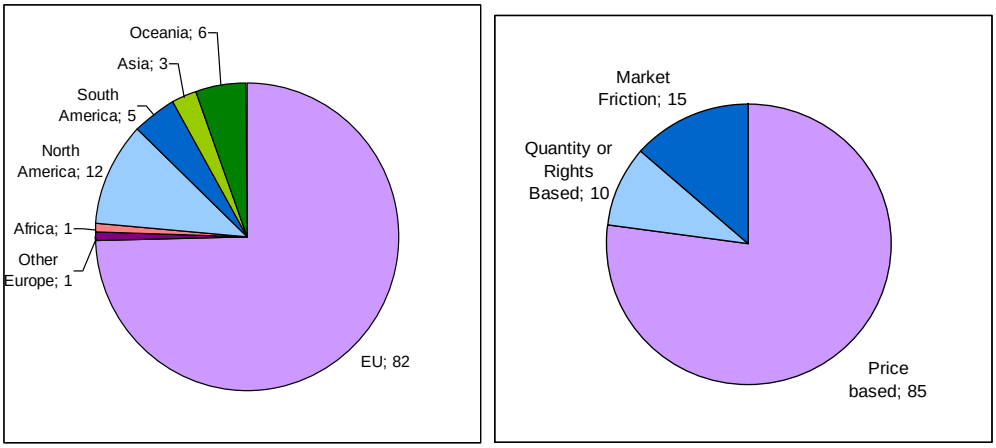
## How are MBIs used globally?

A review was carried out of various sources to put together a sample dataset of 110 MBIs for resource efficiency that are in use globally[1]. A summary of the results is presented below:

**Global MBIs**

- ¾ of the identified instruments were found in EU countries, with the next highest concentrations in North America, South America and Oceania (Australia).
- The majority of instruments (85 of 110) were price based, i.e. taxes or subsidies on products, processes or resources. Quantity instruments were much less prevalent (as were market friction instruments, but the sample is not representative for them).

**Figure 2 Identified MBIs - Geographical Spread and instrument type, number found**




[1] It is clear that there are many more MBIs being employed globally that are related to the environment and resource efficiency, therefore this selection represents merely a sample of those discovered within the time and resource constraints of this study. Among the constraints was the exclusion of MBIs related to energy, and carbon, NOx and SOx emissions as these were felt to already be comprehensively covered. Market friction instruments were also largely excluded.

**EU MBIs**

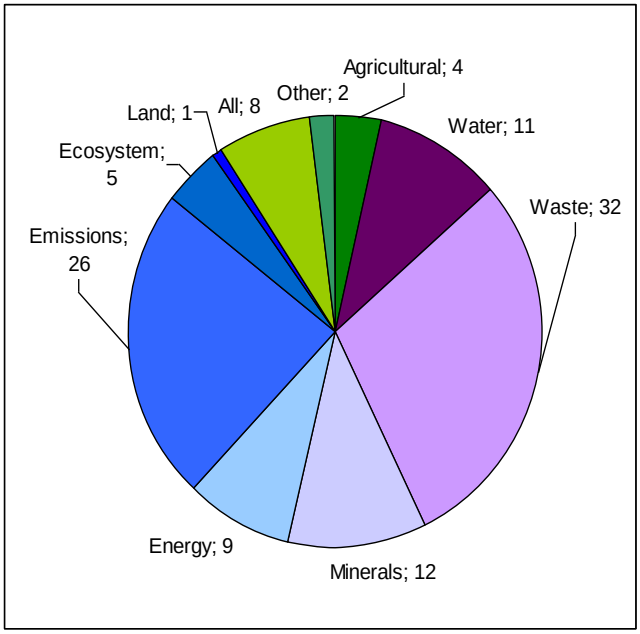
- Only 2 countries within the EU (NL, UK) were found to employ tradable permit (quantity – rights) based instruments.
- There is a considerable difference between MSs. Most MBI best practices were found in Western-Europe, particularly in Austria, Germany, Slovenia, Poland, the Netherlands and UK. Though it should be noted that this is also illustrative of the difficulty of finding information in some MS.

**Resource focus of MBIs**

The broad type of resources targeted by the instruments were also analysed for all 110 identified MBIs. The results are presented in Figure 9, this shows that:

- Waste or waste prevention instruments were most prevalent. Followed by instruments targeting emissions to air (which were not discussed in this report).
- Minerals, water and energy related instruments were the next most common.
- There is only a limited focus on land, ecosystem[2], agricultural or other MBIs.

**Figure 3 MBI instruments – resource targeted by instrument**




## Conclusions on the current role of market based instruments

**Most environmentally related market based instruments in use globally are fiscal (tax) instruments**

Our review of global MBIs found a sample of instruments, of which the great majority (85 of 110) were price-based, with the majority of these imposing a tax, levy or charge for specific consumption or production

[2] A more comprehensive study on eco-system based MBIs can be found here http://ec.europa.eu/environment/enveco/biodiversity/pdf/mbi.pdf.

activities[3]. This trend was similar across countries, although there was little use of quantity or rights based instruments, such as tradable permits, in the EU. In the wider context quantity based instruments were most closely associated with emissions.

**MBIs are applied relatively rarely to resources: waste and emissions are the major focus of existing instruments**

Of the existing instruments around half were focused on waste and recycling or emissions (greenhouse or other air pollutants), neither of which was intended as a focus of this study. Water, mineral resources and energy received some attention but are a less common focus. This demonstrates that instruments concerned with resources and aiming in particular at resource efficiency are not widespread and are poorly developed in comparison to other areas, providing a significant opportunity for improvement and wider deployment.

### MBI focus – Environmental taxation

With tax based measures the most common form of MBI it was interesting to further examine their role as a part of general taxation and GDP, what they are constituted of and how they have changed over time in the EU and by MS.

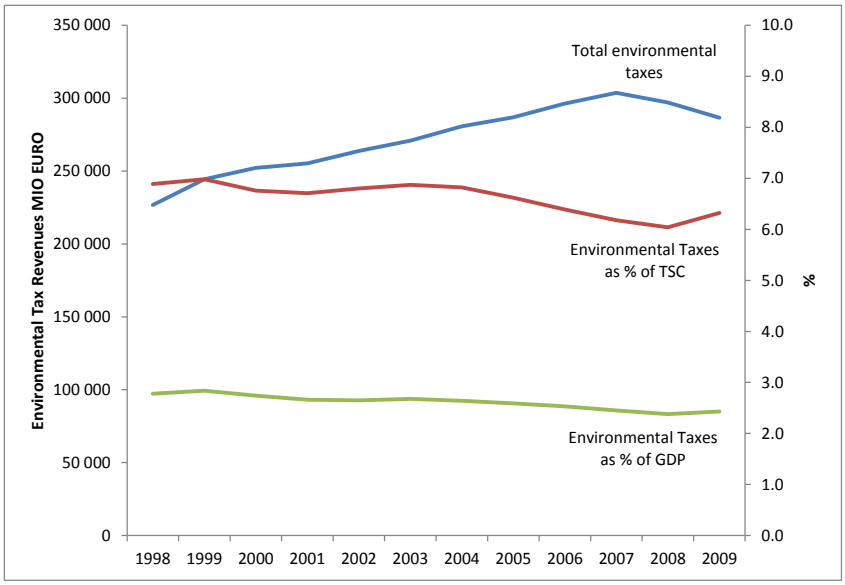
## Conclusions on environmental taxation in the EU

***In the EU environmental taxation varies in importance***

Environmental taxes brought in approximately 287 billion EUR of tax revenue in 2009. They have decreased from a peak of over 300 billion EUR in 2007 (see Figure 4), possibly due to the effects of the economic crisis. Over the last 10 years most Member States have seen a small decline in environmental taxation as a proportion of GDP and of total taxes with a slight upturn in the last year. Even in leading countries such as Denmark and the Netherlands this is evident, with environmental tax revenue growth not quite keeping pace with GDP growth. Revenues from environmental taxes in the EU-27, accounted for 2.4% of GDP and for 6.3% of total revenues in 2009, in terms of a share in total tax revenues it means a slight increase compared with 2008, from 6 to 6.3%. Given that their share in GDP remains on the same level they seem to be arguably less volatile than other taxes during a recession. However, this development, measured at the weighted EU average level, hides substantial differences between the Member States.

[3] It is clear that there are many more MBIs being employed globally that are related to the environment and resource efficiency, therefore this selection represents merely a sample of those discovered within the time and resource constraints of this study. Among the constraints was the exclusion of MBIs related to energy, and carbon, NOx and SOx emissions as these were felt to already be comprehensively covered. Market friction instruments were also decided not to be a major area of focus for this study.

**Figure 4 EU-27 Total Environmental Tax Revenues and as a % of TSC and GDP, 1998-2009**




*Source:* Ecorys based on Eurostat [env_ac_tax]

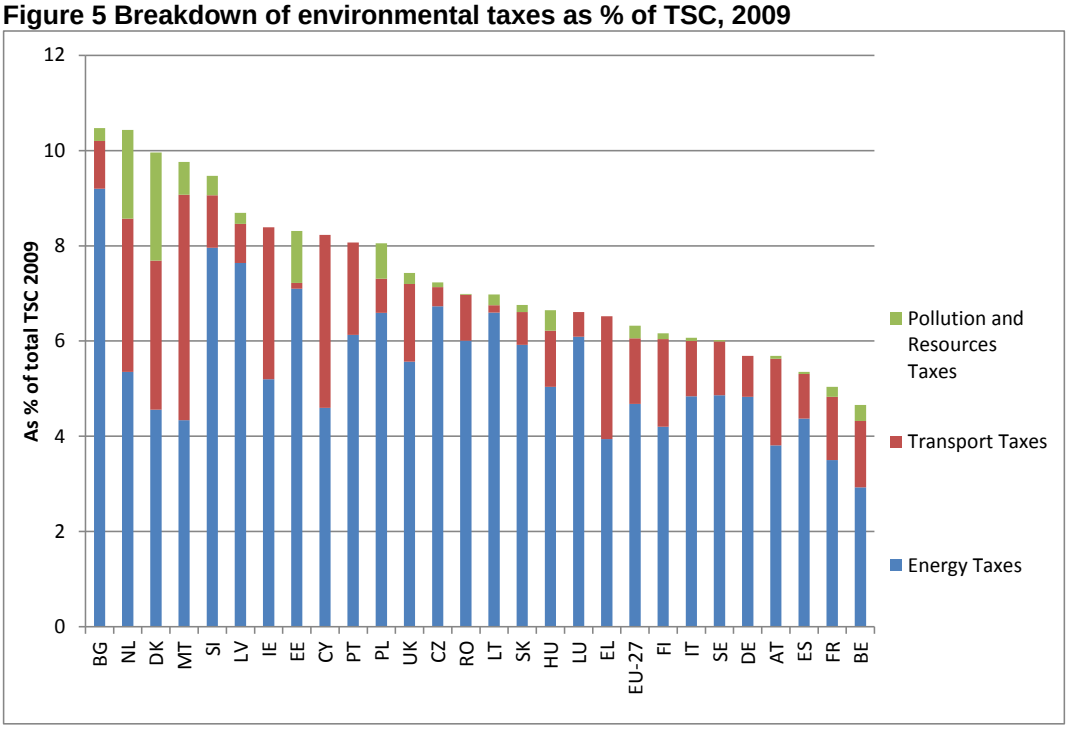
Since 1999 the share of environmental taxation out of total taxation has increased in the EU as a whole, specifically in these Member States: BG, SK, LV, SE, EE, AT, PL, NL, DE; but has remained stagnant or decreased in the others. Many big Member States figure in the last group, which explains the falling trend of the EU weighted average. In the new Member States, the increase has been largely driven by the EU accession process, although some of these countries used the occasion to increase energy tax levels beyond the strict requirement of the EU provisions. Also in some old Member States environmental taxes have been increased recurrently, often as a part of broader fiscal reforms[4].

The differences in the use of environmental taxes are significant. In 2009 in Bulgaria and the Netherlands, they made up more than 10% of tax revenue, whilst in Belgium they made up less than 5% (see Figure 5). What is consistent is that energy and transport taxes make up the majority of environmental taxes across all MS. Pollution and resource taxation shows much more variance, with some MS (EL, CY, LU) not recording any significant tax revenues from these at all.

Denmark and the Netherlands are the countries in the EU with the broadest environmental tax bases, with a much greater focus on pollution and resource taxation. They have been able to successfully broaden their environmental taxes in this way, primarily with a greater targeting of taxes on waste, packaging, water use and treatment and pollution. The impacts of this have not been measured but should be positive environmentally.

4 ht[4]tp://ec.europa.eu/taxation_customs/resources/documents/taxation/gen_info/economic_analysis/tax_papers/taxation_paper_24_en.pdf

**Figure 5 Breakdown of environmental taxes as % of TSC, 2009**




Source: Ecorys based on Eurostat (2011)

***Pollution and resource taxation make up only a very small share of environmental tax revenue…***

Energy and transport based taxes constitute the biggest elements of environmental taxes and market based instruments in individual Member States (see Figure 5). Across the EU, environmental taxes provide just over 6.3% of tax revenue, but of these environmental taxes only 4% on average (or 0.26% of the total tax take) are directly focused on pollution and resources. This demonstrates that resource based instruments, outside of energy and fuel, are not high priorities for policymakers.

***…but Denmark and the Netherlands show that this can be successfully increased***

The case studies on the following page profile Denmark and the Netherlands who have a much broader environmental tax base. They provide evidence that this can not only support tax revenues but also deliver improved environmental performance. There appear few reasons why this approach could not be replicated elsewhere, and with careful design, a double-dividend targeted.

## General environmental taxation case studies:

### *Denmark*

Environmental taxes have been a part of the Danish tax system since the 1970's and they have developed into a broad set of taxes and charges across energy, transport and pollution and resources. These taxes in the most recent years have brought in between 8-10.5 billion EUR of revenue, representing approximately 4% of GDP.

Progression towards this green tax system has been somewhat uneven over time, with steps forward being balanced against adjustment periods, and 'tax stops', where taxes were left unchanged or frozen – reflecting wider economic and political debates about the role and burden of taxation. Moves towards a percentage or index based system could help smooth this process.

Green taxes in Denmark are designed to influence behaviour to more sustainable environmental choices. In this respect the taxes are believed to have been successful, charges on pesticide use and packaging coinciding with reductions in their use, however, more detailed analysis is lacking at this point. As a whole environmental taxes in Denmark are relatively broadly applied, with a greater focus on resource use, particularly waste and water, and pollution (2.3% of the tax take compared to EU average of 0.3%). This has boosted revenues

### *The Netherlands*

The Netherlands introduced environmental taxes in1988 and has since expanded their range, so that they constitute over 10% of the tax base, bringing in over 23 billion EUR in 2009, representing around 4% of GDP.

The taxes are relatively broadly spread across the 3 main categories of energy, transport and pollution and resources. The pollution and resource taxes, accounting for around 20% of the total include charges for waste disposal, sewage treatment and water pollution.

Analysis of environmental taxes in the Netherlands has shown that they generally work as intended, in that taxes result in decreased demand for that product, service or activity. From an environmental point of view the taxes have been a success, leading to reduced emissions and pollution while generating significant revenue for the treasury. Economically speaking the impacts are not well understood, but are believed to be slightly negative. Part of the reason for this is the lack of any explicit recycling of revenues back to sectors or in the form of reduced labour taxes to try and create a double dividend, indeed the implicit tax rate on labour has increased by 2.9% between 2000-2009. Nevertheless, whilst not directly used in this way they have been a source of revenue and the Netherlands has maintained low levels of unemployment over this period.

## Case studies of Resource Efficiency MBIs in the EU

Eight case studies were made of MBIs relating to resource efficiency in the EU. In each case a specific MBI is examined in its application in two Member States to compare and contrast approaches and maximise learning for wider application. The following pages provide short profiles of the cases, including their design and achievements. The full conclusions across all cases are presented in the next section. Please refer to chapters 4 and 5 of the main study for the full case studies.

| **Instrument 1:** | **Water consumption charging** | |
|---|---|---|
| General purpose and rationale: | Water is an essential resource, in many areas it is increasingly scarce or requires close management. Charges on water use provide incentives to use less and to use what is necessary more efficiently. | |
| Country: | **The Netherlands** | **Cyprus** |
| Specific context and rationale: | Water has always been central to Dutch life, in holding back the sea to create land and managing the large inflows of water to keep the country dry. | Cyprus is a dry, arid country, and groundwater resources have faced increasing pressure due to population and economic growth, including tourism. It has the lowest per capita water availability in the EU and since 1997 desalination has become increasingly important. The biggest water users are agriculture (65%) and households (35%). |
| Instrument design: | A groundwater tax (1995) is charged to those that abstract groundwater (mainly water companies and industry) and a tap water tax (2000) is charged to all users depending on quantity used, up to 300m$^3$ / year.<br>Taxes are charged by water companies and paid to the state governments.<br>Taxes not explicitly itemised so consumers may be unaware of tax effects.<br>Objective is reduced usage and funding for infrastructure. | A water tax was first introduced in 1984 and was later adjusted to a tax that is applied on a volumetric (usage) basis. Charges are by m$^3$ of water use and applied at different rates and in different ways by region.<br>The instrument is applied so that the level of charges increase with usage, lowest marginal tax rates at lowest usage levels.<br>Objective of the tax was to reduce usage and raise funds for investment in water infrastructure. |
| Rates and | Taxes equate to approximately 0.131 EUR per m$^3$ | Major reform of taxes in 2004 pushed up prices |

| | | |
|---|---|---|
| Effect: | (groundwater) and 0.107 EUR per $m^3$ (tap water), against average prices of 1.45 EUR per $m^3$ (households) and 1.07 EUR per $m^3$ (business). Together aprx. 25% of water price, which has significantly increased since the taxes were introduced. Has resulted in:<br>• Reduced use of groundwater since the tax.<br>• Per person domestic water use reductions since 1995, resulting from more efficient appliances and changing habits. | significantly. Estimated weighted tax of 0.43 EUR per m3 in 2005. Other instruments and the effects of drougt and water restrictions have are important but results since 2004 include:<br>• a significant and continual decrease in per capita water usage, from 192$m^3$ per person in 2004 to 109$m^3$ in 2008. |
| Revenues, costs and burdens: | Revenue of 381 million EUR in 2006.<br>Administrative burden assessed as insignificant. | Revenues of 25.55 million EUR in 2005, equating to aprx. 62% of the financial, environmental and resource costs of the water management system, up from 45% in 2001. The remaining un-covered costs are picked up through general taxation.<br>No estimate of administrative was possible, though this is believed to be relatively minor. |
| Conclusions: | The tax has been successfully introduced in the Netherlands and provides price signal incentives to consumers to use water more efficiently. | The tax in Cyprus in an important part of the water management framework and since 2004 has helped to successfully incentivise reduced water usage. |
| Wider application: | Similar taxes could be applied elsewhere, points of note include:<br>Price elasticities – greater water use reductions can be achieved in lower income countries, i.e. price changes have greater impact.<br>Households & companies – the impact on water usage of companies was greater than for households.<br>Perception – is important, perceived scarcity of a resource raises the likelihood of consumer acceptance and action. | |
| **Instrument 2:** | **Pesticide taxation** | |
| General purpose and rationale: | Pesticides are important to agricultural production, supporting higher crop yields. Yet pesticides by their nature are toxic to certain forms of life and there are fears that human and environmental health risks exist, though these are not well understood. Managing the use of pesticides is important to reduce these risks and resource use. | |
| Country: | **Sweden** | **Denmark** |
| Specific context and rationale: | Aprx. 1 707 tonnes of active pesticides sold in 2006, over 3.1 million hectares.<br>Sweden introduced a pesticide tax in 1984/5 and formalised efforts to reduce pesticide use began in 1986. | Aprx. 3 254 tonnes of active pesticides sold in 2006, over 2.66 million hectares.<br>A pesticide action plan was first introduced in 1986, specifying use reduction goals. 2nd and 3rd action plans have also since been introduced. |
| Instrument design: | The tax was introduced at the equivalent of 0.4 EUR per kg of active substance, this subsequently increased to its current rate of 3.3 EUR per kg in 2004. This represents on average around 5-8% of the retail price. This is supplemented by a pesticides registration charge made annually with both a fixed and sales related component.<br>Revenues from the tax, finance activities of the pesticides programme including education and inspections, with significant emphasis on the former. | Tax was introduced in 1996 as an ad valorem measure, the rate was increased from 37% to 54% in 1998. Around 75% of tax revenues are returned to the farmers through reduced land taxes, the remainder as used for other measures that are part of the wider system, including education for farmers, buffer zones, tighter pesticide approval procedures and record keeping. |
| Rates and Effect: | While per hectare doses have remained much the same since the tax was introduced, the tonnage of active substance has consistently fallen, by a total of | Pesticide wholesalers responded to the tax by reducing prices, so that the net price effect of the tax was an average 6% reduction in price, effectively a re- |

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| | more than 60%. A more sophisticated monitoring approach, incorporating risk factors reveals that summed risk factors have also declined by over 70% since the tax was introduced.<br>It is believed that the price signal from the tax is relatively weak and that the greater share of these gains is due to the education and training of farmers in better application of pesticides, bans on the most harmful and integrated pest management. | distribution of income from retailers to farmers. By applying a tax proportional to price the tax was also relatively lower on cheaper (usually less efficient, more polluting) pesticides.<br>Overall pesticide use in DK, as measured by the treatment frequency index (TFI), decreased from 2.51 in 1994 to 2.1 in 2003, but has increased to 2.8 in 2010, much higher than the 1.7 TFI targeted.<br>Organic farming has significantly grown in Denmark, although still only 5.5% of all farmland. |
| Revenues, costs and burdens: | The tax brought in revenues equivalent to 50.7 million EUR in 2008, with these remaining around the same level since 2000.<br>No specific estimate of administrative burden is available but a figure of 0.3% has been put forward based on proportions of total tax administration costs. | The tax brought in revenues equivalent to 61.8 million EUR in 2010, up from 38.8 million in 1998.<br>The burden of the tax is small, as it is applied to only the handful of manufacturers and importers. |
| Conclusions: | The role of the taxes in successfully reducing pesticide use is hard to determine. The price signal was understood to be relatively weak and to have had little effect. More credit is given to the education programmes for farmers on correct pesticide use. This latter aspect partially funded by the tax. Overall the system of measures has been effective. | The role of the tax in reducing pesticide use is hard to determine. The price signal was distorted by retailers response and more credit is given to the education programmes for farmers on correct pesticide use. This latter aspect partially funded by the tax. Overall the system of measures was initially effective, but this effect has eroded, with the tax rates and effective price signals too low to influence the TFI. |
| Wider application: | The experience in Sweden and Denmark finds few reasons why a pesticide tax could not be applied elsewhere. While the price signal has been weak in both, the use of revenues, particularly in support of education and training for farmers, is thought to have been vital to reducing pesticide use and impact. | |
| **Instrument 3:** | **Aggregates taxation** | |
| General purpose and rationale: | Aggregates are the stone, rocks and gravel that we use in construction and for other purposes. The way they are extracted, processed, used and disposed of can have significant local and global environmental impacts. Charges to reduce their use and encourage recycling and disposal can be important to manage the use of these resources. | |
| Country: | **The United Kingdom** | **Sweden** |
| Specific context and rationale: | Sector production of 275 million tonnes in 2008.<br>Estimated turnover of stone, sand and clay quarrying sector of 5.28 billion EUR in 2001, employment of 26,400. | Sector production of 75 million tonnes in 2008.<br>Estimated turnover of stone, sand and clay quarrying sector of 288 million EUR in 2001, employment of 1,500. Concentrated among a handful of big firms. |
| Instrument design: | The Aggregates Levy was introduced in the UK in 2002 and is charged by weight, at the quarry gate, on each tonne of aggregates extracted.<br>All revenues from the tax are recycled back to the sector in reduced employer national insurance contributions, while 10% is reserved for an aggregates sustainability fund for research into minimising impacts.<br>The objective of the tax is to mitigate the environmental impacts of extraction, to reduce demand and to encouraging recycling and the use of substitute materials. The tax is complemented by the landfill tax. | The Swedish tax was introduced in 1996 on natural gravel as part of a wider regime including permitting, landfill taxes and extraction targets. The tax is payable by companies that operate quarries.<br>The objective of the tax is to reduce pressure on natural gravel resources and drinking water, by closing the price gap with preferred substitutes. Targets for 2010 include a 30/70 balance between gravel and substitutes, use of 15% recycled material and extraction of less than 12 million tonnes of gravel. |
| Rates and Effect: | The tax is charged at the equivalent of 2.33 EUR per tonne in 2011, this has increased from an initial rate of 1.78 EUR per tonne and represents aprx. 25% of price. | The tax was introduced at the equivalent of 0.56 EUR per tonne, and was increased to 1.44 EUR per tonne in 2006, or around 20-30% of the price. |

| | | |
|---|---|---|
| | The tonnage of aggregates attracting the charge was slowly increasing until 2007/8, where, from a peak of around 275 million tonnes, it has fallen to 179 million tonnes in 2009/10.<br>Government evaluations attribute significant reductions in the use of aggregates to the levy, but other sources feel the environmental impact has been limited. Most tellingly it has impacted recycling with the UK's recycling rate of 25% the highest in the EU.<br>In addition it is believed that the levy has helped generate a small double dividend, increasing employment and competitiveness in the sector. | Use of natural gravel has fallen significantly in the last 25 years, to 18% of the total aggregates, within the 2010 targets, though much of the fall occurred prior to the tax and is attributed to changes in procurement policy by the national road building agency to favour substitutes to gravel. Also believed to be factors were permitting procedures and consumer awareness.<br>The 2010 target for recycling of 15% was scrapped due to low recycling potentials and the target of 12 million has also been changed to target quarry locations.<br>The switch to substitutes can require more energy intensive production, i.e. in the crushing of rocks. |
| Revenues, costs and burdens: | Total revenues from the tax were the equivalent of 275 million EUR in 2009/10, down from a peak of 386 million EUR in 2007/8, due to the downturn in the UK construction sector.<br>Administration of the levy costs an estimate 1.14 million EUR each year, or 0.5% of the total revenues.<br>Compliance costs to industry are low, estimated at 0.85 million EUR. | In 2005 the gravel tax provided revenues equivalent to 22.3 million EUR, this amount trending upwards since the tax was introduced.<br>Administration costs of the tax are estimated at 0.39 million EUR per year, representing aprx. 2% of revenues in 2005.<br>Compliance costs to industry are low, estimated at 0.55-1.11 million EUR per year. |
| Conclusions: | The tax has been successful at stimulating recycling of aggregates, and is understood to have resulted in some economic and environmental benefits. | The tax has been successful at reinforcing moves to substitute materials but the overall environmental impact may be negative as the alternatives are often more energy and carbon intensive. |
| Wider application: | The aggregates levies are understood to have had some positive environmental impacts, though this is not always clear. The most important lesson comes from the UK where use of the tax revenues to reduce labour costs for firms is believed to have supported economic growth, evidencing a potential double dividend. | |
| **Instrument 4:** | **Tree Protection Charges** | |
| General purpose and rationale: | Trees are a crucial part of the global ecosystem, particularly through their role in the carbon cycle. They also play a valuable role in human urban and rural landscapes, both aesthetically and functionally. Sustainable forest management is important so that forests can continue to deliver the products and services we nee while retaining their ecosystem functions. In some places urban tree cover is also under threat by development and insurance. | |
| Country: | **Austria** | **Lithuania** |
| Specific context and rationale: | Trees are recognised in Austria as an important factor in delivering high quality and sustainable urban environments. The tree protection charge is applied in Vienna, of which around 50% can be considered 'green' areas. | Lithuania has seen growing forest cover, from 20% of land in the 1960s to over 30% in 2006. The transition from communism has seen significant changes to forest management, moving from a system of planned forest management towards privatisation (36% in 2006). |
| Instrument design: | The Vienna Tree Protection act was introduced in 1974 following concerns from citizens. It covers all types of trees with a trunk circumference >40cm, regardless of whether they are on public or private land.<br>The act requires a licence to be granted to fell a tree (online application), a fee to be paid and a tree to be replanted elsewhere.<br>Fees also vary by the reason for felling a tree. Among the challenges for the measure is providing adequate monitoring of trees across the city. | The Forest Law was adopted in Lithuania in 1994 and amended in 2001. The law obliges all forest land to have a management plan, which includes planning of felling and restoration. A Forest fund (felling tax) was introduced at 5% of sales income in 2001, very small incomes were exempted.<br>Since 2009/10 a further tax for general budget purposes was added, in 2011 this is set at 10% of sales.<br>State forests are managed by State Forest Enterprises (SFEs) which control public forest and also issue felling permissions for public and private owners. |

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| Rates and Effect: | Fees start from a minimum of 29.15 EUR per application but are typically higher as charges are also made by administrative time requirements and the number of application pages. If replanting is not possible a charge of 1 090 EUR must be paid. Between 1995-2009, an annual average of 1 125 charges were made on this basis. | Revenues from the tax are used for general budget purposes and also inventory and forest management. Forest coverage has been on an upward trend since 2001 (30.9%) to 2006 (32.5%). Illustrating more replanting than cutting.Though forest type/quality is not measured in this.<br>Forest felling has increased since 2001 from 5.7 million $m^3$ to 6.4 million $m^3$ in 2007.<br>Non-compliance, i.e. cutting without permits also brings charges (fines), these averaged 0.11 million EUR per year 1994-2001. A decline in illegal logging has followed the introduction of the tax. |
| Revenues, costs and burdens: | The average revenue from this scheme has been approximately 0.9 million EUR per year.<br>The administrative cost of the measure is primarily borne by the applicant as they are charged on time taken to assess it and by its length. Several public authorities are involved in the process so there is some burden in administration. | Data is limited, in the most recent years of data, 1999-2002, annual revenues averaged 2.3 million EUR. As the tax is applied to sales the revenues vary with the market timber prices.<br>Administrative burdens are not well understood but it is believed the system has been simplified since its introduction. |
| Conclusions: | The instrument has formalised a system to protect and replace trees in Vienna, addressing the contrast between citizens desiring green spaces and trees but often also being unwilling to take responsibility for their own trees. | The management system is felt to be highly effective in Lithuania, delivering revenues for general and forestry purposes. There is some market distortion as the public SFEs have power over what private owners can cut. |
| Wider application: | The models applied in these situations are different, but have both contributed to tree protection. The Lithuanian model demonstrates that a combined regulatory and market based approach can provide sustainable management. In each case monitoring and enforcement remain important to ensuring success. | |
| **Instrument 5:** | **Drinks container deposit schemes** | |
| General purpose and rationale: | Packaging waste is an important part of all waste and drinks containers are among the most common waste packaging items. Improving the way drinks containers are re-used and / or recycled is important to reduce waste and litter and also to make use of the resources embodied in them and reduce the need for energy and resources. Container deposit schemes charge a small deposit on a container (e.g. bottle) at purchase which is then refunded when the bottle is returned – the container can then be re-used or recycled and waste and litter reduced. | |
| Country: | **Germany** | **Denmark** |
| Specific context and rationale: | Packaging waste has been a focus of government as part of general waste and packaging ordinances. Since 1991 a Green Dot scheme has operated. Recycling and re-use of re-usable drinks containers was voluntary in the past and typically had high (80%) return rates. | Denmark has had variations on a deposit-refund system since 1984, with only approved re-usable containers being able to be sold (e.g. not cans). This was not compliant with single market rules and Denmark was obliged to change in 2002. |
| Instrument design: | Germany introduced a mandatory container deposit scheme in 2003 in response to falling proportions of recyclable materials in drinks containers.<br>Some exceptions were made for smaller retailers.<br>The scheme is administered by a group set up for this purpose, the *Deutsche Pfandsystem* (DPG), this sets the framework and standards for the deposit system.<br>Non collected deposits are kept by retailers. | Denmark introduced a mandatory container deposit scheme in 2002 in response to allowing cans and other one-way containers onto the market. At first the scheme was for beer and carbonated soft drinks only, this expanded in 2005 to all alcoholic drinks and energy drinks, and in 2008 to include mineral water bottles.<br>The scheme is administered by the private non-profit NGO Dansk Retursystem. Non collected deposits are kept by Dansk Retursystem and invested in social and environmental programmes. |
| Rates and | The deposit was set at 0.25 EUR per container of | The deposit is the equivalent of 0.13-0.4 EUR per item, |

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| Effect: | between 0.1-3 litres, covering cans, PET bottles and glass bottles.<br>Originally containers could only be returned to where they were purchased, an island solution, return rates fell to 20%. It was decided to move to a multi-point solution and return rates have since risen to >98%.<br>The impact on materials recycling was mixed, at first the effects were weak or even negative, a result of the island scheme, recycling rates improved much more since 2006 and move to the multi-point system, particularly for plastics packaging. | varying by volume and type.<br>Return rates in Denmark have been high, >80%, and increasing, these were estimated at 88% in 2008 for single use containers. This is below a target quota of 95%.<br>Multi-use containers have return rates close to 100%, a result of longstanding policy in this area.<br>Significant increases in packaging recycling rates have been experienced for metal and glass since the introduction of the deposit scheme. |
| Revenues, costs and burdens: | The system was estimated to cost 726 million EUR to setup, primarily in the purchase of machines to accept the bottle returns at retailers.<br>Annual costs for operations and including depreciation, are estimated at 793 million EUR, against which can be set an estimated 507 million EUR of earnings / benefits. Overall an annual deficit of 286 million EUR. | In 2008 Dansk Retursystem stated a 'turnover' of 122.9 million EUR, estimated to represent the use of 446 million containers.<br>Administrative costs to run the scheme were estimated at 29.7 million EUR in 2004. |
| Conclusions: | The scheme faced initial resistance from retailers and appears costly to implement and manage. It has been successful in achieving very high rates of return and improving recycling and re-use rates of drinks containers. | The scheme was partially a response to EU legislation but built on a tradition of similar practice. It has achieved high return rates and increased recycling rates for metal and glass packaging. |
| Wider application: | In both cases the schemes have successfully achieved high return rates and improved recycling of container materials, this was based on an existing culture of deposit-refund schemes. It was shown in Germany that an 'island' solution leads to very low return rates, a multi-point solution is required. A further lesson from both is that related to the cost of such schemes, which is significant, given that they generate little in the way of revenue. | |
| **Instrument 6:** | **Plastic bag taxation** | |
| General purpose and rationale: | Plastic bags are among the most common items in our daily lives, highly useful as they are cheap, light and strong, they are often given away for free by retailers. This puts them outside the price mechanism and the lack of value placed upon them means they are often used only once, found as litter and the resources used in their production wasted. Many different types of bags exist, with moves to biodegradable and re-usable bags increasingly common. | |
| Country: | **Ireland** | **Denmark** |
| Specific context and rationale: | Plastic bags as a litter issue was perceived as a particularly large problem in Ireland. Dealing with this issues was championed by, then minister for the Environment, Mr Noel Dempsey. | Plastic bag taxes were introduced as part of wider green tax reforms and waste and packaging legislation in the early 1990's. |
| Instrument design: | The Irish Plastic Bag Levy was introduced in 2002. It is charged on each plastic bag provided by retailers and is levied at point of sale, retailers collecting on behalf of the tax office. Some bags are exempt for hygiene reasons and the levy does not apply to re-usable bags sold for more than 0.70 EUR each.<br>The levy is part of wider policy on waste and packaging to comply with EU standards. The primary objective of the levy was anti-litter and it was introduced with publicity and advertising supporting this objective. | The Danish plastic bag tax was introduced in 1994 and changed in 2001.<br>The tax is charged on manufacturers and suppliers (importers) and is charged by kg of bags of >5 litre capacity and that can be replaced by alternatives. Charging by weight encourages greater resource efficiency and less waste.<br>These charges in most cases are passed on by retailers to their customers, in charging for plastic bags or selling a range of re-usable bags. |
| Rates and Effect: | The levy was introduced at 0.15 EUR per bag in 2002, this increased to 0.22 EUR per bag in 2007. Fines of 1 905 EUR are payable for retailers not charging the levy. | The tax is charged at the equivalent of 2.95 EUR per kg of plastic bags and 1.34 EUR per kg for paper bags.<br>The initial effect in Denmark was also dramatic, with a |

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| | The levy had a dramatic initial impact, decreasing bag use by approximately 90% overnight. Bag use started to creep bag over time, but then dropped after the levy was increased, only to increase again. The levy has been successful from an anti-litter point of view, reducing bags from an estimated 5% of all recorded litter in 2000 to less than 0.3% in 2009.<br>The scheme has proved popular with consumers. | 60% fall in bag use experienced. With around 80 bags used per person per year in Denmark being considerably below the EU average of 500.<br>A switch to lighter materials and bags has been observed.<br>The tax itself has been somewhat controversial among consumers, many feeling that retailers have been profiteering on selling disposable and re-usable bags. |
| Revenues, costs and burdens: | The tax revenue has increased every year since the levy was introduced, from around 10 million EUR in 2002 to 25 million EUR in 2008. The revenue is ring-fenced to an Environment Fund, which is used to finance various environmental programmes and other waste prevention measures.<br>One-off setup costs of 1.2 million EUR were estimated and annual operating costs of 0.36 million EUR are covered by revenues. The levy has helped the competitiveness of retailers by reducing their costs (although consumers now bear the costs). | Tax revenues from the plastic bag tax are estimated at 26.6 million EUR in 2007 and these have increased each year as bag use has crept up.<br>Revenues are understood to go to general public budgets.<br>Little evidence is available on administrative cost but it is judged to more burdensome than the Irish system. |
| Conclusions: | The tax has successfully achieved and sustained a significant reduction in disposable plastic bag use in Ireland, generating significant revenues for wider environmental improvements and also receiving support from the general public. | The tax has successfully reduced plastic bag use in Denmark, though the measure isn't popular and bag use has been creeping back over time. |
| Wider application: | The tax has successfully reduced bag use in both countries and could be applied elsewhere. In doing so care should be taken to ensure consumer support, transparency at point of sale as in Ireland provides a simple effective way to do this. In each country bag use has increased over time, tax rates should be reviewed to manage this. | |
| **Instrument 7:** | **Effluent charging** | |
| General purpose and rationale: | Water is an essential resource, in many areas it is increasingly scarce or requires close management. Charges on water pollution can help reduce cleaning and management costs, and provide incentives to use less and to use what is necessary more efficiently. | |
| Country: | **Germany** | **France** |
| Specific context and rationale: | Germany is a highly industrialised economy with significant domestic and industrial wastewater discharges. | France is a highly industrialised economy with significant domestic and industrial wastewater discharges. |
| Instrument design: | Effluent charging was first introduced in Germany in 1981 and is applied on a regional (state) basis.<br>The charges are applied by individual pollutant and a threshold unit weight based on its environmental impact. Each pollutant has a different measurement unit.<br>The effluent charge was applied to firms with the possibility of exemptions (of up to 50%) based on their use, and investment in, defined best available technologies (BAT). This expemption has now ceased.<br>The overall objective being to improve the quality of water and water treatment in Germany. | Effluent charges were first introduced in France in the 1960's and are applicable to all surface and sewage water discharges. Abstraction charges also apply.<br>Permits are issued for discharges, with industry often paying directly but households and some treatment plants paying indirectly. Historically agriculture was exempted but in 2008 a new tax was applied to non-point polluters to bring it into the system.<br>Wastewater management is organised across 6 major water basins, with the key principles of the system being decentralisation and planning.<br>The objectives are to fund infrastructure and cover water treatment costs. |
| Rates and Effect: | Effluent charge rates are set centrally and were last increased in 1998 to their current level of 35.8 EUR per | Rates for the charges differ across regions.<br>A large part of revenues are re-distributed to |

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| | unit.<br>This is passed to consumers as a wastewater charge, which averaged 2.36 EUR per $m^3$ in 2010.<br>The effect of the measure is reflected by continuing improvements in water treatment in Germany and also a reduction in water discharges by industry of around 25% between 1991-2007. | municipalities and industry for investment in water treatment and pollution abatement.<br>Industrial and other water pollution has decreased in France since the introduction of the charges, though the reasons for this are varied and also include EU legislation drivers. There is a view that charges in France have been weak and offered more of a permission to pollute with support to abate this. |
| Revenues, costs and burdens: | Revenues from the tax averaged aprx. 300 million EUR between 2005-2007.<br>There are political elements to administering the tax, with a tension between federal and state governments.<br>The burden of the tax is assessed to be small to most industrial sectors, representing on average only 3% of total costs relating to water.<br>Costs are spread across society through a solidarity principle that all households and firms must be connected to wastewater systems. | Total revenues across the 6 basin areas were around 2.4 billion EUR in 2010. These are generally projected to increase in 2011 and 2012.<br>Administrative burden is not clearly estimated but among the factors at work are political tensions between the various stakeholders in the system, national, regional, municipality, industry and river basin area. |
| Conclusions: | The effluent tax has played a role in the successful improvement of wastewater treatment and reduction in discharges in Germany. The size of this role is hard to determine and separate from already existing trends. | Water treatment and quality has improved in France since the introduction of the effluent charges. It is hard to attribute causation but it is clear the tax has helped fund various pollution abatement investments. |
| Wider application: | The learning from both demonstrates that an effluent charging system can operate effectively as part of a framework to reduce the environmental impact of discharges to water and improve water treatment. In doing so, care should be taken to manage stakeholder within the system so it can operate efficiently and respond to change and also to consider the right level of charges to more clearly incentivise resource efficient behaviour. | |

| **Instrument 8:** | **Natural resource taxation** | |
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| General purpose and rationale: | Natural resources are crucial inputs to production and to sustain our lifestyles, but many natural resources are finite. As a result, and due to increasing perceptions and experience of scarcity, it is important to sustainably manage the extraction of these resources, use them efficiently and re-use and recycle them as far as possible. | |
| Country: | **Latvia** | **Finland** |
| Specific context and rationale: | Latvia is a new, small member of the EU. With a variety of mineral resources and an extractive sector that makes up around 4% of economic GVA. | Finland is an established EU economy with a mature extractive industry in forestry and mining of significant metals and mineral deposits. |
| Instrument design: | The Latvian resource tax was introduced shortly after independence in 1991 and applies across a wide range of resources, including air, water, waste and natural resources. Some exemptions are provided for firms that can demonstrate good environmental management or performance.<br>The objective of the tax was to incentivise sustainable economic development and to finance environmental protection measures and recycling. Being a quantity based tax there is an innate incentive for resource efficiency. Non compliance involves a fine in addition to payment of the taxable amount, this fine can vary from 2-10 times the amount payable as tax. | A range of taxes and fees are applied to natural resources in Finland, these include mining extraction licenses, fishing licenses, forest management fees and a real estate tax.<br>The objectives of these instruments are directly related to the resources they deal with, but generally coincide with ensuring sustainable management and resource availability. |
| Rates and Effect: | Tax rates are applied on a resource-by-resource basis, with rates reviewed and adjusted regularly, an example | Rates are charged on a resource-by-resource basis. An example is the real estate tax which is applied to |

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| | being a 0.35 EUR tax applicable per $m^3$ of soil extracted.<br>The impacts of the tax on Domestic Material Consumption (DMC) appear limited, with materials subject to the tax still seeing significant increases in DMC between 2000-2007, and these increases being higher than the overall increase in DMC in the same period. Although resource productivity has improved over the same period. | property, at rates from 0.32-3% each year, with higher rates for unused land in highly populated areas. The idea is to incentivise the re-use of land to reduce pressure on undeveloped land.<br>Significant effects of the taxes are hard to detect as many are set at levels too low to have an effect or data is unavailable. In general Finland has seen an above average increase in its domestic resource extraction, increasing faster than GDP in the same period. |
| Revenues, costs and burdens: | Total revenues from all the natural resource taxes were aprx. 14 million EUR in 2008. This is down from peak of more than 18 million EUR in 2002. In the context of rapid GDP growth in the same period this represents more diversified economic growth.<br>Revenues are distributed on a 60:40 basis, 60% to local government where the revenues were charged and 40% to the general government budget.<br>Administrative burdens are perceived to be low, with exemptions for already well performing firms. | Each tax has revenues that are accounted for separately, most of these revenues are relatively low. The biggest revenues are delivered by energy, transport and carbon taxes outside the scope of this case study. Of those within the scope, the real estate tax brought in revenues of 974 million EUR in 2009. Administrative burdens are perceived as low, but revenues are also low, so proportional burdens may be higher. |
| Conclusions: | The tax appears to have had only a limited effect so far, but has been successfully introduced. Regular review and adjustment of the rates suggests an integrated and involved approach from the Latvian government that could significantly improve its effectiveness over time. | Resource taxes in Finland are long standing but in most cases at levels too low to have much or any effect on resource efficiency. The Finnish economy has seen economic growth that uses more resources than the EU average in recent years. |
| Wider application: | The learning from these cases is that natural resource taxes can be successfully implemented but it can be hard to detect an effect, particularly when tax rates are low. Careful planning and consideration should be given to the resources that will be subject to the tax and at what level the tax needs to be set to have an impact. | |

## Conclusions - Lessons from the implementation of MBIs

The following conclusions can be drawn, based on our analysis of the findings from global MBIs and the eight case studies:

**To introduce an effective instrument, you need support for it**
Perception of the instrument itself is important, for its effective function. This is particularly important for fiscal measures, which, to continue to be effective, require periodic revisions to the rates. This typically requires some level of political support and consent.

Consumer perception of the problem and the solution can therefore be vital to the success of a measure. If the issue of resource use is not perceived as a problem then a measure will have less support. The abundance or scarcity of a resource plays an important role in perception too, as shown by water taxes in the Netherlands and Cyprus, both countries understanding the importance of either too much or too little water. History plays a role in perception and acceptance, the prior existence of voluntary container deposit schemes in Germany and Denmark a factor in their high return rates and effectiveness. Habits can also be a hindering factor, such as farmers use of pesticides, or the use of particular materials (aggregates) in construction. Abundance of a resource may also tilt support in favour of its exploitation and against use of instruments to manage it.

**Education and awareness raising can be powerful supporting tools**
The pesticides tax case provided powerful evidence of the value of education and awareness raising in magnifying the effect of market based instruments. By allocating some of the revenues towards educating farmers in efficient and effective use of the resource (pesticides), significant improvements were made in Sweden and, to a lesser extent, Denmark. The modelling also suggested that this educational impact was stronger than the price effect of the instrument itself. There was less evidence across the other cases studies, but targeted and intensive campaigns to a small group such as farmers, was successful, this could potentially also be applied on a sector level or to users of specific, strategic or high impact resources.

**Substitution effects can have unintended consequences…sometimes leading to lower resource efficiency**
Instruments that address one particular resource or activity can lead to substitution effects. This can, and usually is, desirable, for example involving a switch to items that are re-usable or that can be more easily sourced locally. Yet as shown by the aggregates case in Sweden, the switch from one aggregate resource, natural gravel to crushed rock, can lead to increased overall energy use – from rock crushing. Alternatively a tax on one resource may lead to substitution to a less environmentally friendly resource or one that is less efficient on a life-cycle basis. These substitution effects need to be taken into account in instrument design to avoid conflict with overall environmental objectives.

**Administrative burdens vary considerably, but for container deposit were very high**
Across the case studies data on administrative burden was limited (possibly because the burdens were often not large enough to merit attention). The available estimates of administrative cost ranged from lows of around 0.3% of revenues for the aggregates levy in the UK to estimates of 3% of total costs for effluent charges in Germany. The one case that stood out as being expensive in this respect was the container deposit scheme, while effective in ensuring very high levels of return and resource recycling, the administrative costs estimated in both Denmark and Germany ran into tens of millions of euros, constituting a significant additional burden to retailers, but one that may be argued to be consistent with some level of provider/producer responsibility regarding waste.

**The type and objectives of an instrument tax can be crucial to its impact on resource efficiency**
The case studies found a variety of objectives behind the instruments: many of the instruments were primarily targeted on general environmental goals such as pollution reduction, litter prevention or human and environmental health, which although relevant are only indirectly linked to resource efficiency. Revenue raising was also a primary objective of many of the instruments. Those with resource efficiency as an objective were more usually a result of specific scarcity circumstances, such as water

charging in Cyprus, or driven by other policy such as the Waste and Packaging directive and its recycling targets.

Instruments with objectives other than resource efficiency can still have a positive impact against these other objectives, i.e. litter reduction, their impact on resource efficiency is indirect and often much less. In this sense they are often better at reducing the environmental impact of resource use, bringing more economic value from less inputs.

The type of tax can also be important to its effect on resource efficiency Quantity based taxes – on units produced or consumed – can lead to a reduction in the quantities produced or consumed and only indirectly lead to resource efficiency gains. Taxing by the quantity of resource used (as an input) is a better way to provide a more direct and effective stimulus for resource efficiency improvements. This was evident in the water charging, aggregates, pesticides (SE) and plastic bag (DK) cases. It should be noted that taxing quantity using weight-based measures may not adequately take into account the other environmental impacts, such as pollution or biodiversity effects, from changes in production processes that improve productivity in weight terms.

**Setting the tax at the 'right' level is central to its impact**

Consumers and producers react in different ways to the price signals coming from market based instruments. Most commonly those with higher incomes have lower price-elasticities to resource efficiency MBIs than those on lower incomes, with the reasons being two-fold; for consumers with higher incomes it represents less impact on their income than for lower income consumers and that higher income often means that many of the easiest measures have already been taken, i.e. the cost of further improvement is high and therefore price signals must accordingly also be higher.

Elasticities also vary considerably by the value or nature of the resource, contrasting low price elasticities in water use, in part due to its essential nature, with the very high price elasticities of plastic bag use.

The cases suggest that tax rates are often set too low to have a significant impact. It is unclear what impact taxes at low levels have, as it is hard to separate their specific impact and the price signal may be lost as suppliers absorb the tax increases, e.g. the pesticides case in Denmark. The cases suggest that tax rates of less than 20% of product price are typically ineffective at significantly changing behaviour, though this finding is tentative and, to a degree, case specific, it bears further investigation.

**The impact of tax measures will erode over time, but revenues typically continue to increase**

It is often stated that an MBI that aims to change behaviour and raise revenues at the same time is self-contradictory. Linked to the previous lesson there was evidence that static tax instruments will have their impact erode over time. At first introduction of taxes quite drastic reductions in consumption were observed, the plastics bags cases a very clear example

of this effect. Yet, over time, consumption creeps back up as the rate becomes proportionally less effective. This tends to have the effect of increasing tax revenue but reducing the environmental and resource gains. Modelling of the case studies also showed this effect compared to a no-instrument counterfactual. Further revisions to the tax rate can help to maintain and/or recapture the effect, while taxing on a percentage basis can avoid this problem.

Price elasticities play a role in determining tax revenues, typically price elasticities are less than -1 (i.e. that a proportional change in consumption will not be more than the proportional change in price) show that an increase in price will lead to an increase in tax revenues. Where revenues decline over time, the effect is more likely due to non-price effects, such as education, training, or structural change that would have taken place anyway.

### Market based instruments are part of a wider system of instruments that they need to work with to be successful

MBIs are part of a wider system of governance and regulation, complicating the task of defining specific impacts of the instrument both qualitatively and through modelling. This highlights the fact that instruments rarely work in isolation. They work within in a legislative, cultural and market framework that also has a major bearing on their effectiveness. Ensuring this framework is coherent and supports the instrument objectives is important to achieve improvements in resource efficiency. Where this supporting framework is less coherent, with contradictory or competing goals, or loopholes or gaps in the system, then the intended resource efficiency effects can be weakened or lost.

### Monitoring and data relating to market based instruments is typically weak

Across the study it was apparent that the monitoring and evaluation of impact of MBIs is relatively weak. Quantities can sometimes only be derived from tax revenue data and with this being subject to aggregation, confidentiality and other issues, its usefulness for assessing impact is reduced. For instruments with a solely revenue raising objective this may be sufficient, but for policies with resource efficiency objectives this lack of follow-up and understanding is a weakness in successfully implementing policy.

### Fully understanding impacts would require more detailed econometric analysis

The modelling exercise provided a number of general macro-economic insights into the impact of the instruments, but to fully understand these effects would require a separate econometric analysis with inputs from sectoral experts and more detailed data sources. This study presents clearly the assumptions that have been made but it should be noted that in most cases the approach is fairly approximate and each of the policies could constitute a study in its own right.

### Economic impacts of the studied MBIs were estimated to be slightly negative, which could in many cases be offset by the revenues raised

From our modelling analysis of the case studies, most of the instruments had economic impacts that were small in macroeconomic terms, producing small negative impacts typically less than 0.1%

of GDP[5]. Given the size of the policies and the revenues this type of impact is not unexpected. The overall results represented bigger transfers in GDP between sectors, e.g. from retail or consumers to recycling, such that at the sectoral level the effects could be quite significant, particularly if the instruments were scaled-up. Employment trends followed similar patterns.

As noted, revenue from taxes can be, and was, used to support other policy objectives such as welfare or mitigation of distributional effects so the economic effects should not be considered in isolation. On a more general level it is clearly understood to be preferable for taxes to target resource use (encourage better use of scarce resources) than labour (discouraging employment). How these changes work in a specific economy varies, based on upon a number of factors, including the availability and sourcing (domestic / import) of materials and labour market conditions. It should also be noted that resource taxes may provide disincentives for resource intensive investments, e.g. roads, infrastructure, buildings, machinery, as effective investment costs increase, which could hinder economic growth over the longer term. Equally, this can also help trigger innovation and investment in developing more efficient technologies.

***A double-dividend from environmental taxation was achieved, but only in the UK***

The use of revenues from the UK aggregates levy, recycled to taxed firms to reduce labour costs, was one of the few examples of a direct attempt to secure a double dividend and this succeeded in improving competitiveness. The modelling results in the UK suggested the aggregates levy has led to a small increase in GDP and employment in the aggregates sector.

In the other cases the revenue was typically used as part of general government spend or for wider environmental policy (i.e. the plastic bag levy in Ireland) and no double-dividend was observed. This is consistent with the theory for a double dividend, where recycling of revenues back to the affected sector, in reduced taxes on labour, or other business costs, is necessary to stimulate an environmental AND economic gain. Latest EU tax data[6] suggests that, at the EU-level at least, trends in environmental, specifically real implicit energy, and labour tax rates, have been developing counter to achieving a double dividend since around 2004, though this has reversed in the final year of data (2009).

***Distributional impacts were typically slightly regressive***

By addressing consumption issues, impacts have a social effect, typically instruments that increase prices have regressive impacts by affecting lower income households proportionally more than higher income households. The modelling in this study backed this finding with consistent leaning towards small but regressive impacts (where there were any). This is partly because the products that are affected tend to be low-value ones with higher material inputs and lower labour inputs.

**Competitive impacts of the studied resource efficiency MBIs were estimated to be low**

Most of the studied MBIs focused on final consumption, therefore their competitive effects were limited. This is a result of the focus on households and also that the sectors most affected (e.g. construction, water supply, retail) are not subject to significant international competition.

**Signals for EU level MBIs are mixed**

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5 It should be noted that unless the instruments we reviewed included a specific use of any revenues raised, the modelling did not consider tax recycling options, but these could have been used to offset the negative macroeconomic impacts and generate positive welfare effects. The qualitative evidence in the case studies tends to support the latter point.

6 Eurostat (2011) Taxation trends in the European Union: 2011 edition

The MBIs reviewed in this study were domestic or local in nature, with the environmental benefits generally accruing at this level too. Additionally, with only limited effects on international competitiveness, it could be argued that intervention at the European level is not required.

At the same time there was also little evidence from the case studies or modelling to suggest that EU level instruments could not be successful and effective, for example in the context of the Resource Efficiency Initiative. Indeed, in many cases the domestic and local MBIs were driven by EU legislation and policy. This signals that the EU role should continue, at the very least, to provide the framework conditions, information, drivers and support for greater use of MBIs to deliver resource efficiency at Member State level. EU level MBIs in other areas, such as the EU ETS in greenhouse gas emissions, illustrates how it can also be possible to successfully implement at EU level.

## Recommendations

Based on the conclusions presented above a number of recommendations can be made to Member States and the Commission to improve the use of market based instruments for resource efficiency.

16. **There is strong potential for wider use of MBIs for resource efficiency:** the cases show how MBIs have been successfully used to deliver environmental and resource efficiency improvements in the respective sectors and MS. The balance of environmental taxation clearly shows that pollution and resource taxation is an area where much wider use of MBIs can be considered, mirroring the successful approaches of Denmark and the Netherlands.

17. **Consider a broader range of market based instruments:** to date, most MBIs have been price based measures, typically taxes. A broader range of instruments such as permit trading or market information and network tools are also available and can be successful.

18. **Remember to design instruments as part of a full package – MBIs are not a 'silver bullet':** MBIs should work in concert with legislative, institutional and cultural arrangements to improve their effectiveness and chance of success. This is also important to avoid unintended consequences, to create balanced incentives and avoid contradictory outcomes. It should also be noted that in some cases MBIs may not be the most efficient or effective option.

19. **MBIs for resource efficiency should have resource efficiency as a primary objective:** while each of the MBIs reviewed had a resource dimension not all had resource efficiency, delivering greater economic value from less inputs, as an explicit objective, with the focus often on resource efficiency through the reduction of environmental impact over a product lifecycle. Without this focus, instruments are likely to be focused on mitigating impacts rather than delivering real resource efficiency improvements.

20. **Price based measures should be set at a level that incentivises change:** if tax rates are set too low their effects are much less. Rates need to be tailored to the context, taking relative prices and incomes into account, with rates set high enough to encourage change but not become overbearing. Further research is needed in this area.

21. **Consider how resource taxes can incentivise efficient behaviour and expand the environmental tax base:** most environmental taxes have focused on energy and transport, the growing importance and scarcity of resources makes their efficient use an environmental and economic priority. Well targeted tax instruments can help incentivise more resource efficient production and consumption, those most successful in this area have focused on waste and water charges, these could be more widely applied across the EU.

22. **Tax measures should always consider if revenues can be recycled to companies or consumers to achieve a double-dividend:** To incentivise competitiveness and avoid the negative economic impact typically associated with tax measures, the way in which revenues are used should be closely considered. An economic and environmental double dividend is possible only if new revenues from resource and pollution taxes are used to shift tax burdens and away from labour and enterprise in the affected sector. The evidence is clear that this has not yet been happening in the majority of cases. From a competitiveness point of view it may also be useful to investigate how import taxes could be used, within trade rules, to provide incentives for resource efficiency to firms outside the EU, equivalent to the incentives firms within the EU face.

23. **Tax measures need to be dynamic or regularly reviewed:** the impact of a tax measure erodes over time if taxes are set at a nominal price level. In this situation tax-levels should be regularly reviewed to maintain resource efficiency incentives. Dynamic taxes, based on price or volume percentages reduce erosion effects and can be simpler to implement and more effective.

24. **Take consumer behaviour and perceptions into account in instrument design:** to maintain support and engagement with the MBI this is important. Transparency, awareness and designing the instrument to complement the geographic context are among the best ways to achieve this.

25. **Investigate how targeted education and awareness raising can be expanded:** the success in the pesticides sector points to significant resource efficiency and environmental gains being made from targeted campaigns. There is obvious potential to expand the pesticides example across the EU, but other sectors, with a small number of players but significant resource use and impact could also be targeted.

26. **Carefully consider the cost-effectiveness of container deposit schemes:** the evidence suggests that while these schemes are highly

effective in retaining resources through returns and recycling, they are also relatively expensive. More cost-effective alternatives may be available, such as household recycling collection.

27. **MBIs should link resource quantity and impact:** instruments based on simple quantity or volume (weight) measures do not always fully account for the specific impact, scarcity or importance of resources. Design of measures should try to take both factors into account, through wider use of quantity or weight volumes varying by resource or multiplied by risk/impact factors.

28. **Distributional effects of MBIs are typically not large, but should be considered:** in many cases the effects of new instruments are small but socially regressive, disproportionately impacting low-income consumers or other vulnerable groups. This is particularly sensitive on essential items such as food, water and energy. This should not be a hindrance to further use of MBIs but should be taken into account in the planned use of revenues, potentially to compensate those that lose out.

29. **MBIs should be based on a sound life-cycle basis to support real resource efficiency:** some of the measures appeared to be successful and effective, but their actual resource efficiency and environmental impact benefits could be debateable. Instruments that encourage resource switching and behavioural change should take into account the life-cycle impacts of the changes they promote to ensure the change is positive. This could involve some trade-off between resource efficiency and environmental goals, highlighting the importance of the full life-cycle to reflect on these dilemmas.

30. **Use consistent definitions and methodologies and improve monitoring and evaluation:** these were a weakness observed across the majority of instruments. This is needed to encourage clarity, consistency and sharing of best practice across the EU. This will enable better policy design and greater potential resource efficiency improvements.

# 1 Introduction

The consortium appointed to carry out this research, of ECORYS Nederland B.V, Cambridge Econometrics and COWI A.S, are happy to present this final report for the study “the role of market-based instruments in achieving a resource efficient economy”.

This first chapter briefly summarises the policy context in which this study is highly relevant. It explains what is understood by the term market based instrument and the current broad trends in their usage. Finally it presents the overall study objectives and the structure for the rest of the report.

## 1.1 Context

### *1.1.1 The ‘Europe 2020 strategy’: resource efficiency*

Resource efficiency is one of the important challenges the European Union is facing at the moment. Globalization and the rise of emerging economies resulted in an increased competition over natural resources globally and created competition over recyclable material. In addition to the fact that various resources in the EU are subject to depletion, when possibly “available”, they are not necessarily extractable. Global warming and the consequent impact on biodiversity, water and environment raise additional questions around the preservation of natural resources as well. The recent economic crisis has made all these challenges and the need for a more resource efficient economy even more urgent. The EU has been active and put forward an “*EU 2020 agenda*” with the aim to stabilize the European economy after the economic crisis and prepare it to meet future challenges.

With regard to resource efficiency, the *Renewed EU Sustainable Development Strategy* of 2006 already put forward goals such as:

- Improving resource efficiency to reduce the overall use of non renewable natural resources and the related environmental impacts of raw materials use, thereby using renewable natural resources at a rate that does not exceed their regeneration capacity;
- Gaining and maintaining a competitive advantage by improving resource efficiency, inter alia through the promotion of eco-efficient innovations;
- Avoiding the generation of waste and enhancing efficient use of natural resources by applying the concept of life-cycle thinking and promoting reuse and recycling.

In the light of the recent economic crisis, the Europe 2020 agenda is a 10-year strategy with the aim to stabilize the European economy after the global economic crisis and setting out a vision of Europe's social market economy for the 21st century. The Europe 2020 agenda puts forward three mutually reinforcing priorities:

- ***Smart growth:*** developing an economy based on knowledge and innovation.
- ***Sustainable growth***: promoting a more resource efficient, greener and more competitive economy.
- ***Inclusive growth****:* fostering a high-employment economy delivering social and territorial cohesion.

In order to define specific economic and social goals for the year 2020, the European Commission has proposed a number of EU headline targets which represent the three priorities of smart,

sustainable and inclusive growth. In general the targets concern the increase of employment and investments in R&D, the reduction of greenhouse gas emissions and the share of early school leavers and the number of European living below the poverty line [7].

The EU has put forward seven flagship initiatives to catalyze the progress for each of the headline target. Two of the seven flagship initiatives are of special interest in light of resource efficiency.

## Flagship initiative 4: "Resource efficient Europe"

Especially this initiative aims to help decouple economic growth from the use of resources, support the shift towards a low carbon economy, increase the use of renewable energy sources, modernise the EU's transport sector and promote energy efficiency. To accomplish these aims at EU level, the initiative will focus on mobilising EU financial instruments, enhancing the use of market-based instruments, modernising and decarbonising the EU transport and infrastructure sector, completing the internal energy market, promoting renewable energies and upgrading Europe's networks. In addition the initiative will aim to adopt and implement a revised Energy Efficiency Action Plan and promote a programme in resource efficiency supporting SMEs and households.

In addition, the EU Member States are encouraged to diminish environmentally harmful subsidies, deploy market-based instruments such as fiscal incentives and procurement to adapt production and consumption methods as well as to develop smart, upgraded and fully interconnected transport and energy infrastructures and make full use of ICT. The Member States have to make sure that the implementation of infrastructure projects within the EU Core network is coordinated amongst each other.

## Flagship initiative 5: "An industrial policy for the globalisation era"

The goal of this initiative is to improve the business environment, notably for SMEs, and to support the development of a strong and sustainable industrial base able to compete globally. The European Commission aims to interact closely with stakeholders in different sectors (business, trade unions, academics, NGOs, consumer organisations) in order to create a new framework for a modern industrial policy and in order to support entrepreneurship, to guide and help industry to be prepared to meet the challenges and opportunities of a global "green" economy and to promote the competitiveness of Europe's primary, manufacturing and service industries. The framework will address all elements of the increasingly international value chain from access to raw materials to after-sales service.

This goal ought to be reached by:

- *Greater energy and resource efficiency* in manufacturing sectors;
- Reduced transaction costs of doing business in Europe by promoting clusters and improving affordable access to finance;
- Promoting the use of technologies and production methods that *reduce natural resource use;*
- Enabling access to the Single Market and the international market beyond;
- Supporting the transition of service and manufacturing sectors to *greater resource efficiency;*
- Increasing the share of *effective recycling* across industrial sectors;
- Improving European standard setting in order to leverage European and international standards for the long-term competitiveness of European industry.

[7] The national poverty line is defined as 60% of the median disposable income in each EU Member State.

In the context of resource efficiency, environmental conservation and global economic competitiveness, market-based instruments are believed to play an important role. Market-based instruments are believed to steer industries in the direction of resource efficient and environmentally friendly performance and therewith guarantee international competitiveness.

## 1.2 Market-based instruments in Europe

### *1.2.1 Market-based instruments*

OECD defines Market-based instruments (MBIs) as instruments that "seek to address the market failure of 'environmental externalities' either by incorporating the external cost of production or consumption activities through taxes or charges on processes or products, or by creating property rights and facilitating the establishment of a proxy market for the use of environmental services." The economic rationale for using MBIs lies in their ability to correct market failures in a cost-effective way. Public intervention is then justified to correct these failures and, unlike regulatory or administrative approaches, MBIs have the advantage of using market signals to address the market failures.

There are different sets and subsets of MBIs available for addressing market failures in a cost-effective way. Examples of MBIs are, among others:

- Taxes
- Charges
- Subsidies
- Marketable or tradable permits (cap-and-trade systems)
- Deposit/refund systems
- Eco-labeling
- Licenses
- Property rights

In general, MBIs can be implemented across an entire economy or region, across different economic sectors, or by environmental medium (e.g. water, soil or air). MBIs are of interest when addressing the issue of resource efficiency as additional costs or benefits caused by the particular instrument can induce a more material and natural resource efficient production and/or consumption behavior by consumers and producers.

Internationally, the most widely used forms of MBIs are price-based, like taxes, charges, subsidies and levies. While mostly applied as environmental and resource efficiency (economic) policy instruments, the distinction between them is somewhat difficult to make. For instance, what is the difference between a tax and a charge? The OECD and Eurostat definitions (also applied for this study) for the different classifications of price-based economic instruments are[8]:

- A **tax** is defined as 'any compulsory, unrequited payment to general government levied on tax bases deemed to be of particular relevance. Taxes are unrequited in the sense that benefits provided by government to taxpayers are not normally in proportion to their payments';
- The terms **'charges'** and **'fees'** are commonly used and are defined as compulsory and requited payments to general government or to bodies outside general government, such as

[8] EEA (2005), 'Market-based instruments for environmental policy in Europe', EEA Technical Report No 8/2005.

environmental funds or water management boards. Examples include wastewater, abstraction, and waste charges;

- **'Levy'** is a more general term covering taxes as well as charges and fees, and is commonly used, for example, in the UK (climate change levy, aggregates levy). This is partly to avoid the bad publicity and hence resistance associated with the word 'tax';
- The terms **'fines'**, **'penalties'**, and **'penalty charges'** and **'non-compliance fees'** are also used. These are economic instruments closely related to direct regulation, and are widely used in the former centrally planned economies, where fines are often set up to 100 times higher than the fees charged when emissions are within certain limits.

MBIs have become common policy instrument for managing a wide range of resource- and environment-related aspects. However, MBIs are not a panacea for all (market) problems. There are limitations and challenges to the implementation of MBIs and in specific cases MBIs may not be the appropriate policy solution. An example is a **subsidy***,* which is often economically and socially inefficient as they may present market entry barriers to more competitive economies and support or cover-up actual *inefficient use of resources* if applied wrongly. MBIs may also be inappropriate in dealing with emissions with local impacts, as trading would be restricted to within that region and difficult to establish.

Further, it is important for a MBI to be successful that the economic and environmental targets are assessed independently and comprehensively with regard to economic, social and environmental costs and benefits implied. If the targets are implemented without such an assessment a MBI may have be implemented on the basis of political or business interests which do not serve the effectiveness of the instrument.

### *1.2.2 Market-based instruments for resource efficiency in Europe*

Within Europe and other (non-)EEA countries MBIs are applied to avoid distortions within the internal market (besides its goal to achieve specific policy targets) caused by differences in interpretation on Member State level. As such, MBIs should ensure that there are no potential adverse competitiveness effects, in terms of cost burdens, established within the EU-27.

At EU level, the most commonly used market-based instruments are taxes, charges and tradable permit systems. The European Emissions Trading System may present the most prominent European wide MBI, although carbon is not included as a resource within this study. In addition MBIs such as taxes and charges for polluted water, resource use, notably for beverage cans and other packaging, as well as waste taxes have been introduced in some EU Member States.

## 1.3 Aims of this study

The aim of this study is to research some of the best practices in terms of MBIs relevant for resource efficiency on national and local level, such that successful best practices could be copied to and implemented by other Member States where the same side conditions and market requirements apply.

The specific study objectives, based on the terms of reference are to:

"…feed into the Commission work on resource efficiency under the Resource-efficient Europe flagship initiative of the Europe 2020 strategy providing expert knowledge on links between market based instruments and resource efficiency. 'Getting the Prices Right' by including externalities and future scarcity into the prices of resources and the products that contain them appears to be an essential element of the transition to a resource efficient economy.

…offer a systematic collection of experience from various countries on MBIs addressing resource efficiency, show best practices, explore in quantitative terms how taxes, charges and other market based instruments influence the resource extraction and use and resource efficiency, identify gaps and places for improvement, and draw conclusions for policy makers about the way that these would need to be used to achieve resource efficiency. It should also explore whether concerns regarding their impacts on employment and competition are real.

…[look] into behavioural or other systemic responses to the introduction of economic instruments, the study should also explore any rebound effect on resource use[9]. Such responses may partially offset the beneficial effects resulting from the fiscal stimulus. "

## 1.4 Structure

The remaining Chapters of this report are organized as follows:

- Chapter 2 presents an overview of the methodological approach to this study and the research tools employed
- Chapter 3 presents the findings from a review of MBIs globally, framing these in a typology with a brief first analysis
- Chapter 4 presents the findings from 8 detailed case studies of MBIs active in the EU in 2 comparator countries
- Chapter 5 presents the findings from the econometric modelling exercise, modelling the potential impacts of the cases in chapter 4 to examine the potential impact and applicability of these best practice policies across the EU
- Chapter 6 draws together the overall findings of the study in a set of conclusions and provides some recommendations for policy makers
- Annex A provides a summary description of European and international MBIs examined in chapter 3.

[9] Current literature on the rebound effect generally focuses on the effect of technological improvements on energy consumption; effects in relation to natural resources are not widely explored.

# 2 Our approach

This section provides definitions of the main terms in the context of this work and briefly summarises the research tools and methodological approach the consortium used.

## 2.1 Definitions and Scope

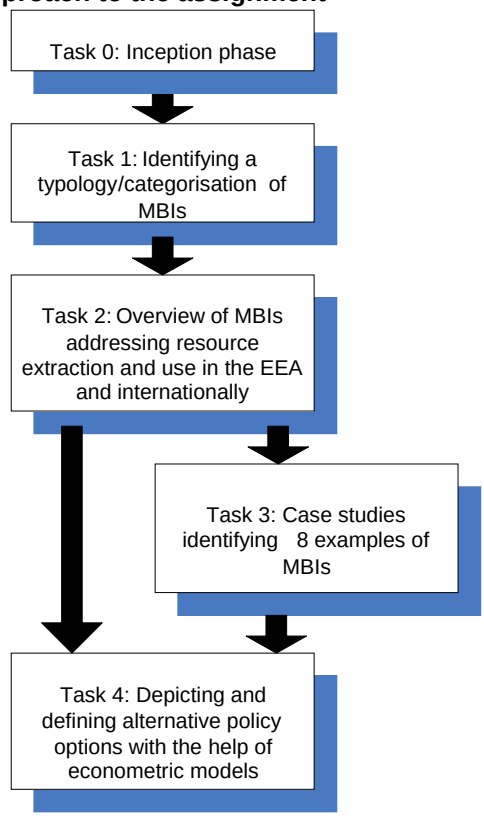
Market Based Instruments (MBIs) are the main area of concern of this study, these were defined in section 1.2.1 and cover taxes and charges, trading schemes, subsidies and other financial incentives. Further definition and sorting of MBIs is carried out in chapter 3 of this study.

The study was also scoped in terms of the resources to be considered, this being done in the context of other studies recently completed or underway. The instruments to be considered include those in relation to products (i.e. pesticides), services (i.e. landfill, ecosystems), and resource extraction and use (water consumption, mineral excavation). It was decided to exclude energy as a direct resource input in this context and additionally also carbon, SOx and NOx emissions were excluded as these issues were felt to be already be well researched.

## 2.2 Methodology

Our approach to this research was based around four sequential task stages, as shown in Figure 6.

**Figure 6 Sequential approach to the assignment**



This entailed the following.

- **Task 0 *(Inception phase)***: During the inception phase the consortium and the Commission finalised the exact work plan, approach and content of the study and agreed upon the exact type and number of products, services and resources to be covered by the study.

- **Task 1 *(Identifying a typology of MBis)***: This task developed a framework which was then used to categorise the various MBIs used in the EEA and in third countries, in order to address resource extraction and consumption. The results of this stage are presented in chapter 3.

- **Task 2 *(Overview of economic instruments addressing resource extraction and use in the EEA and internationally )***: This task provided an overview of MBIs, addressing resource efficiency, in place in the EEA and third countries, based on the categorisation established in task 1. The main differences between countries, both EEA and non-EEA, were depicted and presented.

- **Task 3 *(Case studies)***: this task concerned the development of 8 case studies, in agreement with the Commission, to present examples of both successful and unsuccessful economic instruments addressing resource efficiency. The cases were examined with regard to a variety of economic, social and environmental impacts and the results are presented in chapter 4.

- **Task 4 *(Options for change to deliver resource efficiency)***: Building on the results from tasks 2 and 3, tasks 4 econometric tools were used to further assess the instruments economic, environmental and social impacts. The results of this analysis are presented in chapter 5.

The analysis from these various tasks was then taken forward to form our conclusions, focusing on the lessons to be learnt from the case studies and modelling. Based on these, recommendations were made for possible policy changes, the role of market based instruments in moving towards a more resource efficient economy and areas for further research. This is presented in chapter 6.

## 2.3 Research Tools

We utilised the following research tools to achieve the best possible results within the resource and time constraints of the study.

### Data and information mining

The data we examined was a combination of Commission supplied data, data from the relevant authorities associated with MBIs and additional external data. This data was sourced in a variety of ways, through individual communications and networks and also through information search databases, journals and portals.

## Desk research/analysis

Used hand-in-hand with data and information mining, desk research and analysis was the central component of this study, drawing upon the varied expertise and specialisms within the research team.

## Stakeholder contact/interviews

In preparing the case studies and various other aspects of the study contact was made with a variety of stakeholders including EU officials, Member State Government representatives, industry associations, NGOs and national Environment Agencies. The information from these interviews was used to validate, verify and expand the case studies and to provide, where possible, a more balanced view.

## Econometric modelling

Was undertaken using E3ME which is an econometric model of Europe's Member States developed to assess the interrelationship between economic growth and key environmental pressures of resource use and emissions. It has a detailed sectoral disaggregation (see www.e3me.com). E3ME was used to assess demands for six groups of materials (including minerals and biomass), plus water, resulting from different patterns of economic development and the effects that changes in the price, and use of these materials have on economic growth.

A more complete description of the E3ME model can be provided on request.

# 3 Findings: typology and overview of MBIs

This chapter, and the associated Excel file, presents the typology and categorisation framework for MBIs for resource efficiency. It also presents a summary overview and analysis of the range and type of MBIs in use globally.

## 3.1 A typology and categorisation framework for resource efficiency MBIs

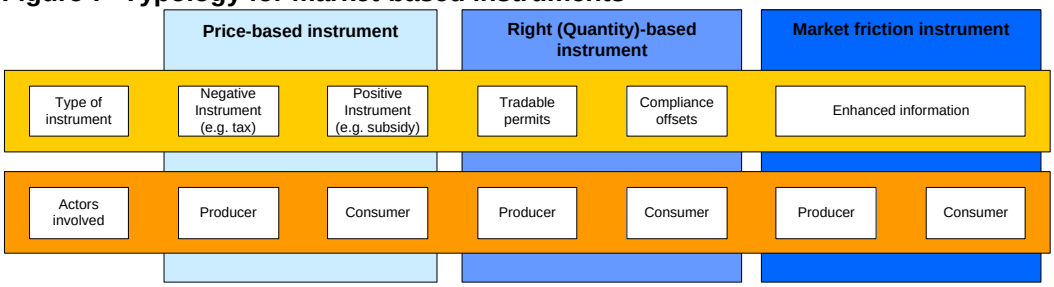
### Typology

In principle three main categories, or pillars, of resource efficiency MBIs can be defined:

4. ***Price-based instruments*** alter the prices of goods and services to reflect their relative impact. Examples for price-based instruments are the introduction of *taxes* on water use or *subsidies* for environmentally friendly bio fuels;
5. ***Rights- or Quantity-based instruments*** are designed to control the quantity of the resource, environmental good or service to the socially desired level. Right- or quantity- based instruments are for example the *European Emissions Trading System* or a *Carbon Offset Scheme*;
6. ***Market friction instruments*** are policy mechanisms which pursue the goal of stimulating a market to produce a desired resource efficient our environmental outcome by improving information flows. An example for a market friction instrument is *eco-labeling*.

Figure 7 presents an overview of this typology, which has been used to categorise market-based instruments in this study. The typology marks differences in terms of the specific instrument, actors and the resource involved. The categorization of resources was selected on the basis of that which is already used by Commission services (in particular DG ENTR from an industry perspective), which makes classifications for: materials (e.g. ores, timber, etc), natural resources (e.g. water, soil, air, etc) and waste/recycling.

**Figure 7 Typology for market-based instruments**




*Source:* Figure is adapted from Stuart Whitten, Martin van Bueren and Drew Collin, An Overview of Market-Based Instruments and Environmental Policy in Australia

The main share of MBIs are typically classed in the first two pillars, in particular in the price-based instruments (taxes and charges). However, the 'complete' umbrella has been included in the typology for MBIs and the literature review, to cover the complete range of classifications, although in the end no market friction instruments were selected as main case studies as these were too far away from the study objectives in assisting resource efficiency instruments to 'get the prices right'.

## Categorisation framework

Having understood and defined the range of possible MBI types and in the light of the study's goal of linking the role of MBIs to achieving a resource efficient economy, further categorization was necessary to provide a comprehensive overview. Specifically this categorisation was required to investigate how existing MBIs affect economic agents (consumers and/or producers) as well as products, services or resources. The following framework was developed for this purpose:

**Table 1 Categorisation framework for MBIs**

| Sample MBI | | |
|---|---|---|
| | Country | |
| *Target of MBI / Policy Design* | Type of Product | |
| | Type of Service | |
| | Type of Resource | |
| *Type of MBI* | Price-based | |
| | Quantity-based | |
| | Market friction | |
| Revenue and use of revenue | | |
| Complementarities and substitutability with other instruments | | |
| Effect of the instrument on/of: | | |
| *...resource consumption* | | |
| *…demand* | | |
| *…future price increase expectations* | | |
| *…hidden subsidies on tax effectiveness* | | |
| *…administrative burden and existence (and degree) of tax erosion* | | |
| *… data availability and reliability* | | |

Using this framework an information search was carried out, with the net cast wide in an attempt to detect as many relevant MBIs as possible.

## 3.2 Overview of MBIs for resource efficiency in use in the EEA and internationally

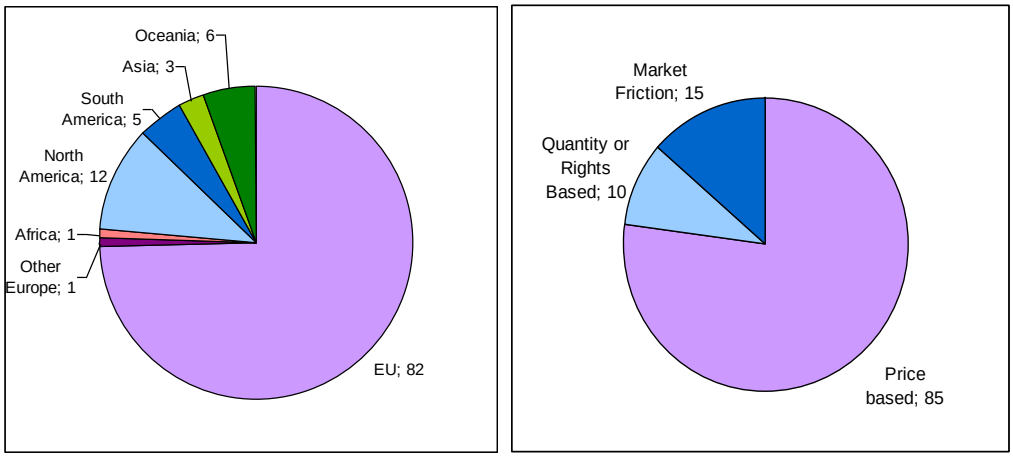
An extensive literature and data review was performed, alongside short interviews with national ministries and a consultation with the European Environmental Agency (EEA). On the basis of this we identified 110 relevant specific examples of MBIs related to resource efficiency. It is clear that there are many more MBIs being employed globally that are related to the environment and resource efficiency, therefore this selection represents merely a sample of those discovered within the time and resource constraints of this study[10]. Among the constraints was the exclusion of MBIs related to energy, and carbon, NOx and SOx emissions as these were felt to already be comprehensively covered. Market friction instruments were also not a major area of focus. A complete overview of the collected information and data for the selected MBIs is provided in the accompanying Excel file and a summary selection of 28 of these, which formed part of the basis for case study selection, is provided in Annex I.

[10] For information on MBIs related to Payments for Ecological Services (PES), please see the following report See http://ec.europa.eu/environment/enveco/biodiversity/pdf/mbi.pdf

## Overview of instruments

In total 110 instruments were identified by the global instrument screening. These were spread geographically as shown in Figure 8. This shows that around ¾ of the identified instruments were found in EU countries, with the next highest concentrations in North America, South America and Oceania (Australia). The instrument types were also analysed, this found that the majority of instruments (85 of 110) were price based, i.e. taxes or subsidies on products, processes or resources. Quantity and Market Friction instruments were much less prevalent and between the two market friction type instruments were more common.

**Figure 8 Identified MBIs - Geographical Spread and instrument type, number found**




Within the EU only 2 countries were found to employ quantity or rights based instruments, the Netherlands and the UK, each with one. The Netherlands instrument a NOx emissions trading scheme and the UK instrument a landfill allowance trading scheme for local authorities.

Within the EU different numbers of MBIs were identified by Member State, although significant resources were devoted to research across all member states, in general, most of the MBI best practices were found in Western-Europe, particularly in Austria, Germany, Slovenia, Poland, the Netherlands and UK. It was possible to identify only a handful of best practice instruments in Eastern and Southern Europe, with Slovenia and Poland the exceptions. Table 2 presents a summary of the number of instruments founds by member state.

**Table 2 MBIs identified by EU Member State**

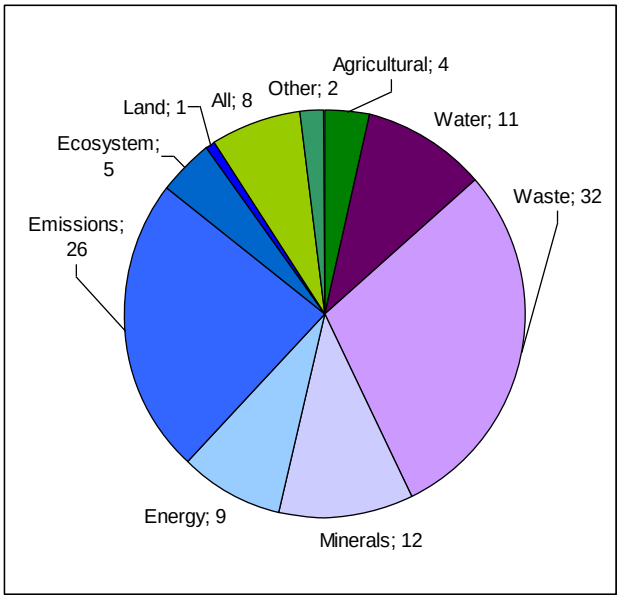
| EU Country | Count | EU Country | Count |
|---|---|---|---|
| Austria | 13 | Czech Republic | 1 |
| Germany | 13 | Spain | 1 |
| Slovenia | 10 | Hungary | 1 |
| Poland | 9 | Latvia | 1 |
| Netherlands | 7 | Cyprus | 0 |
| UK | 7 | Lithuania | 0 |
| Denmark | 4 | Luxembourg | 0 |
| Belgium | 3 | Estonia | 0 |

| | | | |
|---|---|---|---|
| Bulgaria | 2 | Malta | 0 |
| France | 2 | Portugal | 0 |
| Ireland | 2 | Slovakia | 0 |
| Italy | 2 | Romania | 0 |
| Finland | 2 | Greece | 0 |
| Sweden | 2 | **Total** | **82** |

The broad type of resources targeted by the instruments were also analysed for all 110 identified MBIs. The results are presented in Figure 9 which details that waste or waste prevention instruments were most prevalent. These instruments included those targeting waste electrical goods, landfill, container deposit schemes and plastic and packaging waste. Instruments targeting emissions to air were the next most common, and were typically focused either on transport or industrial emissions. Energy was a resource targeted by other instruments, either in improved efficiency or renewable energy, typically achieved through taxes or subsidies. Both emissions and energy were outside the main scope of the study and therefore these instruments were not taken forward for further consideration as case studies.

Minerals (gravel, aggregates) and other natural resources (coal, oils) were the subject of 12 instruments. While water based instruments, either for supply, treatment or effluent, were the subject of 11 instruments. Agriculture related instruments were the subject of 4 instruments, while 8 instruments had a much broader focus. 5 instruments were identified that had a clear focus on ecosystem protection and enhancement, while 1 was found that addressed land as a resource. Ecosystems instruments were found only in Australia and Brazil, countries with important and fragile ecosystems which also have high economic value (agriculture, forestry). As noted previously, a more comprehensive study on eco-system based MBIs can be found here http://ec.europa.eu/environment/enveco/biodiversity/pdf/mbi.pdf.

**Figure 9 MBI instruments – resource targeted by instrument**



Performing a cross analysis of the instruments and resources found the following, see Table 3. This confirmed that price based instruments were the dominant instrument across resources. More interesting it showed that Quantity or Rights based instruments, such as tradable permits or compliance offsets, were primarily employed in emissions control systems and they have so far had little wider application. Similarly, market friction instruments were typically concentrated in a general context for all resource efficiency or also applied to emissions type situations, i.e. emissions from transport, other air pollutants and climate change ($CO_2$, $CH_4$, $N_2O$) emissions.

**Table 3 Resources and MBI types**

| Resource Type | Total | Price based | Quantity or Rights Based | Market Friction |
|---|---|---|---|---|
| Agricultural | 4 | 3 | 1 | 0 |
| Water | 11 | 11 | 0 | 0 |
| Waste | 32 | 29 | 1 | 2 |
| Minerals | 12 | 11 | 0 | 1 |
| Energy | 9 | 9 | 0 | 0 |
| Emissions (to air) | 26 | 15 | 7 | 4 |
| Ecosystem | 5 | 4 | 1 | 0 |
| Land | 1 | 0 | 0 | 1 |
| All | 8 | 2 | 0 | 6 |
| Other | 2 | 1 | 0 | 1 |
| **Total** | **110** | **85** | **10** | **15** |

The summary of the typology points to most MBIs remaining focused on price based mechanisms of taxes, charges and subsidies to achieve their environmental aims. Quantity and rights based schemes being little used outside the emissions sphere. Within the EU there appeared to be little use of quantity based instruments, although market friction based instruments were more common. It is notable then that the focus of instruments to be taken forward for case study in chapter 4 are price based MBIs.

The full overview of MBIs see accompanying Excel sheet Annex, and those summarised in Annex I, provided a good base from which to select case studies to examine the impacts in more detail.

## 3.3 Environmentally related taxes in Europe

### Trends in environmental taxes in Europe

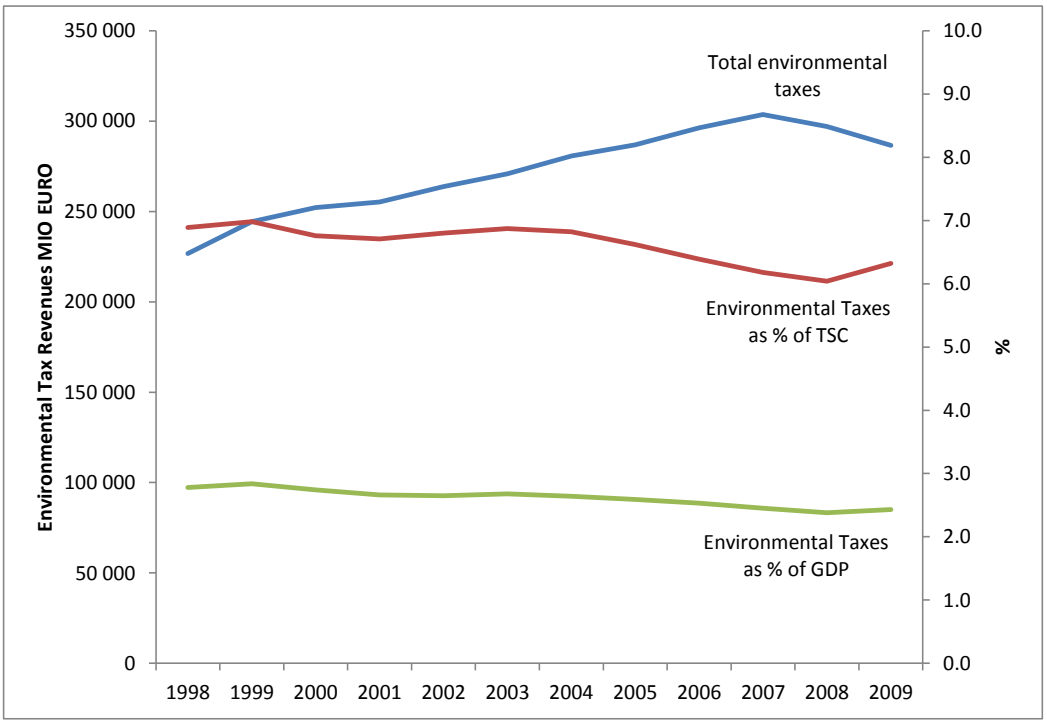
Environmental taxes have been used increasingly over the last years on EU-27 level as on national Member State level[11]. Environmental taxes aim to make consumers and producers more environmentally aware of their behaviour, following the 'polluter pays' principle, by pricing

[11] Eurostat (2011) Taxation trends in the European Union: 2011 edition

environmental externalities. As such, environmental taxes try to avoid environmental pollution and to promote responsively use of natural resources, i.e. resource efficiency. Therefore, the major share of relevant taxes for achieving resource efficiency are part of environmental taxes.

Figure 10 shows that the implementation and revenues of environmental taxes within the EU-27 stood at about 287 billion Euros in 2009, a decline from a peak of over 300 billion Euros in 2007, a result of the financial crisis and decreased tax revenues everywhere. It also shows that until 2008 environmental tax revenues in the EU-27 had also been declining as a percentage of GDP and TSC (taxes and social contributions). From peaks in 1999, environmental taxes have fallen as a percentage of TSC from 6.98% to 6.32% of all TSC in 2009, a relative decline of 9.5%. The equivalent fall for GDP is from 2.84% in 1999 to 2.43% in 2009, a relative decline of 14.4%. These have both bounced back somewhat in 2009, most likely a factor of GDP and other TSC revenue streams contracting faster than environmental taxes, it will be interesting to see if this trend continues.

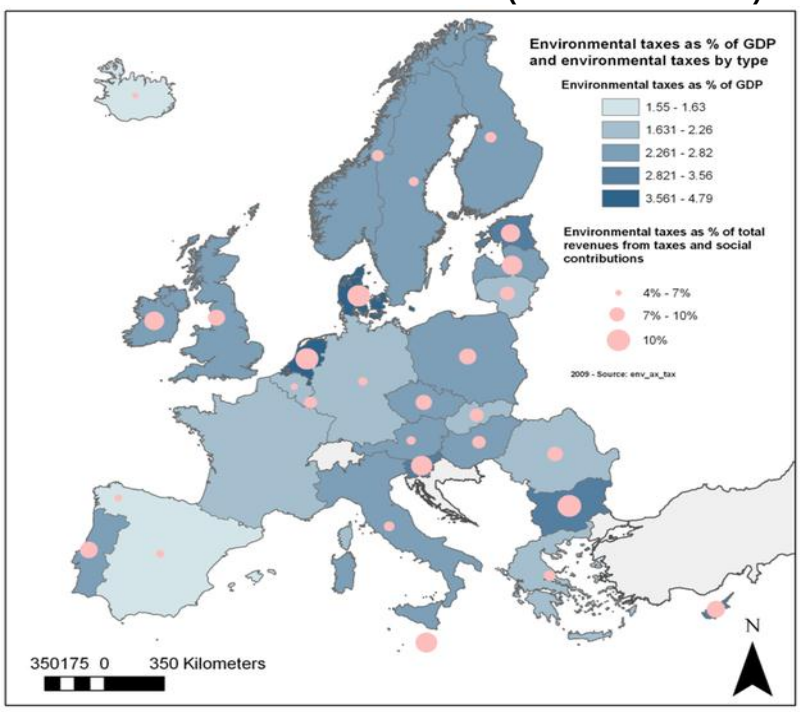
**Figure 10 EU-27 Total Environmental Tax Revenues and as a % of TSC and GDP, 1998-2009**




*Source:* Ecorys based on Eurostat [env_ac_tax]

Figure 11 shows the environmental tax revenues as percentages of TSC and GDP by Member State, showing that these are highest in Denmark and the Netherlands and lowest in Spain.

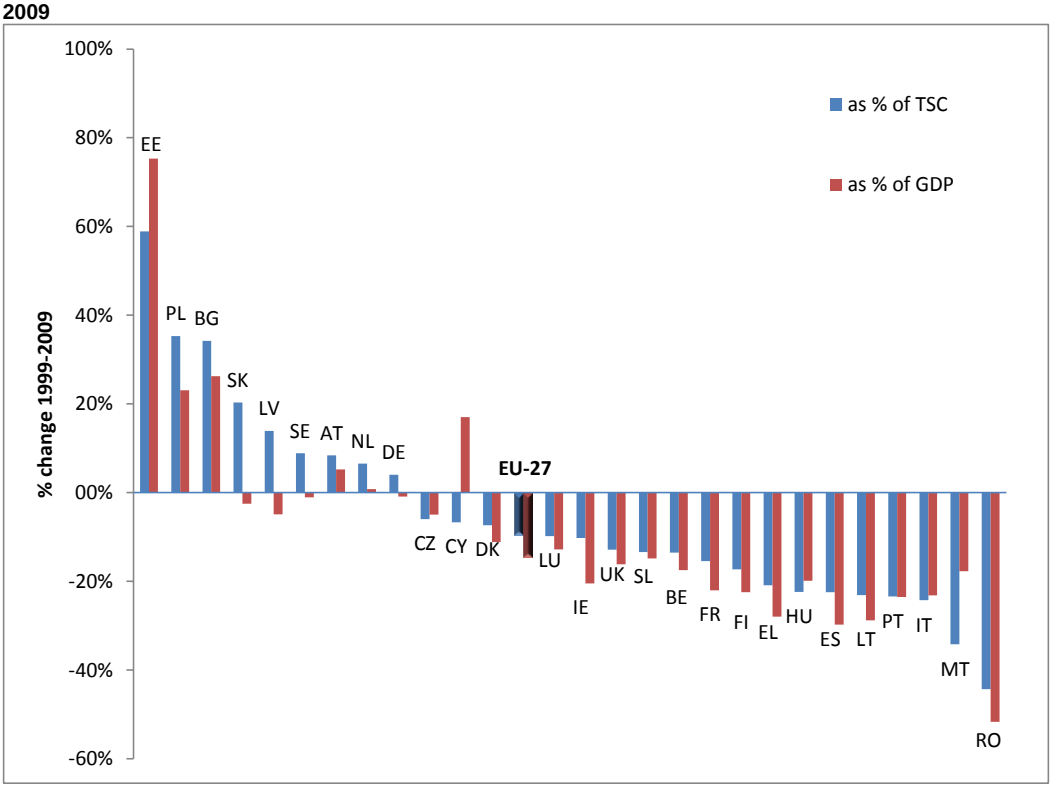
**Figure 11 Total environmental tax revenue in 2009 (% of GDP and TSC)**




Source: Eurostat (2011)

Figure 12 shows the relative changes in environmental tax revenues in each Member State as a % of TSC and GDP between 1999-2009. This shows that in addition to the EU-27 level changes presented in Figure 10 the majority of MS also saw environmental tax revenues fall as a proportion of TSC and GDP between 1999-2009. A group of newer member states (EE, PL, BG, SK and LV) saw an increase in environmental taxes in relation to TSC, and the first 3 also in relation to GDP. This move was interesting as most started from a point of below average proportions of TSC, but finished with among the highest proportions, with Bulgaria the highest in the EU-27 at 10.485 of all TSC coming from environmental taxes. Among the EU-15 MS, only 4 (SE, AT, NL & DE) saw environmental taxes increase as a % of TSC in this period. The other MS all saw environmental taxes decline in importance, this includes some of the larger (UK, FR, IT) and perceived environmentally strong (DK) MS.

**Figure 12 Change in total environmental tax revenue as a share of GDP and TSC within EU-27, 1999-2009**



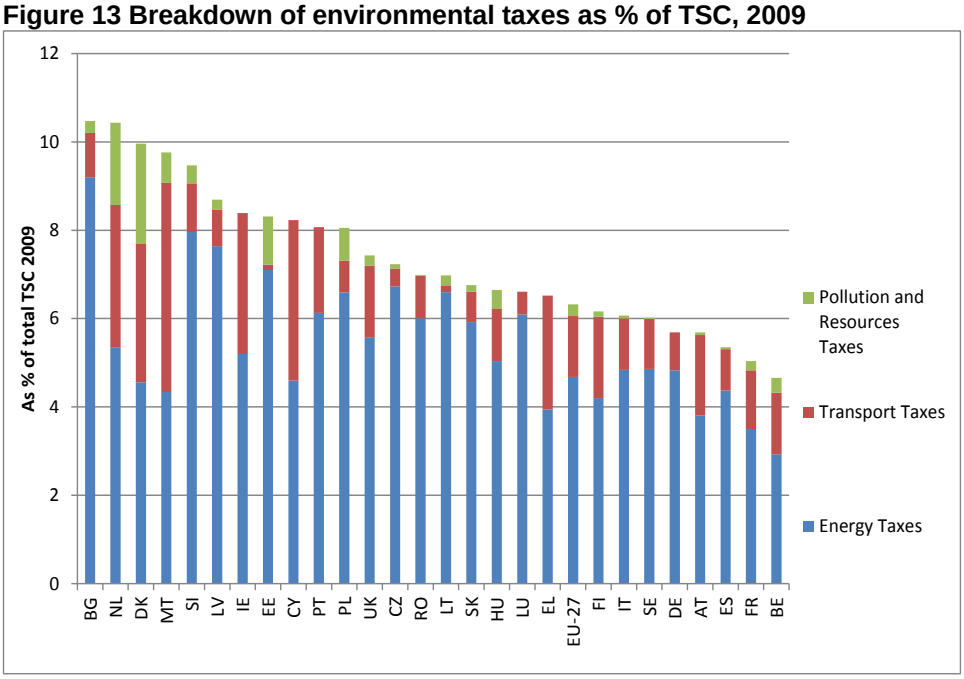

Source: Ecorys based on Eurostat (2011)

It is interesting then to drill-down into what specifically constituted these changes. Environmental taxes are relatively broadly defined and cover different subsets of taxes. Eurostat (2010) [12] defines three different tax schemes under environmental taxes: energy taxes, transport taxes and pollution taxes and resource taxes. With respect to resource efficiency the last two mentioned categories, in particular the last one, are interesting.

Figure 13 and Figure 14 presents a breakdown of environmental taxes, into these 3 constituent parts, as a % of TSC in 2009 and as a % of all environmental taxes in that MS. This shows that in most member states energy taxes are by far the largest constituent of environmental taxes, accounting for between around 4.7% of TSC and 50-90% of all environmental taxes, (74% for EU-27). The second largest category is transport taxes typically accounting for an EU-27 average of 1.3% of TSC, or between 10-40% of all environmental taxes (21.8% for EU-27). The smallest category of environmental taxes, and perhaps the one most relevant to resource efficiency as understood in this study, is pollution and resources taxes, which the EU-27 average is only 0.26% of TSC, or, in most MS, only 5% or less of all environmental taxes. The biggest exceptions to this rule are Denmark, the Netherlands and Estonia, where resource taxes take a more significant share of TSC and constitute more than 10% of the environmental tax base. In DK and NL this represents a much broader environmental tax base than in the other MS, this is more closely investigated and explained in the following sections.

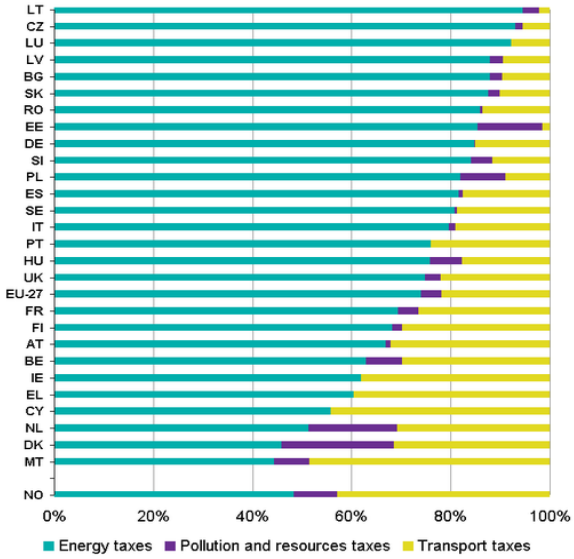
[12] Eurostat (2010), 'Environmental statistics and accounts in Europe', 2010 Edition

**Figure 13 Breakdown of environmental taxes as % of TSC, 2009**




Source: Ecorys based on Eurostat (2011)

**Figure 14 Environmental taxes by tax category in 2009 (% of GDP and TSC)**




Source: Eurostat (2011)

In conclusion environmental taxes are dominated by energy and transport based taxes, albeit with significant variation between countries. It is also clear the pollution and resource taxes also vary but are clearly the smallest part of all environmental taxes. This split demonstrates that the number of market-based instruments in pollution and natural resources taxing are relatively limited compared to the other tax categories. Therefore, most of the best practices regarding environmental taxes are, at present, focused on energy and transport.

Analysis in the most recent published report on EU taxation[13] claims that a handful of MS have explicitly targeted a double dividend through environmental taxation over the last 15 years. The focus of this has primarily been on energy taxation. The analysis shows that between 1995-2002

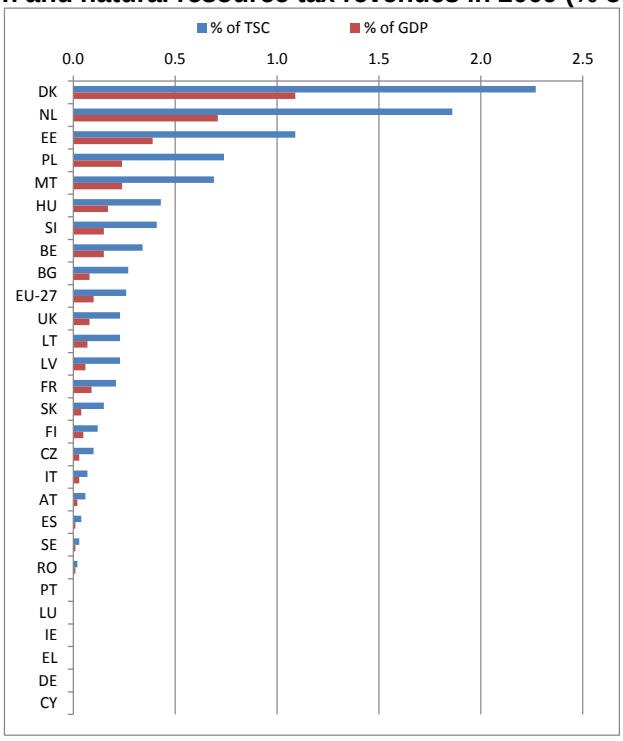
[13] Eurostat (2011) Taxation trends in the European Union: 2011 edition

implicit tax rates on energy rose, and this was matched by a corresponding increase in energy efficiency (as measured by energy intensity), and also a smaller decline in the implicit tax on labour. The trends on energy and labour taxes reversed after this point, although coincidently energy efficiency continued to improve. A conclusion from this is that since 2002-2004 taxation trends in the EU as a whole have been the opposite of that which may encourage a double dividend.

As Figure 14 already indicated, the distribution and size of implemented taxes for pollution and natural resources differ from Member State to Member State, where in particular the North-Western part of the EU has a relatively high share of resource efficiency related taxes. These observations are further extrapolated by Figure 15 which presents the revenues of environmental taxes on pollution and natural resources as a percentage share of GDP and TSC. This shows that in all but a handful of MS the role of pollution and natural resource taxation is less than 0.5% of both TSC and GDP.

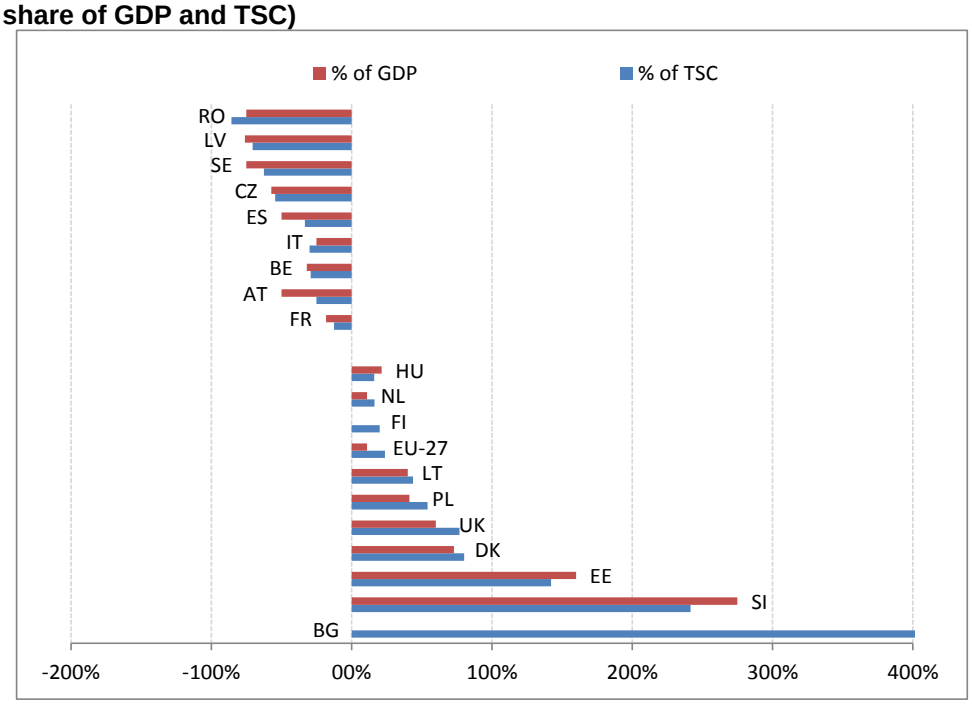
Figure 16 shows the changes in tax revenues for the different Member States between 1999 and 2009. This shows distinct variations in changes in these taxes over the period, becoming more important in the EU-27 as a whole, but not across all MS. DK and NL both saw the importance of these taxes increase, but so did other MS, notably the UK, PL, EE, BG and SI. On the other side SE, FR, ES, IT, AT, BE were among the EU-15 MS that saw declining importance in pollution and natural resource taxes.

**Figure 15 Pollution and natural resource tax revenues in 2009 (% of GDP and TSC)**




Source: Ecorys based on Eurostat

**Figure 16 Change in pollution and natural resource tax revenue between 1999-2009 (% share of GDP and TSC)**




Source: Ecorys based on Eurostat (2011)
N.B. MS not represented have either an incomplete dataset for the full period or no reported pollution and resource taxes.

that the revenues of environmental taxes in general have decreased over the last 10 years, versus the conclusions of the above figure that the revenues from pollution and natural resource taxes have increased over the last 10 years, indicates the growing share of resource related taxes. In other words, the role of MBIs in achieving a resource efficient economy, at least for taxes, seems to have become more important on a European-wide level. This makes it interesting then to look more closely at the impacts of this trend, with Denmark and the Netherlands, among the three countries, the other being Estonia, that rely on natural pollution and resource taxation the most as part of their tax base.

### *3.3.1 Denmark*

#### Green Taxes

Environmental taxes have been a part of the Danish tax system since the 1970's, where energy charges were introduced to regulate the energy sector[14] however it was in the 1990s when 'green' taxes became an integrated part of the system and peoples awareness.

The objective of green taxes is to motivate consumers and business to take environmental considerations into account in their decisions[15]. They are also increasingly important instruments to generate revenue for public finances[16]. The move towards green taxes therefore has a dual objective –

[14] Interview Thomas Lyngaard Germann, Ministry of Taxation, 06/06/2011
[15] Danish ministry of taxation http://www.skm.dk/tal_statistik/skatter_og_afgifter/675.html
[16] Interview Thomas Lyngaard German, Ministry of Taxation, 06/06/2011

both to incentivize behaviour that improves the environment and to generate revenue.

Ideally, the level of a green tax should reflect the environmental cost of producing and consuming goods[17] and be designed to mimic the internalisation of the external cost. Part of this is on the basis that the public sector could use the revenue to mitigate the societal cost of the externalities. In Denmark, the decisive element when defining if the tax is green or not is if the tax is having a positive effect on the environment and hence leads to changes in behaviour that are positive for the environment.

Green taxes are divided into three categories, which broadly equate to the three categories used at EU-level:

1. Energy charges
2. Motor Vehicle charges
3. Environment charges

Energy charges are fees levied on energy sources such as coal, electricity, gas, gasoline and certain oil products. They draw in approximately €4 200 million each year, or on average 45% of all 'green' taxes. The main income from Energy taxes is derived from the gasoline tax. This tax provided an average yearly income of € 1 284 mill per year from 2000 to 2010. This equals about 30% of the energy taxes and about 14% of the total Green tax base.

Motor vehicle taxes average €3 750 million, or around 40% of the green tax base. The vehicle charges cover taxes related to motor vehicles: vehicle excise duty or duty on vehicle fuel consumption[18], the vehicle registration fee, fee on third party liability insurance as well as fees on road use. The main income here is from the vehicle registration fee, which generates approximately 50 % of the vehicle taxes.

The third group of green taxes are the so called environment charges. Environmental charges are levied on[19]:

- Products that are harmful the environment and which are part of production of consumption, hereunder
  - Packaging
  - Chlorinated Solvents
  - Waste
  - Certain batteries
  - PVC and Phthalates
- Emissions of polluting substances hereunder:

[17] Danish ministry of taxation http://www.skm.dk/tal_statistik/skatter_og_afgifter/675.html
[18] Depending on year of first registration – before or ater 1997 respectively http://www.skm.dk/tal_statistik/satser_og_beloeb/183.html
[19] It should be noted that these figures differ slightly from those prepared by Eurostat, this is a factor of exchange rates to Euros and differing classifications used by the Danish Ministry. The broad trends and proportions remain the same across the data.

- $CO_2$
- $SO_2$
- NOx

- Limited natural resources, hereunder
  - Raw materials
  - Piped water

These charges generate much less income than the other two types of green taxes, around €1 300 million annually and represent only around 15% of the total. The main revenue is generated from charges on waste and piped water. An overview of revenues generated from the three main categories of Green taxes is shown in the table below.

**Table 4 Green tax revenues in Denmark 2000 – 2010, Million EUR**

| Million € in nominal terms | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Energy taxes** | 3 825 | 4 048 | 4 177 | 4 230 | 4 264 | 4 183 | 4 211 | 4 155 | 4 242 | 4 243 | 4 591 |
| **Vehicle taxes** | 3 062 | 2 900 | 3 300 | 3 102 | 3 695 | 4 335 | 4 770 | 4 913 | 4 433 | 3 237 | 3 449 |
| **Environment taxes** | 1 251 | 1 245 | 1 246 | 1 231 | 1 240 | 1 283 | 1 300 | 1 331 | 1 331 | 1 264 | 1 388 |
| **Total** | 8 138 | 8 194 | 8 722 | 8 563 | 9 199 | 9 801 | 10 281 | 10 266 | 10 006 | 8 744 | 9 428 |
| **GDP, billion EUR (in market prices)** | 174 | 179 | 184 | 188 | 197 | 207 | 219 | 227 | 233 | 223 | 233 |

Source: Statsregnskabet ( SRC ), Skatteministeriet; Skatter og Afgifter, Danmarks Statistik; Økonomisk Oversigt, Økonomiministeriet; Økonomisk Redegørelse, Finansministeriet.[20]

Note: Numbers for 2010 is an estimation as of December 2010

Green taxes in Denmark were relatively stable at around 3% of GDP during the 1970's, but increased significantly during the 1980's, reaching almost 5% in 1986/87. This was mainly due to an increase in revenues from the car registration fee following increased car sales. Income from green taxes decreased thereafter until 1994 where larger tax reforms switched the emphasis back to green taxes. Both in this reform and again with taxation changes introduced in 1998, changes were made to increasing green taxes while also reducing income taxes, effectively switching the tax base away from labour. This is believed by many to be more economically efficient, stimulating enterprise, employment and also environmental protection, representing a double dividend to be reaped.

As seen in Table 5, the share of environmental taxes of GDP was relatively stable from 1997 to 2007, where after there was a significant reduction until 2009. This is very likely to be linked to the economic recession. The overall trend downwards, as in the mid 80's, is mainly due to lower incomes from the vehicle registration fee. Moreover, with the entry into force of the new government in 2001, a so called "taxation stop" was introduced and following this a number of charges and fees were abolished. According to the Ministry of Taxation, this has also contributed to the reduction of the green taxes[21]. The total burden of taxation has however been relatively stable over the period.

[20] http://www.skm.dk/tal_statistik/tidsserieoversigter/679.html
[21] http://www.skm.dk/tal_statistik/skatter_og_afgifter/675.html

**Table 5 Green taxes and total taxes as percentage of GDP from 1997 to 2010**

| Year | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Green tax** | 4.6 | 4.9 | 5.0 | 4.7 | 4.6 | 4.7 | 4.6 | 4.7 | 4.7 | 4.7 | 4.5 | 4.3 | 3.9 | 4.0 |
| **Total taxes and charges** | 49.1 | 49.5 | 50.3 | 49.5 | 48.6 | 48.0 | 48.1 | 49.2 | 51.0 | 49.8 | 49.1 | 48.2 | 48.2 | 48.1 |

Source http://www.skm.dk/tal_statistik/skatter_og_afgifter/510.html?rel and http://www.skm.dk/tal_statistik/skatter_og_afgifter/675.html

## What impact has this had?

The ministry of taxation has not made any overall studies on the impact of the green taxes, however according to the interviewee in the ministry, some reports have been made analysing individual charges and taxes. These have shown a positive environmental effect from the measures, including reduced pesticide use and packaging. However, it is not possible to comment on the overall environmental effect of the Green Taxes.

As mentioned above, one of the main income sources is the vehicle registration fee. Changes to this fee have been discussed repeatedly and adverse effects of this charge have been highlighted. These adverse effects revolve around the level of the registration fee, which is significant and some argue leads to more older, less efficient motor vehicles on the road, e.g. cars, not being replaced as quickly to avoid the fee, this may lead to an older stock of cars that pollutes more than new cars[22].

As example, Table 6 shows the effect of the charges against the development in average $CO_2$ emissions from cars in Denmark (yellow) from 2007 to 2008, where the charge on vehicle was redesigned so that it was to related to $CO_2$ emissions rather than the weight of the car. Also in Finland a similar charge was introduced at the same time.

**Table 6 Average $CO_2$ figures of new cars sold in EU-25 Member States**

| | Registrations 2008 (1,000) | Average $CO_2$ 2008 | Average $CO_2$ 2007* | Improvement 2007-2008 | Rank 2007 |
|---|---|---|---|---|---|
| 1 Portugal | 215 | 138 | 144 | -4.1% | 1 |
| 2 France | 2,037 | 140 | 149 | -6.2% | 4 |
| 3 Italy | 2,162 | 145 | 147 | -1.2% | 2 |
| 4 Denmark | 146 | 146 | 160 | -8.3% | 12 |
| 5 Malta | 5 | 147 | 148 | -0.6% | 3 |
| 6 Belgium | 536 | 148 | 153 | -3.2% | 5 |
| 7 Spain | 1,045 | 148 | 153 | -3.4% | 6 |
| 8 Poland | 302 | 153 | 154 | -0.4% | 7 |
| 9 Hungary | 163 | 153 | 155 | -1.0% | 10 |
| 10 Czech Republic | 134 | 154 | 154 | 0.1% | 8 |
| 11 Slovenia | 71 | 156 | 156 | -0.3% | 11 |
| 12 Romania | 285 | 156 | 155 | 0.7% | 9 |
| 13 Ireland | 151 | 157 | 162 | -3.0% | 13 |
| 14 Netherlands | 481 | 158 | 165 | -4.2% | 15 |
| 15 Austria | 294 | 158 | 163 | -2.9% | 14 |
| 16 UK | 2,084 | 158 | 165 | -4.0% | 16 |
| 17 Luxembourg | 52 | 160 | 166 | -3.8% | 18 |
| 18 Greece | 276 | 161 | 165 | -2.6% | 17 |
| 19 Finland | 137 | 163 | 177 | -8.2% | 22 |
| 20 Germany | 3,044 | 165 | 169 | -2.7% | 19 |
| 21 Cyprus | 24 | 166 | 170 | -2.8% | 20 |
| 22 Lithuania | 21 | 170 | 177 | -3.7% | 21 |
| 23 Sweden | 248 | 174 | 181 | -4.1% | 23 |
| 24 Estonia | 24 | 177 | 182 | -2.3% | 24 |
| 25 Latvia | 19 | 181 | 183 | -1.5% | 25 |
| Total / average | 13,957 | 153.5 | 158.7 | -3.3% | |

* The figures are 0.7% higher than those presented in last year's report because we have left out the test cycle correction (see page 3).

Green taxes in Denmark are mostly based on fixed charges which are not index regulated. One example of where it was chosen to index the charge on energy with inflation was in connection with

[22] Discussion e.g. reflected in the following article in Børsen: http://borsen.dk/nyheder/politik/artikel/1/177451/fdm_ny_bilafgift_bliver_grotesk_dyr.html

the income tax reductions in the spring of 2009. Hence the relative importance and effect of the taxes is likely to be reduced over time, due to GDP growth and inflation, unless all charges are reviewed and increased periodically, obviously if each increase in tax is negotiated separately then it becomes a political issue and more difficult and costly to achieve.

The positive effect on the environment of such green taxes is also likely to be most significant if it differentiates between impact, e.g. different motor vehicles depending on their pressure on the environment, depending on fuel consumption and fuel type e.g. electric cars vs. diesel cars. In other words the yearly charge one pays for the possessing a vehicle is differentiated according to fuel consumption. However, this also increases the administrative burden somewhat relative to a flat charge.

## Lessons learned / could this be applied elsewhere?

According to the ministry, taxation is a good way of regulating behaviour and green taxes contribute to stimulate more environmentally friendly behaviour and do not entail a significant administrative burden.[23] Taxes should though be indicated as to follow inflation or, where possible be indicated as a percentage to reflect price changes and keep taxes relative impact. This also avoids the need for regular policy re-negotiation.

It will be possible to apply a similar system in most countries. Especially the taxes and charges related to energy and transport, which are based on data already collected in most MS, and therefore could easily be applied. The charges directed more towards the environment, such as water supply and waste water treatment, would be more challenging to implement as these are usually MS specific regimes. Data wise it would also require a high degree of connection with the public water supply and treatment facilities to apply such charges as they have been applied in Denmark. This connectivity varies significantly across MS and would mean the application of similar charges could be more difficult and take a longer time to implement.

[23] Interview Thomas Lyngaard Germann, Ministry of Taxation, 06/06/2011.

**Table 7** Green taxes Denmark 2000 - 2011

| Million EUR | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010* | 2011* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Energy charges etc** | | | | | | | | | | | | |
| pit coal etc | 177 | 188 | 202 | 233 | 214 | 197 | 207 | 190 | 197 | 212 | 342 | 349 |
| electricity | 1 050 | 1 038 | 1 106 | 1 115 | 1 125 | 1 131 | 1 167 | 1 163 | 1 167 | 1 180 | 1 369 | 1 503 |
| *gas*[1)] | | | | | | | | | | | | |
| Natural gas[2)] | 355 | 516 | 509 | 483 | 510 | 499 | 494 | 419 | 510 | 477 | 564 | 564 |
| Certain oil products[3)] | 892 | 943 | 959 | 999 | 1 035 | 1 078 | 1 101 | 1 147 | 1 176 | 1 202 | 1 208 | 1 221 |
| gasoline | 1 352 | 1 363 | 1 400 | 1 399 | 1 380 | 1 278 | 1 242 | 1 236 | 1 191 | 1 173 | 1 107 | 1 128 |
| Total Energy charges | 3 825 | 4 048 | 4 177 | 4 230 | 4 264 | 4 183 | 4 211 | 4 155 | 4 242 | 4 243 | 4 591 | 4 765 |
| **Charges on Motor Vehicles** | | | | | | | | | | | | |
| vehicle excise duty /fuel consumption | 930 | 994 | 1 066 | 1 076 | 1 119 | 1 167 | 1 238 | 1 169 | 1 415 | 1 319 | 1 356 | 1 417 |
| Registration fee | 1 896 | 1 659 | 1 945 | 1 723 | 2 255 | 2 833 | 3 185 | 3 265 | 2 689 | 1 611 | 1 784 | 2 012 |
| third party liability insurance | 195 | 205 | 244 | 258 | 268 | 274 | 285 | 281 | 274 | 249 | 258 | 268 |
| Toll road | 41 | 43 | 44 | 44 | 53 | 61 | 61 | 63 | 55 | 57 | 50 | 52 |
| Total Motor Vehicle charges | 3 062 | 2 900 | 3 300 | 3 102 | 3 695 | 4 335 | 4 770 | 4 913 | 4 433 | 3 237 | 3 449 | 3 750 |
| **Environment charges** | | | | | | | | | | | | |
| $CO_2$ | 647 | 650 | 635 | 646 | 649 | 681 | 687 | 683 | 681 | 674 | 835 | 840 |
| $SO_2$ | 27 | 14 | 16 | 26 | 16 | 10 | 9 | 14 | 12 | 10 | 10 | 10 |
| disposable plates, cups and cutlery[4)] | 9 | 4 | | | | | | | | | | |
| packaging[5)] | 104 | 113 | 130 | 128 | 124 | 126 | 135 | 144 | 145 | 137 | 141 | 137 |
| CFC | 0 | 6 | 8 | 7 | 7 | 7 | 8 | 6 | 8 | 7 | 7 | 11 |
| Chlorinated Solvents etc | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| pesticides | 50 | 48 | 50 | 53 | 57 | 55 | 49 | 60 | 77 | 59 | 67 | 94 |
| Certain growth enhancers | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| waste | 134 | 143 | 146 | 123 | 135 | 146 | 153 | 166 | 151 | 137 | 43 | 9 |
| Raw materials | 24 | 23 | 21 | 21 | 22 | 26 | 30 | 29 | 27 | 18 | 17 | 17 |
| Waste water | 37 | 38 | 36 | 25 | 26 | 28 | 24 | 24 | 30 | 27 | 24 | 36 |
| Piped water | 209 | 190 | 192 | 190 | 192 | 186 | 185 | 185 | 186 | 184 | 201 | 201 |
| nickel/ cadmium batteries | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| pvc og phtalates | 3 | 9 | 8 | 7 | 6 | 6 | 6 | 6 | 5 | 3 | 3 | 3 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| nitrogen | 4 | 4 | 4 | 3 | 4 | 3 | 3 | 4 | 3 | 3 | 3 | 3 |
| Mineral phosphorus | | | | | | 4 | 6 | 7 | 5 | 5 | 5 | 5 |
| $No_x$ | | | | | | | | | | | 30 | 34 |
| Environment charges total | 1 251 | 1 245 | 1 246 | 1 231 | 1 240 | 1 283 | 1 300 | 1 331 | 1 331 | 1 264 | 1 388 | 1 403 |
| **Total Green Taxes** | **8 138** | **8 194** | **8 722** | **8 563** | **9 199** | **9 801** | **10 281** | **10 266** | **10 006** | **8 744** | **9 428** | **9 917** |
| GDP, Bill. € in ,market prices | 174 | 179 | 184 | 188 | 197 | 207 | 219 | 227 | 233 | 223 | 233 | 240 |
| % of GDP – Green tax burden | 4.7 | 4.6 | 4.7 | 4.6 | 4.7 | 4.7 | 4.7 | 4.5 | 4.3 | 3.9 | 4 | 4.1 |

Source: Statsregnskabet ( SRC ), Skatteministeriet; Skatter og Afgifter, Danmarks Statistik; Økonomisk Oversigt, Økonomiministeriet; Økonomisk Redegørelse, Finansministeriet.

*Note: 2010 and 2011 are based on estimations from December 2010

### 3.3.2 Netherlands

#### Green Taxes

The basis for the current green tax system in the Netherlands was established in 1988 with the introduction of the General Environmental Provisions Act. This act introduced a general fuel charge, with revenues from the charge being ring-fenced so that they could only be spent on a limited number of government activities. Before 1988, environmental charges existed on a small scale but only to finance specific government spending programs. From 1988 to 1992 the rates of the fuel charge were raised to finance an increase in environmental expenditures. In 1992 the fuel charge was transformed into a general fuel tax, this meant that revenues from this tax could now be spent on any item of the budget. The change in system came with a higher tax burden and an increase in revenues of Dfl. 615 million (~280 million EUR). The main reason for this increase in environmental taxes was to raise revenues in order to reduce a budgetary deficit.[24]

During the 1990's the main change was the broadening of the tax base. New taxes introduced included a groundwater tax and a waste tax. Before 1992, increasing revenue was the main goal of environmental taxation. With the broadening of the tax base, shifting the tax burden from labour to environmental factors became a goal, next to revenue collection. In general, the focus shifted from revenue as the main goal to affecting behaviour through raising the price of certain products or activities.[25]

Currently, green taxes in the Netherlands are divided into two main categories

- Environmental taxes
- Environmental charges

The aim of the environmental taxes is to reduce activities that are harmful to the environment by raising the price of those activities[26]. The revenues of these taxes are treated as general tax revenues and are thus not specifically used to finance environmental measures/programs. The category 'environmental taxes' is in turn divided in two categories: 'taxes related to mobility' and 'other environmental taxes'. 'Taxes related to mobility', consists of taxes that are specifically related to mobility and transport. Taxes in this category are: the fuel tax and taxes on the registration and ownership of cars and other motorised vehicles. 'Other environmental taxes' consists of taxes levied on various specific products; waste water, pipe water, coal, energy, packaging, garbage and airline tickets.

[24] Greening taxes, the dutch model, (1998), Vermeend and Van der Vaart
[25] Greening taxes, the dutch model, (1998), Vermeend and Van der Vaart
[26] Definition comes from Centraal Bureau voor de Statistiek (CBS).

Environmental charges are (in contrast with regular green taxes) used to finance specific environmental measures. First of all, there is a charge levied on households and firms to finance the collection and disposal of household/firm garbage. Second there is a charge on the use of airports to finance specific measures dealing with noise pollution. Finally there are charges on ground water, use of the sewage system and water pollution.

In Table 8 the three main categories are listed along with the tax revenues for the years 2000-2009. Taxes related to mobility generate the most tax revenue with an average of €12 958 million, or on average 64% of all green taxes. Other environmental taxes and environmental charges account for significantly less revenues with €3 763 (18%) and €3 642 (18%) million on average respectively.

**Table 8 Green taxes in the Netherlands 2000 - 2009**

| Million € | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Other environmental taxes** | 2 849 | 3 352 | 2 953 | 3 081 | 3 278 | 4 128 | 4 545 | 3 789 | 4 785 | 4 872 |
| **Taxes related to mobility** | 11 106 | 11 051 | 11 381 | 11 892 | 12 789 | 13 141 | 14 130 | 14 718 | 14 970 | 14 405 |
| **Environmental charges** | 2 906 | 3 102 | 3 246 | 3 409 | 3 584 | 3 722 | 3 954 | 4 116 | 4 201 | 4 176 |
| **Total** | 16 879 | 17 516 | 17 588 | 18 384 | 19 647 | 20 992 | 22 631 | 22 619 | 23 958 | 23 454 |
| **GDP, billion € (in market prices)** | 418 | 448 | 465 | 477 | 491 | 513 | 540 | 572 | 596 | 572 |

*Source:* Centraal Bureau voor de Statistiek (CBS)

Table 9 shows the revenues for the specific taxes in each category. The largest single revenue in 2009 is generated by the tax on fuel of €7 397 million. The second and third largest revenues in 2009 are generated by the 'tax on possession of motorised vehicles' (€4 863) and the 'energy tax' (€4 148) respectively.

**Table 9 Detailed breakdown of Green taxes in the Netherlands 2000 - 2009**

| Mill € in nominal terms | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Other green taxes** | 2 849 | 3 352 | 2 953 | 3 081 | 3 278 | 4 128 | 4 545 | 3 789 | 4 785 | 4 872 |
| Garbage tax | 220 | 191 | 182 | 121 | 88 | 124 | 181 | 170 | 112 | 46 |
| Coal tax[27] | 612 | 607 | 516 | 538 | 52 | 6 | 6 | 1 | 14 | 0 |
| Energy tax | 1 775 | 2 320 | 2 003 | 2 132 | 2 848 | 3 716 | 4 070 | 3 314 | 4 065 | 4 148 |
| Waste and pipe water tax | 242 | 234 | 252 | 290 | 290 | 282 | 288 | 304 | 285 | 285 |
| Packaging tax[28] | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 161 | 275 |
| Airline tickets tax[29] | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 148 | 118 |

[27] Before 2004 this tax included other fuels than coal, this was changed since 2004 to only include coal.
[28] This tax was introduced on January 1st 2008 along with the airline ticket tax.
[29] This tax has been discarded as of July 1st 2009.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Taxes related to mobility** | 11 106 | 11 051 | 11 381 | 11 892 | 12 789 | 13 141 | 14 130 | 14 718 | 14 970 | 14 405 |
| Fuel tax | 5 290 | 5 224 | 5 737 | 5 952 | 6 458 | 6 420 | 6 818 | 6 975 | 7 225 | 7 397 |
| Tax on registration of motorised vehicles | 2 875 | 2 939 | 2 741 | 2 874 | 3 003 | 3 148 | 3 452 | 3 647 | 3 236 | 2 145 |
| Tax on possession of motorised vehicles | 2 941 | 2 888 | 2 903 | 3 066 | 3 328 | 3 573 | 3 860 | 4 096 | 4 509 | 4 863 |
| **Environmental charges** | 2 906 | 3 102 | 3 246 | 3 409 | 3 584 | 3 722 | 3 954 | 4 116 | 4 201 | 4 176 |
| Charge for garbage disposal | 1 183 | 1 283 | 1 324 | 1 405 | 1 513 | 1 555 | 1 629 | 1 694 | 1 707 | 1 758 |
| Charge on airport use | 36 | 43 | 38 | 37 | 33 | 48 | 54 | 55 | 56 | 51 |
| Charge on groundwater | 34 | 40 | 59 | 33 | 34 | 36 | 35 | 35 | 20 | 24 |
| Charge for sewage system | 650 | 701 | 746 | 805 | 831 | 886 | 1 014 | 1 094 | 1 163 | 1 241 |
| Water pollution charge | 1 003 | 1 035 | 1 079 | 1 129 | 1 173 | 1 197 | 1 222 | 1 238 | 1 255 | 1 102 |
| **Total Green taxes** | 16 879 | 17 516 | 17 588 | 18 384 | 19 647 | 20 992 | 22 631 | 22 619 | 23 958 | 23 454 |

Source: Centraal Bureau voor de Statistiek (CBS)

Table 10 shows the green tax burden for the Netherlands. The average tax burden over the period 2000-2009 was 4% of GDP. As can be seen, the green tax burden in the Netherlands mostly stays close to 4% with no clear up or downward trend visible. Green taxes generated 17,8% of total tax revenues on average. Again this percentage seems mostly stable at more or less 18%.

**Table 10 Green taxes and total taxes as percentage of GDP from 2000 to 2009**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Total green taxes/GDP** | 4.0% | 3.9% | 3.8% | 3.9% | 4.0% | 4.1% | 4.2% | 4.0% | 4.0% | 4.1% |
| **Green taxes/total taxes** | 18.1% | 17.4% | 16.8% | 17.9% | 18.5% | 18.1% | 18.1% | 17.0% | 17.7% | 18.2% |
| **Total taxes/GDP** | 22.3% | 22.5% | 22.5% | 21.6% | 21.6% | 22.6% | 23.2% | 23.3% | 22.7% | 22.6% |
| **Total Green taxes (billion)** | 16.9 | 17.6 | 17.6 | 18.4 | 19.6 | 21.0 | 22.6 | 22.6 | 24.0 | 23.4 |
| **GDP (billion)** | 418 | 448 | 465 | 477 | 491 | 513 | 540 | 572 | 596 | 572 |

Source: Centraal Bureau voor de Statistiek (CBS)

## What impact has this had?

Generally, the Netherlands have recorded various effects from environmental taxation including lower consumption of resources, more environmentally friendly production methods, different patterns of behaviour or increased research into alternative technology. The effects are especially evident for natural gas where the increasingly higher price has been regarded as one contributor to decreased consumption, other factors impacting this trend being technological development such as double glazed windows and high-efficiency boilers.[30]

[30] 'Greening' the tax system pages 6-11

The *Rijksinstituut voor Volksgezondheid en Mileu* (RIVM) has modelled the environmental impact of green taxes at the request of the Dutch Green Tax Commission. The results of these calculations are published in the Green Tax Commission reports. In a 1998 report by the Green Tax Commission[31], price elasticities are listed to be between -0.15 for bulk chemicals and -0.4 for some industrial sectors. The 2010 report[32] on the state of the Dutch tax system addresses the impact environmental taxes have had. One main conclusion is that most studies find a price elasticity for environmental taxes in the Netherlands of between 0 and -1, meaning that in general, demand for taxed products/services/activities will drop as a result of higher taxes.

In a study on the effect of green taxes on transport and traffic, *CE Delft* (2010) found that the fuel tax has been successful in reducing $CO_2$ emissions from transport. Another study looking specifically at the energy tax found that it had reduced $CO_2$ emissions by 1.6 million tons in 2002.[33] The *Centraal Plan Bureau* (CPB) finds that environmental taxes in the Netherlands in general have a positive effect on the environment but negatively affect GDP and employment.[34] The *CPB* finds that the negative impact of environmental taxation is slightly bigger than that of the general value added tax (BTW).

As mentioned earlier, a major goal of environmental taxes is to shift the tax burden from labour to environmental factors. With the goal of a double dividend in stimulating employment and decreasing environmentally harmful activities at the same time.

### 3.3.3 Conclusions

The examples of DK and NL demonstrate that a broader environmental tax base can be effective in supporting tax revenues. It is less clear if this has had any wider economic or resource efficiency impacts. What can be said is that both countries have, pre-crisis, experienced good rates of economic growth and low unemployment in general, so that the taxes appear to have been little hindrance to this. Environmentally, and in terms of resource efficiency, the evidence is weaker, although positive impacts are estimated in reduced resource use (consumption) and innovation for resource efficiency in the Netherlands.

In Denmark the tax ministry claimed that its green taxes were specifically designed to stimulate more environmentally friendly and resource efficient behaviour and that a double dividend was explicitly targeted through the taxes with associated reductions in labour or income taxes. There appear

[31] Greening taxes, the dutch model, (1998), Vermeend and Van der Vaart

[32] Continuïteit en vernieuwing, een visie op het belastingstelsel,Studiecommissie Belastingstelsel, 2010

[33] CPB, Ecofys, Joosen e.a., Evaluatie van het klimaatbeleid in de gebouwde omgeving 1995-2002, 2004.

[34] For example see: CPB: Economische gevolgen op lange termijn van heffingen op energie (1992), CPB,: Vergroening en Energie Effecten van verhoogde energieheffingen en gerichte vrijstellingen (1997) and M. Lijesen, M. Mulder en M.Vromans: Fiscale vergroening en energie II: Economische effecten van verhoging en verbreding van de Regulerende Energiebelasting (2001)

to be some contradictions within the system, although it has achieved relatively high levels of green tax revenues, these are controversial, with political opposition occasionally calling a halt to new measures, and a lack of indexation leading to an erosion of revenues from some taxes (but not total revenues) over time. The pollution and resource taxes are applied to waste, packaging, water and specific pollutants such as pesticides (see chapter 4 for a case study of this measure), CFCs, pvc and cadmium. The largest part of revenues coming from the waste and water charges.

In the Netherlands the pollution and resource taxes were also focused on charges related to domestic waste disposal and charges related to use of groundwater and the sewage system. These latter uses are investigated further in chapter 4.

### Wider application

With the evidence at hand it is difficult to make conclusions on wider application beyond the fact that a broader tax base in both has been successfully implemented and has helped to diversify the tax base. There appears to be little reason for why other MS couldn't follow this example and also introduce or increase pollution and resource taxes. If applied in the right way, with revenues recycled to reduce other taxes for those affected, these measures could successfully support achieving a double dividend in increased economic growth and reduce environmental impact.

The case studies in the following chapter providing some insight into how the instruments applied in NL and DK have worked, but this issue also bears further, more detailed investigation at a macro-economic level.

# 4 Findings: case studies of MBIs in practice

The research carried out in chapter 3 identified a variety of market based instruments for resource efficiency. This section presents a selection of 8 instruments, with a review of their deployment in 2 member states to compare and contrast the approaches and gain maximum learning on the drivers, barriers, factors in their success/failure and potential wider applicability.

The selection process for these cases was based on a variety of factors, initially with the best cases from each Member State put forward for selection (see Annex A). The instruments on this long list were further investigated for match to study objectives, use in more than one member state, geographical spread, resource spread, addressing an item of significant importance or impact and for data availability.

The limited number of non-fiscal instruments restricted the variety that could be examined, because of this 7 of the 8 cases studies are based on fiscal instruments of taxes, charges, levies or compliance fees. The other case study, the container deposit scheme, is an example of a quantity based system, but one that also has elements of a fiscal instrument.

### *4.1.1 Fiscal instruments – intended route to impact*

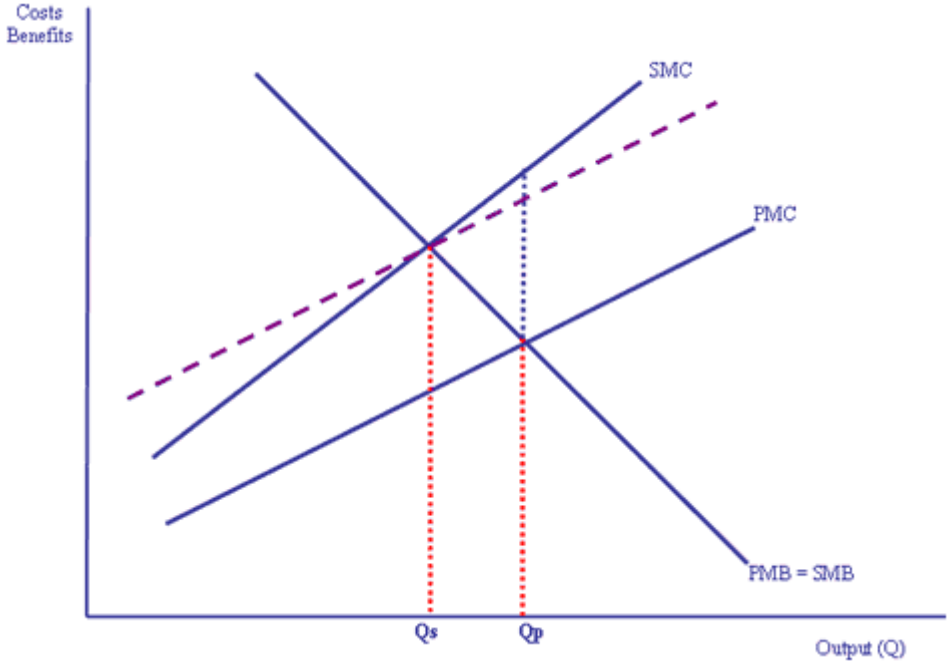
Since nature itself cannot place a monetary price-label on natural resources, exploiters often look no further than the costs they incur during the process of extraction. These costs do not always take into account the wider societal and environmental consequences of resource exploitation. Some resources are still market goods, with their usage determined by the forces of supply and demand, others, such as ecosystems, are not.

By taxing resource use, policy-makers can influence these market forces by influencing the price. The subsequent quantities of resource use will be dependent on the change in price and the price-elasticity of the producers and consumers. Policy mechanisms of this type are designed to ensure polluters take responsibility for the full costs of their activities (Hawkins, 2000). This is the basis of the polluter pays principle, to which the EU is committed through various international treaties. The essence of this is that the negative externalities of resource use are internalised, that is, that the cost of negative impacts are included in the price/cost of their consumption or use.

Figure 17 presents this economic principle, showing the relationship between the firm's private marginal costs incurred by polluting activities (PMC) and the costs incurred by society from these activities (SMC). In the diagram, the marginal benefits to both society and the firm are equal (PMB=SMB). Without the tax, the quantity of the resource consumed is Qp. However, at this point, it is clear that the costs to society are far higher than the cost to the firm. By taxing the firm, raising the PMC to the purple

dashed line, the optimum quantity consumed drops to Qs. This is the socially optimum quantity, where the costs that the firm incurs from consumption are the same as the costs that society incurs. This is the intended outcome of such a tax.

**Figure 17 The 'Polluter Pays' principle**




Source: http://tutor2u.net/economics/content/topics/marketfail/environmental_taxation.htm

There are, of course, certain drawbacks to taxes. Firstly, it is difficult to estimate the exact costs to society, and therefore difficult to estimate the exact tax amount which should be asked. Secondly, taxes demand compliance from a wide range of industries and organisations, without reference to the individual marginal costs involved. The implication of this is that the final cost of the tax may vary widely by organisation, based on individual access to new technologies, or to less resource-intensive goods and services.

Thirdly, taxes are often static, providing little incentive to look for alternatives, once compliance has been achieved. That is, there is little advantage to be gained from anything beyond cost-minimisation, after taking the tax into account. This limits the chance that firms and organisations will incur extra costs to seek these alternatives, which has negative long-term implications.

These types of taxes can be applied in respect of resources with three intentions; providing incentives to reduce use of the resource, providing a source of finance to manage the consequences of resource use, or adjusting the market so that the real environmental consequences of resource-use are translated into financial consequences for the user. The negative externalities caused by the resource-use can in this way, be reduced, mitigated or eliminated.

## 4.2 Water consumption – NL & CY

### *4.2.1 Introduction*

*Water as a resource*

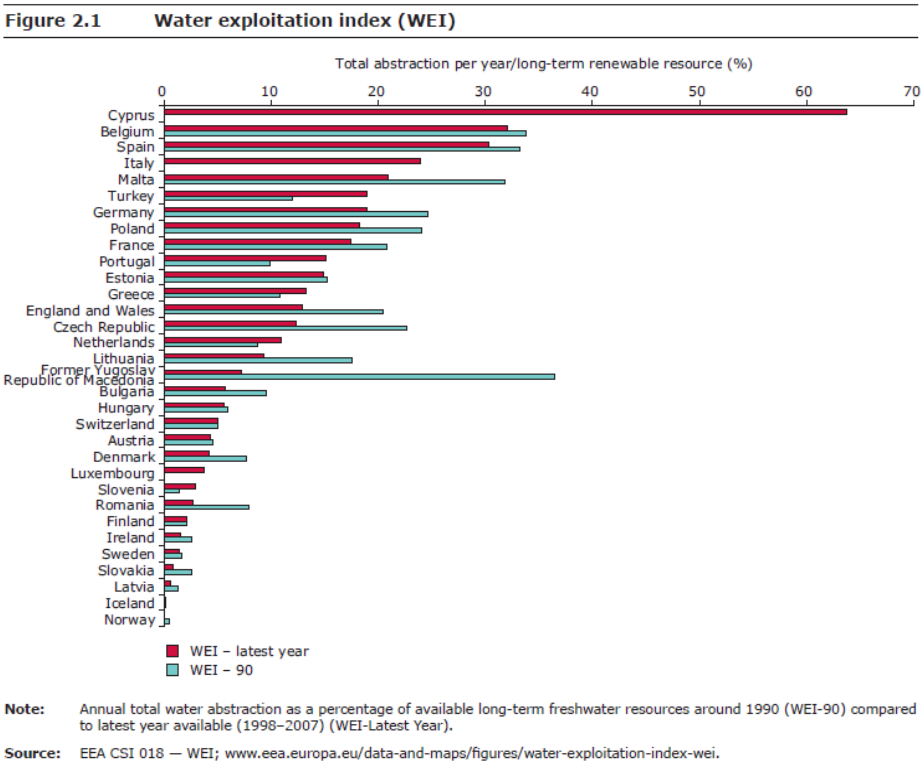
Water is a scarce resource and securing supply of water to citizens, agriculture, industries and other needs is on the top of the political agenda in many countries. Scarcity reflects the adage that “there is enough water, it is just in the wrong places, at the wrong times, in the wrong quantities”. Changes in availability of clean water make this an even more important issue. Sources of water, and the availability of water, differ from country to country. Some countries rely mainly on water from surface water or groundwater, whereas areas with higher scarcity of water sources are increasingly using new technologies such as desalination to secure supply.

Water is used for many purposes such as drinking water, direct input in production processes, indirect input to production processes like cooling or washing, in the agriculture sector for irrigation and as drinking water for animals.

Ownership of water resources also differs. In many countries, there has traditionally been public ownership of water resources, but increasingly privatisation and liberalisation of markets are seen.
There are three major sources of water: ground water, surface water and seawater. The availability of water sources and the techniques required to utilise the resources differ and therefore causes big variation in the types of water used across European countries. In general, water resources provide two major services; one is to provide water for use by human activities, and the other is to provide water to the ecosystem. Because of the nature of these services, water can be seen as a common good as well as a private good.

Water is a renewable resource however there needs to be restrictions on its use in many locations if this is to be true. The following graph displays the water exploitation index (WEI). The WEI measures the percentage of total freshwater abstracted annually compared to the total available renewable resource. The WEI can be interpreted as the size of stress that water resources experience in a country. The higher the WEI index is, the more of the total water resource is used every year. A high WEI makes the resources more vulnerable to pollution and periodic water shortages. Figure 18 displays the major differences that are inherent among the European countries based on the WEI.

**Figure 18 Water Exploitation Index**




## *Organisation*

The organisation of the water sector is rather different between European countries. Some countries have centralised water supply and most of the water comes from the water companies who purify and supply it to users. In other countries like e.g. Denmark, there are also many households and companies with their own water supply. The reason is that the majority of water comes from ground water which is clean and no purification is needed. A similar situation is found in many mountain regions. In cases where the requirements for water quality are lower, e.g. when farmers use water for irrigation, they sometimes take it directly from the rivers. Finally, the need for water also varies over the year. Therefore, where demand is mostly not coterminous with the precipitation, storage of water can be necessary.

## *Economic instrument*

As water is a scarce and necessary resource, many countries introduce measures to limit demand, and because the resource is limited, it is not an option to expand supply without consequences. When estimating water demand, equations generally take form as a function of price, income and other relevant factors[35]. The factors which are taken into account differ depending on the country in question, and their availability of the resource, market structures and climate.

MBIs are introduced in water management to regulate the quantity and the quality of available water. The quantity used by households and businesses can be influenced by introducing a MBI that makes the water

[35] Corbella H. and Pujol D. (2009)

more expensive. If an MBI is directed towards the quality of the water it will also have spillover effects on the quantity. By MBI directed towards the quality is understood that the price consumers pay for high quality drinking water is higher than what is paid for water that can be used for less sensitive use. Where more than one quality of water is present and an MBI is introduced on the better qualities, it is likely that consumers will use more water of lower qualities.

Using a charge or a tax as a tool to manage water consumption has been an issue of growing attention for years, in both Europe and the United States[36]. Alternative measures that have been seen include tools such as tradable permits and information campaigns.

Typical motivators for usage of tax-based instruments are the environmental concerns, combined with creation of tax revenue. There are many different approaches to this taxation, and it depends mostly on the institutional structure in a given country, i.e. whether the rate is charged via a private company or a tax from a publicly owned body.

### *Case countries*

For this case study, the Netherlands and Cyprus have been chosen for detailed study. Across the EU, MS have introduced water charges of varying types and levels. The reason for selecting these particular two countries for the case study is that they represent very dissimilar MS, but that still introduced a similar instrument, - a charge/tax on water consumption. This selection allows a comparison of the effect of similar taxes in countries with very different organisation and challenges when it comes to water resources. Based on such a comparison it will be possible to indicate what the possibilities of wider application of such a charge are in the EU27 context. The two countries differ significantly in a number of key aspects as indicated in Table 11.

**Table 11 Key information Netherlands and Cyprus**

| Indicator | Netherlands | Cyprus | EU27 average |
|---|---|---|---|
| Climate | Maritime | Semi arid-Mediterranean | - |
| Availability of water - measured by water exploitation index* | WEI at about 10 %, demonstrating large water availability | Almost 65%, demonstrating limited water availability | ~ 15% |
| GDP per capita (EURO, 2009)** | 34,600 | 21,200 | 20,660 |
| Year of membership in the EU | 1957 (founding member) | 2004 | - |
| Water consumption per capita (m3, 2004) mainly for domestic use | 124 | 190***** | 150**** |
| Total tax income, as a percentage of GDP, | 39% | 35.1% | 39,7% |

[36] Pashardes et. al, 2000 p. 2

| | | | |
|---|---|---|---|
| 2009*** | | | |

* See Figure 18 above for more information

** GDP and main components - Current prices [nama_gdp_c]

*** Main national accounts tax aggregates [gov_a_tax_ag], accessed March 14 2011

**** http://ec.europa.eu/environment/water/quantity/pdf/exec_summary.pdf

***** partly includes the tourist sector

It should however be noted that as the climate and thereby the availability of water resources varies a lot between the countries in Europe it is very challenging to come to a general conclusion as to what impacts an instrument will have.

Based on the fundamental differences that exist in this case it does provide differentiated views of the effectiveness of the introduction of tax as an instrument to achieve a certain environmental behaviour.

### Delimitation

The case studies are based on a desk study of publicly available documents primarily found via the Internet and supplemented by interviews with the following stakeholders:

*The Netherlands:*

Rijkswaterstaat Waterdienst (Interview, March 8 2011)

Ministry of Infrastructure and the Environment (Email contact March 9 2011 & follow up via MBI forum in July 2011)

*Cyprus:*

Water Development Department, Ms Agathi Hadipanteli (E-mail contact 08-03-2011 and 10-03-2011)

## *4.2.2 Netherlands – water taxation*

### *Frame of Dutch environmental taxation*

Since the 1970s the Netherlands has applied taxation for environmental purposes. The Netherlands was chosen as case country because of its unique approach to environmental taxation. As shown in section 3.3, the Netherlands, along with Denmark, is the only country in the EU having less than 50 percent of its environmental tax revenue coming from energy taxation[37].

### *Organisation*

The Dutch water policy framework is formulated by the central government. Provinces define the policy for non-national waters, and furthermore the provinces are responsible for the spatial planning, including anti-drought measures, which are vital to protect the country's network of dykes. Water boards and municipalities handle operational

[37] https://www.cfe-eutax.org/taxation/environmental-taxes/netherlands

water managements and implementation of the policies. The water supply companies are separate and are operated as private entities.[38]

## Water taxation

### *Delimitation*

In 1995 a ground water tax was introduced and in 2000 a tap water tax was introduced. Both these taxes are the focus of this case study.

### *Context*

The Netherlands has several environmental taxes that concern drinking water usage – hereunder the ground water tax and tap water taxes. The ground water tax is levied on the extraction of ground water – extracting parties being mainly the water companies and industry. According to the Ministry of Finance, "the tax is also due for wellpoint drainage if ground water is extracted in large quantities or for a longer period"[39] .

The water companies transfer the tax to the consumer via the water price. Reduced tax rates apply to industry and agriculture that make their own abstraction of water. Article 10 of the law on environmental taxation moreover lists a number of exceptions when ground water extraction is not levied the tax hereunder extraction of water for emergency situations and for irrigation purposes (art 10d and e)[40]. Initially the tax was proposed to be lower, but for political reasons – a wish to cut the fuel tax – the rate was increased and the level of total revenue maintained.

The tax on tap water, introduced on January 1st 2000, was also part of the environmental tax base. This tax is levied on the delivery of tap water (the quantity delivered to the consumer) and paid by the drinking water companies. The tap water tax is not part of the turnover of the water companies, and therefore treated separately in the data set below.

The companies and persons that receive tap water from a water supply system pay tax on the quantity of water they receive, up to a maximum of 300m$^3$ per connection per year (regardless of the quality of the water, consumable or not). The water company collects the tax and passes it onto the tax authorities.

Taxes from both ground water and tap water go to the state budget. In addition, there is also a ground water levy which goes to the provinces. The overall purpose of the ground water levy is to fund spatial planning related to water infrastructure in the provinces, especially with the aim to initiate anti-drought measures.

Further to these taxes, there is a surface water levy, however this is only charged in some parts of the country. The purpose of this levy is to reduce the use of surface water. However, in reality many parts of the country

[38] Nederland leeft met water (2005:61), Interview with Rijkswaterstaat Waterdienst
[39] Comments to draft case study provided by the Ministry of Finance 1-7-2011
[40] Wet belastingen op milieugrondslag (wbm) http://www.st-ab.nl/wetten/0404_Wet_belastingen_op_milieugrondslag_Wbm.htm

found the levy to be too small to have a significant impact on consumption, and have therefore not introduced the levy.[41]

In addition to taxation, a number of other instruments have been introduced to manage water consumption such as permits and planning instruments, some of which were introduced more or less at the same time as the ground water tax. Due to the mix of instruments used, it is difficult to determine the effect solely contributable to the taxes.

### Instrument

The ground water and tap water tax are central taxes administered by the Ministry of Finance. Table 12 presents the tax rates of the ground water and tap water taxes.

**Table 12 Water tax rates under the Environmental Taxation Act (WBA), EUR**

| | 1998 | 2000 | 2005* | 2006* | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|
| Ground water tax | | | | | | | |
| Normal tariff | 15,5 | 16 | 18,1 | 18,26 | 18,55 | 18,83 | 19,15 |
| Infiltration discount[1)] | 12,7 | 13,4 | 15,16 | 15,3 | 15,54 | 15,77 | 16,04 |
| Tap water tax[2)] | - | 12,9 | 13,2 | 14,7 | 14,9 | 15,1 | 15,4 |

*Source: Vewin 2010: 26 * Source: Vewin 2006:21*

*1) Discount on normal rate in case of prior infiltration 2) The tax only applies to the delivery of the first 300 $m^3$*

### *Reason for introduction of taxes*

In 1994, the Dutch Environmental Taxes Act was introduced. The objective of the groundwater and tap water tax is, as part of the environmental taxes in the Netherlands, to contribute to the move to more indirect taxation rather than direct income taxing, and hence a 'greening' of the tax system. The taxes are not based on actual valuation of the environmental pressures, but are rather intended to have an incentive effect[42]. The introduction of the drinking water tax was a part of the package of environmental taxes which were included at that same time ('Greening of the tax system'). The other taxes included taxes on waste and fuels.[43] This meant that the consumer had to adjust to more than one tax at the time, which might have influenced the responses and effects.

According to the Ministry of Finance a further important objective of the tax is to generate government income to finance government expenses.[44]

### *Ground water tax*

The ground water tax was introduced partly to broaden the environmental tax base to areas other than energy, which had been the main focus of environmental taxation until 1995. One of the further aims was to reduce the use of groundwater compared to surface water. The tax was supposed

[41] Rijkswaterstaat Waterdienst, interview
[42] ECOTEC 2001:66
[43] Ministry of Environment (e-mail)
[44] Comments to draft case study provided by the Ministry of Finance July 2011

to diminish the price gap between groundwater and surface water, although on average the existing price gap was about 0.45 EUR, which compared to a tax of 0.154 EUR is not accomplishing this target[45].

### *Tap water tax*

Prior to the introduction of the current tap water tax in 2000, tap water was solely taxed via VAT which in 1995 was deemed impractical by an analysis of the Dutch Green Tax Commission In 1999 the VAT on drinking water was raised from 6% to 17.5% however, an amendment lowered the VAT on the first EUR 27 of water bills. This amendment increased the administrative burden further and the increase in VAT was moreover found to be non-compliant with EC law.[46] Therefore, the tap water tax was introduced in 2000, and the VAT kept at 6%.

## Limitation of the instrument

The taxes aim to stimulate a positive environmental effect, and also constitute a price signal toward reduced water usage.[47] However, in reality price elasticity in the Netherlands is limited, hence small changes in price do not change consumer behaviour, as the cost of water accounts for only a small proportion of household budgets. Nevertheless, the water consumption per capita is low and well below the EU average. Hence, the potential for further consumption reductions may be limited, this is also likely to be a strong factor in low price elasticity.

From this point of view, the environmental effect from the taxes was expected to be minor, and it is plausible that the tax was mainly a revenue generating measure. The public is not deeply concerned with the water usage taxes, as these are not very high compared to taxes on other goods –the public is rather more concerned with more visible excise taxes e.g. petrol.[48]

A study from ECOTEC in 2001 concluded that the ground water tax had limited environmental effect, due to the exemptions introduced[49]. For instance, a reduced tax rate was introduced for industry and agricultural companies with their own abstraction.[50] Furthermore, it is possible for farmers to install several smaller pumps rather than a single larger pump, to reduce their abstraction capacity and become exempted from the tax. From this it is evident that the taxes have their limitations concerning the effect on environmental impact.

It could be possible that the introduction of such a measure in other countries with greater price elasticity would have a greater impact towards reaching environmental objectives, or alternatively the tax rate could be set higher.

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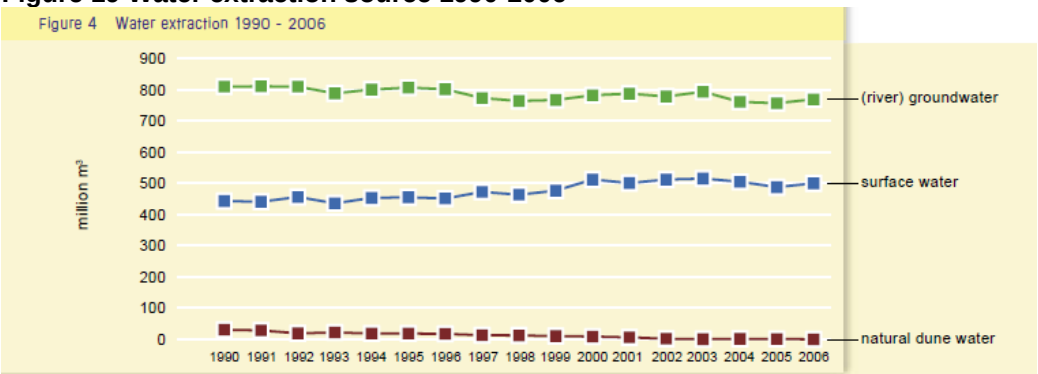
[45] Leder (1998) in ECOTEC 2001:67
[46] Comments to draft case study provided by the Ministry of Finance July 2011
[47] http://www.economicinstruments.com/index.php/water/article/180-
[48] Rijkswaterstaat Waterdienst, interview
[49] ECOTEC 2001
[50] Vermeed and van der Vaart in economicinstruments.com

## Development of the water resource

In the Netherlands in the 1990s drinking water was obtained from groundwater and surface water on a ratio about 2/3-1/3, plus a small amount of dune water. From 1996-2006, the use of surface water increased by 3.7 percentage points to 39.2%. The use of groundwater dropped 2.4 percentage points to a 60% share and the share of natural dune water dropped by 1.3 percentage points to 0.8%[51]. Figure 19 presents the development of water extraction by source.

**Figure 19 Water extraction source 1990-2006**




*Source: Vewin 2006:13*

As can be seen from the figure above, the use of surface water has increased slightly and the use of groundwater has decreased slightly since 1996. This could indicate that the ground water tax has had an effect on the balance of ground water and surface water, thereby reflecting where it has been profitable to change the balance.

### *Water quality*

The taste and colour of water can differ depending on the type of water used. For example, Amsterdam is supplied with dune water from a nearby protected area owned and operated by the water company. Rotterdam uses surface water, which goes through a strong purification process before quality is sufficiently high. Ground water is very soft and of very high quality. Based on these differences, it could be discussed how water should be priced. E.g. should the costs of the water differ across regions? Currently the water companies set the price to cover their costs. It has been contemplated to privatise the companies entirely from the government and increase competition, however, water is a regional resource (it does not make sense to move over great distances) and increased competition is not viewed as a realistic option[52].

The regional approach to water is combined with an integrated water system, which means that water can be transferred across larger distances in emergencies. For instance Amsterdam has a reservoir of drinking water that will last up to about two months, in case the dune water is polluted. The integrated water system is also used when restoration is

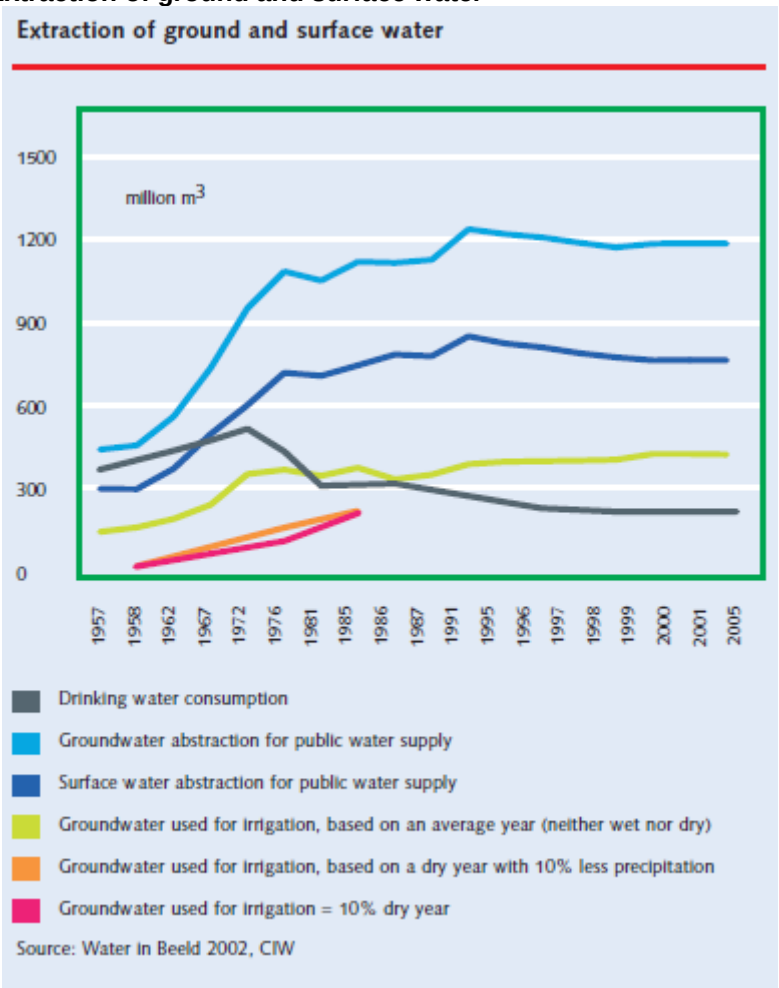
[51] Vewin 2006:10
[52] Rijkswaterstaat Waterdienst, interview

going on – this was for instance done when consumers in one area noted that the water quality changed in a period (colour and flavour of the water).

### *Types of water*

A large share of the water extracted is not used as drinking water, but rather used for irrigation and other purposes, as displayed from the following figure. Drinking water consumption has actually decreased over the past 30 years (since mid 1970s).

**Figure 20 Extraction of ground and surface water**

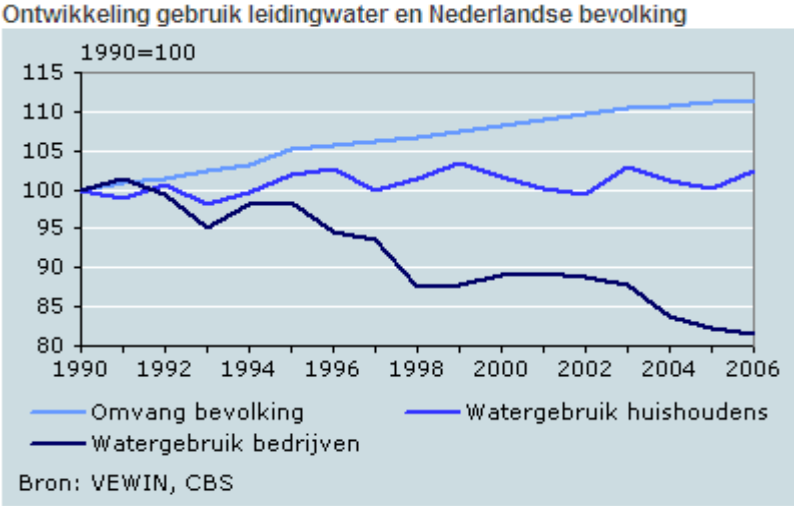



*Source: Nederland leeft met water (2005:57)*

Comparing this graph development to the introduction of the ground water tax, a slight decrease in the use of groundwater is evident from 1995 when the ground water tax was introduced. However, no greater changes in total drinking water consumption appear in 2000 where the tap water tax was introduced.

Figure 21 divides the water usage between business (*bedrijven*) - including agriculture - and households (*huishoudens*). As can be seen water usage from business declined from the 1990s onwards. In particular a steep decline can be observed since 1995, when the Groundwater tax was introduced. Total household consumption has stayed at the same level; however, the size of the population has risen, which equates to a decrease in water use per household.

**Figure 21 Water use divided on business and households**




*Source: [http://www.cbs.nl/nl-NL/menu/themas/natuur-milieu/publicaties/artikelen/archief/2008/2008-2527-wm.htm](http://www.cbs.nl/nl-NL/menu/themas/natuur-milieu/publicaties/artikelen/archief/2008/2008-2527-wm.htm), 2011 March*

The observation regarding household consumption is supported by Table 13 which displays domestic water consumption, with a development from 137.1 litres per person per day in 1995 to 123.8 litres per person in 2004. This equals a ten percent decline in domestic water usage. The reason for this change is mainly to be found in the increased usage of new technology such as low-water-use toilets and washing machines. A decline in water use in baths has been more than offset by water use in showers.

**Table 13 Breakdown of domestic water consumption**

| Application/year | 1995 | 1998 | 2001 | 2004 | 2007 |
|---|---|---|---|---|---|
| Bath | 9.0 | 6.7 | 3.7 | 2.8 | 2.5 |
| Shower | 38.3 | 39.7 | 42.0 | 43.7 | 49.8 |
| Washbasin | 4.2 | 5.1 | 5.2 | 5.1 | 5.3 |
| Toilet flush | 42.0 | 40.2 | 39.3 | 35.8 | 37.1 |
| Washing - by hand | 2.1 | 2.1 | 1.8 | 1.5 | 1.7 |
| Washing - by machine | 25.5 | 23.2 | 22.8 | 18.0 | 15.5 |
| Washing up - by hand | 4.9 | 3.8 | 3.6 | 3.9 | 3.8 |
| Washing up - by machine | 0.9 | 1.9 | 2.4 | 3.0 | 3.0 |
| food preparation | 2.0 | 1.7 | 1.6 | 1.8 | 1.7 |
| drinking coffee, tea and water | 1.5 | 1.5 | 1.5 | 1.6 | 1.8 |
| other | 6.7 | 6.1 | 6.7 | 6.4 | 5.3 |
| Total | 137.1 | 131.9 | 130.7 | 123.8 | 127.5 |

*Source: Vewin 2010:23*

## Revenues and the effects of the tax

Figure 22 presents the total levy from the ground water and tap water taxes. The total levy from the taxes equalled 381 million EUR in 2006 (including ground water levy and VAT). According to the

OECD instrument database this has risen by 10 percent by 2010[53]. Comparatively, total Dutch tax income was almost EUR 215 000 million the same year[54].

**Figure 22 Taxes 2006**

Table 9 Taxes 2006

| | total levy | drinking water share [1] | |
|---|---|---|---|
| | | levy | levy per m³ [2] |
| | *million euro* | | *euro-cent/m³* |
| **direct taxes (cost-price increasing)** | | | |
| national groundwater tax | 147 | 144 | 13.1 |
| provincial groundwater levy | 12 | 11 | 1.0 |
| distribution and concession reimbursements | 14 | 14 | 1.2 |
| total | 172 | 169 | 15.4 |
| **indirect taxes** | | | |
| tap water tax [3] | 118 | 118 | 10.7 |
| VAT on water sales [4] | 88 | 87 | 7.9 |
| VAT on tap water tax [5] | 7 | 7 | 0.6 |
| total | 213 | 212 | 19.3 |
| **total** | **386** | **381** | **34.7** |

[1] The drinking water share has been calculated. On calculation of the direct taxes, the outcomes of the 2006 benchmark were used which differentiate between drinking water activities and non-drinking water activities. The share of drinking water activities in taxes amounts to 98.0% for the national groundwater tax, 98.2% for the provincial groundwater levy and 99.4% for piping and concession reimbursements. The calculation of the indirect taxes is shown in footnotes 3 to 5.

[2] The drinking water levy calculated in the previous column divided by the drinking water supplied to end users (1,099 million m³).

[3] Levy estimated as follows: supply to households x rate for tap water tax (€ 0.147 / m³) + business connections for drinking water x 300 m³ x rate for tap water tax + (in the total column) connections for other water x 300 m³ x rate for tap water tax.

[4] Calculated as follows: income from water delivered to end users x 6% and income from drinking water delivered to end users x 6% respectively.

[5] Calculated as follows: previously calculated tax on tap water x 6% (VAT is also levied over tap water tax).

## *Water unit costs*

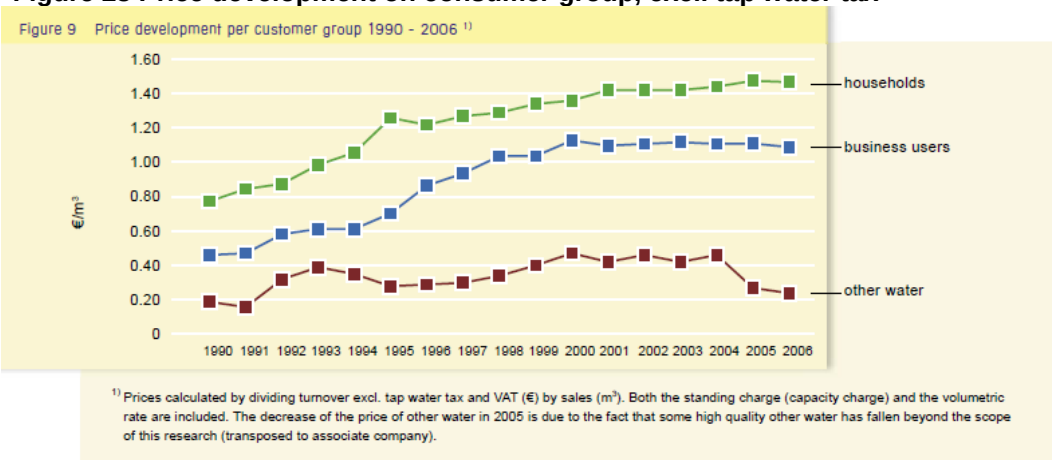
In 2006, the average drinking water price per cubic metre was EUR 1.45 for households and 1.07 EUR for business, exclusive of the tap water tax[55]. Figure 23 demonstrates the price developments since 1990. The price increase effect in the 1990s around the time of introduction of the ground water tax has been the strongest for the businesses, hence to some extent explaining the decreased consumption of water as evidenced above. The figure does not include the tax on tap water.

[53] http://www2.oecd.org/ecoinst/queries/index.htm

[54] Eurostat, Main national accounts tax aggregates [gov_a_tax_ag], March 2011

[55] Vewin 2006:14

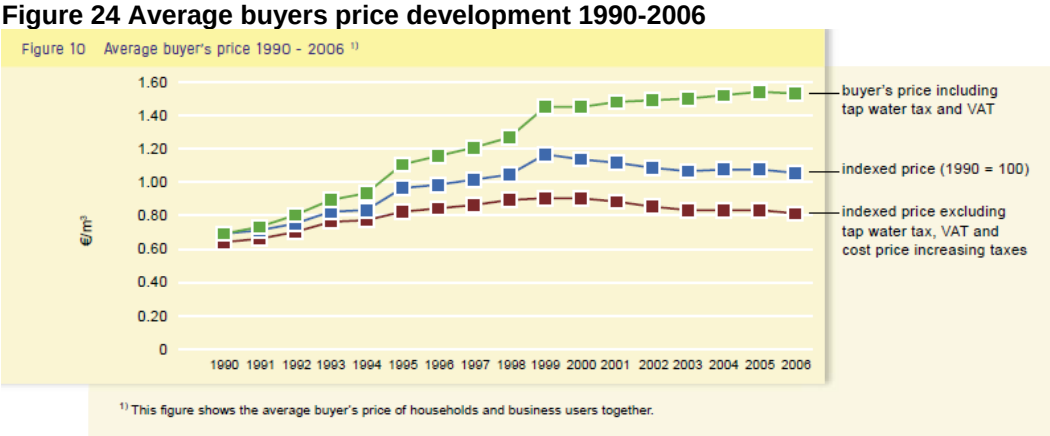
**Figure 23 Price development on consumer group, excl. tap water tax**




*Source: Vewin 2006:15*

Figure 24 shows the average buyer price *including* the tap water tax. As can be seen, the tap water tax did increase the buyers' price, thereby increasing the price of drinking water, although, this is not as clearly evident in the water consumption trends for either households or business.

**Figure 24 Average buyers price development 1990-2006**




Source: Vewin 2006:16

## *Price break down*

Table 14 breaks up the average drinking water price into the cost of the water company, direct taxes including ground water tax and the additional tap water tax and VAT. This demonstrates that respectively 10.2 and 10.3 percent of prices were taxes related to the ground water tax in 2006 and 2008, which indicates that it was rather stable for these years. The tap water tax and VAT increased from 12.8% to 14.9 percent of the average consumer water price. Overall, the total water price to the consumer decreased slightly.

**Table 14 Average drinking water price in the Netherlands**

| | 2006 | | 2008 | |
|---|---|---|---|---|
| | **EUR/m³** | **% of total price** | **EUR/ m³** | **% of total price** |
| Costs water company | 1.17 | 77.1 | 1.14 | 76.2 |
| Direct tax incl. ground water tax* | 0.15 | 10.2 | 0.15 | 10.3 |
| **Average tariff** | **1.32** | | **1.29** | |

| | | | | |
|---|---|---|---|---|
| Tap water tax and VAT | 0.19 | 12.8 | 0.2 | 14.9 |
| **Total cost for average consumer** | **1.51** | | **1.49** | |

*Source:* Vewin 2006:23 and Vewin 2010:28

* For further breakdown of the direct tax, please refer to Figure 16

### *Water company costs*

The drinking water companies cover all costs related to the abstraction and purification of the water in their area, and this is reflected in the price of the water in that area, which means that the drinking water price is at full cost recovery.

The main aim of the water companies is to supply safe drinking water, which is reflected in a high level of environmental orientation of these companies. For example, the dune water comes from nature reserve areas[56], which are areas with particular environmental concerns for preservation. The water companies own the nature reserves and hold responsibility for their preservation. In this manner the water companies are not solely profit driven, but also provide public goods. An example is also that a drinking water company pays farmers to use fewer pesticides and manure on their land, in order to maintain water quality in the dunes or surface water areas.

### *Summary*

Information available during this case study shows that total drinking water usage in the Netherlands has declined, the water usage of businesses having declined most strongly. In particular, a change in water usage is visible for businesses since 1995 when the ground water tax was introduced.

Overall, the ground water and tap water tax create revenue for the Dutch government – amounting to 381 EUR million in 2006 (incl. VAT).

The drinking water price (excl. tap water tax) has increased significantly in the period 1990-2006; most significantly for the business sector. This could explain the larger decrease in water use from businesses.

The price of drinking water increased with the introduction of the tap water tax in 2000, although the introduction of this tax produced no visible change in water usage. This may be due to the fact that per capita water usage in the Netherlands is already quite low, hence the scope for further reductions limited.

A break down of the water price shows that the ground water tax comprises approximately 10.2 percent of the drinking water price, while tap water tax (and VAT) comprises 12.8 percent.

[56] An area of particular nature/environmental intereste, where visitors will have to pay an entrance fee.

It is notable that these conclusions are based on a case country with low price elasticity. In other words, the price changes in the Netherlands need to be significantly higher if a major behavioural change is desired. So when deciding on a charge one should bear in mind the price elasticity in the country. The price elasticity varies between the European countries and in some countries a smaller change is sufficient to achieve the same effect.

We do not include externalities and do not monetise these, so this is therefore not included as an economic benefit in the analysis.

### Administrative Burden

The administrative burden of the ground water tax is insignificant[57]. The tax is administered by the Ministry of Finance and the Central Environmental Tax Unit. The water companies monitor the water abstraction and private abstraction is self-monitoring. The water companies pass the bill on to the consumers via the drinking water price.

For the consumer including industry and businesses, the drinking water taxes are included in the price that they pay for the drinking water. In other words, the consumer experiences one price on water and might therefore not be aware of the share of taxes included in that price.

### Distributional effects

As the tax introduced is the same regardless of user no distributional effects can be detected, though this may be regarded as a slightly regressive measure for household consumers given the essential nature of water.

## Assessment of the effect of the instrument

### *Ground water tax*

Originally, the water price elasticises were estimated at a wide range from -0.05 to -0.3, although the Green Tax Commission found elasticity to be around -0.1, which meant that the decrease in ground water consumption based on the taxes would not reach the levels aimed at by the politicians. Data from a 1998 evaluation of the ground water tax by ECOTEC showed that industry diminished their use of groundwater between 2-12% in the period after introduction of the tax[58]. The effect on households was not available. Overall, the ECOTEC study concluded that environmental effect is lacking because of the overriding purpose of the tax of revenue generation.

Furthermore, the ECOTEC study concludes that exemptions and reduced rates for industry and agriculture have *considerably* diminished the potential environmental effects of the tax[59].

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[57] ECOTEC (2001:68) and Rijkswaterstaat Waterdienst, interview
[58] ECOTEC 2001:69
[59] ECOTEC 2001:69

For the industry and SMEs, the ground water tax amounted to a 40% increase compared to the water supply tariff. For companies that self-abstracted water, the price increase was 113%. Protests about the tax had been recorded at the time of introduction of the tax, especially from industries with high water usage, but no new protests occurred when the rate for industries was increased to the standard level in 2001[60] – this could be attributed that the change was minor relative to that which had already taken place. But even now, the tap water companies and the industry have strong negative feelings about the tax.[61]

Nevertheless, the changes in consumption are not equal across industries. For instance daily producers of food products are very dependent on the water quality, for which reason they will not change behaviour towards more surface water usage, following the introduction of a minor tax. Other industries, including companies that use water for cooling could change their activities, e.g. paper industry and energy plants.[62]

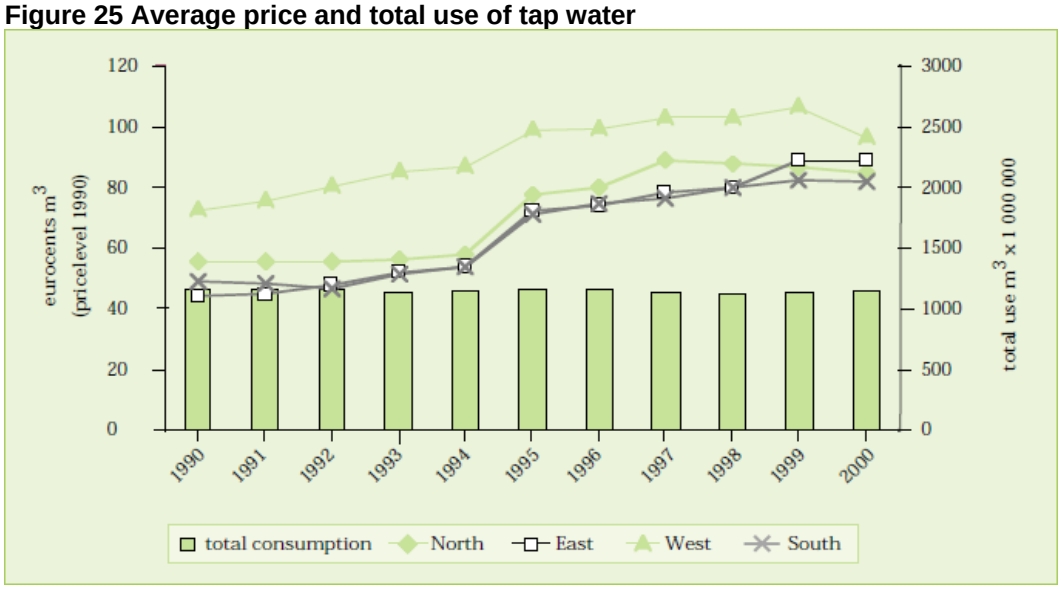
According to an Ecotec study from 2001, for consumers, the ground water tax has meant an increase in prices of 27%, although the wider effects of this could not be assessed. [63] The direct effect on water consumption is not clear, but will also be related to the increased installation of low-water-toilets and other water saving appliances. This observation is supported from the information campaigns that have been conducted in the Netherlands.

*Drinking water usage*

Figure 25 displays a comparison of the total consumption of drinking water in households and the price of drinking water in four regions of the Netherlands. As can be seen from the figure, the price increased sharply in 1995 (which was the time of introduction of the ground water tax), however, the consumption of water remained stable.

[60] ECOTEC 2001:70
[61] Ministry of Environment (e-mail)
[62] Rijkswaterstaat Waterdienst, interview
[63] ECOTEC 2001:70

**Figure 25 Average price and total use of tap water**




*Source: 'Greening' the tax system?*

The effect on price is less clear in the West region of the country. This is most likely due to the fact that this region uses a smaller proportion of ground water all together. The water usage development after 2000 is still slightly declining, any relation to the tap water tax has not been found.

### *Dutch environmental policy – general observations of effect*

It has been observed that information campaigns to reduce water consumption have been effective and efficient. This was based on the point of view that in many cases consumers are not aware or focused on the amounts of the (relatively small) tax they pay for water consumption. Information about environmentally friendly technology such as water and bathing facilities giving less water consumption combined with lower costs is a motivation for the consumer. [64]

The Dutch brewing industry produces about 25 million hectolitres of beers per year – water consumption in production amounts to about 150 million hectolitres. On average it takes six litres of water to produce one litre of beer.[65]

It is the experience of the Ministry[66] that environmental taxation is beneficial towards industry, as a fiscal incentive in their decision making[67]. Industry water consumption in the period from 2007 till 2009 has gone down 8 percent, which can be interpreted as a positive effect of the taxes. However, many of the big companies are at the same time very concerned with their CSR strategies which are also very likely to be part of this success.

[64] Rijkswaterstaat Waterdienst, interview
[65] 'Greening' the tax system pages 40
[66] Ministry of Environment (e-mail)
[67] Ministry of Environment (email)

### Conclusion

Overall, it appears that the ground water tax had an impact on the water consumption – especially on businesses. An effect from the introduction of the tap water tax cannot be clearly discerned, mainly because the tax is relatively small.

The mix of instruments and other drivers such as Corporate Social Responsibility (CSR) strategies of the companies are all pushing in the same direction and the sum of these are positive towards the use of water resources. It should be noted though that it is not possible to isolate the effect of one instrument in a reliable way, there are simply too many factors that influence water consumption to isolate the effect of these taxes. In addition to what is mentioned here there are possibly also some awareness raising campaigns which also have impact on the final water consumption.

## *4.2.3 Cyprus – water taxation*

### *History of Cyprus and water*

Cyprus has, as many Mediterranean countries, a semi-arid climate with mild winters and long, hot and dry summers[68]. Drought and water scarcity is a serious problem and together with Malta, Cyprus is categorised as among the "water poor" countries in Europe, with the lowest water availability per capita[69]. The effect of initiatives to reduce water consumption is therefore interesting. As water is scarce and droughts are frequent a valid assumption seems to be that this is a motivation to save water among the citizens of the country.

Since independence in 1960 the Government of Cyprus has put great importance on water management and has introduced a range of measures to secure supply of good quality water[70]. Upon accession to the EU in 2004, Cyprus had implemented most laws in the field of water, including the drinking water directive and the bathing water directive[71].

### Water in Cyprus

### *Context*

In Cyprus water is used mainly for agriculture and domestic purposes. According to the European Environmental Agency, agriculture and the domestic sector are responsible for 65% and 35% of the water use respectively. However, use by tourism and industry is included under domestic use as the sectors use the same supply system[72]. According to

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[68] EEA, 01-03-2011 http://www.eea.europa.eu/soer/countries/cy/soertopic_view?topic=freshwater
[69] EEA, 01-03-2011 http://www.eea.europa.eu/soer/countries/cy/soertopic_view?topic=freshwater
[70] Michaelidou et.al. 2004
[71] Farmer, 2006, p.4-7
[72] EEA, 01-03-2011 http://www.eea.europa.eu/soer/countries/cy/soertopic_view?topic=freshwater

the Water Development Department, households are responsible for about 28% and tourism and industry for 7% of the water consumption in Cyprus[73].

Water is supplied by Local Water Authorities (LWA) who receives their water from either Government Water projects (GWP) or their own water sources[74].

### *Water management in Cyprus*

Water management falls within the competence of the Ministry of Agriculture, Natural Resources & Environment. Under the ministry is the Water Development Department (WDD) which is responsible for implementing the country's water policy. The main objective of water policy in Cyprus is "rational development and management of the water resources of Cyprus"[75].

Active water management is crucial to Cyprus and has been a tradition within the water authorities of the country.

### *Instrument*

As a water poor country, Cyprus has introduced a range of water saving measures. A mix of instruments is used. In addition to formative measures such as information campaigns[76], both market based and legal instruments are used, including[77]:

- Water charges on a volumetric basis
- Metering of water consumption
- Programs to reduce distribution losses
- Improved irrigation systems
- Measures to promote a water-saving culture and efficiency of water use
- Water rationing during droughts
- Subsidies for saving potable water
- Law banning the use of hosepipes for the washing of cars and pavements
- Abstraction controls

Several reuse schemes have been introduced, and schemes using treated sewage effluent are now operational and many more are under study or construction. Currently more than 50% of the recycled water is used for irrigation of agricultural crops, either directly or through recharge of aquifers. The rest is used for recharge and for irrigation of recreational areas (landscaping, hotel gardens etc)[78].

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[73] Omorphos, 2010
[74] Hadjipanteli, WDD, 08-03-2011, E-mail
[75] WDD 09-03-2011
http://www.cyprus.gov.cy/moa/wdd/Wdd.nsf/mission_en/mission_en?OpenDocument (09-03-2011)
[76] Hadjipanteli, WDD, 08-03-2011
[77] EEA, 01-03-2011
http://www.eea.europa.eu/soer/countries/cy/soertopic_view?topic=freshwater
[78] EEA, 07-10-2011
http://www.eea.europa.eu/soer/countries/cy/soertopic_view?topic=freshwater

This study focus on taxation of domestic water consumption.

### *Water tax*

A water tax was introduced in Cyprus in 1984 at approximately the same time as the installation of water distribution systems in households. At that time each community had its own water sources. In the first years, the tax took the form of a fixed charge per user, but later it has been changed to a "tax on a volumetric basis"[79]. However, the tax is set at a fixed rate whereas the price to the consumers is based on consumption levels. No information has been found of other MBIs directed towards controlling water consumption, therefore the effects of this tax can be analysed in isolation.

Water prices were stable from 1994 to 2004, in spite of several attempts to change water prices, i.e. to increase them to reduce usage. In 2004, a major reform of the bulk domestic tax was introduced by the Government[80]. The tax was increased from 0.45C£/$m^3$ for water supply of the provinces Nicosia, Larnaka, Lemesos and Famagusta, whereas it is somewhat lower for Pafos where the tax was 0,33C£/$m^3$(Delft 2004 and WDD, 2011[81]). Since 2004 the charges for the supply of drinking water from the GWP to the LWA "in bulk", have been €0,77/m3 for the areas of Nicosia, Larnaca, Ammochostos and Limassol and €0.56/m3 for the area of Paphos[82]. This equals an increase of respectively 34,2% and 100% since 2003.

### *Reason for introduction*

Water charges were introduced in the context of water scarcity and insecurity. Water supply from dams and ground water were the only two sources of water when the tax was introduced. The tax aimed mainly to contribute to financing investments in the water sector and thereby securing water supply. According to the WDD, the tax was introduced based on a need to finance water projects. Moreover, it was included in the financial covenants between the Government of Cyprus and the organizations financing the Government Water Projects (mainly the International Bank of Reconstruction & Development and the Kuwait Fund)[83].

### *Challenges*

As mentioned above there have been several attempts to adjust the water price, however politically this has proved difficult. The WWD did not see any particular challenges in introducing the tax[84].

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[79] Hadjipanteli, WDD, 08-03-2011 E-mail
[80] Farmer et.a. 2006, p. 20
[81] It should be noted that Eeueau (2009) mentions different prices named as charge and not tariff – this may be the total price to the consumer including a charge added by the local water management boards in addition to the tax. However, several other sources again give very different prices that vary even more from region to region than what is indicated in Eureau.
[82] Hadjipanteli, WDD, 08-03-2011 E-mail
[83] Hadjipanteli, WDD, 08-03-2011 E-mail
[84] Hadjipanteli, WDD, 08-03-2011 E-mail

*Limitation of the instrument*

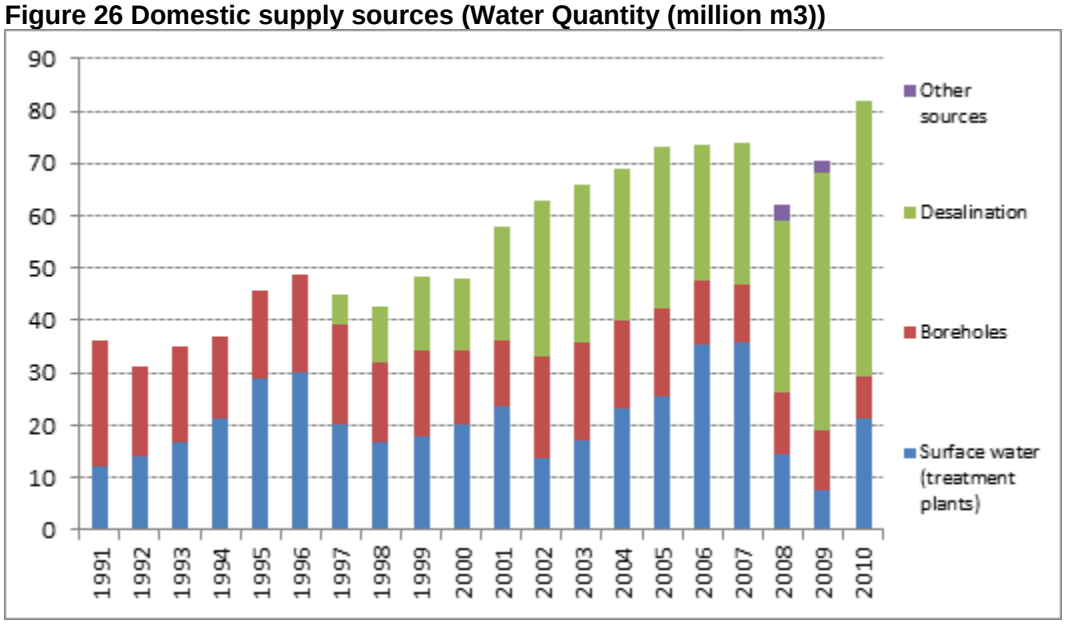
The availability of the water resource is limited, and clean water is expensive to produce as a large proportion of the drinking water is produced through energy intensive desalination. This makes unit cost rather high compared to water from other sources.

According to the WDD, affordability issues and integration of water supply and treatment were taken into account every time a change in the tax was proposed. As the development of the Government Water projects was going on and with the introduction of the desalination plants, the costs were differentiated and the Government had to adjust to the new costs and change the level of the tax. (Hadjipanteli, WDD, 08-03-2011).

## Development in the resource

Traditionally domestic water supply in Cyprus has relied on two sources – surface water e.g. from dams cleaned in treatment plants and ground water from both public and private boreholes[85]. In order to secure supply and reduce the dependence on surface water, desalination of seawater for drinking water purposes has been initiated. The first plant (Dhekalia) was opened in 1997 followed by the opening of another desalination plant (Larnaca) in 2001.The distribution of domestic water supply is shown in Figure 26. Annual rainfall variation is significant. There are often two or three consecutive years of drought and evaporation of water is very high - on annual basis it corresponds to 86% of the rainfall[86].

**Figure 26 Domestic supply sources (Water Quantity (million m3))**




Source: WDD 2011b

The water levels indicated in the table are estimated to cover the 85% of the total domestic water supply in Cyprus, as a number of Local Water

[85] Delft, 2004, p. 4-1
[86] EEA, 01-03-2011
http://www.eea.europa.eu/soer/countries/cy/soertopic_view?topic=freshwater

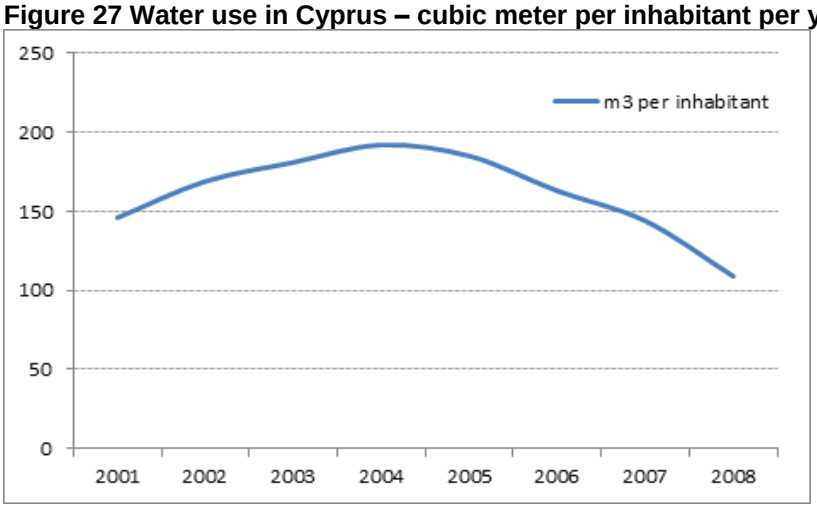
Authorities have their own water resources (mainly boreholes)[87]. Supply of water increased from 2001 onwards, mainly due to the use of the new desalination plants. In 2008 and 2009 water was imported from Greece due to water shortages, this is represented as 'other sources' in the figure above.

Demand for water increased from 2001 to 2004, however after 2004 demand for water was significantly reduced from 192 $m^3$ per inhabitant in 2004 to 109 $m^3$ in 2008 as shown Figure 27. This was a striking decrease in water use from 2004 despite the increased availability of the domestic water sources.

The number of tourists coming to Cyprus was also relatively stable over this period (2.434 million tourists in 1999 and 2.404 million tourists in 2008)[88]. However, we do not have information of the development in average water consumption per tourist, although as tourism accounts for only 7% of the national water consumption this is unlikely to be a key factor in the significant decrease detected below. Therefore, it can tentatively be concluded that water usage from tourism is relatively resistant to changes in the water prices.

Among the reasons for this decrease is the drought that hit Cyprus these years and water restrictions in 2008 and 2009. Given that there was no such restriction from 2004 to 2007 , the change is more likely to be linked to taxation policy and awareness raising initiatives and other measures initiated to reduce water consumption.

**Figure 27 Water use in Cyprus – cubic meter per inhabitant per year**




*Source: Eurostat, 28-02-2011 10:29:21*

Water consumption levels differ depending on income level. Table 15 indicates that higher income households use more water than low income households, however at the same time the share of the water cost in the low income households is higher than the high income households,

[87] Hadjipanteli, WDD, 10-03-2011 E-mail
[88] Cystat – tourism statistics 1999-2010 http://www.pio.gov.cy/mof/cystat/statistics.nsf/services_71main_en/services_71main_en?OpenForm&sub=1&sel=2&e=&highlight=tourism

reflecting their higher incomes relative to water consumption. As the price system is based on block prices where the average price of water consumption increases with increased consumption the marginal price is lowest for the low income groups and increases with consumption.

**Table 15 Water consumption levels per income group (1996)**

| Income group | Consumption (pounds) | Share in income | average price (cents) | marginal price (cents) |
|---|---|---|---|---|
| 0%-10% | 81 | 1,60% | 42 | 70 |
| 11%-25% | 95 | 0,90% | 47 | 76 |
| 26%-50% | 110 | 0,60% | 50 | 79 |
| 51%-75% | 116 | 0,40% | 54 | 82 |
| 76%-90% | 123 | 0,30% | 54 | 83 |
| 91%-100% | 130 | 0,20% | 59 | 85 |

Source: Pashardes et. al, 2000, p. 11

## Revenues and the effects of the tax

### *Water unit cost*

The price of water for the consumer is determined by the Local Water Authorities[89]. Water prices differ from region to region hence the price that the consumer pays is significantly different.

Prices consist of a fixed charge per m3 – which contains the charge set by the Council of Ministers and a volumetric block price. The price paid per $m^3$ therefore differs depending on consumption. In some regions, e.g. in Limassol, the volumetric price is also influenced by social conditions, where block prices are lower for families with more than three children. To illustrate the differences in price and blocks, the two tables below show the water prices in the Nicosia and Limassol areas.

**Table 16 Water prices in Nicosia area**

| Fixed charge (per m3) | | €5,69 |
|---|---|---|
| Variable charge: | | |
| Consumption (m3) | | Price |
| From | To | € |
| 1 | 10 | 0,79 |
| 11 | 20 | 0,91 |
| 21 | 30 | 1,13 |
| 31 | 40 | 1,24 |
| 41 | 50 | 1,93 |
| 51 | 60 | 2,51 |
| 61 | And above | 3,18 |

Source: Hadjipanteli, WDD, 10-03-2011

[89] Hadjipanteli, WDD, 08-03-2011 E.mail

**Table 17 Water prices in Limassol area – general price and price for families with more than three children**

| Standard prices | | | Families with more than three children | | |
|---|---|---|---|---|---|
| Fixed cost | | €14,00 | Fixed cost | | €14,00 |
| Maintenance | | €6 | Maintenance | | €6 |
| Consumption (m3) | | | Consumption (m3) | | |
| **From** | **To** | **€** | **From** | **To** | **€** |
| 1 | 40 | 0,48 | 1 | 40 | 0,48 |
| 41 | 80 | 0,77 | 41 | 100 | 0,77 |
| 81 | 120 | 1,37 | 100 | 160 | 1,37 |
| 121 | And above | 5,00 | 161 | And above | 5,00 |

Source: Water Board of Lemesos (2011)

The differences in prices can be due to differences in policies by the local water authorities. It may also be that some regions have more water supplies and that this is reflected in the selling price to the consumers. We have not been able to find information on the consumption levels of the different geographic areas.

The charges for the potable water supply from the Government Water projects to the Local Water Authorities are fixed and are not dependent on consumption levels. As the prices are set by the local water authorities the change in tax does not necessarily influence the price the consumer pays. We have not been able to get information on the annual development of the price of consumption.

### *Development in the cost*

After the increase in tax in 2004 cost recovery increased and the tax was that year estimated to cover approximately 71% of total financial cost and 60% of total cost. This is shown in Table 18.

**Table 18 Development in cost from 2001-2005(C£)**

| | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|
| Financial cost | 26.326.311 | 28.171.105 | 32.203.719 | 35.686.696 | 35.605.246 |
| Environmental cost | 81.741 | 533.451 | 609.987 | 619.165 | 529.217 |
| Resource cost | 10.194.947 | 6.390.268 | 5.125.465 | 5.717.481 | 5.778.084 |
| Total cost | 36.602.999 | 35.094.824 | 37.094.824 | 42.023.343 | 41.912.547 |
| Quantity sold (m3) | 51.340.391 | 54.394.209 | 56.459.994 | 57.917.012 | 59.414.351 |
| Weighed tariff (C£/m3) | 0,321 | 0,321 | 0,321 | 0,430 | 0,430 |
| Total income | 16.480.265 | 17.460.508 | 18.123.658 | 24.904.315 | 25.548.170 |
| Financial cost recovery rate | 62,60% | 61,90% | 56% | 71,20% | 73,10% |
| Total cost recovery rate | 45.0% | 47,70% | 47,50% | 60% | 62,10% |

Source: Delft, 2004, p. 4-6

Newer numbers are not available, but it is likely that while income from the tax will have increased (although tax rates have remained stable), the degree of cost recovery will have decreased as the new desalination

plants are a relatively costly way of producing clean water, increasing the financial cost. The fixed cost and volumetric taxes set by the water management boards locally may have changed to reflect this increase in costs, but we have been unable to obtain information on this.

The fact that total costs are not recovered through the selling price indicates that taxpayers subsidise water consumption. The subsidy can be estimated by comparing the amount paid by each household under the present water tax system with the amount which the same household would pay for the same water consumption under a system of uniform price corresponding to the average cost of supplying one cubic meter of water for domestic consumption.

The subsidy differs across regions and income groups as there is a transfer from tax payers to cover the cost of water supply due to distributional concerns. The subsidy is largest for the low income groups, where the price of water consumption is lowest and the subsidy is less for higher income groups where costs of water are higher.

Pashardes et. al. (2000) demonstrates that the current block pricing system is inefficient as it creates gross price distortions which are resulting in a deadweight loss [90] indicating that there is an allocative inefficiency. Contrary to Pashardes, Delft and partners found that there are no cross-subsidies with respect to provision of fresh water through the Government Water project works. They find that allocation of costs and the level of the water tax take into account different water users. The water capital, operation and maintenance, as well as administrative, costs are strictly related to the provision of the water supply for that use. Hence the price reflects the cost of the water supplied.

### Administrative Burden

We have not been able to find information on the administrative burden on the public and private sector stemming from this measure. The WDD does not have information on this matter stating that they “can not easily give an estimate of the administrative burden to public or private sector”[91]. Nevertheless, it is likely that the burden on the private sector is limited as the charge is included in the total price paid to the Local Water Authorities supplying the water.

The burden on the local water authorities is also likely to be relatively small. The tax is set at a certain fixed amount per cubic meter of water supplied; hence it is not related to the quantities consumed. This reduces the administrative burden as the local water authorities in principle can multiply their total supply of water with the tax and then have the total sum to be transferred to the tax authority.

[90] Pashardes et. al., 2000. p- 20-23
[91] Hadjipanteli, WDD, 08-03-2011 E-mail

### Distributional effects

As the tax is based on consumption it does not distinguish between users and therefore no distributional effects are detected.

### Assessment of the effect of the instrument

Water consumption decreased significantly following the increase of the charge in 2004. It is difficult to assess to what extend the change in consumption stem from the tax and other factors because of the mix of instruments used and the serious droughts that hit Cyprus in the years following the increased tariff. They also led to water restrictions which were introduced in 2008 further reducing domestic water consumption (Hadjipanteli, WDD, 10-03-2011). Moreover, a range of policy instruments are applied in Cyprus e.g. subsidies for the installation of a system for the recycling of grey water e.g. for irrigation purposes[92]. The effect of those measure on consumption cannot be fully deduced from this analysis and a more detailed analysis would be needed.

A study on household demand and the welfare implications of water pricing in Cyprus (2000) indicated that for households the price elasticity for water demand is -0.79 for the lowest income distribution and -0.39 for the highest income distribution. Hence, price can play a role in managing residential water use[93]. However, it should be noted that the different elasticities detected for consumers depending on their income level suggests that water is regarded as more of a necessity (based on elasticity) for lower income households than for higher income households[94].

One reason for this may be that high income families have a higher water use for non-essential purposes such as swimming pools and lawns, hence uses of water that can be assessed as for luxury purposes[95]. Another reason may be the access to alternative sources of water. This parameter was not included in the model of Pashardes et. al, and the inclusion of this factor may have changed the ranges of elasticity found[96].

Water demand elasticity in Cyprus as calculated by Pashardes et.al is somewhat higher than for other Mediterranean countries like Spain and France[97], however it is difficult to compare the elasticity as different methodologies and factors was taken into consideration when making the calculation.

### *4.2.4 Conclusion*

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[92] EEA, 07-10-2011 http://www.eea.europa.eu/soer/countries/cy/soertopic_view?topic=freshwater
[93] Pashardes, 2000, p. 18
[94] Pashardes et. al, 2000, p. 18
[95] Pashardes et. al, 2000, p. 18
[96] CEMAGREF, 2002, p. 21
[97] CEMAGREF, 2002, p. 21

## Overall results

As presented above, for both cases the data displays a change (decrease) in water consumption in the wake of introducing the taxes. For both countries this change is likely to be attributable to the tax - other factors are also important and therefore it is not possible to say this conclusively that the tax was the primary factor in the changes. For Cyprus, the system to manage water consists of a mix of measures (e.g. water charges on a volumetric basis, metering of water consumption, programs to reduce distribution losses[98] or information campaigns) besides, a range of other factors affect water usage, especially the climatic conditions that cannot be controlled. Droughts are likely to have had impact on the awareness of the consumers and it may have contributed to the decreased water usage. For the Netherlands, other measures were also introduced at the time.

For the Netherlands, the effect was largest for business and this was regarded as being due to the fact that businesses are much more sensitive to the price compared to private households.

### *Rough indicators*

For the Dutch case the following indicators could be seen:

- The tax accounts for 23 percent of the water price.
- Total water price increase in the period mid 1990s-mid 2000s was 40 percent.
- A decrease of 16 percent in private sector water consumption.
- A decrease of 8 percent in household water consumption.

For the Cypriote case:

- An increase of the tax of 100 percent from 2003 to 2004
- Water usage declined 40 percent in the period 2004-2008

### *Comparability*

Overall, the large differences between the two countries also affect the comparability of the tax structures, hence conclusions drawn from such comparisons should be made with caution. The cases studied clearly indicate that the taxes have, to some extent, an effect on water usage. In the Dutch case the effect was most clearly visible for the private sector. For the case of Cyprus we did not have the available information to make such a distinction between users.

Looking at the rough indicators above, it shows that the change in tax level was most pronounced in the Cypriote case (+100 percent), whereas in the Netherlands, the increase of the water price was 23 percent. For comparison the total water price in the Netherlands increased 40 percent in the period 1990 – 2000, which indicated that the tax was only one contributor to the water price increase.

[98] See more examples in section on Water in Cyprus

In regards to water usage, the Cypriote case shows a significant decline – 40 percent, compared to between 8 and 16 percent in the Netherlands. A range of factors may lead to these differences.
First of all differences in income. Per-capita income in Netherlands is almost 40 percent higher compared to Cyprus, suggesting that the price elasticity is much lower. In this way a price increase will have much larger effect in Cyprus comparatively, which is also reflected in the case studies.

Secondly, the availability of water is also very different in the two countries, and since the Netherlands have large availability of water compared to Cyprus, it is also more likely that the consumers will not put as much focus on their water consumption from an availability perspective.

Thirdly, it was interesting to observe in the Netherlands that the mix of instruments, and own self-interest, led the water supply companies to actively manage and protect wildlife and areas of environmental significance. The reasons for this were multiple, not least to preserve the ecosystem function of filtering and cleaning water through the dunes, saving on water treatment costs. This can be a further benefit of resource management, when cost efficiency and environmental protection are aligned then both can benefit.

Finally, the water usage per capita is already at a much lower level in the Netherlands compared to Cyprus, wherefore the same proportional decrease cannot be expected, as each person has a minimum water usage requirement per day.

Still the two cases demonstrate that effects can be achieved. However, the expectations of the size of the effects should be adjusted to the specific context in which the taxes are introduced.

*Lessons learned*

Based on these two cases it can be concluded that in an economy where water or any other resource is relatively expensive a tax is more likely to be effective. This does not mean that a tax in a country with high income is ineffective but one should be aware that to create the same incentives a higher tax might be needed.

There seems to be a relatively larger impact on business, compared to other users, since business is more sensitive to price changes and more likely to make investments on a regular basis. Combined with pressures and incentives for businesses to demonstrate corporate social responsible (CSR) behaviour, it is clear that business has relatively higher incentives to change their behaviour.

*Wider context*

In Europe there are many water charges in place. In some cases, like the two presented here, the charge is directly linked to the quantity of water used. Others are related to the size of the household. This difference is crucial when looking at the possible effect of a water tax. In the case where the tax is directly related to the size of the household it is not

possible to create strong incentives to change behaviour. The only option is to raise the tax revenue. In the other case if the tax is big enough then households are likely to change behaviour in order to save water and thereby money.

When looking at other types of instruments, such as quotas and awareness raising, major effects on water consumption have been detected. In Barcelona an awareness raising campaign was introduced together with major investment in water management. The effect was substantial, decreasing water consumption to 108 litres per person per day in 2010 compared to the EU average of 410 litres per day.

In the Murray Darling Basin in Australia they experienced major challenges with the water supply and with securing the ecosystem of the river basin. Therefore they chose to implement a tradable quota system. The advantage with this instrument was that the authorities had the possibility to buy the exact amount of quotas necessary to restore and maintain the ecosystem of the river basin. Though equally it also reflects the importance of allocating the right number of quotas in the first instance and to be willing to adjust this to circumstance over time.

## 4.3 Pesticide taxes – SE & DK

### *4.3.1 Introduction*

Pesticides are a valuable resource in agriculture enabling higher yields form agricultural plots. However, pesticides are not benign substances that can be applied without consequences to health and environment.

In the mid 1980's it was clear to scientists and policymakers that pesticide use had become a risk to human health and the environment. Residues from pesticides were found in the ground water and in agricultural products. Some of the active substances were identified as highly toxic.

Two of the first countries to adopt national action plans to reduce pesticide use and risk was Denmark and Sweden. In both countries the programmes included many activities such as education and increased control as well as a tax on pesticides.

This case study examines the use of taxes to reduce pesticide use in Denmark and Sweden. The two countries followed somewhat different directions to obtain the same goal. In Denmark the focus was mainly on reducing the quantity of pesticides used, while in Sweden the focus was more on reducing the risk to human health and the environment.

**Table 19 Key information Denmark and Sweden**

| Indicator | Sweden | Denmark | EU |
|---|---|---|---|
| GDP per capita (EURO, 2010) | 34.900 | 33.500 | 20.900 |
| Year of EU membership | 1995 | 1973 | - |
| Total tax income as a percentage of GDP (EURO, 2009) | 47,4 | 49,0 | 39,7 |

| | | | |
|---|---|---|---|
| Sales of pesticides (tonnes of active ingredient, 2006) | 1.707 | 3.254 | |
| Farmland: Number of farms and areas by size of farm (UAA) and region - Utilised agricultural area (Hectares, 2007) | 3.118.000 | 2.662.590 | |

Source: Eurostat

### *Delimitation*

The long term effects of pesticide use on human health and environment are only revealed gradually. There is little hard scientific evidence available on these impacts because the long term effects have not yet happened. In particular there is little knowledge of the magnitude of pesticide use reductions needed to keep suspected environmental and health hazards at a manageable level. Yet there remain significant concern about the long term effects of pesticide use.

The lack of precise knowledge about the long term effects of pesticide use has made it very difficult to set goals for pesticide use reductions. In the mid 1980's when regulation of pesticides became an issue, it seems the goals were set in the hopes of some day completely removing pesticide use. Today focus is more on attaining a reasonable balance between environmental and human health protection and sustainability of the agricultural sector.

## *4.3.2 Denmark Pesticides*

In 1986 Denmark introduced its first governmental Pesticide Action Plan. This plan was prompted by a serious decline in wild plant growth and wildlife in and around farmland. The plan specified pesticide use reduction goals over time.

The long term health and environmental effects of pesticide use is unclear, making it difficult to set standards for environmentally acceptable levels of pesticide use. Instead, the regulation is focused on reducing the use of pesticides within the bounds of reasonable economic costs.

### Context

Among the instruments employed to reach the pesticide use reduction goals are:

- Extension service and plant protection groups. Dissemination of knowledge to the farmers on pesticide use and dosage. Computer software applications to support farmers to chose the best pesticides to meet their specific needs as well as dosage.
- On-farm record-keeping and crop-specific goals. Spraying logbooks on farms of more than 10 ha. Targets for pesticide usage on specific crops.
- Changes to the pesticide approval scheme. Tightening of approval scheme for pesticides. Ban on particularly harmful pesticides that were previously approved.
- Pesticide free farming and buffer zones. Promotion of organic farming. Buffer zones around waterways, typically 10-12 m.

- Pesticide taxation.

## Pesticide Taxation

In 1996 an ad valorem tax of 37% of the wholesale price on pesticides was introduced. Prior to 1996 fees were levied on the agrochemical industry amounting to 3% of wholesale turnover. This case focuses on the ad valorem tax from 1996 and onwards.

In 1998 the tax was increased from 37% to 54% of whole sale price. At the same time retailers cut the price to counteract the tax increase, such that the net result was a 6% reduction in price over the period 1997 to 2003.

Roughly 75% of the revenues from the pesticide tax are returned directly to the farmers in the shape of reduced land tax. The remainder of the revenues fund action plan programme activities and research. Thus, when retailers cut prices to weaken the price signal, the farmer experiences a lower prices as well as a reduced land tax which equals a positive net revenue.

### *Limitation of the instrument*

The tax aims to stimulate a positive environmental effect, and also constitute a price signal toward reduced pesticide use. However, as the retailers took on most of the burden of the tax by lowering prices to match the tax increase in 1998, the price signal to the farmers was in fact very weak. Which lead to a decrease in the turnover of the retailers.

The ad valorem tax has been criticized for giving the wrong price signals. Typically, older more environmentally harmful pesticides are also cheaper. Cheaper products are subject to lower taxes, i.e. there may be a tendency for farmers to favour old pesticide products rather than the newest most efficient and less environmentally harmful products.

## Development of pesticide usage

In Denmark, pesticide use is measured using the Treatment Frequency Index (TFI). This is used as simply measuring the overall tonnage of active ingredients or value of pesticides sold will not give a correct indication, as the dose rates and value of pesticides vary significantly, see Figure 20.

"The treatment frequency index expresses the average number of times an agricultural plot can be treated with the recommended dose, based on the quantities sold"[99]. If the TFI is 2 it means that all agricultural land may be treated with pesticides twice in a year with the quantity of pesticides sold in that year. A higher TFI indicating that pesticides can be, and most likely are being, used more often, with expectation of higher concentrations of active ingredients and increased environmental impacts.

[99] PAN Europe, 2005.

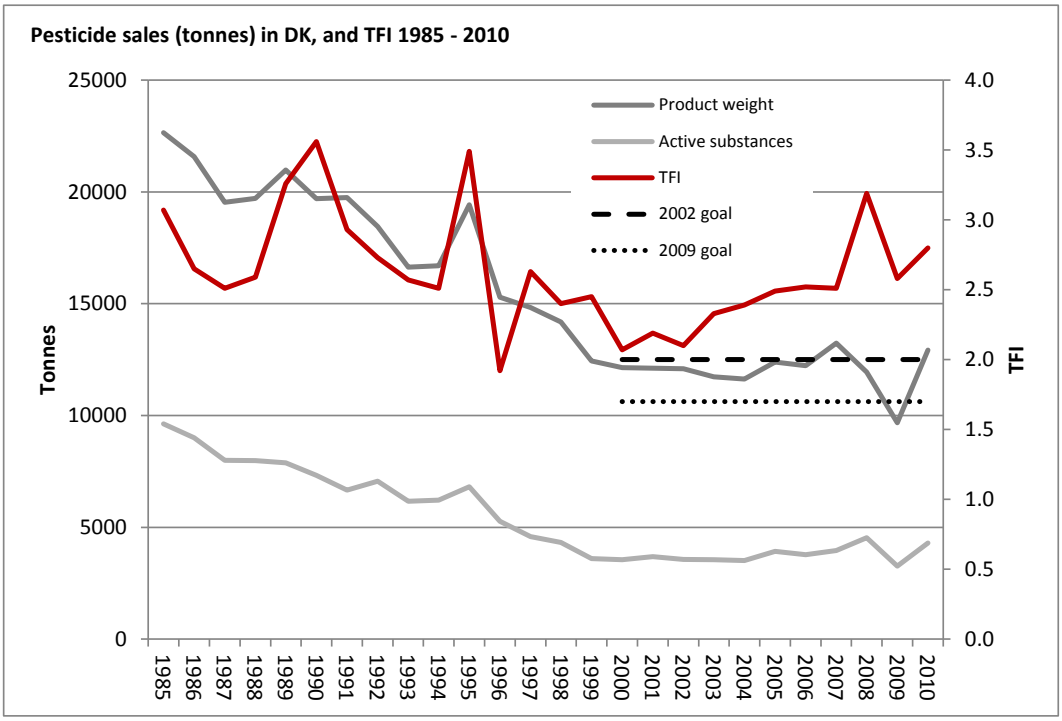
In the first Pesticide Action Plan from 1986, the goal was to reduce total pesticide consumption by 25% by 1992 and 50% by 1997. This goal was not achieved. In fact, by 1992, the TFI was 2% higher than in 1986 and in 1997 the total reduction was 8% rather than 50%.

In light of the more recent goals and achievements in pesticide use reduction, the goals set in 1986 may have been overly ambitious. In 1986, the TFI was 2.5, a 50% reduction would have brought the TFI down to 1.25 which is below the level currently believed to be the level at which pesticide use is at its minimum without economic loss to the farmers (TFI = 1.4).

In the second Pesticide Action Plan from 2000, the goal for pesticide use reduction was set at a TFI of 2.0. Following the introduction of the tax this goal was all but achieved by 2003.

In the third Pesticide Action Plan for 2004-2009, the goal was set at a TFI of 1.7, significantly higher than the goals from the first action plan. However, since 2003 TFI has tended to increase again, moving away from the target level and increasing to 2.8 in 2010. The reasons for this move are not completely clear, though amount of active substance and product sold has been either stable or slightly increasing since 2003, this could point to a trend for stronger pesticides being used, or recommended doses being reduced.

**Figure 20 Pesticide sales (tonnes) and Treatment Frequency Index, Denmark 1985-2010**




*Source:* Ecorys calculations based on Statistikbanken, Danmarks Statistik, 2011

Hoarding in 1995 has an effect on these two years

One important aspect to keep in mind when looking at the development in TFI is the development in organic farming in the same period. From 1995

to 2003 organic farming grew from 17,000 ha to 140,000 ha (770%)[100]. Although this development is significant, the vast majority of farmland in Denmark is still not organic. In 2003, organic farmland constituted 5.5% of the total farmland.

## Revenues

Table 21 presents the total revenues from the pesticide tax from 1996 to 2010. In 2010 the tax revenues amounted to 61.8 million EURO.

**Table 21 Revenues from pesticide tax, 1996-2004 million EURO**

| Year | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 38.8 | 31.5 | 40.2 | 60.8 | 50.3 | 48.1 | 36.3 | 53.4 | 56.7 | 59 | 61.8 |

Source: OECD/EEA (2006) and TOLD&SKAT

## Administrative burden

The Danish pesticide tax is imposed at manufacturing and import level. This greatly reduces the administrative burden of the tax, as there are only a limited number of firms registered at this level compared to the retail level. All firms that produce or import pesticides must register with the customs authorities.

## Distributional effects

Three quarters of the tax revenues are returned to the farmers through reduction in the property Tax. However, a significant share of the tax burden is upheld by the retailers, as they have lowered prices in response to tax increases. The tax is in effect, a net redistribution from retailers to farmers.

## Assessment of the effect of the instrument

Pesticide use decreased from a TFI of more than 2.5 in the mid 80's to around 2 in 2003, showing a a decrease in the TFI and therefore reduced use of pesticides following the introduction of the tax. However, by 2010 the TFI had increased to 2.8 reversing the earliere gains, the reasons for this are unclear, but point to an erosion of the effect of the pesticide tax to a point of growing ineffectiveness.

Still the Danish effort to reduce pesticide use has not been confined to a tax on pesticides. There has been a concerted effort to educate farmers on proper handling and use of pesticides, a ban on the most dangerous or harmful pesticides, promotion of organic farming etc.

When the tax was introduced, the expected effect on pesticide use was a 5-10% reduction. However, a large part of the burden of the tax on pesticides has been borne by the retailers, not the farmers, as retailers have lowered prices to counteract the tax. This more or less negates any effects the tax could have had on pesticide use.

[100] Statistical Bureau of Denmark. tables OEKO1 and AFG.

Overall the Danish effort to reduce pesticide use, measured by TFI, has been relatively ineffective. While TFI decreased until around 2003, with some positive effect attributed to the introduction of the pesticide tax and associated measures, these gains have since eroded with TFI returning to the higher levels experienced in the 1980s. On a pure sales or active substance weight basis the Danish efforts have been more successful with weights now considerably lower than prior to the introduction of the tax in 1996. However, these gains have again flattened out since around 2000.

### *4.3.3 Sweden Pesticides*

The Swedish efforts to reduce pesticide use and risk commenced in 1986. The main goal was to reduce the risk to health and environment from use of pesticides. The third national risk reduction period (1997-2001) had five major specific goals:

1. The magnitude of risk indicators should diminish. The decrease in risk indicators should surpass the decrease in quantities of active substances
2. No residues of non-approved (unregistered) pesticides in domestically grown vegetables or fruits
3. No residues above maximum residue limits in domestically grown vegetables or fruits
4. No detectable residues of pesticides in ground water. The concentration of individual pesticides should not exceed 0.1 micrograms per litre. The combined concentration should not exceed 0.5 micrograms per litre
5. No detectable residues in surface or ground water intended for human consumption

Among the tools used to reach those goals are:

- mandatory training
- regional plant protection centres promoting integrated pest management (IPM)
- advisory services for reduced use
- grants for spray machine maintenance
- Pesticide restrictions
- direct pesticide taxes

#### Pesticide Taxation

Sweden introduced a tax on pesticides in 1984/1985 which later became a part of the efforts launched in 1986 to reduce pesticide use and risk commenced. The tax was initially designed as a levy of 0.4 EURO per kg active substance and was subsequently raised to 2.2 EURO. The latest change to the rate was on 1 January 2004, increasing to 3.3 EURO (30 SEK) per kilo active substance.

In addition to the direct charge on pesticides sold, there is a pesticide registration charge consisting of a fixed application charge and an annual charge based on sales.

Finally a price regulation charge was in place from 1986 to 1992. This charge took the form of a dose based charge of 3.2 EURO per dose in 1986. The charge was abandoned in 1992 as a result of deregulation of the Swedish agricultural sector.

The direct tax on pesticides finances the pesticide action programmes and other activities, while the pesticide registration charge finances the costs of the National Chemical Inspection controlling pesticides.

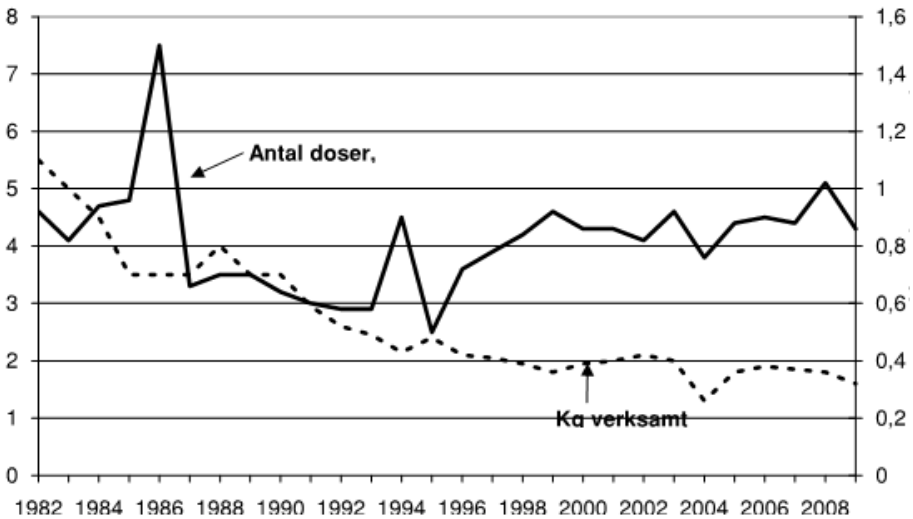
*Limitation of the instrument*

The tax aims to stimulate a positive environmental effect, and also constitute a price signal toward reduced pesticide use. However interviews with Swedish officials suggest[101] that the tax is too low to constitute a noticeable price signal to the pesticide users. The only exception to this may be the price regulation charge active between 1986 and 1992.

## Development of pesticide usage

In Sweden pesticide use has mainly been measured as the total tonnage of active ingredients sold. Recently the Swedish Chemicals Agency has adopted a more sophisticated approach to measuring pesticide use. Instead of measuring the total quantity of pesticides sold, they are now using a hectare dose approach which is very similar to the Treatment Frequency Index (see Danish case).

**Figure 28 Pesticides sold, kg active substance (dotted line) and hectare doses**




Source: KEMI, pesticide statistics 2009.

Figure 28 shows kg of active substance sold and the equivalent hectare doses. While the number of hectare doses has fluctuated around the same

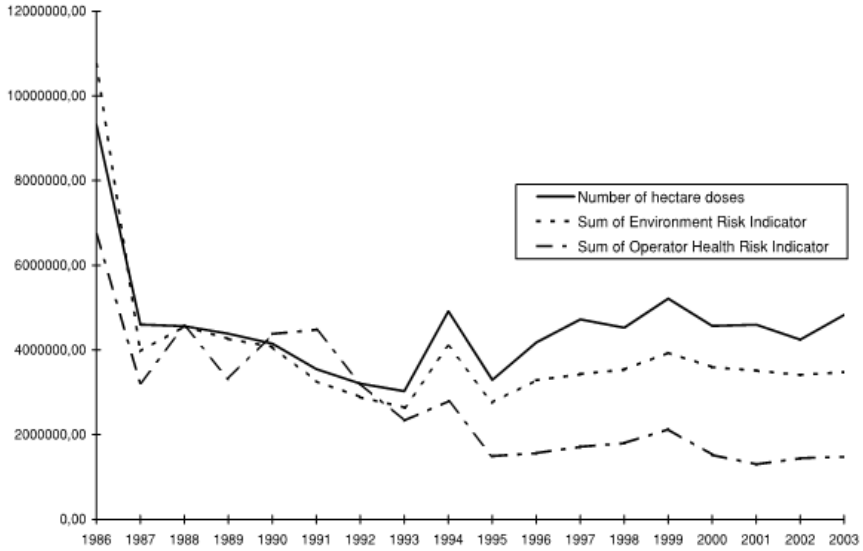
[101] http://www.pan-europe.info/Archive/publications/PesticideTax.htm

level throughout the period from 1982 - 2008, kg of active substance has dropped continually. This illustrates the adoption of new pesticides with a much lower dose per hectare than older pesticides.

In addition to pesticides sold and hectare doses, pesticide used is being evaluated on the basis of risk to the environment and risk to human health. For this purpose, risk indicators have been developed.

The acute toxicity equivalents indicator is calculated by dividing the quantity of sold active substance by the LD50[102] value of the substance a summing for all active substances. Other indicators use human health index scores and environmental index scores.

**Figure 29 Hectare doses and health and environmental risk indicators 1986-2003**




Source: KEMI nr.6, 2004.

Figure 29 illustrates the development in pesticide use and risk indicators for human health and environmental risk. As all three indicators are estimated based on sold quantities rather than used quantities it is advisable to look more at overall trends than at specific observations. There have been examples of hoarding of pesticides in reaction to announcements of changes to regulation.
From the figure it is evident that the majority of the reduction in use and risk was achieved almost instantly or in the period leading up to the implementation of the pesticide action plan in 1986. Risk to operator health has continued to decline whereas hectare doses and environmental risk seems to have reached a plateau.

## Revenues and effects of the measure

Table 22 presents the total revenues from the pesticide tax from 2000 to 2008. In 2008 the revenues amounted to 50.7 million EURO. Tax revenues have remained relatively stable over the period, given the

[102] Lethal Dose 50%. The dose at which 50% of the test subjects die immediately.

increase in the tax rate in 2004 and revenues remaining around the same level, a decrease in overall use may have been incentivised.

**Table 22 Revenues from pesticide tax, 1995-2008 million EURO**

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Revenue | 48.3 | 47.7 | 40.8 | 48.7 | 41.2 | 45.2 | 41.9 | 43 | 50.7 |

Source: Yearbook of tax 2009, Sweden. p. 150, table 6.25.

### Administrative burden

In 2008, the total tax revenue in Sweden amounted to 165 billion EURO while the total cost of administration of the tax system was 523 million EURO. If the administrative burden of a tax is proportional to its revenue, the administrative burden of the pesticide taxes in 2008 would be 156,000 EURO or 0.3% of the revenue generated.

### Distributional effects

There are no clear distributional effects, as the tax revenues are small and are not channelled directly back to the farmers.

### Assessment of the effect of the instrument

The Swedish effort to reduce pesticide use has not been confined to a tax on pesticides. There has been a concerted effort to train farmers on proper handling and use of pesticides, a ban on the most dangerous or harmful pesticides, integrated pest management etc.

The tax has constituted a price signal, but it is widely believed that an inelastic demand for pesticides means this signal has been all but ignored. The tax amounts to around 5-8% of the retail price of pesticides. This was believed to translate into a reduction in use of pesticides of around 2%. Still the Swedish effort to reduce pesticide use and risk has been very successful. Pesticide use has been reduced by more than 60% and human health risks have been reduced by more than 70% from 1986 levels. The main drivers behind this reduction in pesticide use are understood to be the education programmes for farmers in pesticide use.

## *4.3.4 Conclusion*

From the mid 1980's in both Denmark and Sweden there has been a substantial effort to reduce pesticide use by the use of different instruments, with ambitious goals also targeted.

Both countries have introduced a tax on pesticides which serves two purposes. First, it serves to provide a price signal to pesticide users to reduce the quantities consumed. Second, it serves to finance other activities to reduce pesticide use.

As a means of providing a price signal, the taxes have not been very successful. In Denmark the pesticide retailers took on a large part of the tax burden to prevent a reduction in demand. In Sweden the tax was simply not high enough to constitute a noticeable price signal, given the inelastic demand for pesticides.

As a means for providing financing for other activities to reduce pesticide use the taxes have been a success, although more so in Sweden than in Denmark.

In Sweden pesticide use and risk have decreased significantly due to the well functioning complementary mix of instruments, with pesticide sales having fallen by more than 60% while risk has fallen by more than 70%. In Denmark, after initial success, trends in pesticide use have been less positive.

One of the key factors thought to contribute to pesticide use reductions in the two countries, particularly Sweden, has been education of farmers. Certification for pesticide distribution, readily available information on dosage and handling, campaigns to explain the necessity of reducing pesticide use, information on the economic benefits of reducing pesticide use etc. All these activities have been financed by tax revenues from the pesticide taxes.

*Wider context*

The awareness of consumers is increasing and therefore a focus on reducing pesticide use can be relevant to address in a wider EU context. This effect can be seen in the increasing demand among consumers for organic products, produced without artificial pesticides.

As regards to the implementations of a common pesticide tax in EU there are no major organisational and practical obstacles identified.

As experienced in both cases any tax instrument should be accompanied by a mix of complementary instruments, particularly educational measures. The Swedish approach where the revenue from the tax is used for awareness raising campaigns is an excellent example of the success of this type of approach.

## 4.4 Aggregates levies - UK & SE

### *4.4.1 Introduction*

**Aggregates**

The way aggregates are produced and consumed has wide-ranging positive and negative effects in terms of carbon emissions from extraction, processing and transport, effects on biodiversity and landscape, generation and recycling of waste streams and the effects on local communities from extraction and transport.

## Economic instrument

This case study looks at taxes and levies in the aggregate sector. For the cases selected here the instrument is based on the tonnage of material used, and is not attached to quality.

There is a tendency for construction activities to use the materials that are closest to the site –meaning for example, houses are typically built from locally available and extracted materials. Therefore the challenge with aggregates is national but also often regional or local. The economic sectors associated with aggregates are primarily mining and quarrying activities (production) and construction activities (consumption).

## Case countries

The two countries selected for this case study are the UK and Sweden. The major reason for selecting these two countries is that the countries have implemented taxes in different ways but that both attempt to address resource usage within the aggregate industry. They provide for good examples and quite recent data are widely available for both countries. The two countries have many similarities, but also some dissimilarity. The following table provide an overview of some relevant indicators.

**Table 23 Key information UK and Sweden**

| Indicator | UK | Sweden | EU Average |
|---|---|---|---|
| GDP per capita (million EURO, 2010) | 29.600 | 34.900 | 20.900 |
| Year of membership in the EU | 1973 | 1995 | - |
| Total tax income as a percentage of GDP (EURO, 2009) | 36,7 | 47,4 | 39,7 |
| Number of persons employed in the construction industry (2008) | 1.511.026 | 314.964 | 150.474 |
| Development in no. of persons employed in the construction industry (2005=100) | 94,63 (2007) | 121,69 (2007) | 94,49 (2007) |
| Number of persons employed in Quarrying of stone, sand and clay | 26.388 (2001) | 1521 (1999) | N/A |
| Turnover in Quarrying of stone, sand and clay (mill EURO, constant prices) | 5.280 (2001) | 288,4 (1999) | N/A |
| Production value of Quarrying of stone, sand and clay (mill EURO, constant prices) | 6.326 (2001) | 325,4 (1999) | N/A |

As Table 23 shows both countries have an GDP well above the EU average, and both countries are part of the older group of EU Member States. Sweden has a somewhat higher tax pressure than the UK, measured as a percentage of GDP. The construction industry is not surprisingly larger in the UK than in Sweden, but while the UK construction sector has declined (in terms of number of employed persons), Sweden has in recent years experienced an increased occupation in this sector. Compared to the EU average, UK has a similar development, while Sweden has grown much more.

Table 24 shows some facts on the aggregate industries in the two countries. The industry in UK is double the size of the Swedish industry, measured in number of companies. However, Sweden has about one-third more sites. Total aggregates production is more than 3½ times higher in the UK than in Sweden, as is the share of recycled material.

**Table 24 Production and recycling activities**

| | Sweden | United Kingdom |
|---|---|---|
| Companies operating | 170 | 350 |
| Number of sites | 1,940 | 1,280 |
| Total production (mill/tonnes) | 75 | 275 |
| Total recycled (mill/tonnes) | 8 | 68 |
| Recycling rate | 11% | 25% |

Source: EEA 2008

Note: Recycling rate is defined as % input in aggregates

*Delimitation*

This case study is based on an in-depth desk study, combined with information from a previous DG ENV study (Economic Analysis of Resource Efficiency Policies) on a similar topic.

The comparability of the gravel tax in Sweden and the aggregate levy in the UK is limited by their different objectives. One also covers all types of aggregates while the other only covers gravel.

### *4.4.2 UK Aggregate Levy*[103]

#### Context

*Frame of UK environmental regulation*

The Aggregates Levy introduced in April 2002 in Great Britain and Northern Ireland (United Kingdom) is an example of a centralised ad quantum tax (quantity tax) by weight. The aggregates levy, which is understood as a "green tax" in the UK, is designed to address and internalise the environmental impacts of the extraction and transportation of the construction materials, including noise, dust, vibrations, visual intrusion, loss of biodiversity, etc. The funds are earmarked for environmental projects used in the construction industry and for compensating the regions.

The aggregates levy is embedded in a set of progressive initiatives and policies in the UK that should be taken account of. Those policies are, inter alia, the Strategy for Sustainable Construction, which is a joint

[103] Parts of this case study are directly taken from the case study on the UK aggregate levy developed under the project *Economic Analysis of Resource Efficiency Policies* with permission from DG ENV.

industry and Government initiative intended to deliver benefits to both the construction industry and the wider economy.[104]

*Organisation of the aggregate sector*

As displayed by the table above, the UK aggregate sector constitutes 350 companies, and about production 1280 sites. Total production equals 275 million tonnes, of which recycled material amounts to 25 percent (EEA 2008).

## Aggregate levy

*Reason for introduction of measure*

The most important aim of the levy is to maximise the use of alternatives, such as recycled construction and demolition waste, and secondary materials, such as china clay waste, and to encourage the more efficient use of aggregates. Including greater resource efficiency in the construction industry, to be achieved by a move away from aggregates by development of a range of alternatives, such as the use of waste glass and tyres in aggregate mixes.

*Type of measure*

The levy applies to all extraction and imports to the UK, but it excludes exports[105].

The three main targets of the aggregates levy are:

- To compensate for environmental externalities
- To reduce demand for primary aggregates[106]
- To encourage substitution of alternative materials such as recycling and secondary materials.

*Business context*

The British aggregates industry is represented by the British Aggregates Association (BAA)[107]. The mineral products industry, which includes cement, asphalt, concrete, lime, mortar and silica sand industries is represented by the Minerals Products Association (MPA).[108] According to information on BAA and MPA websites, the industry provides employment for around 40,000 people, mainly in rural communities in around 1,300 quarries, contributing around EURO 3.4bn[109] in primary products to annual GDP.

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[104] The development of three sector resource efficiency plans prepared and implemented by trade associations has begun by the end of 2008 under the responsibility of the Construction Products Association (HM Government 2008).

[105] Söderholm (2011:19)

[106] Sand, gravel and crushed stone

[107] http://www.british-aggregates.co.uk/

[108] http://www.mineralproducts.org/

[109] All amounts originally in GBP are converted to EURO by use of the online currency converter www.xe.com, May 11th 2011

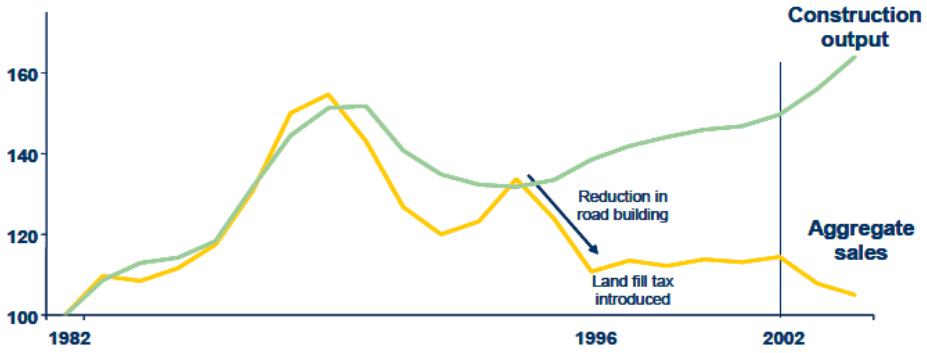
*Limitation of the instrument*
The levy is independent of the type of resource used, which means that the instrument cannot contribute to a differentiated usage of e.g. gravel versus rocks.

The competitive impacts of the tax are negligible as much of the aggregates are used nationally.

## Development of Aggregate extraction

As Figure 30 shows there has been a decline in the use of aggregates with particular highlights in both 1996 and 2002. These developments will be discussed further below.

**Figure 30 Trends in construction output and primary aggregate sales**




Source: Leggs 2007B

## Revenues and effects of the measure

*Price breakdown*
A tonne of mined "aggregates", which includes sand, gravel and crushed stone (including marine aggregates), was initially taxed at EURO 1.8 This represents approximately 20 per cent of the average raw material price. Since 2009, the rate has been EURO 2.28 per tonne, and from 2011 EURO 2.33.

**Table 25 Aggregate levy rates**

| | 2002 | 2009 | 2011 |
|---|---|---|---|
| Levy, GBP per tonne | 1.60 | 2 | 2.10 |
| Levy, EUR per tonne[110] | 1.78 | 2.22 | 2.33 |

The UK tax level equals about 20 percent of the aggregate price.

*Revenues*
In the fiscal year 2008/2009 the Aggregates Levy received a total of EURO 380 million in tax revenue (HMRC 2010). According to Leggs (2007B) these revenues equate to less than 0.9 percent of total

[110] Currency converter:, May 4th 2011, http://www.google.com/finance/converter?a=2.1&from=GBP&to=EUR

environmental tax revenues without energy taxes, and 0.1 percent of total tax revenue.

**Table 26 Revenues from aggregates levy in UK since FY 2002/2003**

| Financial Year | Tonnage (Thousands) | Total Receipts (million EURO) |
|---|---|---|
| 2002/03 | 232 219 | 281 |
| 2003/04 | 266 584 | 386 |
| 2004/05 | 264 381 | 380 |
| 2005/06 | 265 154 | 371 |
| 2006/07 | 263 303 | 366 |
| 2007/08 | 273 845 | 386 |
| 2008/09 | 224 572 | 380 |
| 2009/10 | 179 216 | 275 |

Source: UK Trade Info https://www.uktradeinfo.com/index.cfm?task=bullaggr

In the Government's view, the levy has been a significant factor in reducing sales of virgin aggregates by about 18 million tonnes between 2001 and 2005.[111]

### *Mix of instruments*

Two additional instruments are important in the context of the Aggregates Levy. The Landfill Tax (implemented 1996) is a tax on the disposal of waste, aiming to encourage waste producers to produce less waste and recover more value from waste through recycling. The tax applies to all kinds of wastes and is charged by weight with two rates: the standard rate since April 2010 is EURO 54.6 per tonne and will increase by approximately EURO 9 each year until 2014; while inert or inactive waste is subject to the lower rate, which is EURO 2.8 per tonne. Although aggregates are usually classified as inactive waste, the landfill tax does act as an incentive to consume more efficiently. The costs for disposal of construction and demolition waste depend on the type of waste and how well sorted the fractions are. The costs for disposal of well sorted concrete waste at Roseland Aggregates are EURO 15 per tonne (Roseland Aggregates, 1 June 2010).

### *Use of revenues*

All tax revenues are transferred back to business, through a 0.1 percent reduction in employer NIC's (National Insurance Contribution)[112] for firm working within the sector. A proportion of the revenue that is generated through the Aggregates Levy, approx. 10 per cent, is used to provide a source of funding for research aimed at minimising the effects of aggregate production. This is delivered through Defra and is called the Aggregate Levy Sustainability Fund (ALSF).

### *Company benefits*

The benefits to the companies are:

[111] http://www.theyworkforyou.com/debates/?id=2010-03-30a.791.0
[112] Söderholm 2011:19

- Increasing profitability by using resources more efficiently
- Increased resource efficiency
- Increased process efficiency
- Minimisation of waste and waste charges
- Enhancing company image and profile in the market
- Opportunities for firms which supply recycling and secondary aggregates
- Reduced reliance on non-renewable resources (quarried mineral products)
- Reduced embodied carbon content.

### Administrative burden

The yearly administrative costs to the Government for the levy are estimated to be EURO 1.14 million, in most years this represents less than 0.5% of the value of the revenue collected. In addition, there was an initial cost of EURO 2.3 million in the year of implementation.[113]

Compliance costs to industry were estimated to be around EURO 1.4 million for the entire industry to set up, which is less than 0.6 cents per tonne extracted, and EURO 853,000 yearly which is 0.34 cents per tonne on average. The cost estimates were based on a consultation exercise. [114]

### Distributional effects

The price changes have had only a small impact on demand, meaning that the larger part of the additional costs has been passed on to the consumer (purchaser of the aggregates). For this reason no negative impact on industry profits is expected or detected.[115]

### Assessment of the effect of the instrument

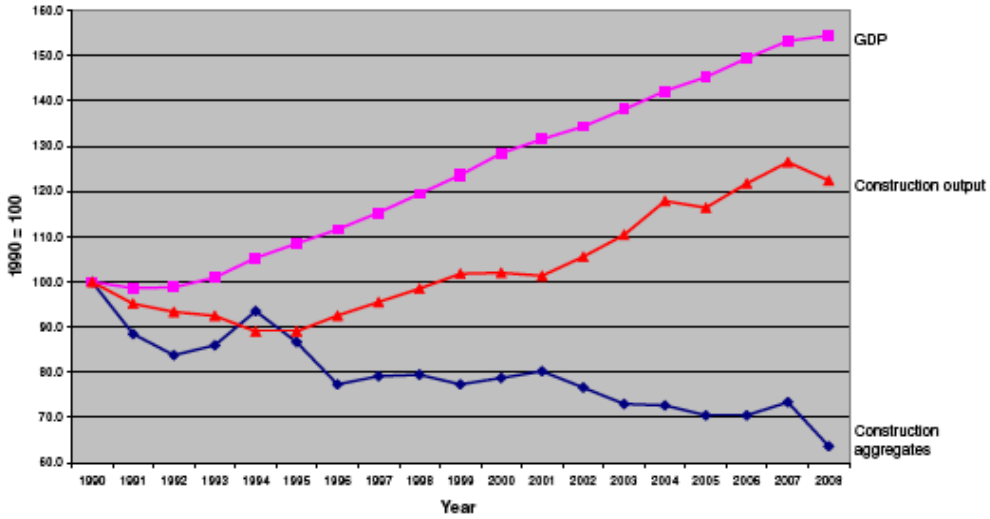
The primary effect of the levy has been a decrease in the extraction of aggregates from 2002 and ongoing. The recycling of material have raised to 68 million tonnes (equivalent to approximately 25 per cent of all aggregates required) (EEA 2008).

The recycling market has been highly dynamic, while reductions in primary extraction have been relatively low. This effect is ascribed not only to the tax, but also to measures introduced before, such as the "landfill tax" implemented in 1996. In addition, there has been a general decline in road construction in the same period. Technical improvements in the construction industry that allow for a lower intensity of the use of raw materials have reinforced these effects (EEA 2008). These trends are clearly displayed in Figure 30, where the events are highlighted on the trend curves.

[113] Leggs 2007B:20
[114] Leggs 2007B:20
[115] Leggs 2007B:20

Aggregates sales since 1990 in UK are compared with construction output and GDP in Figure 31.
This displays a similar relationship between construction output and aggregate sales in the UK, with a clear decline in aggregate turnover in 1996 coinciding with the landfill directive, and again, although less visible, in 2002 from the aggregate levy. There has also been a clear de-linking of construction outputs and construction aggregate usage over the same period.

**Figure 31 Trends in GDP, construction aggregates sales and construction output since 1990**




Source: BDS 2009, p. 6[116]

The market for aggregates in the UK has changed in recent years. The Aggregates Levy has encouraged the use of recycling and secondary material, which has led to a decrease in aggregates output. However, views on the effectiveness of the levy are mixed. Compared with an overall levy cost of over EURO 455 million a year, the additional one million tonnes of recycled aggregates supplied due to the levy has therefore "cost" EURO 455 of additional taxation.[117] On the other hand, using recycled aggregates means avoiding paying the levy and suppliers offering recycled aggregates are likely to have an increase in business.[118] Use of aggregates from further away, e.g. china clay waste and slate waste has increased due to the levy increasing the price competitiveness despite the longer transportation.[119]

Other estimates find that the tax has reduced aggregate sales by around 18 million tonnes between 2001 and 2005[120].

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[116] Much of the rise in construction output by value has been from meeting higher requirements for environmental, health and safety issues.
[117] http://www.envirovaluation.org/index.php/2005/02/24/www_letsrecycle_com
[118] http://www.crwplatform.co.uk/conwaste/aggregates-levy/
[119] Leggs 2007B:12
[120] UK Government in Söderholm 2011:20

Critical points mentioned in the literature are effects such as the lack of measurement of the impacts on environment externalities, trade distortion in Northern Ireland that ended up in a scheme allowing an 80 percent exemption of the levy, larger transport distances and stockpiling of unsold but locally available lower quality primary aggregates increasing at quarries.[121] And the sum of this led to the tax having less effect.

Other evidence also points out that the aggregate tax has been most efficient in decreasing the demand for low quality crushed rock and only increasing the demand for recycled aggregates slightly[122].

### *Recycling*

The BDS (2009) published details of all known static aggregates recycling plants in Great Britain, including details of over 650 recycling plants. Before the introduction of the landfill tax, the number of new plants established each year averaged 16, doubling in the following period. Following the introduction of the aggregates levy, this trend has not stopped, however, and has even accelerated with 39 recycling plants established every year.

**Table 27 New aggregates recycling plants**

| Period | Average number of new aggregates recycling plants established per annum |
|---|---|
| 1990 – 1996 | 16 |
| 1997 – 2001 | 33 |
| 2002 – 2004 | 39 |

Source: BDS 2009

The combination of policies has provided a strong incentive to producers to change production methods and practices. Within the triangle of instruments, which includes the aggregate sustainability fund and landfill tax, the aggregate levy forms an important component, indeed it provides much of the funding for the sustainability fund. The overall effect has been to encourage the substitution of primary aggregates for recycled construction and demolition waste, which have a much lower environmental impact from energy use and carbon dioxide emissions (Legg 2007B).

### *Reduction of material costs*

The price of aggregates in the UK at the quarry gate is of the order EURO 5.7 per tonne (average delivered prices are EURO 9 per tonne) although the price varies depending on quality and volume purchased (Legg 2007). The effect of the EURO 2.4 tax, therefore, is to increase prices in the order of 25 per cent. However, the low elasticity of demand for the product means that much of the burden of the levy has been passed onto the

[121] http://www.british-aggregates.co.uk/documentation/doc118.pdf; Leggs 2007B
[122] EEA in Söderholm 2011.

purchasers of aggregates (Legg 2007). Recycled aggregates have prices in the range of EURO 6.3 to EURO 9.00[123] per tonne.

A complete recycling of mineral resources is probably not within reach in the medium-to long term. Many natural stone products cannot be dismantled into their raw materials because irreversible processes have taken place in production processes. Even where treatments are possible, the original quality can often not be achieved. This is called "down cycling". According to Haefner, the proportional recycling rate to the total consumption can reach 20 per cent at best (Haefner 2006). However, the estimates vary greatly in this issue (between 8% and 28%). No evidence has been found to suggest that the UK – with a recycling rate approaching 25% - is starting to run into such limits.

*Environmental impacts*

The UK aggregate tax has not been proved to have any effect in addressing environmental externalities. The major reason is argued to be the highly specific and localised nature of impacts. The general conclusion from Söderholm is that *"a uniform tax levied across an entire industry will only be able to achieve environmental improvements by reducing demand for the extracted product, while it will provide no incentives to ensure that polluting behaviour is changed"*[124]. The use of 10 per cent to provide a source of funding for research aimed at minimising the effects of aggregate production should over time be expected to show some positive environmental effects. Still, from an administrative point of view, a single tax is cheaper to administer.

### Conclusions

The overall conclusions are:

- There is an effect from the aggregate levy, however, it is enforced by a combination of initiatives.
- The combined effect of the policies has increased substitution effects, which can also be more resource intensive, depending on the substituted material.
- There were no direct effects for the environment.

## *4.4.3 Sweden Gravel Tax*

### Frame of Sweden environmental regulation

In 1996 the Swedish government introduced a Law concerning a Tax on Natural Materials, which included a particular tax on the extraction and sales of natural gravel (not including crushed rocks and sand).

Other policy instruments within the same area include:

[123] http://valerecycling.co.uk/aggregates.htm,
[124] Söderhom (2011:22)

- The environmental Code (1999), which is the main Swedish legislation for environmental protection.
- Environmental Objectives, including a specific target for gravel that extractions should be less than 12 million tonne in 2010.
- Permit regime, where permits are required for commercial rock and gravel pits
- Landfill tax, that states that gravel, earth, clay, slates, limestone etc. are exempted from the tax if deposited in separate landfills.[125]

### *Organisation – of Swedish aggregate sector*

As displayed in the table in the introduction, the Swedish aggregate industry comprise 170 companies with a total of 1940 sites. Total aggregate production is 75 million tonnes, of which recycled material comprises around 11 percent (EEA 2008). Table 28 shows how aggregates are used, and that the most significant usage is for roads.

**Table 28 Aggregate use in Sweden 2005**

| Use | % |
|---|---|
| Roads | 57 (most significant) |
| Filling | 16 |
| Concrete | 12 |
| Other | 15 |

Source: Leggs 2007:9

Sand and gravel from natural deposits account for 24 percent for each of these.[126]

The aggregates industry as a whole is dominated by a few large players (including Skanska, BallasT/NCC, Heidelberg Cement, Swerock, Vägverket). They hold 10 percent of the plants, but produce almost 70 percent of total aggregates. The small suppliers handle the remaining 30 percent of the market. Data has not been identified for the sand and gravel sector separately.

## Gravel Tax

### *Context*

In the Southern and mid parts of Sweden natural gravel is scarce, while in the Northern parts gravel reserves are large. Estimates suggest that given the 1996 production level availability of natural gravel, Southern parts of Sweden will run out within 20 years. Furthermore, in Sweden, natural gravel is considered to be an invaluable resource, as it constitutes an important ground water reservoir material, in regards to provisions of clean drinking water as well as an important part of the landscape.[127] For this reason the implementation of the gravel tax was relevant and important for Sweden.

[125] Leggs 2007:3
[126] Leggs 2007:9
[127] SEPA in Söderholm (2011:13), www.economicinstruments.com

### *Reason for introduction of measure*

The Swedish Aggregate tax was introduced in 1996 with the aim to decrease gravel extraction and sale, by closing the price gap between gravel and its substitutes (crushed rock). It was intended that the tax would have both an informative and incentive effect, by increasing the price of the materials it would stimulate usage of other materials such as crushed rock and recycled materials such as concrete.[128] Initially the price gap was 0.8-0.9 EURO per tonne[129], and the tax level was introduced at EURO 0.6 per tonne, thereby providing an incentive to switch material.

### *Type of measure*

The tax is levied on the extraction of gravel, as a unit price per tonne. Initially the tax amounted to EURO 0.6 - in 2006 the tax was increased to EURO 1.5, which in real terms represents a doubling of the tax level. The tax revenue is included in the central state budget[130]. The tax does not take into account regional differences in gravel availability, but is the same across all of Sweden.

The tax is paid by companies (and others) that exploit a site that requires a permit under the Nature Conservation Act or Road Act. Natural gravel is defined as naturally sorted earth materials, which consist mainly of sand, gravel, cobble and boulder size fractions. Activities within gravel pits and for aftercare at the site are exempt[131].

The tax is only attributable to domestic supply – imports are exempted. Therefore the tax does not address competitiveness issues, even though, theoretically, imports become cheaper. This could be regarded as incentivising the export of the externalities associated with aggregate extraction. Yet the potential for this is small as high transportation costs, from the weight and bulk of the material, limit the potential for international trade in gravel. This is reflected in very low levels of imports to the Swedish gravel market over the past years.[132]

### *Aims of the measure*

There are three main aims of the measure[133], by 2010 to:

1. Reach a 30/70 usage of natural gravel and substitutes;
2. Use 15% recycled material; and
3. Extract less than 12 million tonnes gravel.

### *Limitations of the instrument*

No major limitations have been identified.

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[128] SEPA in Söderholm (2011), www.economicinstruments.com/ 'Aggregates Tax (Sweden)

[129] All amounts originally in SEK are converted to EURO by use of the online currency converter www.xe.com, May 11th 2011

[130] Söderholm 2011

[131] www.economicinstruments.com/ 'Aggregates Tax (Sweden)

[132] Legg, 2007 in Söderholm (2011:14)

[133] Söderholm 2011

## Development of aggregate usage

As Figure 32 shows, deliveries of natural gravel have declined significantly in Sweden over the past 25 years. Especially in the period from mid-1980s till the end of the 1990s, the use of natural gravel has declined, while the use of crushed rock has increased. In 1984 gravel constituted 82 percent of total aggregates, while in 2008 this share had fallen to 19 percent, well within the 30% target set by the measure.

**Figure 32 Deliveries of Aggregates in Sweden by Type of Material, 1984 - 2008**

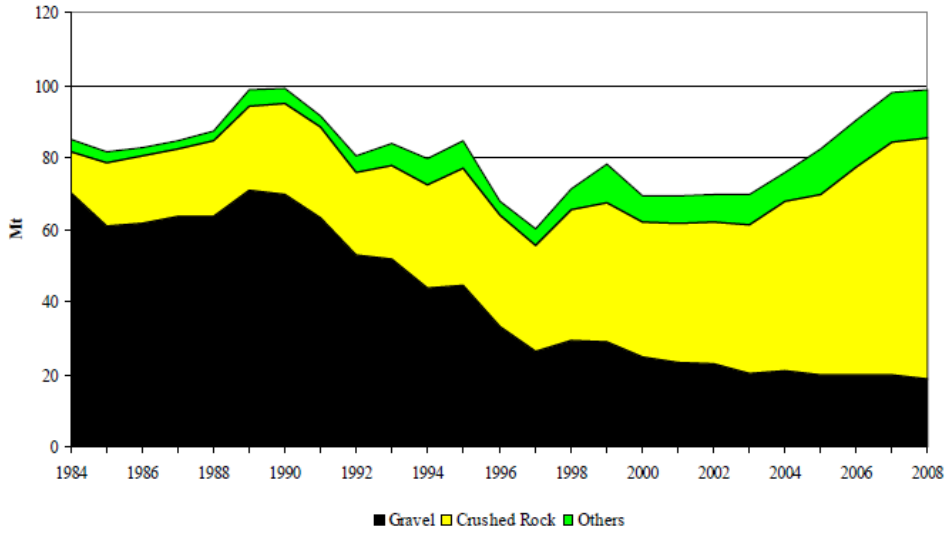


**Figure 2: Deliveries of Aggregates in Sweden by Type of Material (Mt), 1984-2008**

Note: "Others" mainly consist of crushed rock from, for instance, separate crushing mills, scrap stone and excess stone from quarrying industry minerals and ornament stone

Sources: SEPA (2000) and Swedish Geological Survey (2009).

Source: Söderholm (2011:14)

The major reasons for the steep decline in deliveries is that consumers started demanding higher quality materials, which meant that crushed rock was more sought after. As early as 1988 the road building material procurement was changed by the Department with responsibility for National Road Building Policy, to encourage use of crushed rock rather than gravel. In 1994 they raised their quality standards, which meant that tendering companies that substituted gravel with crushed rock were prioritised first in the bidding process. Another issue is that permits for gravel pits have been increasingly controlled. On average it takes 2-4 years to obtain a permit from the County Administrative Boards.[134]

## Revenues and effects of the measure

Based on the figure above, displaying the development in deliveries of aggregates, then it appears that the aim of reaching a 30/70 share

[134] Leggs 2007, Söderholm 2011

between gravel and other substitutes has been achieved, though, the tax's impact in this regards is minor according to Söderholm[135].

### *Unit costs*

Table 29 displays the tax level of the gravel tax:

**Table 29 Tax level**

| | 1996 | 2003 | 2006 |
|---|---|---|---|
| Tax level, per tonne | SEK 5 | SEK 10 | SEK 13 |
| Tax level, EUR per tonne[136] | 0.56 | 1.11 | 1.44 |

The initial lower tax level was to diminish the pressure on the smaller gravel pits in the beginning to help them adjust to the new system.

### *Revenue*

The revenue from the tax goes into the general Swedish State budget. The size of the revenues is displayed in Table 30:

**Table 30 Revenue from gravel tax**

| Year | Revenue (million EURO) | Million tonnes |
|---|---|---|
| 1997 (tax rate = 0.6 EURO) | 13.4 | 24 |
| 1998 | 14.3 | 25.6 |
| 1999 | 16.0 | 28.8 |
| 2000 | 14.0 | 25 |
| 2001 | 14.0 | 25.2 |
| 2002 | 12.7 | 22.8 |
| 2003 (tax rate = 1.1 EURO) | 21.1 | 18.9 |
| 2004 | 22.6 | 20.2 |
| 2005 | 22.3 | 20 |
| 2006 (tax rate = 1.5 EURO) | - | - |

Adjusted from similar table with SEK in Leggs 2007:22.

According to economicinstruments.com, the revenue has risen over a period of four years from 2004-08, despite decreasing use and extraction of gravel. Though the Tax Authority[137] expects this to be due to delayed reports from the extracting companies. Companies themselves are responsible for reporting the annual extraction of gravel.

### *Company costs*

The 1996-tax level corresponded to a 10 percent increase in the price of natural gravel. Initially it was estimated that the major part of the tax was

[135] (2011:14) – based on data from Statistics Sweden, 2005
[136] Currency converter, May 4th 2011, http://www.google.com/finance/converter?a=13&from=SEK&to=EUR
[137] In economicinstruments.com

borne by the consumer because of low own-price elasticity of the demand[138]. Therefore, the cost to companies was assessed to be minor.

The tax is assessed to have had some signalling effect[139], and producer's awareness on lowering the use of natural gravel has been raised. Still, even before the tax was introduced, producers had already started to shift towards substitutes. This development is also visible in Figure 32 displaying the deliveries of aggregates.

In addition to the administrative costs (see below), companies did experience some adaptation costs, mainly related to the higher energy use required for the extraction of crushed rocks.[140]

### Administrative burden

In 1995, the administrative burden from the Gravel tax was estimated to be EUR 0.39 million per year, including administrative costs and control. These estimates were prepared prior to the implementation of the tax and would represent approximately 2% of tax revenues in 2005.

Additional costs to the companies are not included in this estimate, but a similar burden was estimated for the companies. A total estimate of the administrative burden is EUR 0.55-1.11 million per year.[141]

There are some administrative issues on the gravel tax, which mainly relate to the measuring of the exact extracted amounts of natural gravel. These arise because produce is often mixed, cash sales occur in rural areas, estimates of volume is done in the pits and identifying the actual operator can also be a challenge.

### Distributional effects

No particular distributional effects have been identified.

### Assessment of the effect of the instrument

*Aggregate usage*

As Figure 32 shows, the development in aggregate production was already declining prior to the introduction of the gravel tax.

According to a study from the Swedish EPA in 1999, the gravel tax had a modest effect. According to Leggs, because the tax was passed on to suppliers/consumers the incentive to switch to other materials was there. However, a later study from the Swedish Geological Survey could not document a clear linkage between the gravel tax and gravel production.

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[138] SEPA 2000 in Söderholm 2011.
[139] Arrell in Söderholm 2011:14
[140] Leggs 2007:21
[141] Swedish EPA, in economicinstruments.com

One noticeable effect was that only six months after the introduction of the tax, there was an increase in permits for rock quarry, which could imply a shift towards this material. Actually, the shift towards crushed rock was more evident than increased use of recycled gravel material.[142]
The gradual increase of the tax level appears to have had a signalling effect, which made companies predict such an increase and therefore take precautions and alter their production methods accordingly.[143]

Still, evidence from the Swedish EPA[144] displays that the introduction of the tax increased the price of natural gravel by about 11 percent, and that the proportion of gravel sold decreased by 10 (+/-5) percentage points. Indicating that a large part of the tax was passed to the consumers, thus creating an incentive to switch to other materials.

*Mix of instruments*

The major reasons for the decline in aggregate production is to be found in the changes in:

- road building procurement;
- the permits allocation;
- consumer preferences; and
- awareness raising, because in the period 1994-96 the preservation of gravel pits to secure clean drinking water was heavily discussed. [145]

In general it is difficult to separate the tax effect from the other factors.

*Substitution effects*

In regards to substitution effects, the Swedish EPA[146] has prepared a study that concluded that substitution amounted to 10 percentage points, which corresponds to 5.6 million tonnes in 1997 and 6.6 million tonnes in 1998. In other words, the tax did have some effect on the preservation of natural gravel. A later study did not show as strong an effect. [147]

To support the substitution effect, is the fact that upon introduction of the tax an increasing number of applications for rock crushing extraction were received by the Authorities. Finally, transportation distance and cost is important in this regards, as it has been estimated that the costs of moving low quality gravel 20-30 km equals the cost of the gravel, thereby increasing the substitution effect.

As discussed above recycling is not an easy task in Sweden and is therefore limited. Still some examples exist of successful substitution, e.g. in building of roads, where recycling is taking place at the construction site.

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[142] Leggs 2007:5
[143] Leggs 2007:6
[144] In Leggs 2007:16
[145] Leggs 2007:15-16
[146] In Leggs 2007: 16-17
[147] Söderholm (2011)

### *Environmental effects*

In addition to the other effects, some environmental effects have been discussed in the literature. One is energy consumption. In this regard, energy usage is estimated to be three times higher for rock crushing activities compared to gravel extraction. This makes it possible that another, most likely unintended, effect from the tax is higher energy consumption. In regards to transport, the tax potentially contributed to a slight decrease in total transport volume. The reason was that buyers choose the product based on the total price of the material plus transport and because gravel would initially be transported further, the tax increased the price of the gravel; then more often rocks will be preferred from the buyer and thereby travelling distances diminished. Quantified data on these effects were not identified.[148]

### *Limitations*

Limitations to assess the direct effect of the tax include several issues. First of all, at the time the tax was introduced a decline in natural gravel usage was already initiated in the sector, as a response to an increased demand for quality from consumers. Furthermore, permits to gravel pits were placed under stricter controls, which can also be assumed to have had a major impact on the production of natural gravel. Such factors make it difficult to separate the effect that comes from the tax from the effect that comes from other measures.

Finally, Söderholm (2011) also points to the linkage between the overall economy and the extraction of gravel, since the construction sector, where the majority of gravel is used, is highly affected by changes in the general economy.

Another limitation of the tax is that it does not address regional differences, i.e. that reserves of natural gravel are very large in the Northern part Sweden, but much smaller in other parts of the country.

### *Fulfilment of aims*

According to SEPA[149], the primary aim of the tax was to reach a proportion of 30/70 usage of natural gravel and substitutes. Initially, indicators were also set on the volume usage of recycled material to constitute 15 percent in 2010, though this measure was since removed. The reason was that on one hand data on recycled material was not available to a sufficient extent and also, recycling potential in Sweden is limited because the replacement rate of buildings is low. The final aim was to decrease extraction of gravel to less than 12 million tonnes in 2010. In 2008 extraction was still quite high at 18.8 million tonnes and it was suggested to set a 2020 goal

[148] Leggs 2007:19
[149] SEPA 2000, in Söderholm (2011:14-17)

instead. Now the aim is to only have gravel pits in places where they do not affect drinking water and other environmental impacts are very low.

Söderholm points out that addressing the environmental concerns might be more effectively targeted *:"… thus illustrating that often regulatory measures could provide more apt incentives than economic instruments that are not targeting the underlying environmental damages*" (2011:17).

*Indirect effects*

There has also been identified a number of indirect effects from the substitution of gravel to crushed rocks, where the tax is contributing to create the effect. The overall energy consumption of the sector has increased, as extraction of crushed rock requires about 1.7 times more energy than extraction of gravel. Also more cement is being used to production of concrete, which implies very carbon dioxide intensive processes. Overall, there are indications that the total environmental benefits form the tax might not be positive.[150]

Another wider effect is a positive contribution to employment, because crushing rocks require more labour compared to gravel extraction.[151]

**Conclusions**

Considering the objectives that were laid out for the gravel tax, then some of these appear to have been fulfilled, while others have been changed over time.

- Reach a 30/70 usage of natural gravel and substitutes was completed.
- Use 15% recycled material was not completed, but this was mainly due to the general challenges of recycling in the construction sector in Sweden, i.e. limitations of waste.
- Extract less than 12 million tonnes of gravel by 2010. This objective was changed, and instead of a quantitative measure the new objective addresses the gravel pits location in regards to environmental impacts.

### *4.4.4 Conclusion*

Comparing objectives of the taxes, then the UK is more focused on recycling, whereas Sweden is focused on the protection of the gravel for drinking water purposes.

The level of the taxes is somewhat higher in the UK than in Sweden – namely 20 and 11 percent respectively. This has however not led to a visibly larger effect in UK compared to Sweden.
In Sweden the tax was only on gravel, whereas in the UK, the levy applied to all aggregates. There was no major difference in the effect. In Sweden the level of the tax was adjusted to fill the gap in the prices between gravel and crushed rocks, which is the substitute material. For this reason sufficient effect could still be expected.

[150] Söderholm (2011:16)
[151] Leggs 2007:6

In regards to recycling, then the UK case shows a greater usage of recycled materials compared to Sweden, where there are structural limitations to recycling potential due to limits in available construction material.

From the data it appears that Sweden has increased its usage of aggregates and thereby the activities in the construction sector faster than the EU average. In the UK construction activities have been around or below the EU average in the most recent years, a change from the relative boom in the 2000's, reflecting the impact from the financial crisis.

*Rough indicators*

As the effect of the taxes are very minor, it is not possible nor relevant for this case to make rough indicators on the size of the effect. (E.g. for the UK case there was a decrease in extraction of aggregates of 6 million tonnes in 2005, while the total demand equalled 275 million tonnes, thereby the effect was about 2 percent).

*Lessons Learned*

The cost of aggregate material is low as well as the tax levels; these are the major reasons that most aggregate taxes have only limited impact on resource efficiency and recycling behaviour[152].

Another issue is that the 'own-price elasticity' of supply of alternative materials is very low, because the supplies are limited to the range of past construction activities, leaving a fixed supply. In addition, incentives to increase waste sorting are low. Therefore, Söderholm (2011) proposes more recycling policies to support such developments.

Another challenge for both the UK and Swedish taxes is that they have multiple objectives. If they were limited to one objective, either fiscal or environmental, this would also increase the potential for evaluation of the effects.

Still, the taxes are part of a policy mix that affects the use of aggregates. These include: taxes, other policies, national conditions, and information campaigns etc.

*Wider context*

There is a challenge between the national and local level. The major reason for this is that it is important to avoid greater transporting distances. As also displayed from the Swedish case, there can also be a need to distinguish between regions with a high availability of a material, while other regions might be short on availability.

Another issue is that it is interesting to address the substitution effects, as done in the Swedish case, where gravel was to be substituted by crushed rocks. Such issues should be a national decision or even a regional

[152] Söderholm 2011:22

decision, as the availability of aggregates differs widely across regions. Generally, using taxes on aggregates is a way to stimulate recycling, where this is feasible.

There are a number of countries e.g. Italy and Czech Republic that already have implemented similar instruments or regulations on aggregates, and therefore, the variations, synergies and costs/benefits of harmonisation must be considered before any central initiatives. It is also very likely that it is much better to regulate on a local/national level due to these different characteristics and the fact that a lot of the aggregates are used nationally and that the transport cost are very high due to the weight.

## 4.5 Tree protection charges – AT & LT

### *4.5.1 Introduction*

Trees are essential in the production of oxygen, reducing $CO_2$ levels and for protection and maintenance of ecosystems. They play an important role in the landscape of both urban and rural environments.

This case looks at tree protection charges – one case focusing on the urban environment and the other on forest protection.

#### *Urban tree protection – the case of Vienna Municipality*

One of the key objectives of urban planning today is sustainable urban development. Having trees in cities is recognised as an important factor for achieving high quality urban environments and the reasons for urban tree protection are many, such as[153]:

- Protection against erosion
- Water protection (retention)
- Climate protection and health
- Protection against wind and air pollution
- Protection of species and of biotopes and habitats
- Regeneration through nature
- Creative, architectural and urban functions
- Road safety

In Europe, laws on tree protection in cities are rather common. A study from 2003 showed that out of 34 cities analysed 25 had laws protecting trees in public and/or private areas. Most of these laws were adopted from the 1970s and onwards[154].

Tree protection has been a focus area for the municipality of Vienna for many years with activities based on administration, research and private actions. A tree protection order was first introduced in 1974, and this was updated in 1998. The Tree Protection Act introduced a framework for the protection of urban trees through a requirement for a permit, a fee and replanting. This case therefore contains a mix of instruments.

[153] A Schmied and W Pillmann (2003) p. 116
[154] A Schmied and W Pillmann (2003) p. 115

### *Forest protection – the Lithuanian case*

Most reasons for urban tree protection are also applicable for forest protection, and maintaining biodiversity and sustainable ecosystems has a key role. According to McAlpine et.al "the loss and fragmentation of forest habitats by human land use are recognised as important factors influencing the decline of forest-dependent fauna"[155].

During the last decades, however, forest growth has been increasing in Europe. Many causes have been suggested to explain this including climatic changes such as increasing atmospheric carbon dioxide concentration, increased temperatures, precipitation patterns, increasing nitrogen deposition as well as better forest management[156]. Lithuania is relatively rich in forest resources, compared to most other European countries and has seen a significant increase in forest land –in the 1960s approximately 20% of the country was covered by forest, this had increased to over 30% by 2006. The country has significantly changed its forest management as part of the post-communist transition the country has seen the last 20 years.

## Key facts on Austria and Lithuania

The table below presents key information on Austria and Lithuania. The two countries are very different regarding both climate and levels of GDP. In 2009, Austria had the fourth highest GDP level in the EU whereas Lithuania came in fourth from the bottom[157]. Both countries are relatively new members of the EU with entry in 1995 and 2004.

**Table 31 Key information Austria and Lithuania**

| Indicator | Austria | Lithuania |
|---|---|---|
| Climate | transitional between maritime and continental | temperate climatic zone with a Central European climate |
| GDP per capita (EURO, 2009) | 124* | 55* |
| Year of membership in the EU | 1995 | 2004 |

* Source: Eurostat

## Instruments

Trees are protected through use of different instruments such as certification schemes, felling permits, replanting requirements and charges for felling. In this respect certification is mainly used to inform consumers that the products they are buying come from sustainably managed forests. Two of the most recognised international forest certification programs are the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification schemes (PEFC).

[155] McAlpine et. al 2006
[156] Kahle et. al (2008)
[157] http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/GDP_per_capita,_consumption_per_capita_and_comparative_price_levels

Instruments such as permits, charges and replanting requirements are on the other hand targeted at controlling the actual felling of the tree.

A study carried out for DG Environment by Ecologica in 2006, showed that where particular types of flora were targeted, charges for tree protection are the most commonly applied instrument[158].

*Delimitation*

The case studies are based on a desk study of publicly available documents primarily found via the Internet. Furthermore a number of stakeholders have been contacted. The following have provided input to the case study:

- Margit Cech, Vienna City Administration, Dep. for Public Parks
- Mr Nerijus Kupstaitis Head of Forestry Policy Unit, Director of Forestry Department
- Mr. Gintautas Cinga from Lithuanian University of Agriculture
- Liana Sadauskienė, Lithuanian Research Centre for Agriculture and Forestry, Department for resources, economics and policy

Despite the fact that tree protection measures are relatively common, it has proved a challenge finding scientific articles and previous studies on this specific topic. This is also reflected in the progress of the case study which is based on a limited number of sources.

During the work with the Lithuania case, it has turned out that what was a tree protection charge according to OECD, does no longer exist and has been replaced by an income tax on timber sale for private forest owners.

### *4.5.2 Vienna – urban tree protection*

#### Context

The primary objective of the Department of Environmental Protection of Vienna is "to develop and implement precautionary and integrated activities and strategies to improve environmental standards"[159]. This includes air quality measurement, network, strategic air quality management, nature protection, noise abatement, waste and resource management, environmental law, environmental analysis and comprehensive official and expert activities[160].

Currently, green areas cover approximately 50% of Vienna (about 200 square kilometres) and the urban green areas of Vienna are managed by the Municipal Department 42 - Parks and Gardens (MA 42), by the Municipal Department 49 - Forestry Office and Urban Agriculture (MA 49) and *Friedhöfe Wien* (cemeteries) [161].

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[158] Bräuer et al 2006 p. 6
[159] Vienna Environmental report 2006/2007 p. 4
[160] Vienna Environmental report 2006/2007 p. 4
[161] http://www.wien.gv.at/english/environment/parks/

## Instrument

Under the Vienna Tree Protection Act, the city of Vienna has introduced strict requirements for cutting down trees with a trunk circumference of more than 40 centimetres, measured at one meter height from the beginning of root branching. In order to cut a tree covered by the act, both a license must be obtained and a fee must be paid hence a combination on two instruments – a rights (quantity) based instrument, the license, and a price based instrument, the fee. Moreover, with an authorized removal of a tree, replanting is required[162].

The Act covers both deciduous and coniferous trees and all are covered independently of whether they are private or public property (Tree Protection Act (TPA), art 1). There are however a number of exceptions where trees are not covered by the legislation. This includes forests covered by the forestry legislation, certain trees in nurseries or garden centres, fruit trees, trees which need removal due to water specific considerations, agricultural production or trees that falter in small gardens (TPA, art 1).

### *Reason for introduction*

The first tree protection act in Vienna was introduced in 1974 following complaints from citizens that too many trees were being removed.

### *Challenges*

We have not received any information from the administration of Vienna regarding challenges. Overall, it is reasonable to believe that it can be a challenge to monitor the number of trees on private properties and enforce the charge so that no unauthorised cutting of trees takes place.

### *Limitation of the instrument*

Efficient implementation is necessary for tree protection orders to have an effect. Schmied and Pillmann (2003) confirm the statement of Profous and Loeb (1990) that the effectiveness of legislation relies heavily on three factors[163]:

- Public opinion
- Trained and motivated individuals in the planning and resource management agencies
- The administrative and judicial commitment to fulfil legislative mandates

As mentioned above, the measure was introduced following pressure from citizens hence it is likely to believe that public opinion is supporting the measure. The measure is moreover limited by the ability to monitor compliance and limit illegal felling, particularly in private properties.

[162] Except if felling is done to protect remaining trees re para. 4.1.2
[163] A Schmied and W Pillmann (2003) p. 124

Generally GIS has increasingly been used for monitoring tree populations in this regard.

## Development of the resource

According to Margit Cech from the department *Angelegenheiten und Gebäudemanagement* responsible for managing the charge, there is no registration of the development of private trees. It is expected that overall the number of trees in Vienna is rising due to the replanting requirement.[164] However, there is no data to support this statement.

## Costs and revenues

Firstly, there is a fee for acquiring a licence to cut down a tree, and second there is a charge if replanting is not done as prescribed.

Concerning the cost to obtain the licence, we have received different information. According to the *Angelegenheiten und Gebäudemanagement department (*Affairs and property management department) [165], there is a fixed cost of €45 to obtain such licence. It is stated that "there is no bill of charges for the administration effort. The administration is managed by the general municipal authorities and financially supported by taxes."[166]

However, according to the website, the cost structure of the measure is composed of several variables. First of all there is a fixed federal fee for applying for the tree removal permit. Secondly, there is a cost per page (A3) assessed. Thirdly, the applicant must also pay a fee for the time spent to assess the application hence the administrative cost of time spent on the individual application is shifted from the public administration to the applicant. And finally, the applicant must also pay an administrative fee per tree[167]. The size of this fee depends on the reason for felling the tree. An overview of the fees is provided in Table 32.

**Table 32 Fees for obtaining a tree felling permit**

| Price category | Fee € |
|---|---|
| Federal fee for application | 13.20 |
| Fee per page (A3) Schedule | 3.60 |
| Commission fees for every half hour (review) | 7.63 |
| Administrative fee per tree depending on the reason for felling the tree | 4.72 and EUR 21.80 (maximum of € 494.17) |

Source: http://www.wien.gv.at/amtshelfer/wirtschaft/mba/genehmigungen/baumentfernung.html

This means that the minimum cost per application is €29.15, but the cost in most cases is likely to be much higher.

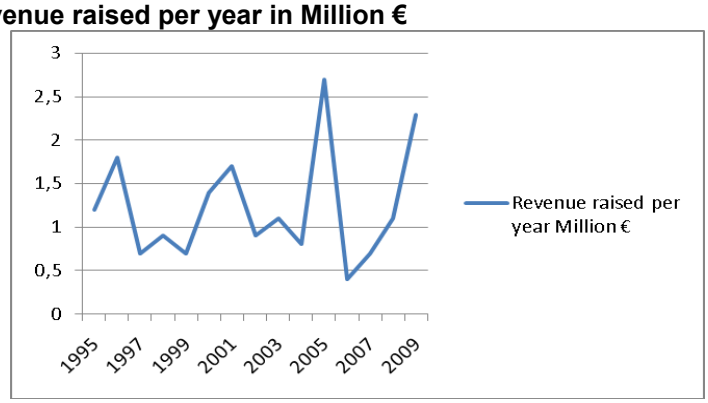
As mentioned above, with the right of felling a tree there is an obligation for replanting. If such obligation cannot be fulfilled a charge of €1 090 must be paid (TPA art 9). The revenue raised by this charge differs significantly

[164] E-mail from Ms Margit Cech, 19-05-2011
[165] E-mail from Ms Margit Cech, 19-05-2011
[166] E-mail from Ms Margit Cech, 19-05-2011
[167] http://www.wien.gv.at/amtshelfer/wirtschaft/mba/genehmigungen/baumentfernung.html

from year to year as can be seen from the table below. From a revenue of €2.7 million in 2005 to only €0.4 million in 2006. The average income from 1999 to 2009 was approximately €0.9 million per year.

The average number of charges issued over this 15 year period is 1 125. However, the actual number of charges issued has varied from approximately 2 475 charges issued in 2005 to some 365 in 2006 with a new peak in 2009 of approximately 2 110 charges issued. There is no link to the size of the charge as this has been stable over the time period. We have unfortunately not been able to get information on the reason for this change – i.e. to understand if it is due to a reduced number of applications for felling trees or if the replanting rate has increased hence fewer charges issued.

**Figure 33 Revenue raised per year in Million €**




Source: OECD overview of economic instruments Scheme Details: Vienna -- Charge for tree protection in Austria[168]

## Administrative Burden

The application form for requesting a permit for tree removal is available online. The applicant must submit the following information which is then assessed by the administration:

- Agreement of land owners.
- Proof of right of disposal - extract from the land or building permits, stock agreement or lease, use agreement or other proof (simple).
- Plan or sketch of the noted location of the tree(s) to be felled, the proposed replacement tree planting and for all other trees (four times).
- Consent of the owners of neighbouring property if the replacement tree planting to be carried out on a different plot of land.

According to the authorities managing the charge, the administrative burden is limited as it is fairly easy to apply for the permit, however the procedure may take some time as it needs to go through several authorities. The fact that many authorities are involved in approving an application for a permit indicates that there may be an administrative burden related to the application of this instrument in Vienna.

We have not been able to find further information on the administrative burdens linked to this measure.

[168] http://www2.oecd.org/ecoinst/queries/index.htm

### Assessment of the effect of the instrument

According to Ms Cech the charge was introduced following pressure from citizens to protect trees. The paradox is that citizens find trees and green areas important at the same time as trees are cut down in private gardens as the citizens do not want the work and responsibility of having trees on their property[169]. The fact that the charge and permit as well as replanting requirement covers both private and public trees thus seems very relevant.

In order for the instrument to be effective monitoring is necessary as the risk of cheating, particularly on private property is noticeable.

## *4.5.3 Lithuania – forest tree protection*

### Context

With the transition into a market economy Lithuanian forestry has, like the rest of the society, undergone a significant restructuring. The fundamentally altered economic conditions and ongoing forest privatisation are key drivers for this change[170]. Contrary to the Nordic countries, where supply of timber has been closely linked to market conditions, the impact of market conditions on timber supply and thus felling of trees can be questioned due to the historically strict regulation, previously allowing no private forestry and where harvesting levels were linked to institutional and management priorities[171]. Forests have seen significant privatisation since 1991. In January 2000, some 20% of Lithuania's forest area had been privatised[172], by 2006, 36% of the forests were privately owned and managed.

State forests are managed by State Forest Enterprises, (SFEs), replacing the Soviet *leskhozes*[173]. The SFEs moreover issue felling permissions and also control private forest owners[174].

In addition to the traditional tasks of forest management, SFEs have the functions of consultancy and control of private forest owners, e.g. issuing of felling permissions. This arrangement is in discordance with market principles as SFEs gain authority over their only rivals in the production of timber.

The Forest Law was adopted in 1994 and was last updated in 2001 (10 April 2001 No IX-240). The law defines forest as areas of land that are no less than 0.1 hectares with trees, the height of their natural habitat, mature age must not be less than 5 meters and other forest vegetation, as well as

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[169] Cech, 24-06-2011 e-mail
[170] Larsen and Brukas (2000)
[171] Larsen and Brukas (2009)
[172] Larsen and Brukas (2000)
[173] Larsen and Brukas (2000)
[174] Larsen and Brukas (2000)

areas where habitation is thin i.e. due to human activities and natural vegetation-loss (cleared, burnt areas, squares )[175].

All forest estates[176] i.e. forest land area managed by the right of private or State ownership[177] are obliged to have a management plan. This plan specifies how the forest shall be managed, utilised and regenerated[178] and also includes requirements for tree cutting and forest restoration.

### Instrument

Between 1991 - 2001 – a so called "Forest fund" was established, this allocated a share of income from state forest enterprises to be used for "general forestry needs". The payments into this fund were differentiated for each enterprise according to forest conditions.

The instrument is defined as a tax set at 5% of income for round-wood and stumpage sales[179]. In the 2001 amendment of the Forest law this was introduced in the legislation (art 7), whereas it was not an integrated part of the legislation before this amendment. The revenues are earmarked for forest protection.

The instrument contains an exemption for small forest owners and income under 8000 LTL (~2 320 EUR) are exempted of the tax.

#### *Reason for introduction*

Based on the information available, it appears that the background for introducing the instruments was partly to obtain funds for forest management to improve the management of the Lithuanian forest resources and partly for funding for the overall state budget. Resource availability was not an objective. The funds for forest management are, inter alia, used for inventory and forest science[180].

#### *Challenges*

No information on challenges has been obtained. One challenge is that as the tax is based on the sale and not on the logging, revenue will fluctuate with the market price and not follow the rate of logging.

### Limitation of the instrument

The instrument put a tax on selling the wood as a percentage of the revenue generated and not a charge on forest felling. It targets sales and not the logging.

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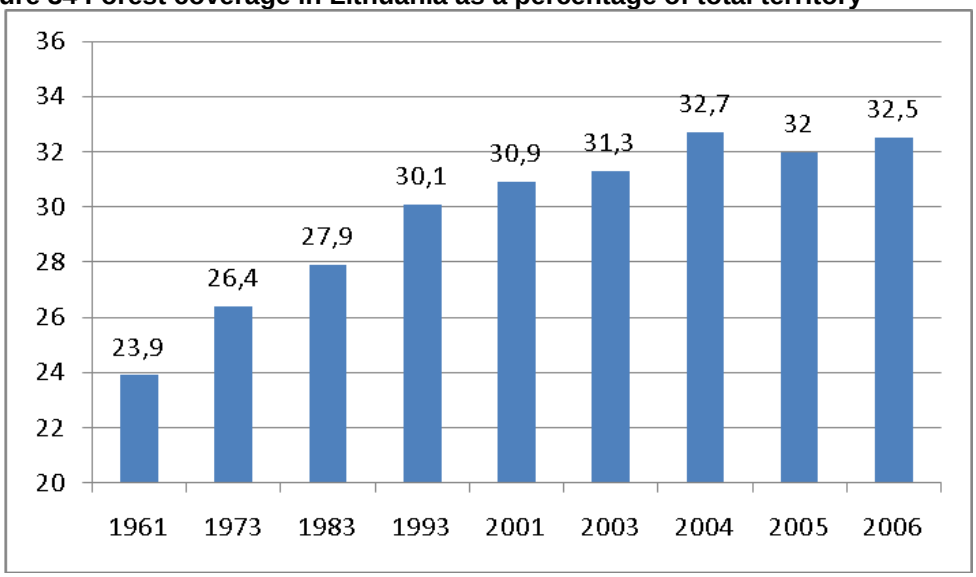
[175] Unofficial translation of the forest Law IX-240 art 2.1
[176] Except estates covering up to 3 ha of forest in small tracks (Forest Law art 17)
[177] Unofficial translation of the forest Law IX-240 art 2.9
[178] Unofficial translation of the forest Law IX-240 art 14
[179] OECD/EEA database
[180] Sadauskiene, e-mail 10.10.2011

## Development in the resource

Forest coverage in Lithuania is increasing, and in 2007 32.7% of the country was covered in forest. A reason for this (re-)forestation is a transformation from unsuitable agricultural land to forested area[181]. It is likely that this will continue and that forests will cover more than 33% of the territory in the coming years[182].

**Figure 34 Forest coverage in Lithuania as a percentage of total territory[183]**




Lithuanian forests are divided into four different groups[184]:

1. Forest reserves;
2. Special purpose forests divided into two subgroups A) ecosystem-preserving forests and B) recreational forests;
3. Protective forests; and
4. Commercial forests.

Only in forest types 3 and 4 is felling allowed. In protected forests (3) felling under specific conditions is allowed e.g. for educational or sanitary reasons. In commercial forests (4) covering all forest areas not falling under categories 1-3, all kinds of felling is allowed however clear cutting areas must not be larger than 8 ha[185].

Felling has increased significantly since the 1980s and there was a surge in harvesting following the introduction of the open market. From a peak in 1995 felling decreased steadily until 1999, when it again began to increase. There was a limited reduction in 2004-2006 before this increase continued in 2007. From 2002 to 2007 the average forest felling was at 6.3 million $m^3$ per year.

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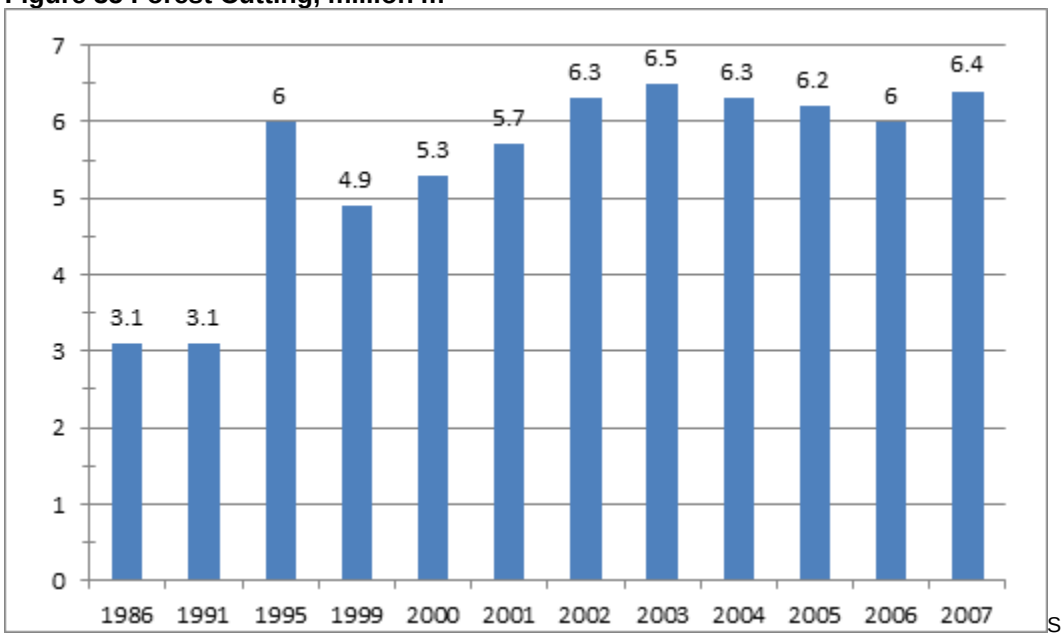
[181] Marozas, year unknown
[182] Marozas, year unknown
[183] Marozas V. (year unknown) based on information from the Global Forest Resources Assessment
[184] Unofficial translation of the forest Law IX-240 art 3
[185] Unofficial translation of the forest Law IX-240 art 3

According to Mr Gintautas Cinga “Replanting and other forestry works are carried out using enterprises' own income. The "general forestry needs" are allocated to cover expenses of the national forest inventory, the general forest directorate, management of protected areas, improvement of genetic forest resources and research and development.”[186]

According to Mr Mr Nerijus Kupstaitis Head of Forestry Policy Unit in the Forestry Department, “The 5% level of the tax is an effective and efficient instrument to finance the common needs of forestry listed above. But the 10% deductions from the revenue to go towards general (not for forestry) public finances, has a negative influence on forest management. This has led to the reduction of some important non-commercial forest management activities (like pre-commercial thinning etc.) due to the reduced financial possibilities of State forest enterprises.”[187]

**Figure 35 Forest Cutting, million m$^3$**




S

ource: Kupstaitis, Ministry of Environment of the Republic of Lithuania and Burkas et.al (2009)

## Costs and revenues

Parts of the income from the tax on timber sale are earmarked for forest protection and management including forest inventory and scientific works organisation, maintenance, forest fire-fighting, consultancy and training of private forest owners[188].

From mid 2009 a part of the timber sales tax has been allocated the general state budget as a consequence of “the economic crisis and

[186] E-mail Mr Gintautas Cinga, 31/5/2011
[187] E-mail Mr Nerijus Kupstaitis Head of Forestry Policy Unit, 1-05-2011
[188] OECD/EEA database on environmentally related taxes, fees and charges, other economic instruments and voluntary approaches used in environmental policy and natural resources management

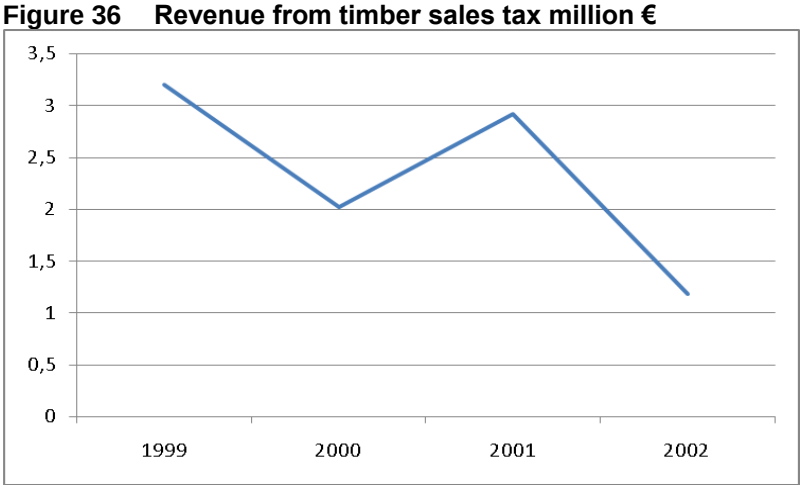
conclusions of State Control Service that the financial return from public forest sector is too small."[189]

**Table 33 Timber sales tax**

| Period | Forest management | General budget | Total |
|---|---|---|---|
| 1997 | 7,10% | | 7,10% |
| 1998 | 5,60% | | 5,60% |
| 1999 | 6,00% | | 6,00% |
| 2000 | 4,10% | | 4,10% |
| 2001 - mid 2009 | 5% | | 5,00% |
| Mid 2009-2010 | 5% | 5% | 10,00% |
| 2011- | 5% | 10% | 15,00% |

We have only had access to data from 1999-2002 but this indicates that there was an annual average revenue of €2 332 000 from forest felling charges. There were however significant fluctuations from year to year.

**Figure 36 Revenue from timber sales tax million €**




Source: OECD/EEA database

As seen from the figure above, revenue from the charge decreases from 2001 to 2002. This, despite the fact that forest felling increased in this year, as seen in Figure 35. Assuming that the rate of the charge was stable – as it is stipulated in the legislation, and we have no indication of any changes being made – the price of timber must have decreased or the full quantities harvested were not sold immediately.

As we have not been able to get any information from stakeholders or policy makers yet, the reason for these fluctuations is still unknown to us.

According to Brukas et.al, timber prices had a "golden age" in the mid 1990s where after they decreased with only a few upturns. However, in the years 2001 to 2003 prices were rather stable before steadily increasing again. This could indicate that not all timber that was felled in 2001-2003 was sold immediately, with timber prices low from an oversupply it may have made more sense to stockpile wood and wait for,

[189] E-mail from Gintautas Cinga 31/5-2011

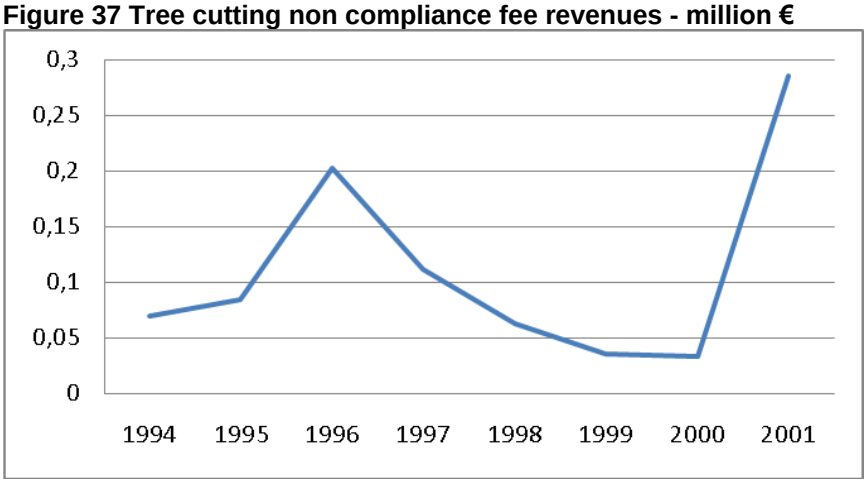
and influence the market towards, higher prices and better sale values. While speculative, this may provide an explanation for why tax revenues decreased as felling increased.

### *Compliance and enforcement*

A charge is levied on those that do not comply with the tree-cutting legislation. The fee is levied on persons or companies causing damage to the forest, hence it is a sanction following non-compliance.

The average revenue generated from the non-compliance fees from 1994-2001 was approximately €110 300 per year. Also here there was a significant increase from 2000 to 2001. The revenue from this fee is earmarked for a special programme to meet general forestry needs.

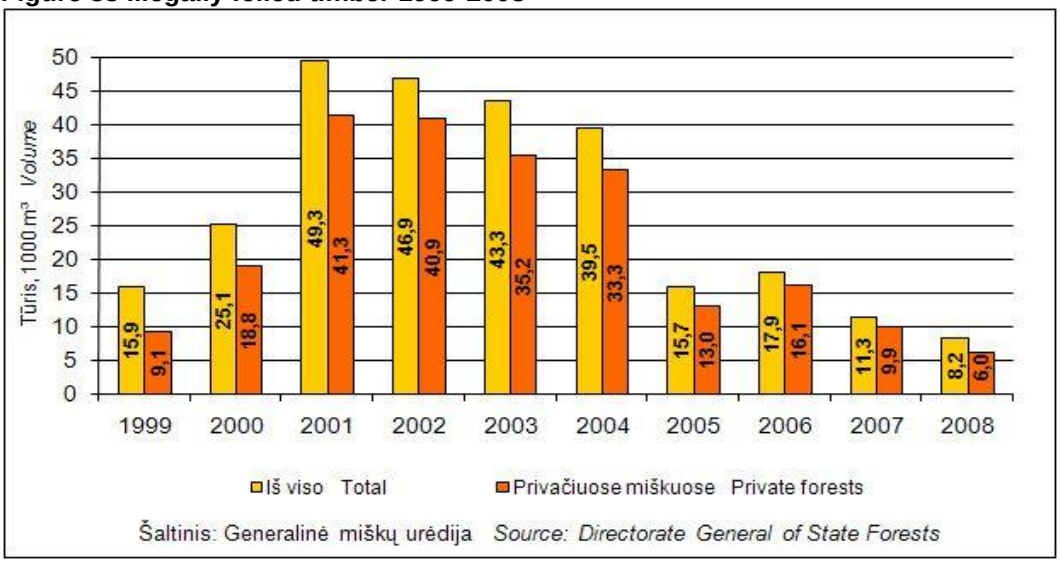
**Figure 37 Tree cutting non compliance fee revenues - million €**




Source: OECD/EEA database

Data on non-compliance is unavailable after this time but data is available in relation to illegal felling. As shown in Figure 38 illegal felling surged to a peak in 2001, from which time it has decreased. Although this change coincides with the introduction of the felling charge into the forest law in 2001 it is difficult to find any connection between the level of the charge and levels of illegal felling. The observed decline in illegal felling is somewhat counterintuitive as a new charge would be expected to lead to evasive behaviour among some loggers. Changes in these figures in 2009, 2010 and 2011 will be instructive, as the rate of the tax will increase from 5%, first to 10% and then 15% over this time.

**Figure 38 Illegally felled timber 1999-2008**




Source: Lithuanian Forestry Statistics

## Administrative Burden

In the early years of the tax, up to 2001, the percentage tax rate was calculated individually for each enterprise. Later the tax rate has become general and this has decreased the administrative burden.

## Assessment of the effect of the instrument

The so called forest felling charges are indeed a tax on income of revenue from timber sales and are not directly linked to the cutting of forest, which is determined by management plans and hard regulations. The tax does not therefore have an influence on regulating the market.

The fact that income is earmarked for forest protection makes it a ‘green’ tax. The cost of administration and collecting the tax is likely to be limited as it is collected together with the normal income tax charged to all Lithuanian companies.

Sales for less than 8000 LTL (~€2 320) are exempted from the tax and small forest owners strive to limit their sales to stay below this threshold. This may lead to less cutting in order to stay under the limit. Figure 36 showed a significant increase in revenue from the tax 2000 to 2001. At the same time Figure 38 indicated an increase in illegal logging – however the increase in the former is greater, so unless the fee was increased it is unlikely that there is a direct link between the two. If such an increase in the charge should have occurred in 2001 the effect on illegal felling is rather limited as only small decreases are seen until 2005 where illegal felling has fallen by more than 50 %. We have not been able to get an indication of the reason for this decrease from the stakeholders contacted.

According to the Lithuanian Research Centre for Agriculture and Forestry[190] regards the tax as an effective instrument to generate funds for general forest management and the fact that the tax is centralised increases the efficiency due to the complex structure of the forest sector in Lithuania with 42 forest enterprises.

### *4.5.4 Conclusion*

We have only been able to gather limited information for these two cases.

The two instruments analysed are different, however a common feature is that the revenue, or part of it, is earmarked for replanting or forest management. The incentive built into the instruments for preservation though is different. Where the charge in Vienna provides an incentive to limit cutting and an obligation for replanting, the Lithuanian tax is targeted at sales rather than the cutting itself.

The Lithuanian model with a combination of hard regulation of cutting levels and earmarking income for forest protection is according to the ministry highly effective. Also the Lithuanian Research Centre for Agriculture and Forestry endorse this measure. Provided that monitoring and enforcement is sufficient, in order to minimize illegal logging, this is a reasonable perception.

The model applied in Vienna seems relevant and well functioning for a city environment and may contribute to maintain green areas in cities which is an important element in creating a living urban environment.

The two instruments thus seems relevant in their given context, however close monitoring and enforcement is pivotal to ensure the desired effect

## 4.6 Drinks container deposit schemes – DE & DK

### *4.6.1 Introduction*

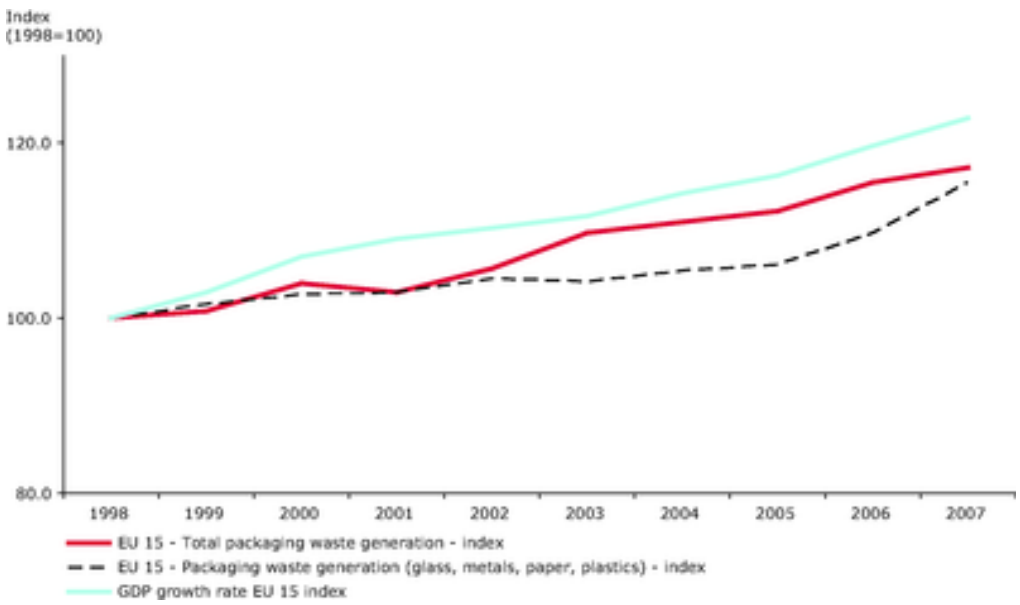
In the past, economic growth seemed to be inexorably connected to the creation of more and more waste. However, in recent times the emerging public discussions on resource competition and scarcity, and anthropogenic climate change, is leading to intense global debate over this erstwhile dogma. As pictured in Figure 39, the relation between growth and packaging waste production of glass, metal, plastics and paper experienced a decoupling point in 2002, though this was only relative as total packaging waste generation continued to increase. Although the increase in packaging waste was lower than growth in GDP, it should be noted that many aspects of activity that generate GDP require no packaging, so this is only a limited measure. However, over the course of around five years (2002 to 2007) the consumption of glass, metal, plastics and paper waste showed a tendency to merge again with the higher levels

[190] Sadauskriene, 10.10.2011 E-mail

of total waste generation. This development shows a worrying trend which can be tackled by a variety of policy instruments.

Most apparent is the waste produced locally by the daily course of life and at the same time it appears to be the most tangible starting point towards a decrease in total waste consumption. According to Eurostat statistics[191] each year around three billion tonnes of waste are produced in the European Union. This amounts to about six tonnes of solid waste for every man, woman and child.

**Figure 39 Graphical Depiction of GDP and Packaging Waste Development in the EU 15**




In order to significantly reduce the amount of waste generated, the EU bases its efforts on three principles: Waste prevention, Recycling and reuse and improvement of final disposal and monitoring. These principles are congruent with the levels in the waste management hierarchy shown in Figure 40. The hierarchy is aimed at extracting the maximum practical benefits from products and generating the minimum amount of waste. The most preferable option is to prevent the production of waste followed by the three ‘Rs’ (reduce, reuse, recycle) and finally energy recovery and waste disposal are the least preferable options of waste treatment.

[191] http://ec.europa.eu/environment/waste/index.htm

**Figure 40 Waste Hierarchy**


Although disposable drinks packaging accounts for only a small fraction of the total packaging waste volume – 2.7% in 2005 according to Roland Berger – they constitute around 20% to 25% of total littering (Witzenhausen Institute) and thus have a very high negative impact on the environment. When comparing one-way (use) and multiple-use beverage containers it is clear that refillable containers are the preferred option for pollution prevention and environmental protection.

One-way beverage containers are filled once and, at best, recycled after use, more often they are simply disposed of, either through energy recovery (incineration) or landfill. Their production and extremely short life cycle is typically energy intensive and generates significant amounts of waste. It can also result in valuable material resources being simply buried and lost. In contrast, refillable beverage containers, such as glass bottles, are typically refilled and circulated over 50 times before they go into recycling (average for water bottles: 53.4 times) according to German Environment Aid (2009). In comparison, a refillable PET bottle is typically used only 13 times before recycling is necessary. Balanced against this the production process for PET bottles consumes less energy than that of glass and due to their light weight, energy consumption during PET bottle transportation and in particular, on long distance haulage, is reduced (Vest, 2003). Therefore, while it can be concluded that refillable containers have a clear environmental advantage over single-use containers, within the field of multiple-use beverage containers the exact trade off between glass and PET bottles is not clear.

One instrument used as part of efforts to reduce single-use container waste is the so-called Container Deposit Scheme. Accepting the need for containers these schemes are positioned within the next two principles of the waste hierarchy, namely reuse and recycling. The basic principle of the scheme relies on a deposit-refund system where the consumer pays a deposit, additional to the product price, which is then refunded on the return of the packaging - in this case beverage containers - for re-use. This provides an economic incentive to increase re-use, decreasing the number of new containers required and the volume of waste generated.

This instrument is focused on, and requires, the cooperation of consumers, and is aimed at:

- reducing littering;
- increasing the recycling rate;
- alleviating the amount waste, and valuable resources, sent to landfill.

*Organisation*

The treatment of waste is traditionally a country-specific topic and is commonly delegated to local communities and municipalities within each respective Member State. However, EU regulations, especially regarding hazardous substances and $CO_2$ emissions (e.g. Directive 2008/98/EC and 2006/12/EC), also underlie waste treatment practices. These regulations aim at encouraging MS governments to promote waste prevention, recycling and processing for reuse. Thus, the means by which reductions in packaging waste in general and beverage container related waste specifically, are achieved, are delegated to the respective national governments so that every MS is able to adopt the approach most suitable to their existing system. This has as a goal to stimulate environmental protection in the industry and society concerned with the production and consumption of packaging waste. MS initiatives on waste reduction however need to comply with existing EU law on the freedom of trade and the principles of the joint EU market.

This might in some cases lead to conflicting guidelines. For example, Denmark, among the leading progressive countries with regard to environmental protection policies, was forced to remove its long-standing ban on aluminium cans as this regulation acted against the free movement of goods in the European Union. The basis being that a ban on this type of product existed in only one country (Denmark) and represented an unfair barrier to trade. Part of the Danish response to this was to pursue an alternative path to the same objectives; this led to a focus on reducing the amount of packaging waste, and, in 2002, to the introduction of a container deposit scheme[192]. However, for most MS the introduction of a container deposit scheme was not a response to conflicting previous regulations. Most MS introduced container deposit schemes in an attempt to curtail the increase, since the 1970's, in packaging material waste, which was, in part at least, resulting from a move away from refillable containers, to new one-way (use) packaging materials.[193]

The introduction of container deposit schemes in the waste material sector is a rather recent development and they were first introduced in the EU by Sweden in 1984. This was a deposit scheme on aluminium cans. A list of countries with a container deposit scheme in place and dates of implementation can be found below in Table 34.

[192] http://www.endseurope.com/746/denmark-planning-to-tax-aluminium-cans
[193] http://www.zerowasteeurope.eu/beverage-packaging-and-zero-waste/

**Table 34: Implementation and Coverage of Deposit Systems for one-way Containers in the EU**

| Country | Date of Introduction | Type of Containers |
|---|---|---|
| Sweden | 1984 (cans), 1994 (PET) | Soft drinks, Beer |
| Finland | 1996 (cans), 2008 (PET) | Soft drinks, Beer |
| Norway | 1999 | Soft drinks, Beer |
| Denmark | 2002 (cans, PET, glass) | Soft drinks, Beer |
| Germany | 2003 (cans, PET, glass) | Soft drinks, Beer, Water |
| Croatia | 2005 | |
| Estonia | 2005 | |
| Netherlands | 2006 (large PET) | Soft drinks |

Source: http://www.zerowasteeurope.eu/beverage-packaging-and-zero-waste/

### *Economic Instrument*

Beverage containers are made from a variety of resources, such as glass, paper, oil (in the form of plastic) and aluminium. Containers are produced as either one-way products or designed for re-use and recycling. The opportunity for re-use of beverage containers, and the saving and recycling resources, depends on efficient and reliable collection systems. Consequently, an important factor in the success of container-deposit type measures is the level of cooperation between consumers and retailers. The biggest difficulty often lies in regulating in a way that creates efficient systems that are consumer-friendly, have the support of industry and protect the environment.

Typically, by means of a deposit scheme consumers pay a marked-up product price and have the incentive to return their beverage containers in order to regain the initial mark-up. Retailers are often supported by the government to introduce the scheme through financing of the “reverse vending machines” placed within their premises.

Although the schemes do not usually result in increased tax revenue (see case of Germany) governments are typically motivated to implement them in order to reduce the costs of landfill and related pollution, in turn safeguarding the environment.

### *Case Countries*

Germany and Denmark have been selected as case studies of container deposit schemes. They represent a sound overview of the systems in place, their focus and implementation. Although the time frame of implementing a Container Deposit Scheme is approximately the same (2002 and 2003 for Denmark and Germany, respectively) the cases differ significantly in the structure, range of coverage and implementation of the systems. For example in Germany no single enterprise has exclusive rights to collect and recycle used beverage containers[194] whereas in Denmark the Dansk Retursystem A/S was founded by the Danish Ministry

[194] http://anker-andersen.com/deposit-laws/germany.aspx

of the Environment solely for the purpose of introducing, operating and administrating the deposit refund scheme. This variation is interesting for the study since it exemplifies the different approaches these MS chose, to implement an effective system within their historical and cultural context.

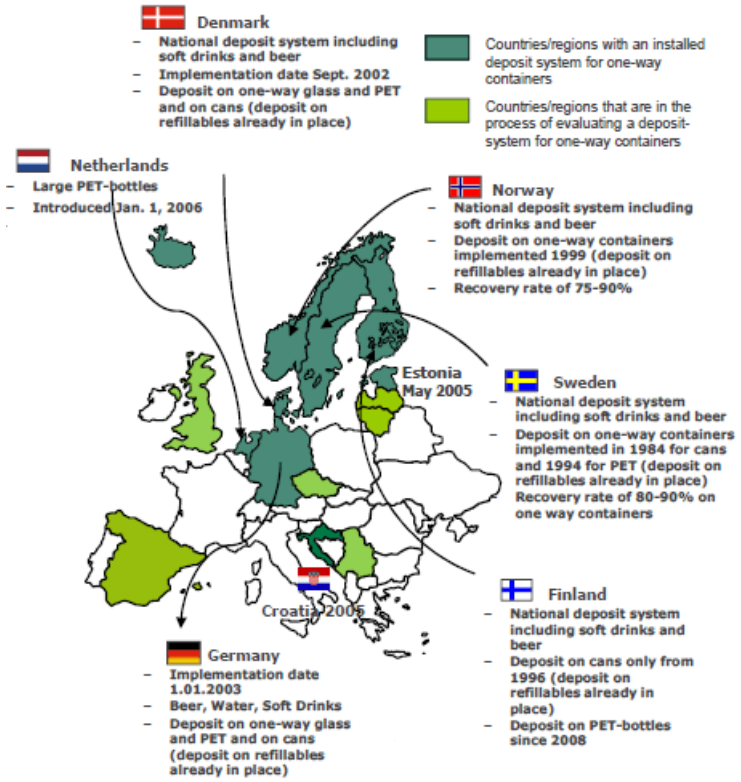
**Table 35: Comparison of Case Countries**

| Indicator | Germany | Denmark |
|---|---|---|
| Year of Implementation of Container Deposit Scheme | 2003 | 2002 |
| Rate of Return | 95% (2007) | 87% (2007) |
| Number of People per Reverse Vending Machine | 3,936 (2007) | 1,897 (2009) |
| Consumption of Packaging Waste per capita 195 | 176 – 200kg | 150 – 176kg |

In comparison to most EU countries, both Germany and Denmark can be said to have advanced environmental protection policies. However, the countries differ in their ways to push for environmental related policies. A study by Liefferink and Andersen (1998) identified Denmark to be the most "activist" green country whereas Germany has largely abandoned its activism of the 1980s in favour of more cautious tendencies in new environmental protection policies. Because of its size and relative political and economic impact, the role of Germany is seen as crucial among member states with 'green' aspirations.[196] The following Figure 41, shows all MS which currently operate a container deposit scheme.

[195] UNEP, http://maps.grida.no/go/graphic/packaging_waste_production_per_capita_in_europe
[196] http://www.informaworld.com/smpp/content~db=all~content=a713773653

**Figure 41: Overview of EU Member States having a Container Deposit Scheme in place**




Source : http://www.zerowasteeurope.eu/beverage-packaging-and-zero-waste/

### *4.6.2 Germany - Container Deposit Scheme*

Frame of German environmental taxation: The Recycling and Waste Management Act (KrW-/AbfG) is the central federal law of the German waste legislation introduced in 1994. It controls basic waste handling and its aim is to ensure environmentally sound disposal of waste and the associated promotion of a recycling economy. The Packaging Ordinance which comprises the Container Deposit Scheme is part of this comprehensive (KrW-/AbfG) law.

#### Container Deposit Scheme (*Pfandpflicht auf Einweggetraenkeverpackung*)

*Delimination*

As part of the Packaging Ordinance, a deposit refund scheme was introduced in Germany in 2003.

*Context*

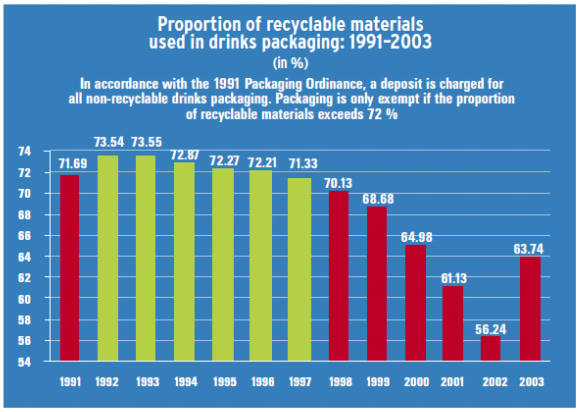
In 1991, the Green Dot (*Gruene Punkt*) was introduced as part of the Packaging Waste Ordinance, operated by Duales System Deutschland GmbH (DSD).

DSD is a not-for-profit organisation, separate from the local municipal recycling schemes, which recovers and recycles packaging in Germany on behalf of its licensees (any company wanting to sell their end-consumer

products in Germany can apply for a Green Dot license).[197] This system established a voluntary recycling mechanism under which refillable bottles could bear a deposit. According to Roland Berger (2009), under this system around 80% of reusable bottles were returned, but the overall numbers of refillable bottles were in decline.

Since the emergence of beverage cartons and one-way glass bottles in the early 1970s and the parallel decline of refilling, the discussion about beverage packaging grew. After a variety of proposed measures between 1977 and 1997, such as quotas, tradable permits and taxes, failed to have a substantial environmental impact, the decision was taken by Environment Minister Trittin to uphold the existing law requiring deposits on only those beverage sectors where the proportion of recyclable materials in the container fell below 72% (1991 was taken as a base year) as depicted in Figure 42. This was in response to a decline in levels of recyclable materials used in drinks packaging from the late 1990s.

**Figure 42: Development of proportion of recyclable materials in beverage containers from 1991 to 2003**




Source: Gesellschaft für Verpackungsmarktforschung GmbH (GVM, Society for Packaging Market Research)

On 1 January 2003, the compulsory deposit refund scheme was introduced; this was initially constituted under part of the 'Packaging Ordinance' of 1991, where provision for such a scheme had been made but only on a voluntary basis. Resistance to a mandatory scheme from both the industry and the public had been expected, but was put to one side with the scheme. The scheme covers single use beer and soft drink cans, PET bottles as well as single-use glass bottles. The Government set a deposit/refund of €0.25 per item with a volume between 0.1 to three litres. The structure of the regulation was organized as a retail-specific return scheme, meaning that items could only be returned to the retailer where originally bought, called the "Island Solution". This system proved to be very inefficient in the collection of returnable containers, showing a return rate of only one bottle in five[198], much lower than the 80% rates achieved prior to the scheme. Due to the inflexibility of the return system

[197] http://www.tradeangles.fsbusiness.co.uk/articles/green_dot.htm
[198] http://www.sueddeutsche.de/wirtschaft/dosenpfand-aldi-lidl-und-die-inselloesung-1.814718

and its impracticality consumers refrained from using it, causing a twofold effect. On the one hand, less of the beverages liable for the deposit were purchased, causing frustration among producers, on the other, retailers gained around €500 million in the first 11 months, from deposits retained from non-returned containers[199].

As a response, a third amendment was developed in 2005 and, after a transitional period, the so-called "Point Solution" came into effect, obligating distributors to accept all returned containers from 1 May 2006. This change was highly successful and has resulted in the highest container return rate in the world, around 98.5% of bottles being returned[200].

The organisation of the deposit refund scheme in Germany is currently under the responsibility of the Deutsche Pfandsystem GmbH (DPG). The DPG provides the legal and organizational framework for settlement of the deposits (deposit clearing) between those companies participating in the system. To this end DPG has developed a set of standards for a uniform labelling procedure that enables the automatic collection of one-way drinks packaging subject to compulsory deposit.

DPG does not, however, discharge the function of a central clearing organisation that undertakes settlement of the deposits for those companies involved. Instead it provides the participating companies a framework system within which DPG participants can undertake this settlement between themselves.

There exist four exceptions to the Pfandpflicht scheme's applicability[201]. The first exception aims at protecting small vendors from disproportionate economic obligations. Shops with a floor space of less than 200m$^2$ are allowed under the law to restrict the return of bottles in their sites to the brands which are part of their product portfolio. The second exception applies to containers of multiple-use. Under the scheme, only one-way containers are subject to the deposit whereas multiple-use containers can only be returned to retailers who voluntarily state their participation in the system.

Thirdly, beverage containers with a volume less than 0.1L or bigger than three litres, do not fall under the applicability of the Deposit Scheme. Finally, packaging regarded as ecologically friendly, such as cardboard packaging, are exempted from the scheme in order to foster the purchasing of these containers.

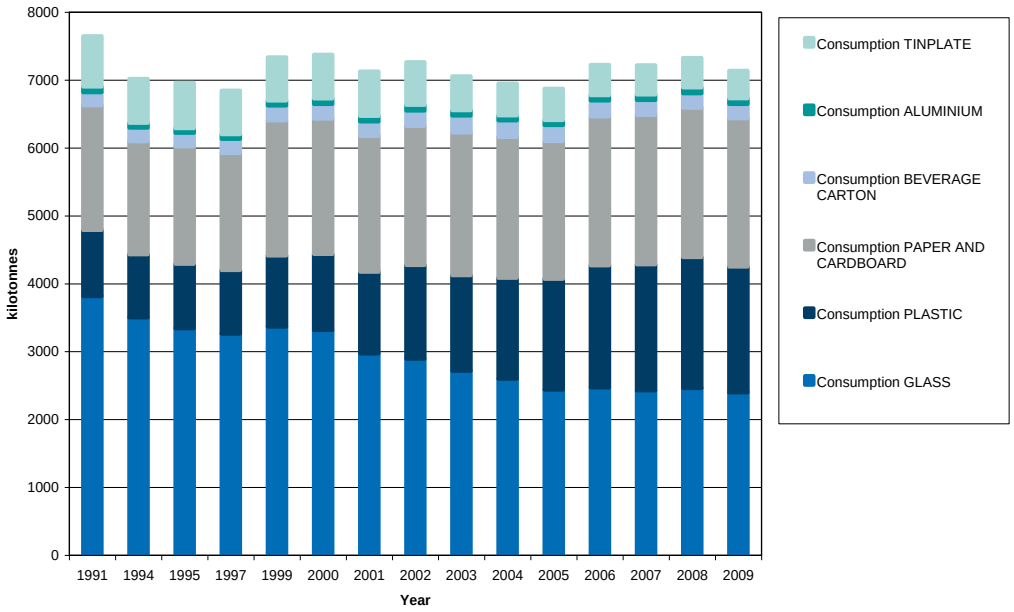
### The Development of (Packaging) Waste Consumption in Germany

[199] http://www.sueddeutsche.de/wirtschaft/dosenpfand-aldi-lidl-und-die-inselloesung-1.814718
[200] http://www.zerowasteeurope.eu/beverage-packaging-and-zero-waste/
[201] http://www.dpg-pfandsystem.de/pb/site/dpg/node/210584/Lde/index.html

As can be seen from Figure 43 below, since the introduction of the Packaging Ordinance in 1991, Germany has decreased the amount of glass, tinplate, aluminium and beverage cartons it consumes. In contrast, the amount of plastics and paper consumed in packaging showed a tendency to increase - or in the latter case - maintain the same levels over the time period of 1991 to 2005.

Additionally, some materials, such as glass and tinplate show a sharp decline in waste amount in 2003 presumably due to the introduction of the mandatory container deposit scheme. Paper, beverage carton and aluminium show significant declines in the 2004 numbers, just one year after the introduction of the mandatory deposit refund scheme was introduced.

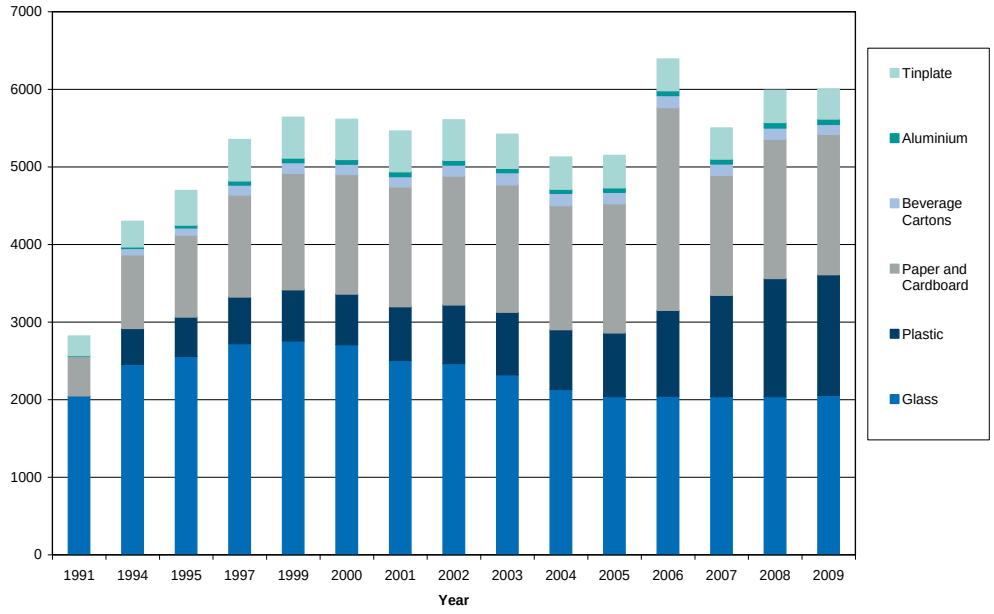
**Figure 43: Sales packaging consumption in Germany 1991-2009 (in kilotonnes)**




Source: Ecorys based on data from Gesellschaft fuer Verpackungs Marktforschung mbH (GVM)

Similarly, increasing percentage rates for recycling of the respective materials can be identified such as for paper, aluminium and tinplate.

**Figure 44: Recycling amounts of packaging waste, Germany 1991-2009 (in kilotonnes)**




Source: Ecorsy based on data from Gesellschaft fuer Verpackungs Marktforschung mbH (GVM)

The recycling percentage rate for glass and beverage cartons maintained its level on a rather steady base and does not distinguish greatly over the observed period of time. When looking at the pre-container deposit scheme period (1991 – 2003) it is evident that initially all materials experience a sharp increase of recycling rates between 1991 to 1995; in the most extreme cases - Aluminium and Plastics – increases of 45.9% and 50.3%, respectively. This jump of actual recycling quotas can be explained by the introduction of the Packaging Ordinance in 1991 which specified the following quotas:

**Table 36: Material recovery rates as set by the Packaging Ordinance 1991**

| Material | Recovery and Recycling Rates |
|---|---|
| Glass | 75% |
| Aluminium | 60% |
| Tinplate | 70% |
| Paper/Cardboard | 70% |
| Plastics | 60% recovery/36% recycling |

Source: German Environment Aid (Umwelthilfe), 2009

In the subsequent period of 1994 to 1997, the recycling quotas continue to increase in a milder manner but still increasing the total recycling rate from 61.9% to 78.2%.

In contrast, the period between 1997 and 2000 is characterized by a slow down and reduction of recycling waste in glass, tinplate, aluminium and plastics while amounts consumed increase over the same time horizon.

Paradoxically, after the introduction of the container deposit scheme, recycling rates for plastic and aluminium packaging waste materials fell

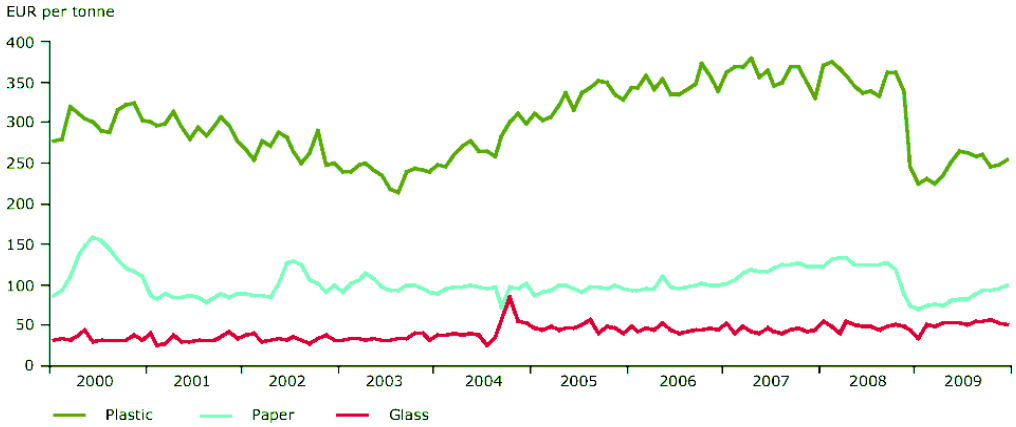
compared to the pre-container deposit scheme period of 2000. However, other materials further increased their recycling rates. Tinplate especially reducing its total consumption from 645 kilo tonnes (2000) to 498 kilo tonnes (2003) while increasing recycling rates from 79.8% to 87.7% over the same period. This observation might indicate an initial failure of the container deposit scheme to reduce the amount of plastics and aluminium packaging waste but having a positive impact on the reduction of other waste materials. However, this raises the question about the scheme's success in promoting environmentally friendly beverage containers and its effect on increasing recycling rates of packaging waste covered by the scheme, namely plastic bottles and aluminium cans.

Overall, the post-scheme (2003-2005) trend shows that beverage cartons maintain approximately the same level and plastic being the only material experiencing a negative trend in its recycling quota. In contrast, recycling rates for aluminium, paper, glass and tinplate increased.
This observation is coherent with, and can be partly explained by, Figure 45 which depicts the development in unit price of waste plastic, paper and glass on a monthly basis from January 2000 to December 2009. The graph shows a high price for plastic waste materials over the entire period, ranging between €250 to €400 per ton, followed by the price of paper varying between €75 and €150 per ton. The least valuable waste material according to Figure 45 is glass, showing a rather stable price over the 10 year period within the range €0 to €50 per ton. More specifically, the price of plastic waste material shows a downward sloping trend over the pre-container deposit scheme period (2000-2003) with a turnaround point around mid-2003 followed by a subsequent increase in plastic waste material prices until the end of 2008. Although it is unclear if plastic prices of EU traded waste materials are influenced by the introduction of the container deposit scheme and the potential increase in recycling in Germany, it is interesting that recycling rates for plastic packaging materials decreased over the same period that plastic waste material was becoming more valuable in the European market.

At the end of 2008 a sharp decline can be observed in all three material prices, presumably due to the economic crisis. However already in mid-2009, waste material prices were increasing for all three types, indicating the resilience in markets for these resources. The prices are calculated as weighted averages of a number of sub-waste fractions for both export within and outside of the EU[202] and thus give a reliable picture of the demand for those waste materials. In summary, the price development of these waste materials is assumed to constitute an attractive market for the recycling and reuse of beverage containers.

[202] External trade database, Eurostat; 2010; http://appsso.eurostat.ec.europa.eu/nui/show.do?query=BOOKMARK_DS-016890_QID_60911498_UID_-F171EB0&layout=PERIOD,L,X,0;REPORTER,L,Y,0;PARTNER,L,Z,0;PRODUCT,L,Z,1;FLOW,L,Z,2;INDICATORS,L,Z,3;&rankName1=REPORTER

**Figure 45: Price Development of Waste Materials (Plastic, Paper, Glass) in Europe between 2000 and 2009**




Source: http://www.eea.europa.eu/data-and-maps/figures/price-developments-for-selected-waste

The container deposit scheme contributes to the recovery of large amounts of plastic waste in the form of beverage containers. From the price developments depicted in Figure 45 it is apparent that collecting plastic waste is a potentially lucrative business due to rising prices, meaning economic growth can go hand in hand with environmental protection.

## Revenues and Effect of the Deposit Refund Scheme

Table 37 summarises the financial position of the operation of the Deposit Refund Scheme from the perspective of the German industry involved in the Container Deposit Refund Scheme. Estimated one-off start-up costs of €726 million were incurred by the scheme, primarily in the purchase and installation of the reverse vending machines. Ongoing annual costs, including depreciation of the initial investment, total approximately €792.7 million. Benefits and revenues from the scheme are estimated to total €507 million. Secondary raw material income, retained deposits and the saving of costs otherwise spent in the system previously in place (dual system) yield the greatest earnings of the system, while costs incurred during logistics, redemption and clearing (administration) constitute the biggest share in the costs.

Comparing the annual costs to the economic benefits of the scheme it can be identified that total annual costs exceed total annual earnings on the Deposit Scheme and thus resulted in a ‘loss’ of €285.7 million in 2007. Even taking the depreciation and interest costs from the initial investment out of the equation the scheme would still be deemed to run at a significant (~€135 million) annual deficit.

**Table 37 Cost Estimation of the Container Deposit Scheme base on Roland Berger (2007)[203]**

| Item of Calculation | Data According to Roland-Berger Study (2007) |
|---|---|
| Total Number of Reverse Vending Machines | 20,960 |
| Average Investment per Machine | €33,500* |
| Total Investment | €726 million** |
| Depreciation | €102.7 million |
| Interest | €43.4 million |
| Costs incurred during logistics, redemption and clearing | €646.6million |
| Security Costs | ** |
| Other | n/a |
| **Total Annual Costs** | **€792.7 million** |
| Secondary raw material income | €82 million |
| Assumed rate of return | 95% |
| Earnings on non-returned containers (*Pfandschlupf*) | €175 million*** |
| Opportunity (Costs)/Benefits of not using the Dual System | €250 million |
| Other Earnings | n/a |
| **Total Earnings** | **€ 507 million** |
| **Net Total** | **- €285.7 million** |

* infrastructural costs average €3,500

** security cost of initial start-up amounting to €23.8million are included in total investment

*** These 'earnings' are not necessarily a positive from the scheme, from a resource efficiency point of view they suggest materials lost as resources by being disposed of outside the return / recycling system

The presented data is based on analyses performed by the consulting firm Roland Berger on behalf of industry agents. For this reason the data has to be regarded with caution, with potential for some bias towards the industry view, which given their opposition to the scheme is likely to tend towards a more negative view.

In Germany, the deposit refund scheme does not yield economic benefits (according to the Roland Berger Study conducted in 2007) however it is regarded as the best option available to control waste streams, increase recycling rates and educate consumers. However, in recent years, big discounters and supermarkets realize their profits from the system. Firstly, additional revenues from not-returned deposit containers are gained and secondly, the deposit paid by consumers can be regarded as a free-of-charge mini-credit which sums up to millions providing financing opportunities.[204]

Next to the pure economic incentives for the implementation of this scheme, one has to look at the other effects, which are not easily quantifiable and thus do not appear in the above calculations. One example of such a positive effect, supporting continuation of the scheme,

[203] Roland Berger (2007), a study on behalf of AGVU, and Prognos AG (2007), a study on behalf of APEAL / The Association of European Producers of Steel for Packaging, Ball Packaging Europe Holding GmbH & Co. KG, SKB – Stichting Kringloop Blik (NL).

[204] http://www.umweltjournal.de/AfA_recycling/16896.php

is improved awareness and uplift in the recycling rates of all materials, due to changes in cultural attitudes and behaviour[205]. Although there are not yet studies which prove this specific point, it is these types of effects that are likely to play a valuable role in the continuation of the scheme. Another example of an intangible effect of the container deposit scheme is the incentive for industry to develop innovative and environmental friendly beverage packaging, to avoid inclusion in the refund scheme. Triggering innovation is one of the desired side-effects of the national government but again this is difficult to quantify. Other effects could include a reduction in littering or less injuries and damage from broken glass and other disposable containers.

In summary, the container deposit scheme is not intended as a means to generate additional tax revenue but is based on environmental protection objectives. This means that rather than looking at industry cash-flows generated by the system an analysis of the increase in environmental safeguarding should be held relevant.

### Administrative Burden

The core task of the DPG, the government appointed administrators of the scheme, is constituted by organising the interaction of the various parties involved in it. This means setting standards and frameworks while ensuring their practicability for industry and consumers. Especially the central database, labelling and the so-called deposit-clearing (*Pfandclearing*) is part of the responsibilities of the DPG. From Table 37 it can be seen that exactly these activities account for the greatest share in the total costs position (€646.6 million in 2007).

### Assessment of the Effect of the Instrument

In order to assess the effectiveness of the instrument it is essential to recall the objective and its long-term aim. The Container Deposit Scheme relies on a 'deposit-refund' system increasing purchasing prices by a certain amount which can be regained by showing a desired behaviour, in this specific case the collection of beverage containers and thus the avoidance of littering. To differentiate, firstly the usage of ecologically advantageous beverage containers should be promoted. In this case the use of ecologically disadvantageous drinks packaging should become unattractive by incentives to carry out the substitution on the demand side. Secondly, the government set their goal to make ecologically disadvantageous containers unattractive, achieving an increase in waste collection and the avoidance of littering, by refunding the deposit to consumers[206].

When looking at the first goal, the reduction of ecologically disadvantageous containers by means of substitution on the demand side, the market share of the respective form of container can be observed in

[205] http://www.pro-e.org/files/08-11_Position_Paper_Mandatory_Deposit_RBV01.pdf
[206] Groth, 2008 retrieved from: www.leuphana.de/vwl/papers

order to examine the success of the instrument. In Table 38, Groth (2008) illustrates the development of market share of reusable beverage containers in Germany. It is clearly observable that the percentage of reusable drinks package is declining, from 71.7% in 1991 to 56% market share in 2005. Thus it can be concluded that the instrument (up until 2005) failed to increase the use of ecologically-friendly refillable packaging. Additional evidence to this point is delivered by Pro-Europe who claim that "the quota of refillable containers for main beverage sectors is decreasing after reaching a short peak during the initial introductory phase of the deposit system."[207] Yet these rates were recorded before the scheme switched from the 'island' based system to one where consumers could return their containers at most retailers stores, data from 2006 onwards would be interesting in illustrating if this made any difference.

**Table 38: Market Share of reusable Beverage Containers in Germany[208]**

| Beverage Range | 1991 | 1993 | 1995 | 1997 | 1999 | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|---|---|---|---|---|---|---|---|---|---|
| Mineral Water | 91,3 | 90,9 | 89,0 | 88,3 | 84,9 | 74,0 | 68,3 | 73,0 | 67,6 | 60,5 |
| Non-carbonated soft drinks (incl. juice) | 34,6 | 39,6 | 38,2 | 38,8 | 34,8 | 33,2 | 29,5 | 24,0 | 23,6 | 17,4 |
| Carbonated soft drinks | 73,7 | 76,7 | 75,3 | 77,8 | 74,9 | 60,2 | 54,0 | 65,4 | 55,9 | 54,5 |
| Beer | 82,2 | 82,3 | 79,1 | 77,9 | 74,8 | 70,8 | 68,0 | 89,2 | 87,5 | 88,5 |
| Wine | 28,6 | 28,9 | 30,4 | 28,1 | 26,8 | 25,4 | 25,3 | 24,6 | 20,0 | 19,0 |
| **All beverages (without milk)** | **71,7** | **73,6** | **72,3** | **71,3** | **68,7** | **61,1** | **56,2** | **63,6** | **60,3** | **56,0** |

Source: Groth (2008)

With regard to the second aim, the reduction of littering and the increased waste collection rates, reference can be made to the observation made in Figure 44 which clearly shows an increase in total recycling from 1991 to 2005. The German Environment Aid (*Deutsche Umwelthilfe*) states that until 2002 around 20 to 25% of all littering were constituted by one-way packages in Germany.[209] Further the Environment Aid claims that according to a study conducted by Witzenhausen Institute the proportion of containers under deposit in litter disappeared entirely with the introduction of the mandatory container deposit scheme in 2003. Although, at this moment in time there are no recent numbers available on overall littering amounts in Germany it can be assumed that the reduction of around 20% of one-way containers littering will lead to a decrease in the amount of total litter. In 2005, 74.9% of all waste materials were recycled compared to a rate of only around 37% in 1991. More recent data from the Ministry for Environment in Germany shows that in 2008, this number increased to around 81.6%.[210]

[207] http://www.pro-e.org/files/08-11_Position_Paper_Mandatory_Deposit_RBV01.pdf
[208] Source: Groth 2008 based on BMU data
[209] www.repak.ie/files/Juergen%20Resch.pdf
[210] http://www.bmu.de/files/pdfs/allgemein/application/pdf/entw_verbrauch_verwertung_bf.pdf

When looking in the container deposit collection history, data shows that Germany already experienced high return rates in 1998 when no mandatory system was in place[211] (see Table 39).

**Table 39: Return Rates of Beverage Containers in 1998**

| Beverages included in the early Deposit Schemes[212] | Rate of Return in 1998 |
|---|---|
| Beer | 84% |
| Mineral Water | 92% |
| Soft drinks | 76% |
| Wine | 40% |

It can thus be assumed that the compulsory participation in the refund-deposit scheme introduced in 2003 enjoyed a good base of consumer acceptance and established behaviour to build from. The extremely high overall return rate of an estimated 95% (in 2007 according to Roland Berger) is proof of the success of the instrument in achieving its second goal, namely the increased collection of waste and the related reduction in littering.

In conclusion, the effects of the German deposit scheme are twofold. On the one hand it appears that the promotion of environmentally friendly beverage containers was not successful, at least not by 2005. Some critics have focused on this failure of the container deposit scheme and argue that other mechanisms would be more successful in promoting the desired goal. On the other hand however, the collection rates are estimated to be very high and the rates of recycling have been increasing steadily over recent years. This leads to the overall conclusion that the container deposit scheme in Germany has been successful in improving systems to deal with waste following purchase of a good but has been less successful in encouraging more sustainable and resource efficient consumption choices among consumers.

As a final and important point the scheme appears, based on the available data, to also be highly expensive to implement and administer, with net costs of approximately €285 million each year.

### *4.6.3 Denmark – container deposit scheme*

#### Frame of Danish environmental taxation

Denmark has had a deposit/refund system since 1984; originally this scheme was directed at the collection of refillable beverage containers[213]. Over the years, Denmark has placed an increasingly strong focus on the prevention of the use of non-refillable containers and the use of aluminium

[211] http://www.bottlebill.org/legislation/world/germany.htm
[212] http://www.grrn.org/beverage/refillables/Europe.html

[213] http://www.pro-e.org/Denmark

cans was completely banned. The implementation of a mandatory container deposit scheme on non-refillable containers was established in 2002, based on the Statutory Order No. 713.

#### Delimitation

The overall legal framework for waste management is given by the Environmental Protection Act. However specific Statutory Orders transposed the provisions relating to packaging and packaging waste.

### Context

Before 2002 domestically produced beer and soft drinks were only sold in reusable glass and plastic bottles with a deposit while cans were prohibited. The packaging had to be approved by the Danish EPA. Imported beer and soft drinks could be sold in one-way glass and plastic packaging (with a deposit). Each producer and importer was obliged to set up a deposit and return system.
However, this legislation violated EU law and Denmark was forced to adapt to EU legislation. More specifically, the ban on cans violates the EU Directive on Packaging and Packaging Waste because it contravenes the Directive's purpose of harmonizing the management of packaging across the EU. The EC also argued that the ban is a trade barrier under Article 28 of the EEC Treaty.[214]

In 2002 the regulation was changed, allowing all beer and carbonated soft drinks to be sold in one-way packaging, including metal cans. At the same time a common deposit-return system was established to cover all one way packaging for beer and carbonated soft drinks. The initiation of establishing a container deposit scheme was taken by brewing and retail trades in partnership with the Danish Environmental Protection Agency. The deposit is between €0.13 and €0.40 depending on the volume of the packaging.[215] In 2005, the system was expanded to include all alcoholic sodas, ciders and energy drinks. The 2008 amendment expanded the scheme to also cover mineral water bottles.

The implementation of the deposit/refund system was assigned to the Dansk Retursystem A/S and exclusive rights for administration and operation were granted for a six year period. It is a private non-profit organisation that was established in 2002 to run the deposit-refund scheme as approved by Statutory Order no. 634 from the Danish Ministry of the Environment. All producers, bottlers and importers of beverage containers are obliged to sign up with Dansk Retursystem A/S to legally distribute their products in Denmark.

In contrast to Germany, where non-collected deposits stay with the retailers, in Denmark non-collected deposits are kept by Dansk Retursystem A/S and spent partly on improving the efficiency of the

[214] http://anker-andersen.com/deposit-laws/denmark.aspx
[215] http://scp.eionet.europa.eu/facts/factsheets_waste/2006_edition/Denmark

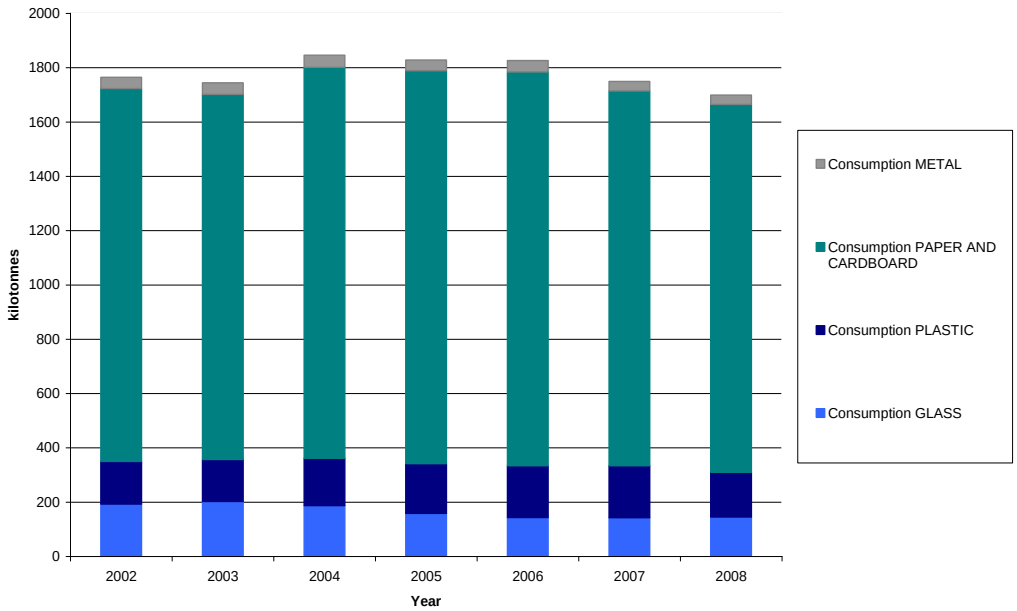
reverse vending process at the retailers and partly on funding a number of social and environmental programmes.

## The Development of (Packaging) Waste Consumption in Denmark

Denmark is bound by the provisions of the EU Packaging and Packaging Waste Directive. However, the transposition in national legislation took a different turn compared to other countries because Denmark already had a packaging waste management system in place, thanks to which the targets set by the Directive had already been reached in 2001[216].

Total waste generation in Denmark is increasing at similar rates to economic growth. The increase in total waste generation per capita was 45 % from 1994 to 2008, compared with an increase in GNP per capita of 32 %. The total amount of waste generated per capita per day was approximately 7.8 kg in 2008. The total amount of waste increased from 13.0 million to 15.6 million tones between 2000 and 2008. However in recent years, there has been a tendency for stagnation.[217] According to the Danish Environmental Protection Agency (DEPA), packaging waste accounts for only 7% of total waste production.[218] In 2007, packaging waste experienced the highest recycling rates (88%) for glass packaging, but recycling rates for paper and cardboard (61%), and metals (87%) were also above the EU average.[219]

**Figure 46: Index for total waste generation per capita**




Source: Ecorys based on Miljøprojekt Nr. 1333 2010, Statistik for genanvendelse af emballageaffald 2008: http://www.mst.dk/Publikationer/Publikationer/2010/09/978-87-92668-17-2.htm and http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/udgiv/publikationer/2006/87-7052-286-3/html/sum.htm

[216] http://www.pro-e.org/Denmark
[217] http://www.eea.europa.eu/soer/countries/dk/soertopic_view?topic=waste
[218] DEPA (1999). Waste in Denmark. Ministry of Environment and Energy
[219] http://www.eea.europa.eu/soer/countries/dk/soertopic_view?topic=waste

## Revenues and Effects of the Deposit Refund Scheme

The deposit refund scheme in Denmark is under the control of the Retursystem A/S and financed by fees paid by importers and producers for the packaging that they sell on the Danish market. Total fees can be divided into firstly; logistics fees aimed at covering administrative overheads, handling fees and efficiency improvements in grocery stores. Secondly, collection fees, which cover the costs of collecting and counting one-way packaging. Retursystem is a non-profit organisation and achieves a clearance of accounts by adjusting fees on an annual basis. [220]

### *Cash flows generated*

Any 'revenue' generated is due to deposits that are not claimed by consumers and stay with Retursystem A/S. These funds are spent on improvements to the Danish deposit and return system, as well as on community projects. In 2008, Dansk Retursystem A/S spent DKK 3 million (~ € 0.4 million[221]) on such projects. [222]

In 2008, Dansk Retursystem A/S stated on their website a turnover of DKK 842 million (~ € 122.91 million[223]).

Although the exact composition of container types (A, B and C see Table 40) is unknown, it was assessed that Danish consumers returned around 446 million empty items of packaging on which deposits were payable: ~57 million glass bottles, ~99 million plastic bottles, and ~290 million cans.[224]

**Table 40: Danish deposit scheme**

| Type | Coverage | Deposit |
|---|---|---|
| A | Cans, glass and plastic bottles under 1 litre | DKK 1.00 |
| B | Plastic bottles of 0.5 litres | DKK 1.50 |
| C | Cans, glass and plastic bottles of 1 litre and over | DKK 3.00 |

Source: Pro Europe

### *Collection rates*

In its first two years of operation (2003 and 2004) Denmark's new common deposit-return system for disposable beverage packaging achieved a total recovery rate of 80 to 83% for disposable packaging for beer and soft drinks. In 2005, 84% was recycled. The recovery of disposable packaging was thereby falling short of the target of 95% by 1 January 2005. Actual return rates can be extracted from Table 41 and compared against a target total collection rate of 95% by 2013.[225]

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[220] http://www.dansk-retursystem.dk/content/us/about_dansk_retursystem/finances
[221] ECB Average Conversion rate 2008: 1DKK= 0.1341EUR Available at: http://www.ecb.int/stats/exchange/eurofxref/html/eurofxref-graph-dkk.en.html
[222] http://www.dansk-retursystem.dk/content/us/the_danish_system/facts_and_figures
[223] ECB Average Conversion rate 2008: 1DKK= 0.1341EUR Available at: http://www.ecb.int/stats/exchange/eurofxref/html/eurofxref-graph-dkk.en.html
[224] http://www.dansk-retursystem.dk/content/us/the_danish_system/facts_and_figures
[225] http://www.dansk-retursystem.dk/content/us/the_environment/returns_percentages_are_important

In contrast, the return rate for refillable packaging – operated by breweries themselves – was approx. 100% in 2005[226] and 102% in 2008. These extremely high return rates for multiple use beverage containers can be explained by Denmark's active policy history, only allowing for refillable containers. In particular the collection of over 100% is accomplished due to the fact that more bottles were returned in one year than sold in the same year. Thus, bottles bought in 2007 and returned in 2008 may allow the return rate to be higher then 100%.

The country's policy strategy has led to an institutionalization of refillable container use and Denmark thus, distinguishes itself from the German case, where falling multiple-use container rates could not be absorbed by the implementation of a container deposit scheme.

**Table 41: Actual Return Percentages for single-use beverage containers**

| Returns percentages for one-way packaging by material type | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|
| Metal | 83% | 84% | 84% | 83% |
| Plastic | 88% | 88% | 93% | 93% |
| Glass | 87% | 87% | 91% | 93% |
| Total Packaging | 84% | 86% | 87% | 88% |

Source: Retursystem A/S

## Administrative burden

Administrative costs of the Dansk Retursystem A/S were approximated by the EEA and are represented in Table 42 below. Costs of €30 million in 2004, compared to turnover of €123 million in 2008, point to administrative costs of approximately 25% of turnover. Against revenue (i.e. retained refunds from non-returned items) of €0.4 million, the scheme is administered at a significant cost. These costs are proportionally higher than in the German scheme on a population basis, i.e. Germany has around 15 times the population of Denmark but administration costs of €285 million are less than 10 times as large – this may indicate administrative economies of scale in Germany, but also the greater complexity of the Danish scheme.

**Table 42: Summary of administrative costs implied by the container deposit system**

| Year | Amount of Administrative costs (in million EUR, approximated) |
|---|---|
| 2000 (first six months) | € 4.3 |
| 2001 | € 12.8 |
| 2002 | € 17.0 |
| 2003 | € 28.6 |
| 2004 | € 29.7 |

[226] http://www.dansk-retursystem.dk/content/us/the_danish_system/danish_deposit_and_return_system

Shortly before the implementation of the deposit refund scheme, at the beginning of 2002, small importers of foreign beer products claimed that the planned system was too expensive and was acting as an import barrier limiting the range of beer products that could be marketed in Denmark. However, the actual implementation of the system proved the opposite effect. Between 2002 and 2006 the quantity of beer imported increased from 4 million litres to 13 million litres. Similarly, the amount of producers and importers increased from 269 to 343. Finally, also the variety of goods could be extended over this period, from 2050 in 2002 to 4918 in the year 2006. This illustrates that although some administrative burdens were present, they were largely borne by the consumer and Dansk Retursystem A/S, the burdens on business did not pose barriers to a significant expansion in related sectors.

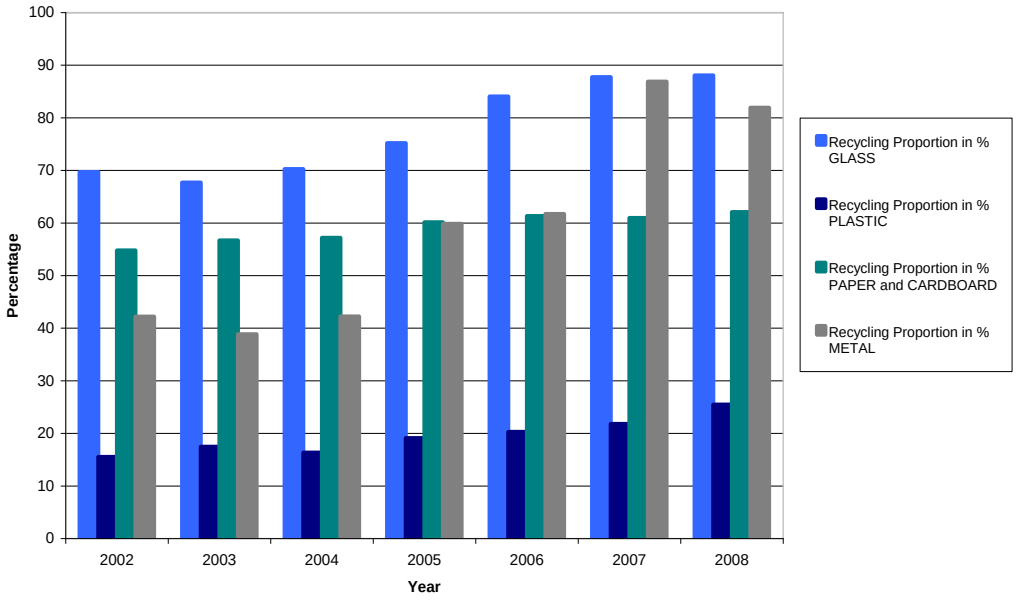
### Assessment of the Effect of the Instrument

The original objective of reaching a return and recycling quota of at least 95% by the end of 2005 was not achieved. Instead the total rate of return for one-way containers had reached 84% at the end of 2005.

As a reaction, objectives were revised, setting the initial goal in a time frame to be achieved by 2008. As Table 41 shows, 2008 total collection rate was approximately 88%, still short of the target rates. Finally, 2013 was indicated as the target year to achieve a 94% return rate.

With regard to the wider context, the instrument aims at increasing packaging waste recycling rates and reducing total packaging waste consumption. Figure 47 shows increasing recycling rates over the period of 2002 to 2007 in metals and glass. Especially, the development of metal packaging material recycling rates demonstrates significant jumps in 2004/2005 and 2006/2007 of around 18% and 17%, respectively. Compared to glass, metal recycling does not have a traditional background in Denmark, thus the fact that recycling rates almost equal in 2007 (88% for glass and 86% for metals) is a remarkable improvement. In contrast, the recycling rates for plastic packaging materials show little variation, rising from around 15% in 2002 to only 20% in 2007. This minor progress lets plastic packaging material classify as the packaging material with the lowest recycling rates.

**Figure 47: Denmark's Recycling Rate of major packaging materials from 2002 to 2007**




Source: Ecorys based on Miljøprojekt Nr. 1333 2010, Statistik for genanvendelse af emballageaffald 2008: http://www.mst.dk/Publikationer/Publikationer/2010/09/978-87-92668-17-2.htm and http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/udgiv/publikationer/2006/87-7052-286-3/html/sum.htm

To get a better impression of actual effects of the container deposit scheme on environmental protection, the recycling rates have to be compared against the development of total packaging waste consumption in Denmark. Table 43 compares packaging material waste generation and its recycling rates over the periods 2002 to 2008. Total packaging waste amounts since the introduction of the container deposit scheme are not observed to fall significantly. After a temporary increase from 2002 to 2006, the period 2006 to 2008 indicates a decreasing tendency of total packaging waste material consumption and similarly for all individual waste categories.

Plastic packaging waste shows an extraordinary development in 2008; after continuous growth throughout 2002 to 2007, plastic consumption falls significantly in 2008 while the amount recycled maintains previous year's level, thus increasing the recycling proportion as a percentage by almost four points, to 25.5%.

Although differences exist in the waste sub-categories, the overall recycling percentage is continuously rising which is – at the presence of increasing total consumption – an indicator that recycled waste amounts grow at an increasing rate.

**Table 43: Total Packaging Material Consumption and Recycling 2002 - 2008**

| Packaging Material | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|
| Consumption **GLASS** | 193.0 | 202.1 | 187.2 | 158.7 | 143.4 | 142.4 | 144.8 |
| Recycling Amount | 134.5 | 136.8 | 131.5 | 119.3 | 120.5 | 124.9 | 127.5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Recycling Proportion in % | 69.7 | 67.7 | 70.2 | 75.2 | 84.0 | 87.7 | 88.1 |
| Consumption **PLASTIC** | 157.3 | 154.8 | 174.3 | 182.8 | 190.8 | 192.0 | 164.8 |
| Recycling Amount | 24.4 | 27.0 | 28.4 | 34.9 | 38.7 | 41.8 | 42.0 |
| Recycling Proportion in % | 15.5 | 17.4 | 16.3 | 19.1 | 20.3 | 21.8 | 25.4 |
| Consumption **PAPER AND CARDBOARD** | 1373.0 | 1345.0 | 1440.0 | 1447.0 | 1450.0 | 1380.0 | 1355.0 |
| Recycling Amount | 752.0 | 762.0 | 823.0 | 870.0 | 889.0 | 841.0 | 841.0 |
| Recycling Proportion in % | 54.8 | 56.7 | 57.2 | 60.1 | 61.3 | 60.9 | 62.1 |
| Consumption **METAL** | 41.1 | 42.2 | 44.8 | 40.0 | 42.4 | 35.1 | 34.3 |
| - of this Steel | 33.9 | 30.9 | 30.4 | 31.3 | 30.0 | 26.8 | 25.4 |
| - of this Aluminium | 0.3 | 11.3 | 14.3 | 8.6 | 12.3 | 8.3 | 8.9 |
| Recycling Amount | 17.4 | 16.4 | 18.9 | 23.9 | 26.1 | 30.5 | 28.1 |
| Recycling Proportion in % | 42.2 | 38.8 | 42.2 | 59.8 | 61.7 | 86.8 | 81.9 |
| Consumption **TOTAL** | 1764.4 | 1744.0 | 1846.2 | 1828.5 | 1826.6 | 1749.5 | 1699.0 |
| Recycling Amount | 928.3 | 942.2 | 1001.8 | 1048.1 | 1074.3 | 1038.2 | 1038.6 |
| Recycling Proportion in % | 52.6 | 54.0 | 54.3 | 57.3 | 58.8 | 59.3 | 61.1 |

*Source:* Data taken from the Danish Ministry of Environment: Miljøprojekt Nr. 1333 2010 Statistik for genanvendelse af emballageaffald 2008, available at: http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/udgiv/publikationer/2006/87-7052-286-3/html/sum.htm

In summary, the Danish deposit-refund system works fairly successfully from a resource efficiency perspective with high and improving return rates and recycling rates. Its efficiency and effectiveness is less clear, the scheme is costly to administer at ~€30 million a year and the environmental objectives have had to be relaxed due to slow progress towards meeting targets. Nevertheless an increasing number of products are currently being examined for inclusion in the deposit-refund system to ensure that more and more packaging material is removed from general household waste and recycled into new products[227]. Some recent changes to tax systems in Denmark have seen a reduction in packaging taxes, to remove an indirect subsidy to businesses that clean and empty bottles, etc. as the tax on retail packaging is refunded when exported.

### *4.6.4 Conclusion*

#### Overall results

In both cases it is difficult to isolate the net effect of the container deposit scheme on enhancing resource efficiency and environmental performance through the reduction of littering and waste generation and increasing the re-use of containers and promoting recycling.

For example, general consumer trends can be equally observed in both case countries such as the increase in mobility and “on-the-go”

227 http://www2.mst.dk/common/Udgivramme/Frame.asp?http://www2.mst.dk/udgiv/publikationer/2006/87-7052-286-3/html/sum.htm

consumption habits, as well as producers' preferences for plastic packaging materials due to its favourable attributes (lightweight and flexible). Both of these factors have contributed to increased pressure for the use of plastics in packaging materials, with little consideration of the environmental impacts.

Looking just at the container deposit instruments in can be concluded that the schemes yield positive effects for the environment and resource efficiency. However, when taking the wider context in consideration, it is more accurate to say that a container deposit scheme reduces material loss and potential environmental damage, however it does not prevent it entirely and its effectiveness in directing consumers towards more sustainable behaviour is impossible to quantify. Thus, the presented results should always be regarded critically with regard to other uncontrolled factors influencing the analysis.

*Rough Indicators*

Although the initial years after the introduction of the container-deposit schemes in 2002 and 2003 showed significant increases in recycled packaging waste amounts, the most recent years showed fluctuating quantities of total packaging waste generation and recycling for both countries, pointing to some potential erosion of the impact of the schemes.

Additionally, regarding the fact that estimates of Witzenhausen Institute (2007) which state that only 2.7% of total packaging waste is constituted by disposable drinks packages covered under the container deposit scheme in Germany, the contribution of this instrument to resource use and pollution prevention as a whole might appear marginal. However, when looking at absolute numbers and especially beverage container return rates (88% in 2008 in Denmark and 95% in 2007 in Germany) it becomes obvious that the container deposit scheme is an effective tool for resource re-use and recycling, with added benefits in environmental aspects such as littering. Total recycling rates increased in 2008 to 82% in Germany and 61% in Denmark.

*Comparability*

Variations in objectives achieved can be firstly explained by differences in the design and implementation of the mandatory deposit schemes for single-use beverage containers. The decentralized organizational structure of the return process in Germany might be better able to provide wide geographical coverage, boost innovation and also to provide incentives to cooperate. In contrast, the centralized Retursystem A/S in Denmark, constitutes an intermediate arrangement and may not be as efficient in implementation as retailers themselves would be.

Secondly, previously established systems concerned with deposit-refund or recycling serve as important factors in the ease of implementation of a mandatory scheme and can lead to enhanced outcomes as consumers are already familiar and have 'bought-in' to such a scheme. Both countries in this case study had this in place, with a long-standing tradition of reuse/refillable beverage containers and recycling as part of the collective

mind set. For this reason, it can be concluded that an established recycling tradition positively contributes to the success of a container deposit scheme implementation.

Thirdly, administrative factors might either hamper or facilitate the cooperation of retailers and consumers. As could be observed primarily in Germany during the island solution, retailers and the packaging industry play a key role in implementing a container deposit scheme. The mandatory scheme was new in Germany and the lack of co-operation and flexibility did little to 'sell' the scheme, because of this retailers aimed initially at frustrating the implementation efforts. It was not until the switch to the point solution that this was overcome. In Denmark, the introduction of the deposit scheme constituted a loosening of regulations and therefore this type of problem was largely avoided. It is clear from this that the function of an instrument is reliant on its acceptance by both industry and consumers.

*Lessons learned*

Scrutiny of the Danish and the German cases lets us conclude that the existence of a tight set of national policies can serve as a driver for the successful adaptation of a container deposit scheme. Similarly, high levels of environmental awareness and previous experience with recycling regulations on a household basis will support the successful operation of a refund-deposit instrument aimed at beverage containers.

The initial impact of the mandatory scheme seems to be significant, while its effect on reducing the consumption of single-use beverage containers appears to be diminishing over time. This however does not imply that collection rates decrease but accumulated packaging waste generation increase in total.

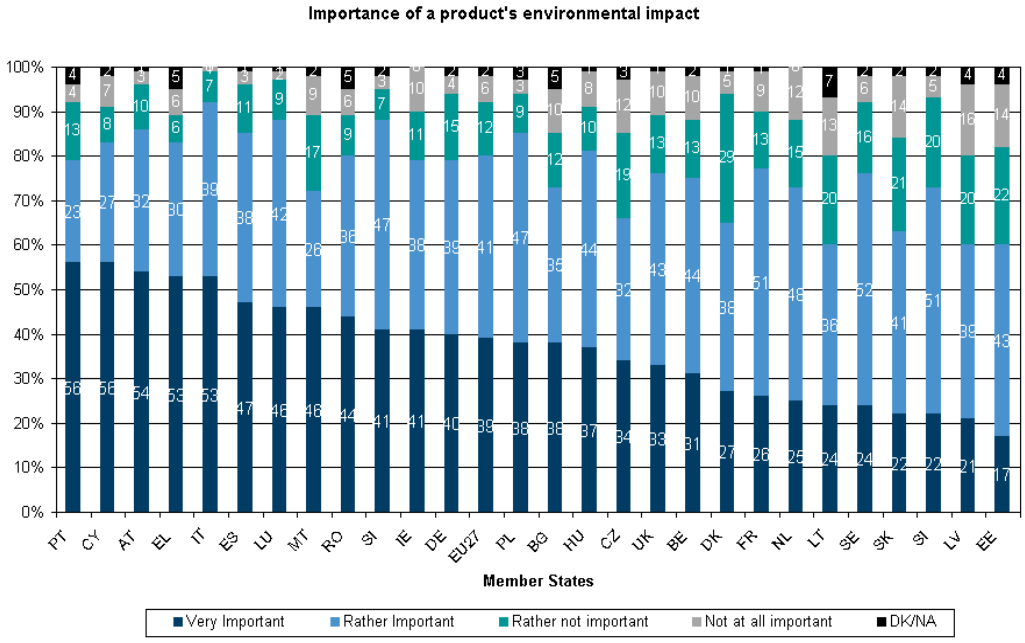
The final lessons relate to cost of implementation. In both countries administration of the scheme was expensive, imposing annual costs to the administrative bodies, these more than €285 million in Germany. Proportionally, costs were lower in Germany than in Denmark, representing a more simplified scheme applying equally to all container sizes, but possible also economies of scale. Quantified resource efficiency benefit values are harder to find, the one estimate from Germany in relation to secondary materials suggests a value of only €82 million in income of materials, much less than the full administrative cost of the scheme. This suggests that deposit schemes can be relatively very expensive ways of improving resource retention and re-use.

*Potential for application in other EU countries*

Based on a recent survey conducted by the European Commission entitled "Attitudes of Europeans towards resource efficiency" (2011) the importance of the environmental impact of consumer products was assessed (among other factors) and yielded that especially Portugal, Cyprus, Austria, Greece, Italy as well as Spain and Luxembourg assigned - above average – importance to it (see Figure 48). As it was identified that the attitude of consumers plays a key rule in determining the success of a

container deposit scheme, it might be worth considering the mentioned countries as potential target for such an instrument.

**Figure 48: Results of EC Survey on Attitude towards Resource Efficiency in Consumer Goods**




Source: Ecorys based on data from EC Study "Attitudes of Europeans towards resource efficiency" (2011) for Question 7: How important for you is a product's environmental impact – e.g. whether the product is reusable or recyclable – when making a decision on what product to buy?

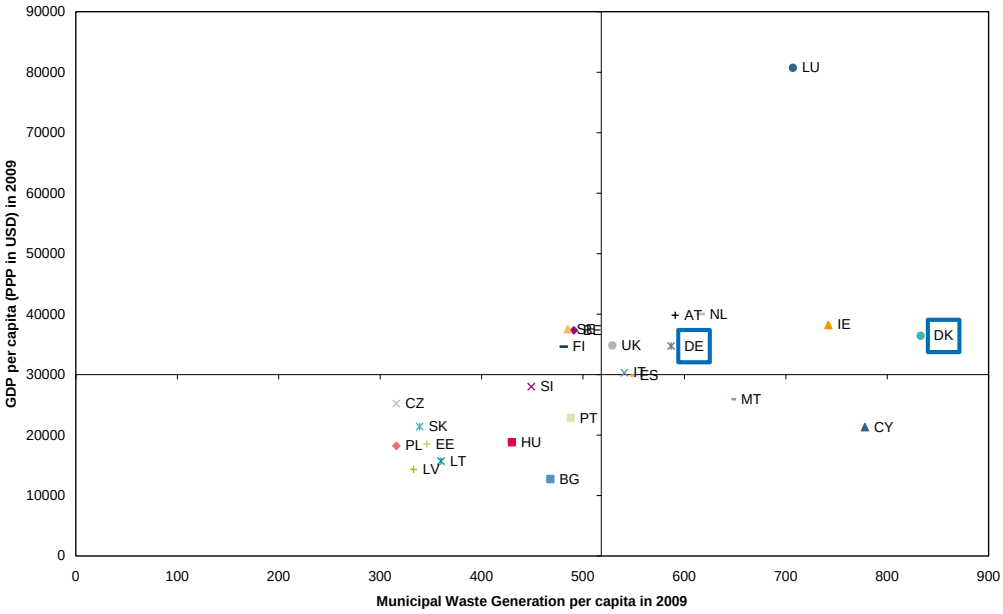
An interesting take on consumer acceptance can be found in the case of the USA, which has a longstanding reputation of ignoring human-caused environmental damage, and is well known for a culture of "on-the-go consumption". Even though only 11 out of 51 States[228] have yet adopted a container deposit scheme, the so-called "bottle-bill", collection rates have been high (ranging between 60 to 90%) and reductions in littering are significant (56% in Maine and 75-78% in Oregon in 2008). [229]

Especially, when regarding the mapping of countries according to their Municipal Waste production per capita versus GDP in Figure 49, it becomes obvious that Luxembourg, Ireland and Cyprus both have the financial resources (GDP) and need (amount of waste) to be a potential target to employ a container deposit scheme. However, other factors have to be assessed first, such as e.g. the existing policy set, as well as development of packaging waste generation and consumer behaviour. Reference to the previous figure suggests that consumer reaction could be positive in these 3 member states at least.

228 California, Connecticut, Hawaii, Iowa, Maine, Massachusetts, Michigan, New York, Oregon, Vermont, Guam

229 *yosemite.epa.gov/ee/epa/eerm.nsf/...06.../EE-0216B-06.pdf*

**Figure 49: EU MS on their Waste generation and GDP per capita in 2009 (axes represent averages)**




Source: Ecorys based on Eurostat (2009) and CIA Factbook

Note: Axes represent EU averages

An important critique by EUROPEN concerning the container deposit policy instrument in the context of Europe claims that deposits are incompatible with cross-border movement. The freedom of EU citizens to work, travel and shop in neighbouring countries is widely perceived as a benefit of EU membership, but deposit systems for non-refillable containers are not compatible with cross-border shopping. Containers purchased abroad will become waste in the home country of the purchaser. Even if a deposit system operates there, it will not apply to containers sold in another country. Thus these containers will either end up in the waste stream or in an integrated recycling system. (EUROPEN, 2003).

## *Wider context*

In Europe a variety of countries (see Figure 41) have launched a container deposit scheme with different coverage and organization. The Commission reported in May 2003 that 50% of all packaging placed on the EU market was already being recycled by 1999, and there have been further increases since[230]. This is being achieved through collection systems that include beverage containers along with all other types of used packaging. Similar systems are being developed in the ten acceding countries due to join the EU in 2004 and in the second wave candidate countries. The launch of a deposit refund scheme in Estonia (2005) and Croatia (2006) can be regarded as successful step towards potential use of this instrument in Eastern Europe.

However, consistent with the findings on administrative burden and costs-benefits in this study, other assessments have also shown that the cost of launching mandatory deposits for single-use beverage containers in the new MS would be very high, threatening the successful replication of EU

[230] EUROPEN (2003)

recovery system models in these countries[231]. It is not clear on this basis whether it would be cost-effective to advise further adoption of container deposit models along the lines of the German or Danish systems, the evidence suggests not, but the subject bears further investigation to develop a clearer picture of costs and benefits.

## 4.7 Plastic bag taxation – IE & DK

### *4.7.1 Introduction*

**Context**

Plastic bags are among the most commonly used items in our daily lives. Cheap, lightweight and durable, these qualities have made them highly useful, and hundreds of billions are produced and used globally each year. The qualities that have made them so useful are also crucial to their negative environmental impacts. Their cheapness means they are typically given away, and their loss, or use of more, means little to most consumers. Their lightness means they easily blow away and their durability means that when they do, they remain in the environment for a considerable period of time.

Across our cities and countryside plastic bags are one of the major litter items, polluting the landscape. Their impact goes beyond the visual though, as they can release toxic chemicals into the ground and water courses as they slowly decay. Plastic bags are also a danger to wildlife, particularly marine life, if mistaken for food or otherwise ingested they can choke or slowly poison animals.

There are many different types of plastic bags available, one of the main distinctions from an environmental point of view is the way in which they degrade, with typical plastic bags estimated to take up to 1 000 years to fully decompose. Alternatives are available, Bio-degradable plastic bags are made from biological materials such as cornstarch and can degrade, with the right conditions i.e. composting not landfill, in around 12 weeks and be fully decomposed within 6 months. Degradable bags can also be made from non-biological materials and these are usually designed to degrade in 3-18 months under certain conditions. In addition, moving from disposable plastics to harder wearing re-usable plastic bags is also an option, indeed, encouraging re-use of bags should be a major element of any efforts to reduce environmental impact.

There are material alternatives to plastic bags, among them paper and cloth. These alternatives have their own advantages and disadvantages, some are more expensive, or requiring the use of more energy, water or material resources in their production. Strong arguments can be made for plastic bags being more resource and energy efficient than other materials

[231] Recent studies estimated that a deposit system on all non-refillable beverage containers in the Czech Republic would
cost €63.4 million per year, and in Hungary, €31.2 million per year (EUROPEN, 2003)

over their lifecycle. For these, and a variety of other reasons, plastic bags have remained the most common form of carrier in most countries.

Switching from certain types of plastic bags to others, or alternative materials will have economic impacts on the sector. As a whole the plastics conversion sector in 2009 was estimated to comprise nearly 50,000 companies, employing more than 1.3 million people[232], though plastic bags specific companies and employment will be a small proportion of these totals.

At the same time, the environmental impacts of plastic bags are hard to ignore, and therefore the use of plastic bags has drawn attention, with calls for measures to alleviate their negative impacts.

*Organisation*

Plastic bags are currently regulated across the EU as part of the packaging and packaging waste directive (94/62/EC) and its amendment (2004/12/EC). This legislation covers all packaging produced in the EU and main objective is to reduce the amount and environmental impact of packaging waste in the EU, by encouraging reductions in packaging or improvements to its potential for re-use or recycling. In addition the directive is aimed to improve safety, hygiene and acceptability for consumers.

The directive has set a range of binding targets on the disposal of packaging waste, including the requirement for 60% of packaging waste, by weight, to be recycled or incinerated with energy recovery, and for 55-80% of packaging waste to be recycled by the end of 2008. Specific recycling targets for waste types were set, the level for plastic waste as a percentage of recycled packaging was set at 22.5%, by the end of 2008.

The terms of the directive also make it illegal to impose unilateral bans on plastic bags.

*Instrument Type*

Various measures have been considered to mitigate the environmental impact of plastic bags, voluntary and mandatory, outright bans, bans on free distribution and campaigns to encourage re-use, among them. One of the most commonly suggested instruments is a tax or levy. The logic is consistent with other negative price based market instruments, to increase costs/prices to change consumption behaviour either directly or indirectly. In addition, that the revenues from the levy could be used to reduce the negative externalities from production and consumption.

In terms of plastic bags there are various points at which such a tax or levy could be applied to influence their impact. On the producer side, taxes could be applied to the raw material feedstocks so alternative materials

[232] European Plastics Converters (2010) Plastics Converting in Europe: understanding the plastics industry

are considered or cost increases are passed on. They could be applied to outputs, by volume, for similar effects. Or taxes could be applied closer to, or at, the point of consumption, through a tax or levy on sales or distribution.

In each case the idea is to bring plastic bags into the price mechanism so that a cost is imposed on their use, to make their free distribution and use less and less attractive to retailers, bringing an economic dimension to decisions. This economic dimension is absent when the private cost of plastic bags to producers, retailers and consumers is so low and the wider environmental cost is borne by society as a whole. This type of mechanism is consistent with internalising environmental externalities and also with the polluter-pays-principle.

## Case study countries

While a number of countries have considered a levy or tax on plastic bags only a handful of countries have actually implemented such a measure. The two case-study countries selected for the plastic bag tax are Ireland and Denmark. These countries were selected as they are among the earliest adopters of this type of measure, therefore a wider and deeper range of data is available, and long term effects can be seen. In addition the two countries have applied the instrument in different ways, Ireland imposing the levy at point of sale, while Denmark imposes the tax on producers 'at the gate'. A short profile of each country and their plastic use is provided below.

**Table 44 Key information - Ireland and Denmark**

| Indicator | Ireland | Denmark | EU27 average |
|---|---|---|---|
| Year of membership in the EU | 1973 | 1973 | - |
| GDP per capita (EURO, 2010) | 34 400 | 42 300 | 24 500 |
| Total tax income, as a percentage of GDP, 2008 | 29.3% | 48.2% | 39.3% |
| Population (2007 total, millions) | 4.47 | 5.53 | 501.1 |
| Packaging Waste Generation – Plastic 2007 (tonnes) | 237 685 | 191 782 | - |
| Annual estimated use of plastic bags (total, million) | 121.2 (2008) | 450 | - |
| Annual use of plastic bags per capita | 27.1 | 81 | 500 |
| Estimated weight of plastic used in plastic bags (tonnes)* | 2 424 | 9 000 | - |
| As % of total plastic packaging waste generation | 0.71% | - | - |
| Packaging and Packaging Waste Directive implementation date | 2011 – exemption received | 2008 | - |

Sources: Eurostat (GDP & Tax)

* estimate based on average of approximately 20g plastic per plastic bag[233]

Note: the average weight of plastic bags is difficult to accurately determine due to the variety in sizes, uses and material mixes. For simplicity and comparability we have assumed the same average bag weight in both countries. This does add some margin of error into the weight-based calculations made in this case-study.

### Delimitation

The cases are primarily based on desk review of publicly available documents, including government and NGO reports, journals and academic literature (see references). In addition, the case studies were supplemented with information received in direct contact with ministries and other organisations in the case countries.

## *4.7.2 Plastic Bag Levy – Republic of Ireland*

A plastic bag levy was introduced in Ireland in 2002 to tackle a growing problem of litter, to address wider concerns regarding their environmental impact and to contribute towards meeting recycling targets.

### Context

A study for the European Environment Agency (EEA) in 2005[234] noted that the environmental system in Ireland, in respect of packaging waste, was designed to tackle the problem of it having the highest per capita packaging waste generation of all member states in the EU15. It also noted that prior to the packaging waste directive in 1997 Ireland had a packaging waste recovery rate of around only 10%, with the majority of waste sent to landfill. This demonstrated the significant steps that were needed to comply with the directive. Such a big challenge and low starting point are among the key reasons that an extension for compliance to 2011, was requested and granted.

It was estimated that prior to the introduction of the plastic bag levy approximately 1 300 million plastic bags were used in Ireland each year, or approximately 328 bags per person. As a windy country, plastic bag litter in Ireland was problematic, being able to spread easily across the country, becoming entangled in trees, hedgerows and other obstacles, and becoming highly visible in winter when the leaves fell.

The issue had been on the political agenda in Ireland since at least 1994, before the eventual introduction of the levy in 2002 and its amendment in 2007.The plastic bag levy was strongly driven by the then Minister for Environment and Local Government, Mr. Noel Dempsey. Interestingly, a report was commissioned to analyse the options for a plastic bag levy and it recommended an upstream levy, similar to the Danish system. A tax at point of sale was thought to be too administratively complex. The minister disagreed and pushed ahead with this option, securing agreement for its implementation. Indeed the commitment and determination of Mr

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233 Based on industry estimates in Denmark - http://www.plast.dk/Fakta/Faktaomplastposer/S%C3%A5mangebrugervi/

234 EEA (2005) Effectiveness of packaging waste management systems in selected countries: an EEA pilot study

Dempsey was noted as one of the principal driving forces behind the implementation of the levy[235], a quote from him in 1999 summing this up "Litter is everyone's problem and we have to tackle it together…let there be no mistake: we mean to act."[236]

The primary objective of the levy is anti-litter. It can be argued that if this is the primary goal of the instrument then a ban on littering is a more direct approach to the problem[237]. There are already regulations of this type in Ireland, with strong penalties applicable. Obviously the impact of regulation is closely tied to the level of enforcement, with strict enforcement of anti-litter legislation often regarded as petty. Having the plastic bag levy on top of the anti-litter regulation is understood to have been deemed necessary given the higher relative visibility and durability of plastic bag litter, particularly in rural areas, and also for the signalling impacts to consumer behaviour towards sustainability[238].

### *Organisation, scope and rates*

Waste management in Ireland is governed by the Waste management act 1996 and subsequent amendments. The packaging directive was transposed under this act in 1997. Producer responsibility obligations for packaging waste are organised under Repak, an industry organisation consented by the Department of Environment, Heritage and Local Government.

The plastic bag levy is set by the government but is collected by retailers at point of sale, who then report to and pay the Revenue Commission (the tax and customs office). A minimum fine of €1 905 is charged to retailers that do not apply the levy, in addition to the levy revenues unpaid.

The levy is charged on all disposable plastic bags with the exception of small bags used for food safety and hygiene purposes, bags provided in passenger-only areas of ports and airports and re-usable bags sold for more than €0.70 each. No distinction is made between bags on the basis of their degradability.

The levy was introduced at €0.15 per bag in 2002 and rose to €0.22 per bag in 2007, following concerns about upwards trends in plastic bag use. A proposal[239] is currently being considered to increase the maximum ceiling for the levy to €0.70, giving ministers the flexibility to raise the levy over time.

As noted by Convery et al[240], the setting of the initial tax level was not believed to have been in keeping with Pigouvian principles, with no

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235 Convery, F., McDonnell, S., Ferreira, S. (2007) The most popular tax in Europe? Lessons from the Irish plastic bags levy, Environmental Resource Economics, 38:1–11

236 http://www.mindfully.org/Plastic/Laws/Plastic-Bag-Levy-Ireland4mar02.htm#2

237 Convery, F. et al (2007)

238 Ibid.

239 Environment (Miscellaneous Provisions) Bill 2011 - http://www.oireachtas.ie/documents/bills28/bills/2011/0211/document2.pdf

240 Convery, F. et al (2007)

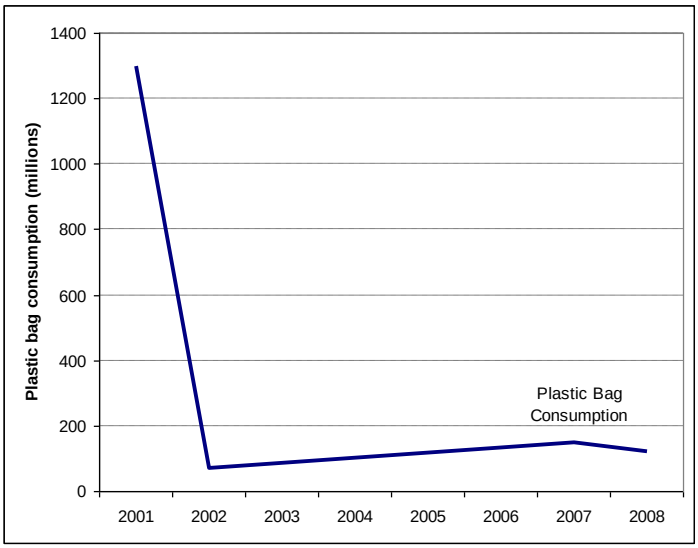
attempts to determine the optimum level based on marginal costs and benefits. The objective was explicitly anti-litter and to be achieved by changing consumer behaviour, for which, a levy high enough to impact on consumers decisions was needed.

## Results

The plastic bag levy in Ireland was hailed as an overnight success, an estimated 1 300 million shopping bags were used annually prior to the introduction of the levy. In the first year following the ban this was estimated to have fallen by over 90%, to 70 million[241].

Figure 50 presents the impact of the levy on plastic bag use, interpreted through the levies received by the tax office on plastic bags. This shows that following the immediate effect of the levy in 2001-2, the use of plastic bags increased again, doubling on 2002 levels by 2007. Following the increase in the levy to €0.22 a decline in bag levies of approximately 20% was reported in 2008.

**Figure 50 Ireland, plastic bag consumption, 2001-2008**




*Source:* 2001 estimate of 1 300 million from TES (2002)[242], 2002-2008 from Ireland Environmental Fund Accounts – see http://www.environ.ie/en/Environment/Waste/EnvironmentFund/

### *Environmental*

The primary purpose of the levy was to reduce litter and a national annual litter survey records the proportions of plastic bags in litter at various spots. The survey does not provide overall numeric data but rates the proportion of plastic bags in the litter that is recorded, the results are presented in Figure 51. This shows that plastic bags have declined as a percentage of total litter over the period, indeed by some estimates the starting point was even higher at 5% of total litter prior to the levy, rather than the 0.75% recorded in the first survey[243].

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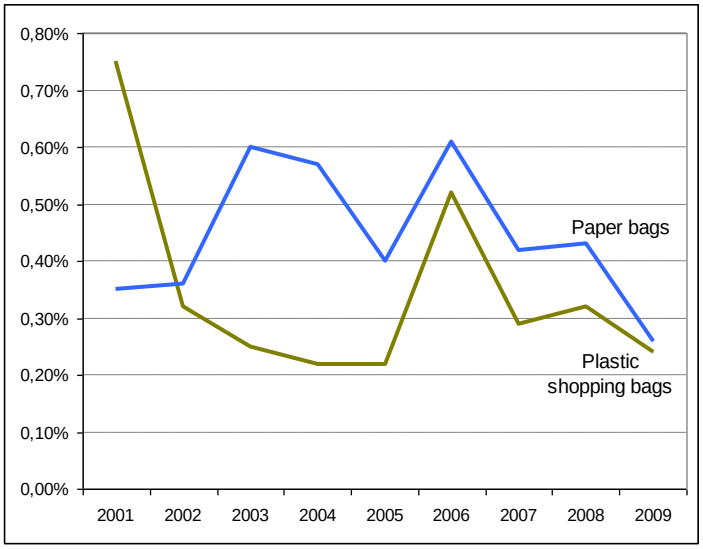
241 Estimate based on tax revenues collected 2002.

242 TES Ltd (2002) The National Litter Monitoring System, Litter Monitoring Body, System Results Report May 2003

243 TES Ltd (2002)

**Figure 51 Ireland, proportion of plastic shopping bags and paper bags of total litter, 2001-2009**




*Source:* Ecorys analysis from National Litter Monitoring Survey Reports by TES 2002-2010

Some things are noticeable from the trends, among them, that the proportion of plastic shopping bag litter rose in 2006, but fell immediately again in 2007, coinciding with the increase in the levy from €0.15 to €0.22.

Comparison to the paper bag alternative, shows that the trends are broadly similar across bag materials following introduction of the levy, providing little evidence of any material substitution effects. Shortly after the introduction of the tax there were some concerns that single-use paper bags were being substituted and this was limiting the impact of the levy[244]. The litter survey does bear this out to some extent, with divergent trends in litter in the years immediately after 2002, though this has since begun to mirror movements in plastic litter. Overall it can be said that this points more clearly to a real change in the way bags are used, rather than a simple switch to alternative materials.

One final point to note is the very low proportions of total litter quantity that plastic bags constitute, this is curious and could be interpreted that plastic bag litter is a relatively minor problem. Yet the quantity based nature of reporting means that in most years around 70% of recorded litter is constituted of cigarette butts and chewing gum, small but numerous items, arguably with less wider environmental impact than plastic bags. In this way the proportional quantity of plastic bag litter is low, but its proportional impact may be higher. Nevertheless the evidence suggests that since the levy plastic bags have been a relatively minor litter problem.

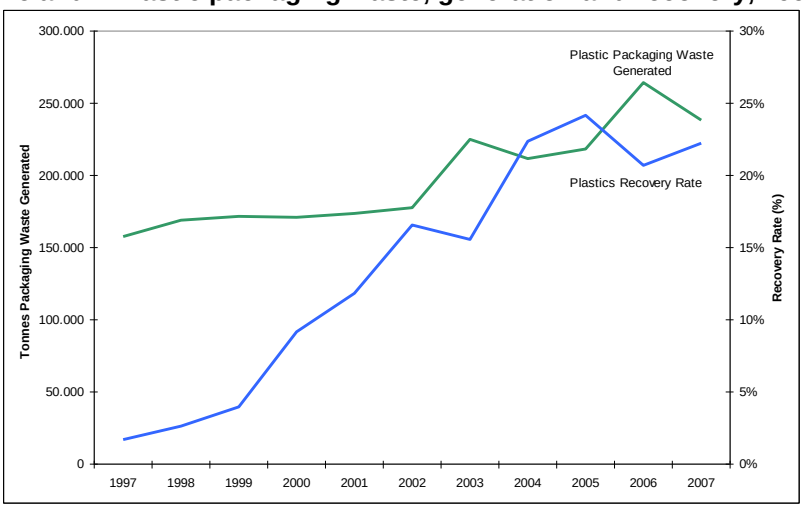
The low level of proportions also suggests that the variations that take place from year to year are at such a low level that very small changes in quantities could have amplified effects. Yet the study is carried out widely,

[244] Environmental Protection Agency (2003) Assessment and development of a waste prevention framework for Ireland

at multiple locations in each local authority area and therefore the scope is wide. As the survey is targeted on litter hot-spots, these hot-spots would be expected to be concentrated where litter is common and relatively static. This may under-record the prevalence of plastic bag litter as it is more likely to become airborne and dispersed than, for example, a cigarette butt or a drink bottle. There is at this stage though, no evidence to support this supposition.

The other environmental impacts of plastic bags are linked to their disposal and the energy and resources consumed in their production. There is little specific evidence on the impact of the levy on disposal methods for plastic bags. Indeed, the waste disposal sector in Ireland has undergone something of a revolution since the implementation of the waste framework and packaging directives and therefore it is near impossible to separate out such effects. At the overall level, plastic packaging waste generation increased rapidly from 2002, while recovery rates rapidly increased over the period. As noted in Table 44 in 2005, following the introduction of the tax, plastic bags constituted only 2 400 tonnes, or around only 1%, of plastic packaging waste. On the basis of this being 10% of the original amount (90% decline in use) then approximately 24 000 tonnes of plastic packaging waste in 2002 was from plastic bag use. The decline to 2 400 tonnes represented a saving of around 21 600 tonnes of plastic annually, representing 12.5% of all packaging waste generation in this period, a significant saving. Yet this estimate is quite loose and does not take account of the impact of the potential growth in use of plastic by weight in re-usable bags.

**Figure 52 Ireland – Plastic packaging waste, generation and recovery, 1997-2007**




*Source:* Ecorys from EU data reported under Waste Framework directive

Recovery rate is Total recovery and incineration at waste incineration plants with energy recovery (h) = (d)+(e)+(f)+(g)

## *Social*

The other primary aspect of the tax was behavioural change, the levy was hoped to reduce plastic litter, but also to encourage consumers to think and act more sustainably. There is evidence that the levy itself has proved

highly popular, some claiming that it would be politically damaging to remove the levy[245].

It is harder though to separate the improvement in consumers sustainable behaviour following the introduction of the levy. A survey carried out prior to the levy indicated that 43% never re-used their bags, 25% did occasionally and 32% always re-used their bags[246]. It would be expected that following the introduction of the levy that re-use has increased considerably. Another survey in 2001 showed support for something to be done, with 78% of those surveyed supporting a ban on plastic bags[247]. There is little other data available regarding the social impact of the levy.

*Economic*

The wider economic impact of the levy on firms operating in the sector is unclear. A study in 1999 attempted to analyse the potential impact of such a tax[248]. This estimated that in 1999, approximately 79% of the plastic bags consumed in Ireland were imported, the remaining 21% produced by four domestic plastic bag manufacturing firms. Since the implementation of the levy it has been observed that one of these four firms has gone out of business, with the loss of 26 jobs. It is unclear on the causation in this and whether this would have happened even if the levy had not been introduced.

The levy has had further economic impacts, through the costs and benefits to consumers and retailers, these are discussed in the next sections in the context of levy revenues and burdens.

### Revenue and use of revenue

As noted previously, the levy was set at a rate of €0.15 per bag in 2002, and rose to €0.22 per bag in 2007. The revenues are collected by retailers at point of sale and reported and paid to the tax office with standard VAT returns. Figure 53 presents the revenues raised by the levy, from an initial €10.4 million in 2002, revenues have continued to increase every year, the fall in bags levied in 2008 was compensated for by the increase in the levy, so that approximately €26.7 million was raised by the levy. Similar growth rates over time are also observed for the landfill levy, for waste sent to landfill, which raised €33.5 million in 2008.

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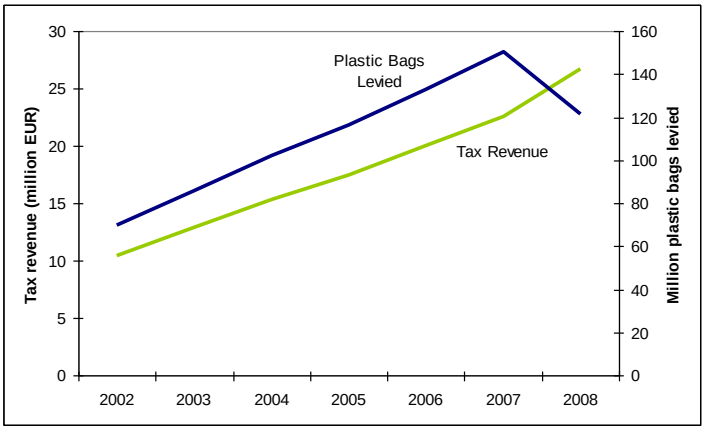
245 Convery, F. et al (2007)

246 Environmental Protection Agency (2003)

247 Environmental Protection Agency (2003)

248 Fehily, Timoney & Company (1999) Consultancy study on plastic bags. Report prepared for the Department of Environment and Local Government, Dublin

**Figure 53 Ireland, plastic bags levied and tax revenue, 2002-2008**




*Source:* Ecorys from Ireland Environmental Fund Accounts – see http://www.environ.ie/en/Environment/Waste/EnvironmentFund/

Revenues from both the plastic bag levy and the landfill levy are 'ring-fenced' and paid into the Environment Fund, which recorded total income of €61.4 million and total expenditure of €79.6 million in 2008, the difference covered by previous surpluses to the fund. The revenues are used in a variety of ways, some directly related back to the objectives of the individual policies, but also for wider environmental objectives. The expenditure items listed in the fund accounts include the following, with all *starred* items involve expenditure of greater than €8 million:

- North-South (Ireland) waste management programmes
- Waste management/prevention programmes
- Producer responsibility initiatives
- Environmental levy collection costs
- Waste prevention operational costs
- Waste management including recycling projects*
- Recycling operational costs*
- Local authority enforcement initiatives*
- Environment awareness*
- Pollution control air/climate
- Contributions to national and international bodies
- Environmental international sustainability
- Anti-litter initiatives
- Office of environmental enforcement
- Environmental Protection Agency research and development*
- Water quality
- Comhar – the sustainable development council
- Hazardous waste management facilitation*
- North/South (Ireland) environmental initiatives

Given the ring-fencing of funds, there is little evidence of any "double-dividend" type effects, i.e. where taxes on labour or income are reduced using the revenue from the environmental tax.

The costs to consumers of the levy can be broadly thought to be equivalent to the cost of bags, and therefore the fees levied plus any

mark-up or additional costs applied by retailers. A further additional cost factor is likely to have been the need to purchase re-usable bags, with minimum prices set at €0.70 under the levy. No data has been produced to quantify this effect, but it is likely that the total cost runs into millions on this basis, a very rough estimate for example: 3 million people, 2 re-usable bags each, at €0.70, equals a cost of €4.2 million.

### Administrative burden

It is understood that the costs to government of implementing the levy were modest, these involved one-off set-up costs of €1.2 million, constituting new computer systems and other resources to administer the levy. In addition to this advertising costs of €358 000 were incurred in a publicity campaign for the levy launch. Annual operational costs are charged to the environment fund each year and in the 2008 totaled €392 000, or approximately 1.5% of the tax revenues collected. These amounts are typical of operational costs across the period.

These operational costs are for administering collections, but do not include enforcement costs which are incurred by the Environmental Protection Agency. These costs are also refunded through the levy - environment fund, but it is not possible to separate out specific costs or burdens attributable to the levy. The following table, taken from an official waste enforcement report[249], gives an indication of the scale of inspections related to the levy, with 1 500-1 850 producer responsibility inspections each year. Enforcement of the scheme is understood to be relatively simple, with support from the public in reporting retailers that fail to charge the levy[250].

**Table 45 Producer responsibility inspection activities by Local Authorities 2007 & 2008**

| Producer responsibility inspections | 2007 | 2008 |
|---|---|---|
| WEEE | 1,030 | 993 |
| ELV | 445 | 640 |
| Farm Plastics | 89 | 158 |
| Plastic Bag Levy | 1,831 | 1,542 |
| Packaging Regulations | 3,104 | 2,034 |
| **Total** | **6,499** | **5,367** |

*Source:* EPA (2009) Focus on environmental enforcement in Ireland 2006-2008

For retailers the burden of the levy is understood to be small with most being able to easily integrate the levy with their existing Value Added Tax (VAT) systems[251]. The costs of adjustment and additional administration are believed to be small and more than offset by cost savings from no longer needing to purchase plastic bags for free distribution and also increased sales of bin-liners.

249 EPA (2009) Focus on environmental enforcement in Ireland 2006-2008
250 Convery et al (2007)
251 Ibid.

### Conclusions

The introduction of a plastic bag levy in Ireland can be considered a success story of a market based instrument reducing the environmental impact of consumption with the support of the public and retailers. The levy succeeded in reducing plastic bag consumption by an estimated 90% in its first year, and, although these early gains are being slowly eroded, levels of bag consumption remain far lower than what they were before. Against its primary goal, of litter reduction, the levy has been successful over time, reducing the proportion of plastic bags reported each year in the annual litter monitoring survey and these downward trends continuing.

The scheme has generated considerable revenues, which have been used both to cover the administration costs of the scheme, which are low, and also to fund wider environmental and waste programmes.

Importantly, the scheme is widely accepted by the public, with most people supporting the levy. This is significant in respect of the further objectives of the levy to change peoples behaviour, in respect of bag use in the first place, and also to influence people towards more sustainable choices in general.

There are few negative impacts with the levy, although it may have played a role in the closure of one plastic bag manufacturer in Ireland, and also led to increased consumer expenditure on bags, in both levies and the purchase of re-usable bags.

An interesting finding from the levy in Ireland was that the levy was driven through by strong ministerial support, going beyond the recommendations in original advice. The concerns from the original advice, that administration may be too complex for a point of scale scheme, have proven unfounded, or perhaps well considered and taken on-board, with the scheme carefully designed to integrate easily with retailers existing systems.

## *4.7.3 Plastic Bag Tax – Denmark*

### Context

Denmark introduced a range of “green” taxes in 1994, including the plastic bag tax as part of wider legislation on packaging. The tax is based on the “polluter pays” principle where manufacturers and importers have to pay a levy based on the weight of products sold. The objective of the packaging tax as a whole is for waste reduction and encouraging the use of less packaging.

At the time, Denmark was a pioneer in using regulation to try to reduce the use of plastic bags and incentivise the use of alternative bag materials such as cloth, net or re-usable bags. Initially, costumers reacted swiftly

and there was a 60% reduction in the purchase of bags in 1994. However, since then, there has been an incremental increase in purchase and use of bags reaching 450 million sold bags a year (2007).

The tax has remained unchanged since it was introduced. Public discussions have revolved around the high margins supermarkets make off the plastic bags. Denmark is today known for having the some of the world's most expensive plastic bags.

### *Organisation*

According to the 2001 *Consolidated Act on taxes on certain types of packaging, bags, disposable tableware and PVC foils* the tax is paid on both paper and plastic bags. The bag needs to have a volume of at least 5 litres and be easily replaced by a textile bag, carrying net or similar. The law provides examples of how to calculate the volume of the bag. Freezing bags, bags used for purposes other than carrying, and bags with a tying function, are all exempt from the tax. [252] The tax for paper bags is 10 DKK (~1.34 EUR) per kilo and for plastic bags 22 DKK (~2.95 EUR) per kilo.[253]

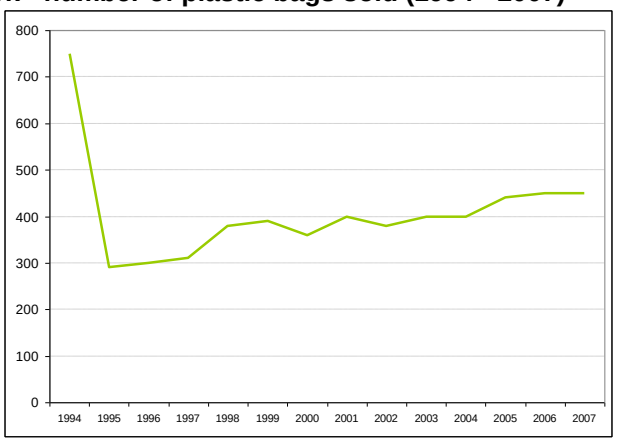
The tax applies to companies that manufacture or import bags subject to the tax. The costs are typically passed on to retailers who decide whether to pass on the cost to consumers. In many cases, retailers (especially supermarkets) have used the tax to justify charging for plastic bags.

The tax is weight based, which provides incentives to move to lighter materials and/or to maximise uses from the same weight materials, i.e. by making bags thinner. This directly impacts on resource efficiency.

## Results

The use of plastic bags dropped immediately, by over 60% when tax was first introduced. Since 1994 however, the sales have incrementally increased (see Figure 54).

**Figure 54 Denmark - number of plastic bags sold (1994 - 2007)**




*Source:* Plastindustrien (www.plast.dk) and Ecorys

[252] http://skat.dk/SKAT.aspx?oId=133680&vId=202462&i=5#i133680
[253] http://www.skm.dk/foreign/english/2087.html

In 2007, Danes used approximately 450 million plastic bags compared to 750 million in 1994 which represents a fall of 40%. 450 million plastic bags is equivalent to 81 bags per person[254] and approximately 9000 tons of plastics, or 20g per bag.[255] The EU average is 500 plastic bags per person and year, which makes the Danish usage relatively low.[256]

### *Environmental*

The environmental impacts of the bag tax are difficult to separate from overall trends. The wider packaging tax can be said to have played a role in reducing plastic usage and increasing recycling rates so that Denmark has hit its recycling targets. Based on 20g per plastic bag assumed above, the fall from 750 million bags to 450 million bags represents a saving of approximately 6 000 tonnes of plastic. Other reports[257], put initial use even higher, at 1 billion bags before the tax, so the saving could be even greater.

As a result of the relatively expensive plastic bags, some supermarkets are offering costumers a range of alternatives, from more expensive bags in jute, to 100% recycled plastic. Irma, a nation-wide supermarket, even offers a 15 DKK (2.01 EUR) carbon neutral bag made out of recycled plastic.[258] According to the industry organisation of supermarkets, the sale of “green” bags has been meagre and costumers appear to discard the more expensive options.[259]

Clearly the tax has resulted in changed business and consumer behaviour. Producers looking to produce smaller, thinner bags and retailers to provide fewer free bags or bags in sizes that better fit consumer needs. The price increase from the tax has also made consumers less willing to purchase bags.

### *Social*

The price of plastic bags has generally been passed over to the consumer. Retailers have been blamed for making large profits on the sale of plastic bags.[260] However, even if Denmark is generally considered to have the world’s most expensive plastic bags, consumption continues to increase, demonstrating a level of price-inelasticity in the demand for bags. The newspaper Dato made an estimate that at 2.75 DKK (0.37 EUR) a bag, the supermarkets made 0.5 billion DKK (67.1 million EUR) a year, and could save an average family 385 DKK (51.7 EUR) a year in switching to reusable bags.[261]

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[254] Estimating Denmark’s population to 5.5 million (Worldbank 2008)
[255] http://www.plast.dk/Fakta/Faktaomplastposer/S%C3%A5mangebrugervi/
[256] http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/580&format=HTML&aged=0?uage=EN&guiLanguage=en
[257] Miljo Ministriet (2008) Statistik for genanvendelse af emballageaffald 2008
[258] http://politiken.dk/tjek/tjekmad/tjekmadartikler/ECE653684/supermarkeder-tjener-millioner-paa-poser/
[259] http://avisen.dk/millioner-af-plastikposer-flyder-i-naturen_132467.aspx
[260] http://www.dr.dk/Nyheder/Indland/2007/01/26/013741.htm?rss=true
[261] http://www.dr.dk/Nyheder/Indland/2007/01/26/013741.htm?rss=true

Some stores, such as Irma, Superbrugsen, Daglibrugsen and Kvickly, have developed “charity bag”[262]. Some part of the revenue from these bags is then donated to charity goals.

## Revenue and use of revenue

### *Tax evolution*

The tax regime was introduced in 1994 at 20 DKK per kg for plastic bags and 9 DKK per kg for paper bags, the rates increased to their current level of 22 DKK per kg and 10 DKK per kg in 1997. A general review of the packaging taxation system is under consideration.

### *Revenues*

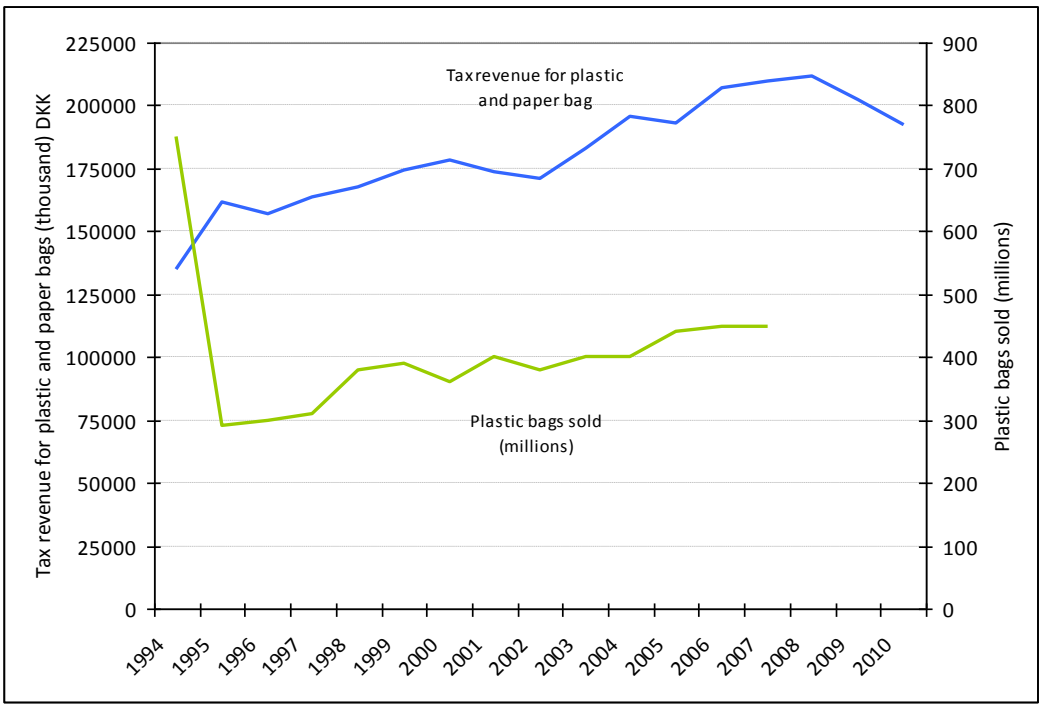
The revenues for plastic and paper bags are combined in the Danish statistical system. From 1994, when the levy was introduced, the bag tax delivers an average of 181 million DKK (24.3 million EUR) per year.[263] The revenues also show an increasing trend correlating with the number of plastic bags sold, as shown in Figure 55. This matching trend indicates that the ratio of plastic/paper bags sold is fairly stable, otherwise greater divergence would be evident given the different taxes on each. A drop in revenues could have indicated a shift towards paper bags (since the tax on paper bags are half of plastic bags). The drop in 2008 corresponds with the start of the economic crisis.

Tax revenues are used for general public finance activities.

[262] Translated from the Danish: velgørenhedspose (http://www.coop.dk/ansvarlighed/miljoe+og+oekologi/10+handlinger.aspx)

[263] Calculation based on tax-revenues from plastic and paper bags, 1994-2010 (www.statistikbanken.dk)

**Figure 55 Tax revenue (DKK) for plastics and paper bags (1994-2010) + plastic bags sold**




*Source:* Ecorys based on Danmarks Statistik, Plastindustrien.

To separate plastic and paper bags revenue is challenging. However, if one assumes based on previous data that 450 million (2007) plastic bags use 9000 tonnes of plastic, the fee for one kilo is 22 DKK, resulting in 198 million DKK (26.6 million EUR) in tax-revenues for Danish authorities per year, or approximately 95% of the total tax (plastic + paper) revenue each year.

Among the trends observed by the tax authorities is a trend towards thinner (lighter) bags being used, this is having some impact on bag use as compared to revenues, i.e. the number of bags used increasing slightly faster than revenues. The results are positive in resource efficiency terms but may slowly erode revenues over time.

### *Bag costs*

The cost of an individual plastic bag for the supermarket consumer ranges between 2 – 3.50 DKK (0.27-0.47 EUR). The manufacturer or importer sells the bag to the retailer for 0.80-1.80 DKK (0.11-0.24 EUR) depending on thickness and size. If one assumes a wholesale price of 1.30 DKK (0.17 EUR) per bag and one kilo represents 50 bags (20g per bag), then the tax per bag is 0.44 DKK (0.06 EUR) per bag, considerably lower than the Irish levy.

### *Costs to retailers / consumers*

Supermarkets have made plastic bags a significant source of income. To provide an indicative example we use Fakta[264], a discount market found all

[264] http://www.fakta.dk/

over Denmark. In May 2011, they charge 2.50 DKK (0.34 EUR) for a conventional plastic bag (0.04 mm, max load 15kg). In a survey made by the Danish newspaper Politiken, thick re-usable plastic bags cost between 1.50 – 1.80 DKK (0.20-0.24 EUR) in purchase cost for the supermarket (including tax) and thin plastic bags approximately 0.80 DKK (including tax).[265] Assuming that Fakta purchase their bag from the producer for 1.50 DKK, the marginal revenue is 1 DKK (0.13 EUR) per bag.

#### Administrative burden

As part of the wider packaging tax regulations no specific information is available for the burdens relating to the plastic bag tax. As of 2010, 270 companies in Denmark were registered to pay the tax. This contrasts with the Irish levy which is applied by almost all, i.e. thousands, of retail outlets.

The design of the Danish tax requires both tax and customs officials to enforce the plastic bag law, although these are both employed by the Danish Tax and Customs Administration (SKAT – *Skatteministriet*). In comparison to the Irish system this places extra administrative burden on the authorities, but less on firms.

#### Impact of instrument

Clearly, there was a significant drop in plastic bag use in the period after the tax was introduced. The initial drop was over 60% however this gap has shrunk to a 40% decline on pre-tax consumption, due to incremental increase in use of bags.

#### Denmark Conclusions

The usage of plastic bags went down significantly immediately after the tax was introduced. Since then there has been an increase in usage despite Denmark's reputation for having the world's most expensive plastic bags.

Since the introduction, plastic bags have become a source of revenue for supermarkets and they are believed to take high margins using environmental arguments. Consumers appear to shy away from more expensive environmentally friendly alternatives on offer from some supermarket chains.

The design of the tax, targeting manufacturers and importers instead of consumers, might explain the smaller reduction in usage compared to Ireland.

### *4.7.4 Conclusions*

In both Ireland and Denmark the implementation of a tax on plastic bags has had a significant and immediate effect on their usage, with respective

[265] http://politiken.dk/tjek/tjekmad/tjekmadartikler/ECE653684/supermarkeder-tjener-millioner-paa-poser/

falls of 90% and 60% experienced from the first year. In respect of this overall objective the taxes can be regarded as highly successful.

The environmental impact is difficult to track, it is notable that in Ireland the primary anti-litter objective of the tax has been met, with the national litter survey recording that they now make up only a small fraction of total litter. In Denmark no similar data is present but similar declines in plastic bag litter would be expected. The wider environmental impact of the tax is debateable, in each case there is some argument that the tax has saved materials, particularly in Ireland, where this represented an estimated 12.5% by weight of packaging waste, a significant impact but not enough to slow overall increasing trends in plastic packaging waste in both countries. This is also without taking into account any rebound in usage in stronger re-usable plastic bags in Ireland. This also draws into the wider discussion on what, on a life-cycle and environmental basis, the best bag material would be. In neither case is a distinction made between the specific plastic type and its degradability.

The economic impacts of such a tax are not understood to be significant, in Ireland it may have played a role in the closure of one firm but the causation is far from clear. In Denmark the tax is understood to have led to profiteering by some retailers and increased costs for householders. Yet the impacts to householders can easily be mitigated through the switch to re-usable bags.

### Lessons learnt

The experiences in Ireland and Denmark with such a tax offer a number of interesting lessons. Erosion of the consumption reduction impact of the tax is an issue that has arisen in both countries, with the tax having an immediate impact on consumption but usage then creeping back over time. Although consumption remains well below original levels it is something that may need to be reviewed. In Ireland the system has adjusted for this, with an increase in tax rates in 2007 leading to a further decline in consumption, though initial signs are that this is still creeping back. Measures are being put in place to enable tax rates to be adjusted again in future to manage this issue. The tax rate has remained the same in Denmark since 1997 and bag use is continuing to rise. The key point from this is that a static tax rate will see its impact erode over time and should be reviewed periodically to maintain its impact. The evidence from Ireland suggests this also has positive effects on total tax revenues.

Consumption levels are linked to resource efficiency although the two are not the same thing, a reduction in consumption does not necessarily mean improved resource efficiency. This is important in considering instrument design. The Irish tax focused on overall bag use, not resource use. It is estimated to have achieved significant resource savings, for plastic at least, although overall plastic packaging waste continued to increase. This could be a result of increased resource use through increased production and use of re-usable bags. The overall resource efficiency gain being unclear as it is a factor of many things, such as how many re-uses of bags are made and the type and size of additional fuel or resource inputs. The

Irish tax may not therefore directly incentivise resource efficiency, but indirectly contributes towards it by incentivising sustainable consumption.

The Danish tax by being weight-based offers a more direct link to materials, directly incentivising greater efficiency in the use of the primary material resource, if not of other resources in the production process. For example a firm that sells 100 bags for 1 kg, will be incentivised to produce 100 bags that weigh less than a kg, this will then attract less tax, but could result in increased energy or water use requirements. By not making a distinction between the type of resources and the other environmental impacts the tax could incentivise moves to using resources with greater environmental impact. For this reason it is important that instruments are part of a wider package that addresses the other aspects of resource use, such as pollution to air, land, water.

In setting the instrument level, the fact that the tax rate has stayed at the same level in Denmark since 1997 is most likely a factor of public opinion on the matter. There is a feeling among consumers of profiteering by retailers in Denmark, and the cost of plastic bags gives some backing to this. An increase in the tax would therefore be likely to have little public support. This is in contrast to the popularity of the tax in Ireland. The lesson from this is related to ensuring public support and would appear to be related to the fundamental nature of how the tax is applied in each country. In Denmark the tax is levied on producers who then choose how to pass this through to retailers, this leaves a number of steps which are not transparent, for firms to take an unearned margin. In Ireland by charging the tax at point of sale the process if transparent and the retailers have little scope for increased margins. A further benefit of charging the tax at point of sale is the signalling factor to consumers who can clearly see and respond to the price (tax) signal. On this basis a tax applied at point of sale direct to consumers appears to offer the more transparent, popular and effective solution.

Popularity of the scheme may also be closely related to the perception of plastic bags as a problem, in Ireland the conditions are such that it was a visible problem, clear in the minds of the public. This can be argued to have created both the conditions for the tax's popularity and also the support and impetus to drive the legislation through in the first place. Indeed this is a further lesson, that it can take a committed drive from a ministry or Government, such as from Mr Noel Dempsey in Ireland, to put such a narrow measure in place.

The taxes can also create significant revenue streams for government, in Ireland this has been used to fund a national environmental fund which supports a variety of environmental measures in Ireland.

### Applicability to wider context

As Ireland and Denmark are one of only a handful of jurisdictions that plastic bag taxes have been applied there is significant potential to introduce plastic bag taxes elsewhere in the EU. The tax has been shown to be successful in reducing bag use, which although only a minor part of

total plastics and packaging use, is a highly visible item. For authorities seeking to raise revenue, achieve some material savings and challenge consumers to think more sustainably in their consumption habits the tax appears to offer a relatively low risk, high success scheme, with low economic impacts, which can attract wide support if implemented in a transparent way.

From an environmental point of view a plastic bag tax as deployed in Ireland and Denmark leaves some important questions unaddressed. Including the extent to which plastic bags may actually be preferable on a life-cycle basis and whether a distinction in taxation should be made on the basis of whether bags are made from biological or chemical materials and / or are biodegradable. Answers of this type are beyond the scope of this study, but could perhaps display a contradiction between resource efficiency and environmental objectives, with the most resource efficient solution perhaps being one which makes use of more environmentally damaging or persistent materials. This highlights the importance of life-cycle analysis as a method and tool to reflect on these dilemmas.

In considering implementing a tax, its objectives should be clear on this and consider the knock-on impacts in these other areas. Equally it may be more appropriate in some cases to consider legislative measures instead, with adequate enforcement to achieve similar effects. This highlights a crucial point, that an instrument is part of an overall framework of legislation and instruments, these need to form a coherent and consistent whole, to both incentivise resource efficiency without unintentionally leading to other negative environmental impacts.

As a final point, there may be other product areas where a tax like this could be applied. Items which are typically provided free of charge, on for only a small fee, but where a small tax could reduce environmental impacts, improve resource efficiency and lead to more sustainable choices.

## 4.8 Effluent charging – DE & FR

### *4.8.1 Introduction*

**Context**

Abundant worldwide, but overexploited and polluted by human activities, water is a fragile resource and the lack of clean water remains the number one cause of mortality in the world with 4 million deaths per year according to the World Health Organization (WHO) (cited in Noel 2009, p.3). This is why sustainable human development requires good water management and water pollution policies. Although a lesser problem in the EU, clean water remains essential for people, industry and the environment. This means that sound legal institutions and economic instruments should be able to provide sufficient financial resources and incentives to prevent pollution and sustainably manage water resources.

One of the financial instruments to address these challenges is the application of effluent charges. These are defined as money paid by polluters (dischargers) for the direct discharge of effluents into natural waters (Hansen et al. 2001, p.1). Effluent charges are common instruments in environmental policies and are being increasingly incorporated into the environmental law of the EU Member States. The main objective of the charges is to ensure that environmental and resource costs are not borne by the society, but are instead allocated to the direct dischargers and polluters (Hansen et al. 2001, p.7). They also serve as an economic instrument that allows governments to earn revenue and as an incentive to promote investment in pollution abatement measures.

*Wastewater treatment*

The term "wastewater" (or “effluent”) defines water that ends up in the sewer system and that comes from one of these sources: water that has been altered or contaminated, through domestic or commercial use, surface run-off, or rainfall[266]. To reduce the environmental burden, wastewater is treated before it is discharged back into open waters. If wastewater is not properly treated, it can have negative impacts on the environment and on human health. These impacts can include harm to water ecosystems (e.g. fish and wildlife populations), beach closures and other restrictions on recreational water use, restrictions on fish and shellfish harvesting and contamination of drinking water (EUROSTAT 2010, p.157). For example, higher concentrations of pollutants (heavy metals and toxic organic compounds) in marine ecosystems result in chronic effects such as carcinogenicity, mutagenicity and endocrine-disrupting effects and can damage marine mammals’ reproductive systems (BMU 2008, p.44).

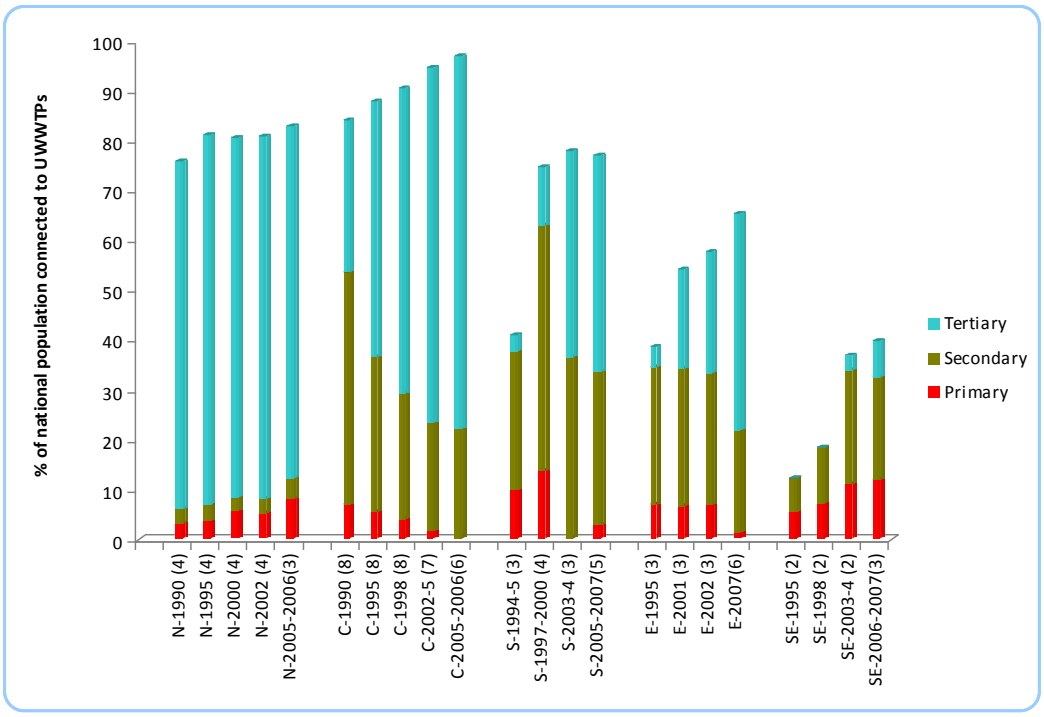
The main objective of wastewater treatment is to remove pollutants (dissolved substances and suspended solids) before the remaining water, called “effluent”, is discharged back to the environment. In general terms, there are three types of water treatment, each more effective but costly than the previous; primary treatment, which, removes about 60 % of suspended solids from wastewater; secondary treatment (biological), which, removes more than 90 % of suspended solids and a considerable part of the nutrients, and; tertiary treatment, which, removes specific nutrients such as phosphorus and nitrogen and practically all suspended and organic matter from wastewater. The by-product of treating wastewater is sludge: the accumulated settled solids separated from various types of water either moist or mixed with a liquid component as a result of natural or artificial processes (EUROSTAT 2010, p.159).

Figure 56 shows the changes in the percentage of population connected to Urban Waste Water Treatment Plants (UWWTP) in several regions of the EU, where there are obvious differences between Northern Europe and the rest of Europe particularly for tertiary treatment. However, the

266The Federal Environment Agency, Water Sector, available at: http://www.umweltbundesamt.de/wasser/wsektor/wasserdoku/english/s6_e.html

evolution over time shows that there is substantial improvement in the performance of the remaining regions of Europe.

**Figure 56 Percentage of population connected to Urban Waste Water Treatment Plants by region in the EU**




Source: Eurostat

N= North Europe, C= central Europe, S= south Europe, E= East Europe, SE= south east Europe. The numbers between the brackets refer to the number of countries computed.

## Case countries

Germany and France have been selected for the "effluent charges" case study. The selection of both countries is based on the fact that both countries were early implementers of effluent charges, Germany started in 1976 and France in 1964. The two systems were introduced for different purposes and have shown specific weaknesses in their design that are worth noting and where lessons for the future can be learned. Table 46 compares the two countries on a few parameters.

**Table 46: Comparison between Effluent Charges in France and Germany**

| Country | Population connected to UWWTP | Primary Purpose | Charges Revenues (mill EURO) |
|---|---|---|---|
| Germany (1976) | 95 %* in 2007 | Incentive to pollution abatement | 300 (in 2007)** |
| France (1964) | 79 %* in 2004 | Financing pollution control measures | 2 214 (in 2009)*** |

* Source: EUROSTAT. ** Source: BDEW (2011). Branchenbild der deutschen Wasserwirtschaft 2011, p. 29.. *** Source: Agences de L'eau 2010

### 4.8.2 Germany – Effluent Charges

#### Delimitation

According to the Effluent Charges[267] Act (*Abwasserabgabengesetz*) of 1976 a charge is to be paid at the point where sources discharge treated wastewater into a water body. The charges were first introduced in 1981 in only three states (Schleswig-Holstein, Hessen, Saarland) and their coverage was later extended to the whole Germany in 1983. After the reunification in 1990, the system of water pollution charges was extended to East Germany in two stages: enterprises already subject to an emissions charge under the legislation of former East Germany became subject to the federal *Abwasserabgabe* in 1991, and the system was fully extended to former East Germany in 1993 (Smith 1995, p.25).

#### Description of the instrument

According to the Effluent Charges Act, charges must be paid whenever treated wastewater is discharged to a water body. The charges are based on the 'damage unit' which corresponds to the harm caused by the untreated wastewater on one inhabitant per year, and is defined on the basis of selected effluent charges and distinguished among ten areas of application: carbon monoxide (CO), carbon dioxide ($CO_2$), sulfur dioxide ($SO_2$), nitrogen oxides (NOx), combined industrial air pollutants, biological oxygen demand (BOD) load, total suspended solids (TSS), combined industrial water emissions, nitrogen and phosphorous, and landfill, incinerator, and hazardous waste discharges. The equivalent units of pollutants for one pollution unit are shown in Table 47.

**Table 47 Pollutants and pollution units' measurements**

| No. | Evaluated pollutants and groups of pollutants | Units of measurement corresponding to one pollution unit | Threshold values according to concentration and annual quantity |
|---|---|---|---|
| 1 | Oxidizable substances in Chemical Oxygen Demand (COD) | 50 kilograms of oxygen | 20 milligrams per litre and 250 kilograms annual quantity |
| 2 | Phosphorus | 3 kilograms | 0.1 milligrams per litre and 15 kilograms annual quantity |
| 3 | Nitrogen, as the sum total of individual amounts of nitrate nitrogen, nitrite oxygen and ammonia nitrogen | 25 kilograms | 5 milligrams per litre and 125 kilograms annual quantity |
| 4 | Organohalogen compounds as adsorbable organic fixed halogens (AOX) | 2 kilograms of halogen, calculated as organicfixed chlorine | 100 micrograms per litre and 10 kilograms annual quantity |
| 5 | **Metals and their compounds** | | |
| 5.1 | Mercury | 20 grams | 1 microgram 100 grams |
| 5.2 | Cadmium | 100 grams | 5 microgram 500 grams |
| 5.3 | Chromium | 500 grams | 50 microgram 2.5 kilograms |
| 5.4 | Nickel | 500 grams | 50 microgram 2.5 kilograms |

[267] For Germany, the terms "charge" and "tax" are going to be used interchangeably in this text. The dual use of these terms in academic papers and governmental reports originates from the different translations of the German word "Abgabe"

| | | | |
|---|---|---|---|
| 5.5 | Lead | 500 grams | 50 microgram 2.5 kilograms |
| 5.6 | Copper | 1000 grams of metal | 100 microgram 5 kilograms per litre annual quantity |
| 6 | Fish toxicity | 6,000 cubic metres wastewater divided by GEI | GEI = 2 |

$G_{EI}$ is the dilution factor at which wastewater is no longer toxic in the fish egg test. The data in this table is based on the procedures for determining the toxicity of wastewater according to the relevant numbers in the Annex "Analysis and measurement techniques" to the Wastewater Ordinance in the version promulgated on 17 June 2004 (Federal Law Gazette I, p. 1108, 2625).

*Source:* BMU 2006, p.36

The average wastewater charge in Germany increased from €2.18 per cubic metre in 2001 to €2.36 in 2010. Of this amount, 5% is attributed to the charge paid by wastewater operators under the Effluent Charges Act (Statistisches Bundesamt 2010). Farms also pay effluent charges for direct discharges under the same scheme and are subject to the same methods of calculations as industrial plants. The wastewater charge is calculated based on freshwater extraction and population density in a respective community; furthermore rainwater charges for non-permeable surfaces are charged different rates (in 2007 on average: €0,41 per year per non-permeable $m^2$) and additionally each household faces a basic annual fee (in 2007 on average: €13,15). The exact methodologies for calculating the wastewater charges are documented in the *Qualitätsbericht: Wasser und Abwasser Entgelte* (2008) published by the Statistisches Bundesamt Deutschland. These quality reports are updated approximately every 3 years, with the next update expected early 2012. Another relevant publication to be consulted for additional information on the calculation of the charge is *Dipl.-Geograph Hans Lamp, Dr. Thomas Grundmann (2009), Neue Entgeltstatistik in der Wasser- und Abwasserwirtschaft Methodik und Ergebnisse.*[268]

The burden of the charges on the industrial sector is considered to be very small and falls in the range of less than 1% (for the automotive industry) and 9% (for the water-use intensive pulp and paper industry). The average cost to firms is usually 3% of their total operation and investment costs in water pollution control (ECOTEC 2001, p. 339).

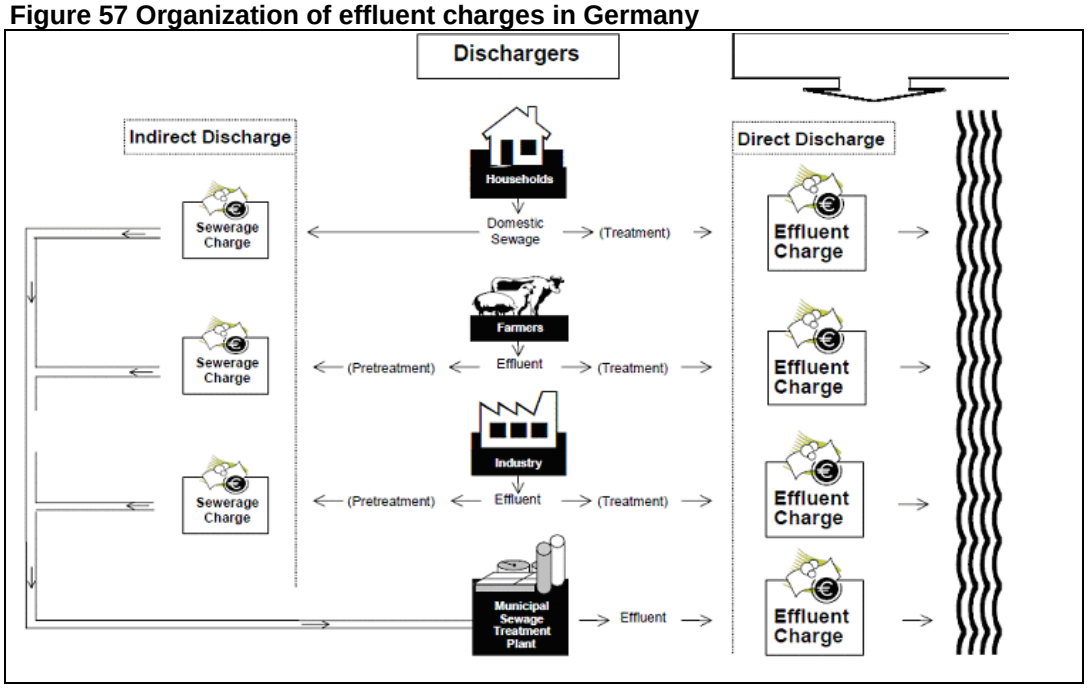
### *Charge payers*

The federal states (*Bundesländer*) collect charges only for direct discharges (into the surface water) such as from sewage treatment plants (STP) who pass the cost of the effluent charges indirectly to emitters such as households, industry, small and medium-sized enterprises and farmers. An estimated 80% of enterprises are indirect dischargers and are indirectly affected by the tax (OECD 2010, p. 25). "Direct discharges" include industrial effluents; agricultural discharges; discharges from sewage treatment plants; discharges and leakage from landfills; direct rainwater discharges; and minor effluents such as domestic sewage from

[268] http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Querschnittsveroeffentlichungen/WirtschaftStatistik/Umwelt/EntgeltWasser,property=file.pdf

decentralized treatment facilities (Hansen et al. 2001, p.56). The charges for effluents from sewage treatment plants are calculated in a similar manner as the direct discharges from industry and no reductions or exemptions apply to them. Figure 57 shows the organization of effluent charges in Germany.

**Figure 57 Organization of effluent charges in Germany**




*Source*: adapted from Hansen et al.(2001), p.2

The payment of effluent charges does not imply exemption from the responsibility of treating wastewater. This charge is the first eco-tax to be levied at Federal level, as a steering instrument and where the polluter-pays principle is applied in practice, since it requires direct dischargers to bear some of the costs associated with their use of water (BMU 2006, p.35).

In Germany the conditions for permits for industrial discharges based on general emission limit values (ELV) are linked to the use of “best available technologies” (BAT). Since the 1996 amendment of the Federal Water Act (to comply with EU legislation), all wastewater management should be based on BAT standards. Furthermore, discharge permits are granted only if discharges from the various sources satisfy the minimum requirements laid down in the 1997 Waste Water Ordinance. This notion is very important because it means that the quality of the water discharged into the environment is a result of various processes, first the application of BAT, and second, its treatment to a level that is acceptable before a permit to discharge (i.e. effluent charge) is granted. This implies also that the net impact of the charge is hard to determine.

The authorities responsible for issuing permits consider the types of substances discharged, industrial plant size, and the discharger (industry or municipality). The municipal governments issue permits for small discharges (generally sewage) and the regional administrations for the

larger effluents, i.e. large sewage treatment plants or industry (Hansen et al. 2001, p. 35).

### Functions of the Effluent Charges Act

The primary objective of the Effluent Charges in Germany is to provide incentives for the adoption of pollution abatement measures. It also has a secondary objective of financing and covering the costs for establishing, maintaining and upgrading the wastewater infrastructure. Given these objectives, local authority by-laws oblige all households and businesses to be connected to the wastewater systems in order to spread the cost evenly over all members of society (solidarity principle) (Lanz, 2004, p.7). Revenues are used to preserve and improve water quality and thus benefit directly or indirectly those liable to pay (*Gruppennützlichkeit*) (e.g. construction of treatment facilities, retention basins, research and development, monitoring, direct measures in water bodies, etc.). In addition, the revenues can also be used to cover administrative costs.

#### *Rate reduction and exemptions*

The original version of the Effluent Charges Act provided economic incentives (discounts) for cases in which the payer met certain minimum requirements. As per Table 48, Pollution parameters were eliminated from the calculation of the charge if they were below certain thresholds. If the amount and the toxicity (*Schädlichkeit*) of an effluent met the minimum requirements of the Federal Water Act (*Wasserhaushaltsgesetz* – WHG), the payable rate was reduced by 50% (Hansen et al. 2001, p.64). In addition, certain investments for the improvement of wastewater handling could be offset against the charge or per unit charge could be reduced by pollution control equipment investment. Also the expenditures for enlargement or new construction of treatment plants could be offset if the load of at least one pollution parameter was reduced by at least 20 %, on the condition that the overall amount of pollution decreased as well (Hansen et al. 2001, p.64).

**Table 48: Offsets and Rate Reductions**

| Collection Frequency | Offset against expenditures | Rate reductions |
|---|---|---|
| Annual | 1. For construction or expansion of treatment plants that may result in reduction of harmfulness by at least 20 %<br>2. For construction or expansion of treatment plants in former East Germany | 1. If effluents meet the BAT derived ELV, the charge is reduced by 50 %<br>2. Charges are reduced when the monitored values are lower than stated in the permit<br>3. Parameters which do not exceed specific threshold values or dilution factors are not included in calculation. |

*Source*: Hansen et al. (2001), p. 62

Effluent charge rebates were originally designed to provide incentives to comply with compulsory BAT standards. Part of the investment expenditure by treatment plants that conform to the BAT standards (50% in 1986, 100% since 1990) could be offset from the charges payable for up to three years during construction. Since 1994, investment in sewers and

installations other than treatment plants were eligible for a 50% rebate (OECD 2001b, p.66).

With the updated version of the Effluent Charges Act in 2004[269] and the latest update of the Federal Water Act (*Wasserhaushaltsgesetz – WHG* [270]) in October 2011, these rate reductions and exemptions are no longer applicable due to the now high standards of effluent cleaning levels achieved in Germany[271]. In 2007, 96% of the total population had been connected to the public wastewater system; over 540 723 km of wastewater pipes and approximately 10 000 sewage treatment plants had been set up by 2007. In order to protect waterbodies from pollution, direct effluent discharges are only permitted if they follow strict rules based on paragraph 57, article 1 of the Federal Water Act (WHG) and thus do not exceed certain pollutant limits based on BAT. Concrete regulations for such direct discharge options are regulated under the 2005 version of the *Abwasserverordnung*: the annexes provide standardized requirements for 53 sectors.[272]

Exemptions in the first decade of the tax regime were possible under a special '*Härteklausel*', which allowed for a reduction or even cancellation of the tax. The possibility for obtaining exemptions according to the *Härteklausel* was removed in 1989, but nowadays exemptions from the charge are given according to paragraph 10 of the Effluent Charges Act to- for example- wastewater from watercrafts, discharge in underground layers which are naturally not suitable for drinking water supply and other special cases (Strosser et al. 2010. p.24). The rainwater from railways is also exempt and no effluent charge is levied on rainwater from industrial plants not exceeding the size of three hectares (Hansen et al. 2001, p.56).

## Revenues and effects of the charges

### *Beneficiary*

In Germany, the *Länder* (State Environmental Ministries) are the recipient of the revenue of the effluent charging system and they control its utilization, since they are the competent authorities issuing discharge permits, water management and legislation. Wastewater treatment facilities are obliged to pay this effluent charge to the local government and they pass on the cost to their customers. During the first two decades of operations (1981 to 1996), the total revenue raised increased from 87.4 million EUR in 1981 to 164 million EUR in 1996, due to the steep increase

269 http://www.bmu.de/files/pdfs/allgemein/application/pdf/abwv_neu_bekanntmachung.pdf

270 http://www.gesetze-im-internet.de/bundesrecht/whg_2009/gesamt.pdf

271 BDEW (2011). Branchenbild der deutschen Wasserwirtschaft 2011. http://www.bdew.de/internet.nsf/id/40873B16E2024175C125785A00350058/$file/110321_Branchenbild_dt_WaWi_2011_Langfassung_Internetdatei.pdf

272 http://www.bmu.de/binnengewaesser/abwasser/doc/3142.php

in charge rate.[273] Between 2005 and 2007 the average revenue from the effluent charge amounted to 300 million EUR. This continuous increase in revenue can largely be explained due to continuously rising effluent charges per cubic meter.[274]

### *Effects of the charges*

The most observable impact of the charges was the high level of compliance to standards of best available technology. Ex-ante evaluations of the effluent charges scheme indicated that both companies and municipalities improved their measures for water pollution abatement in anticipation of the charge[275]. As the amount of charges paid depends largely on the level of compliance of the payer, for many industries, the charges have provided strong incentive both for compliance and reduction of their discharges, given the fact that charges were reduced by 50% if effluents met the BAT derived ELV.

Although public sewage treatment plants (STPs) do not act as commercial entities and therefore might be expected to be less motivated to improve compliance beyond the technological guidelines or required minimum or to reduce their effluents, there was still an observed increased level of compliance in their performance. In fact, the cost of non-compliant public STP may previously have caused an increase in sewage bills of up to 25% (ECOTEC 2001, p. 324).

The link between the tax and standards has played an important role in reducing effluents in Germany; between 1977 and 1987 industrial discharges of wastewater (to surface waters and to sewerage) fell in volume by 14%, while industrial production increased by 14%[276]. Another study showed a 31% decline in industrial wastewater between 1981 and 2001 (ECOTEC 2001, p.86). A further 25% decrease of total wastewater quantities had been achieved by 2007 compared to 1995 figures. [277] Figure 58 below shows effluent reductions in the major categories of dischargers in Germany between 1991 and 2007.

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[273] Waste Water Charge (Germany), Economic instruments in environmental policy, UCD Dublin, available at: http://www.economicinstruments.com/index.php/component/zine/article/166-

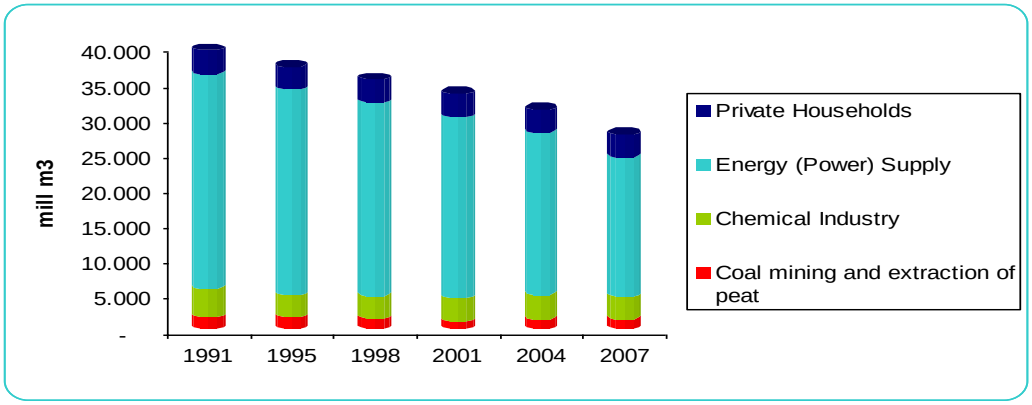
[274] Statistisches Bundesamt, Umweltnutzung und Wirtschaft, Tabellenband, 2010: http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Fachveroeffentlichungen/UmweltoekonomischeGesamtrechnungen/Querschnitt/UmweltnutzungundWirtschaftTabelle5850007107006Teil__4,property=file.pdf

[275] Waste Water Charge (Germany), Economic instruments in environmental policy, UCD Dublin, available at: http://www.economicinstruments.com/index.php/component/zine/article/166-

[276] Effluent Charges in Germany, U.S Environmental Protection Agency, National Center for Environmental Studies, available at http://yosemite.epa.gov/ee/epa/eed.nsf/a8aa55f234e6571a852577420067397e/1d5b30a41b32654385257746000aff62!OpenDocument

[277] Statistisches Bundesamt, Umweltnutzung und Wirtschaft, Tabellenband, 2010: http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Fachveroeffentlichungen/UmweltoekonomischeGesamtrechnungen/Querschnitt/UmweltnutzungundWirtschaftTabelle5850007107006Teil__4,property=file.pdf

**Figure 58 Effluents evolution 1991-2007 selected enterprises (Germany)**




Source: EUROSTAT and Statistisches Bundesamt, Umweltnutzung und Wirtschaft, Tabellenband, 2010- calculation by Ecorys

The large majority (73,8%) of the total wastewater in 2007 was water used for cooling purposes in electricity production processes.

While it is clear that the introduction of the charge has led to a substantial reduction of effluent discharges in Germany, it is difficult to accurately attribute this effect to the Effluent Charge Act only, since it could simply be the result of other contributing legislative changes (Smith, A 1995, p.29). Changes such as the 1996 amendment of the Federal Water Act (to comply with EU legislation) which specifies that all waste water management should be based on BAT standards and the 1997 amendment, which stipulates that permits are issued only in the case discharges satisfy the minimum requirements specified by the Federal Water Act, which promoted the removal of dangerous substances from discharged water.

Positive ecological effects from these changes include the reduction of inputs of nutrients and pollutants from wastewater from local authorities and industries. These appear to have resulted from the replacement or upgrade of existing treatment plants. In addition, it is acknowledged that 94% of wastewater in Germany is treated in compliance with the highest EU standards (BMU 2008, p.49) and that 96% of households in Germany were connected to wastewater treatment plants in 2007[278].

## Administrative burden

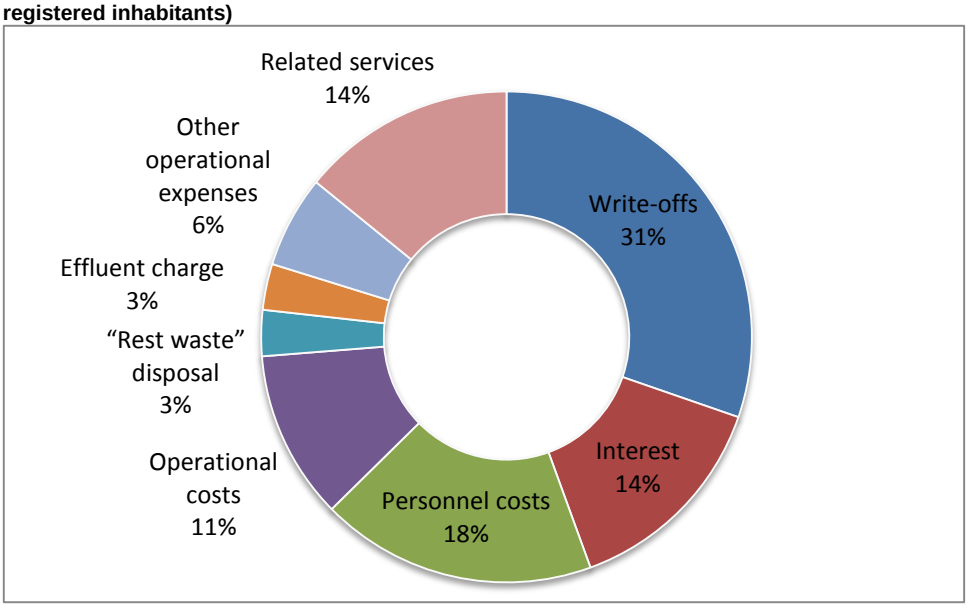
While there are no available studies which explicitly outline the administrative burden of the German Effluent Charges Act, it is acknowledged, that some administrative burden could occur as a result of the institutional set up of the German system. Based on its structure, effluent charges regulations have to go through the “wringer” of German federalism and be subjected to power struggle between States (*Bundesländer*) and German Federation. Also in many cases, State laws supersede federal laws, such as for example, the water legislation of the

[278] Water Statistics, *Statistics Explained*, Eurostat, available at: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Water_statistics accessed on 03-05-2011

*Bundesländer* (e.g. state water acts and state wastewater acts) still maintain their importance, even though the new extended Federal Water Act (WHG) was introduced (BMU 2006, p.38) and recently updated in October 2011. [279]

The treatment of wastewater requires substantial financial commitment, which is primarily borne by the polluters (following the polluter-pays-principle). For example, public wastewater treatment is covered via the revenues of the effluent charge. In 2007, producers, the government and privatized public waste management businesses encountered total costs of 15,7 billion EUR, of which 65% were operational costs and 35% investments into infrastructure.[280] Out of this total cost structure, approximately 3% are effluent charges (see figure below).[281] This remains largely unchanged from the figures reported in the 2001 ECOTEC report on the same. The figure also shows how around 70-85% of wastewater removal costs are fixed costs that are independent of the amounts of wastewater treated per year.

**Figure 59 Cost structure in the wastewater removal sector 2008 (Percentage shares, weighed by registered inhabitants)**




*Source:* DWA Wirtschaftsdaten der Abwasserbeseitigung 2009, erschienen 07-2010

In terms of administrative burden on government, however, the intention is to keep costs minimized by focusing primarily on determining national safety functions and the overall legal framework for wastewater management including monitoring mechanisms, while leaving the

[279] http://www.gesetze-im-internet.de/bundesrecht/whg_2009/gesamt.pdf

[280] Statistisches Bundesamt Deutschland (2010), Umweltnutzung und Wirtschaft. Bericht zu den Umweltökonomischen Gesamtrechnungen, p. 68. http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Fachveroeffentlichungen/UmweltoekonomischeGesamtrechnungen/Querschnitt/UmweltnutzungundWirtschaftBericht5850001107004,property=file.pdf

[281] BDEW (2011). Branchenbild der deutschen Wasserwirtschaft 2011. http://www.bdew.de/internet.nsf/id/40873B16E2024175C125785A00350058/$file/110321_Branchenbild_dt_WaWi_2011_Langfassung_Internetdatei.pdf

implementation to the private sector via technical self-management. The technical-scientific associations DVGW and DWA are umbrella organisations under which over 2 300 volunteer experts from the water industry develop technical and scientific management rules and standards under a fully transparent process. Rules and standards are also coordinated with other standards organisations such as DIN, VDI, CEN, CENELEC, and ISO. The government is thus relieved of implementation duties because the industry, as part of technical self-government, implements the norms and regulations on its own, based on broad consensus. This cooperation principle is in line with the cornerstone implementation principles of German and European technology and environmental law: the federal government in its 2009 "Standardisation Policy Concept" firmly committed itself to promoting technical self-government as an important tool for reducing the public administrative burden.[282]

### Assessment of the effect of the instrument

It is a challenging task to assess the independent ecological and environmental impacts of the effluent charges in Germany, because they interact with other standards (e.g. BAT standards of the Federal Water Act, minimum requirements for water quality according to the Federal Water Act) in a complex way. They do however, provide an example of a well functioning system where the charges and the implementation of environmental standards (EEA 2005, p.76) contribute to the same objective.

In the initial implementation phase the instrument certainly constituted an incentive to companies to reduce their effluents, but the instrument did not necessarily induce companies to reduce these effluents beyond the set standards, i.e. companies received a 50% reduction if they complied with standards (Kirkpatrick et al. 2001, p.35). This type of incentive has ceased to exist in the new millennium, as Germany has reached a very high standard of cleanliness requirements for effluent discharge and has since stopped offering such reductions in fees.

According to the economics of the firms, firms engage in investment, if the cost of investment is lower than the charge. But in reality, the charge in the case of Germany, was set at a very low level (only 2-4% of total costs), which did not create enough incentives for firms to take the issue seriously. In the views of many it thus did not achieve the objectives it was designed for as a control and financing instrument (Helmer & Hespanhol 1997, p.169).

Apart from its objective for a strong incentive function to promote pollution abatement, its fiscal function has been increasing as effluent charge prices have also increased over the years. Today, the effluent charge brings in

[282] BDEW (2011). Branchenbild der deutschen Wasserwirtschaft 2011. http://www.bdew.de/internet.nsf/id/40873B16E2024175C125785A00350058/$file/110321_Branchenbild_dt_WaWi_2011_Langfassung_Internetdatei.pdf

an average of 300 million EUR per year to the local governments. The spending of this money is allocated differently in the various states, some have the obligation to invest it in the sector, while others can apply it toward their general budget.

Despite the fact that efficiency was found to be relatively difficult to measure as illustrated above, effluent charges in Germany are perceived, as shown in the table below, as an important environmental policy instrument for all industries in Germany, encouraging cost-effective measures and innovation in pollution control technology.

**Table 49 Role and Significance of Environmental Policy Instruments**

| Environmental policy instruments | Not important | Important | Very important | Not applicable | Total |
|---|---|---|---|---|---|
| Input Bans | 15.8% | 42.5% | 32% | 9.7% | 100% |
| Technology-based Standards | 11.7% | 55.8% | 23.7% | 8.9% | 100% |
| Performance-based Standards | 14.3% | 52.3% | 24.2% | 9.2% | 100% |
| Input Taxes | 17.3% | 44.4% | 34% | 4.3% | 100% |
| Emission/effluent Taxes/Charges | 19.6% | 42.2% | 30.7% | 7.5% | 100% |
| Tradable Emission Permits or Credits | 40% | 22.5% | 11.5% | 26% | 100% |
| Liability for Environmental Damages | 10.2% | 46.6% | 37.5% | 5.7% | 100% |
| Demand Information Measures | 38.4% | 35.2% | 10.3% | 16.1% | 100% |
| Supply Information Measures | 29.7% | 48.8% | 11.55 | 10% | 100% |
| Voluntary/Negotiated Agreements | 27.8% | 43% | 13% | 16.2 | 100% |
| Subsidies/Tax Preferences | 30.2% | 36.4% | 19.4% | 13.9% | 100% |
| Technical Assistance Programs | 36.9% | 35.3% | 9.1% | 18.7% | 100% |

*Source*: Requate et al. (2004), p.26

### *4.8.3 France – Effluent Charges*

#### Context

#### Background

In order to better manage its water resources and to reduce water pollution, the French government decided to apply effluent charges as an economic instrument to supplement its regulations in 1964. The *Loi de l'Eau* (the Water Act number 64/1245) was passed on the 16th December 1964. It was not before 1968-69 that the decrees necessary to secure the implementation of the law were issued (OECD 2001a, p.7.) The Water Act structured the French water management system in six river basins (Artois-Picardie, Seine-Normandie, Loire-Bretagne, Adour-Garonne, Rhin-Meuse, Rhone-Méditerranée). In general terms, the system was built on two principles: decentralization and planning. Decentralization meant that responsibilities were transferred from the French republic to municipalities, departments and regions[283], which became autonomous from a legal and financial viewpoint and where Water Agencies and River basin committees were installed in each metropolitan river basin. These two types of institutions play distinctive roles; while the Water Agencies perform

[283] There are 26(4 overseas) Regions, 101(5 overseas) Departments in France and 36 783 Municipalities.

executive functions, the River Basin Committees have an advisory role (Kraemer et al. 2003a, p. 74). The planning principle is meant to provide a consistent approach to decision making for the six river basins and to introduce a medium-term perspective on integrated water management that was put into practice by the creation of the River Basin Committees.

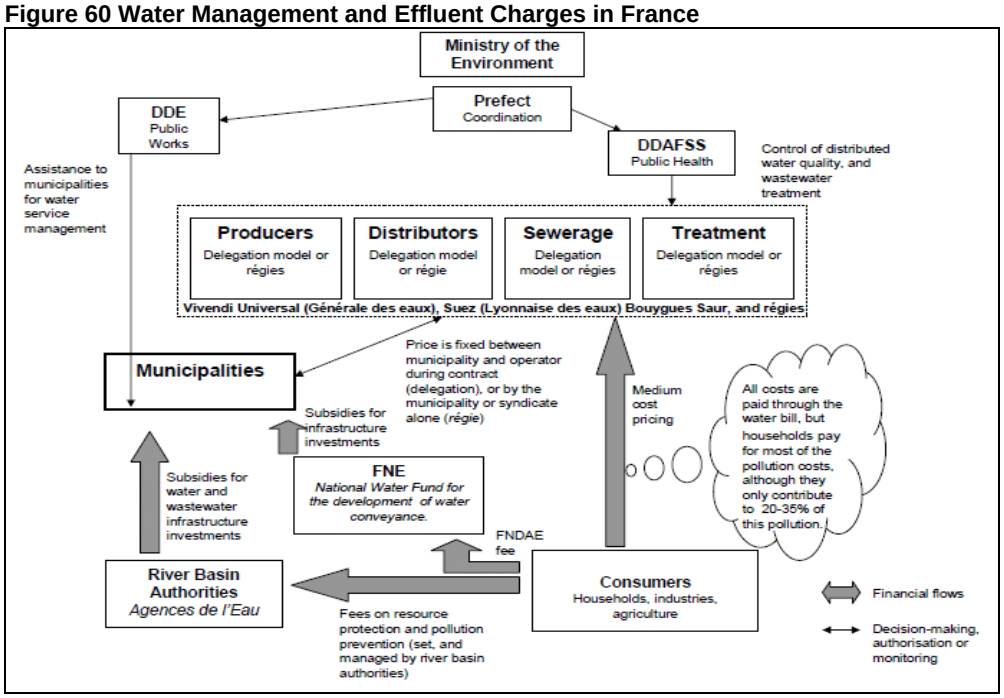
### Description of the instrument

Effluent charges are applicable to all discharges to the surface water and sewage in France. They vary considerably between regions (Water Agencies) and the size of the urban area. In municipalities inhabited by less than 400 inhabitants, effluent charges are not applicable. They also differ for different substances (quantity and quality of effluents discharged) and are based either on permits or are calculated on the basis of actual measurements at the request of the firms or authorities. They are applicable to entities discharging at least the equivalent of 200 inhabitants[284]. For industrial polluters, charges are calculated from the net annual pollution discharged of these substances: suspended solids (SS), chemical oxygen demand (COD), biological oxygen demand (BOD5), reduced nitrogen (RN), phosphorus, nitrates, toxic metals etc (Noel 2009, p. 12). Industrial emitters need to obtain a permit before emitting any discharge into water.

The authorities issuing permits for direct discharges differ according to the type of discharger. In the case of industrial discharger, the Regional Directorates for Industry and Environment (DRIRE) is the responsible authority. In the case of sewage treatment plants, the *Préfets de Département,* are the responsible authority (Hansen et al. 2001, p.35). Figure 60 provides an overview of the organization and management of water and effluent charging in France.

[284] Water Effluent Charge - Brief Summary (France), Economic instruments in environmental policy, UCD Dublin , available at: http://www.economicinstruments.com/index.php/component/zine/article/170

**Figure 60 Water Management and Effluent Charges in France**




*Source*: Bauby & Lupton 2004, p. 36

## Charge payers

In France, industries are subject to the effluent charges for their direct discharges, while the discharges from sewage treatment plants (STPs) are exempt from these charges. Households, and Small and medium sized enterprise (indirect dischargers) do not pay directly the effluent charge, but the price is passed on to them through their water companies (Kraemer et al. 2003b, p.67). The price is calculated at the municipality level then levied through the drinking water bill paid by consumers based on actual consumption.

Historically, agricultural dischargers were exempted from paying the effluent charges due to political and social sensitivity. But, since January 2008, a new tax has been established on non-point pollution according to the volume or toxicity of the marketed products (Noel 2009, p.12).Table 50 gives an overview of the system of effluent charging system in France.

**Table 50: Effluent Charges in France**

| Effluent charging system | Collecting authority | Effluents/ charge rate | Taxpayers | Exemptions |
|---|---|---|---|---|
| Distributive charging scheme (*redevance pour pollution*) introduced in 1964.<br>- Revenue is returned to the polluter in the form of subsidies for | River Basin Authorities (*Agences de l'eau*)<br>**N.B!** In the case of households, the municipality or the concessionaire (in the case of delegation) collect | All discharges to surface waters and sewers are subject to the charge. Charges are based on pollutants.<br><br>Charge rates differ | Non-domestic dischargers (large industries and agriculture) are charged for **direct discharges**. | Effluent charges from sewage treatment plants.<br><br>Municipalities |

| | | | | |
|---|---|---|---|---|
| pollution abatement – subject to conditions[285] | the *redevance* (included in the water bill) and give it to the River Basin Authorities. | between regions. | Households and SME are charged **indirectly**. | with fewer than 400 inhabitants. |

*Source*: Kraemer et al. (2003a), p.29

### Functions of the Effluent Charges in France

The French system of effluent charges has a dual function. On the one hand, it is meant to act as an incentive to fund water-related investments to abate water pollution and on the other hand to cover the general costs of wastewater collection and treatment services (EEA 2005, p.64).

### Revenues of the charges

Being introduced jointly, both effluent charges and abstraction charges are collected from the households by the municipalities (or concessionaires in case of delegation) through the water bill (part of the water bill is collected as "*redevance*" and given to the Water Agencies[286]), while the Water Agencies collect directly the pollution charges from industry and agriculture. The specific charges are visible to consumers in their bills, as water companies itemize the charges based on usage[287].

The revenues (from abstraction and pollution charges) are collected on yearly basis and are used by the Water Agencies for different purposes, such as providing subsidies to municipalities, particularly with regards to the implementation of protection parameters which can reach up to 60% of expenditures, or financing projects associated with the improvement of the wastewater infrastructure and drinking water quality etc. (Bauby & Lupton 2004, p.39). In essence, it can be said that the revenues are to a great extent redistributed to investors in pollution abatement such as industrial emitters or municipalities responsible for treating household effluents (Glachant 2001, p.5).

The total revenue of the Water Agencies rose from FF2.2 billion (335.4 million euros) in 1975 to FF9 billion (1.37 billion euros) in 1995 (Barde & Smith 1997, p.24). In 1996 the amount was FF10 billion (1.52 billion euros), whereas the generated revenue in 1999 was 1.26 billion euros (Kraemer et al. 2003b, p.68). Figure 61 presents revenue amounts and estimates from the effluent charge by region for 2007-2012, this shows that revenues are expected to increase by 13.8% over the period, from approximately 2 200 million in 2007 to 2 500 million by 2012. The biggest

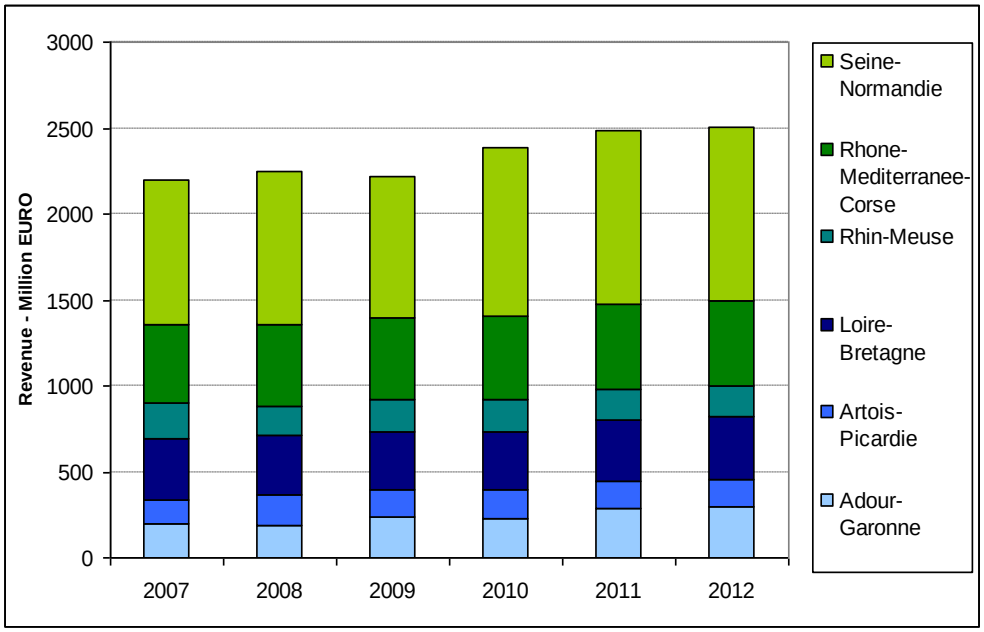
[285] These conditions for financial aid for industry and agriculture include obligations to 1. fight against water pollution, 2. preserve and improve water resources, 3. improve maintenance. More information is available (in French) here http://www.eaurmc.fr/aides-et-redevances/aides-et-redevances/aides-pour-le-bassin-rhone-mediterranee/les-objectifs-phares-pour-le-bassin-rhone-mediterranee.html

[286] The part paid to the Water Agencies in 2006 amounted to 1.445 billion euros

[287] Further information on invoicing (in French) is available here http://www.eaurmc.fr/fileadmin/aides-et-redevances/documents/Redevances/Pollution_domestique/les_redevances_dans-votre-facture.pdf

proportional increase, of over 50% is expected in the Ardour-Garonne region, while the biggest revenue region, Seine-Normandie, sees a 20% increase. One region, Rhin-Meuse, is expected to see a decline in revenue of 11% over the period.

**Figure 61 Revenues from effluent charging by region, Million EURO, 2007-2012***




Source: Ecorys based on Agences de L'eau (2010)

*2011-2012 - projections

### *Rate reduction and exemptions*

The effluent charges system in France allows for premiums for good environmental performance for companies and municipalities. Furthermore, in some municipalities reduced rates are offered to large industrial indirect emitters, where the threshold is generally bigger than 6,000 $m^3$/per year of discharge (Hansen et al. 2001, p.64). Other subsidies are also provided by water agencies in the form of grants, loans and other assistance, which can reach up to 80% of total costs and that can be obtained from the government, the region or the department. In general terms loans are offered at lower interest rates than the market and are paid over a period extending from 10 to 125 years (Helmer & Hespanhol, p. 170).

As noted previously, two entities are exempt from paying the effluent charges in France: (1) municipalities with less than 400 inhabitants and (2) sewage treatment plants discharges into natural waters (Kraemer et al. 2003a, p. 27)

### Effects of the charges

The primary purpose of the effluent charging system in France was to raise revenues to finance wastewater treatment facilities and improve drinking water quality.  The revenues recycled to the industries have contributed substantially to the clean up of many large industrial polluters and the adoption of BAT (Kraemer et al. 2003a, p. 27.)

From an environmental point of view, the charges have achieved some success in protecting sensitive waters as well (Zabel et.al 1998, p. 12). This is manifested in the reduction of industrial pollution, such as for example, the reduction of discharges of oxydisable substances by 28%, suspended solids by 38% and heavy metals by 39% between 1980 and 1992 (Barde & Smith 1997, p.24). A substantial part of these reductions can be attributed to the use of revenues raised by the charges, although the net impact of the charges as an incentive in reducing pollution is hard to distinguish from other instruments such as the Water Framework Directive, the European Urban Waste Water Directive and discharge permits. A study by the European Environmental Agency in 1996, however, concluded that the environmental effect in reducing pollutants of the effluent charges in France is relatively modest (EEA 1996, p. 31). Effluent charges in France can be considered as a revenue-raising economic instrument and the charge rates are calculated not to cover the perceived environmental costs of discharges, but rather to fulfill the revenue needs of the water agencies.

The French centralism and the struggles between the different ''actors'' in implementing an effective charge rate is another challenge that has contributed to the limited effects of the effluent charges system. The relations between the six water agencies, the Ministry of Finance, the Ministry of Environment and the municipalities played an important part in that, where the status of the Water Agencies as independent decision making bodies was challenged by the Ministries of Finance and Environment, who tried to control and influence the Water Agencies (OECD 2001a, p.13). Whereas the Water agencies and the municipalities had an interest in increasing the charges, the ministries had a contradicting interest, i.e. keeping the charges collected by municipalities and water agencies at a low level, because they are considered to be "public spending" and which were subject to austerity measures by the Ministries. The differing interests of actors in the French context has been the primary reason why effluent charges have been kept at a low rate, which in turn has reduced the effectiveness of the schemes (Glachant 2001, p.4).

### Administrative burden/institutional challenges

According to the OECD report "Economic instruments and Clean Water", it seems that the management and construction of waste water treatment plants was met with resistance from municipalities, due to the lack of financial resources to build them. According to the report, even when they had the opportunity to obtain 80 percent subsidies, they were unable to raise the remaining 20 percent (OECD 2001a, p.23).

As mentioned above, there seems to have been some tension between the State and the water agencies, which resulted in keeping the level of charges below an incentive level. The misalignment of interests between different actors may be considered also as an administrative burden and can play a role in rendering operations more complex from an administrative point of view.

### Assessment of the effect of the instrument

Despite the fact that the scheme has enhanced the adoption of BAT and increased investments in water pollution abatement, it is very difficult to assess and attribute the specific role of the effluent charges. As mentioned earlier, the primary reason behind this is that water pollution abatement in France is also incentivised through the premiums offered to companies for good environmental performance, subsidies, the Water Framework Directive, the European Urban Waste Water Directive (UWWTD) and discharge permits. As such, it is difficult to isolate the impact of the charges themselves.

In general terms, the instrument in France is perceived to have had weaknesses in terms of its effectiveness. This is mainly attributed to the low level of charges to the extent that they were considered to be a permission to pollute rather than an incentive to "not pollute" (OECD 2001a, p. 19). In addition to that, it is argued that the water regulations in France and the economic instruments in place are "competing against each other" to change polluters behavior. In that sense, it is believed that the level of pollution abatement imposed by regulations would have – in any case- been reached without the scheme.

In addition to that, the provision of positive economic instruments such as subsidies for investment was considered to be disincentives for further investments in pollution abatement, for example, agricultural producers could use sector subsidies to compensate for the burden of water charges, thus reducing their incentives for reducing pollution or changing their behavior towards water pollution (Kraemer et al. 2003a, p.77). Similarly, these subsidies were distorting to competition and were be considered as an illegal form of support to industries, as they correct a "company failure" rather than a "market failure", which made the French government abolish this type of subsidy from 1978. Nevertheless, as part of the 9$^{th}$ sustainable development plan in France for 2007-2012, direct subsidies were removed and rules for financial aid to assist in investments in infrastructure were revised.

### *4.8.4 Overall Conclusions*

In each of the two country case studies on effluent charges there has been a reduction in water pollution and an increase in the use of BAT. However, the contribution of the effluent charging regimes to these results is not clear because, they were intertwined in wider institutional arrangements that also played important roles in performance and the uptake of various abatement measures. The attribution problem is very important to quantifying the actual scale of benefits of such schemes.

Effluent charging measures were targeted both at reducing pollution and/or increasing revenue rather than improving resource efficiency. The systems typically provided greater incentives for the deployment of mitigation and abatement measures and technologies rather than directly incentivising consumers and producers to look at their consumption. In each case the resource efficiency driver is indirect, with the potential to

reduce charges for pollutants if less are used, but is not the overall objective of the charges.

For the replication of the instrument in other EU Member States, it would first be important to consider its direct relevance to resource efficiency and whether such a scheme is suitable, beyond pollution control and clean water objectives. If implemented it would be important to consider a few factors:

**Make sure that the effects of the schemes are not obscured by subsidy instruments:** The effectiveness of the instrument in the two countries has been limited and has been obscured by specific weaknesses in the system. In the case of Germany, the fact that the system has become associated with rebates from the need to conform to BAT, has significantly weakened the effectiveness of the instrument and reduced its primary incentive function. In a similar manner, the French case has also demonstrated a similar phenomenon, where companies could obtain loans or subsidies for investments in BAT (which was finally abolished after 1978- as an uncompetitive practice), and which reduced companies incentives to invest in water pollution abatement or to exceed the minimum standards. Both cases are an example of a situation where the effects of a negative market based instruments were diminished by other positive market based instruments.

**Consider the right level of charges and make the system dynamic:** Despite the fact that the charges in Germany are relatively higher than in France, in both cases, the level of charges was considered to be too low to induce investment beyond the set minimum. For companies, it was cheaper to pollute (pay the charge and make symbolic investments just to meet the minimum standards) than to invest in smarter abatement solutions. This is particularly obvious when comparing France and Germany to the Netherlands, which set effluent charges at a much higher level, and motivated further investment. The main lesson learnt here relates to the “right” level of the charges that should be placed in a way that creates incentives to industries, i.e. by making the cost of new investment, lower than the charge. Equally it is important to avoid the effect of the charge being eroded, to do this dynamic standards should be applied in relation to BAT, as firms will often only meet the minimum BAT standard and this will also erode over time as technology advances.

**Alignment of incentives of the institutional actors:** Institutional and power relations in the two countries were a determining factor for the success of the instruments. In both countries, the institutional set up and power relations have negatively affected the implementation of the instruments, creating competing political and institutional objectives. This hindered the proper implementation and hence the achievement of the desired objectives of instruments. It is important to consider the alignment of incentives of the different actors involved in the design and implementation of the instrument.

## 4.9 Natural resource taxation – LV & FI

### *4.9.1 Introduction*

Natural resources are the actual and potential resources supplied by nature. Finite resources are those which cannot, or will take a very long time, to be replaced (such as crude oil), while renewable resources are those which will not run out (sun, wind, tides) or will naturally replenish if harvested in a sustainable manner (fish, forests, water). Natural resources can be either finite or renewable and include minerals in the ground and soil, wood availability within forests, animal and plant diversity, and fish stocks. The exploitation of these resources for economic profit, can increase social welfare, if wisely performed, but can also have negative social and especially environmental impacts, typically referred to as negative externalities.

A trend throughout history, but one which has intensified in recent times, due to rapid increases in population and advances in technology, is the overexploitation of natural resources. Overexploitation of natural resources has dramatic consequences, both for the balance in the environment, as well as for the long-term welfare of society. Examples, stemming from the growth in resource consumption, are problems such as the excessive release of greenhouse gases (GHG) into the air and the pollution of water resources to the point where they are unusable. These problems are often not limited to within geographical borders, but have consequences that are global in nature. In order to preserve air, water and soil quality, the EU and its member states are placing increasing emphasis on effective natural resource management. One of the methods through which to do this is natural resource taxation.

#### Economic Instrument

Natural resource taxation has typically focused on energy based taxes, either on fuels used for electricity generation or transport, or increasingly in recent times, the emissions resulting from energy consumption. These types of taxes, while important and of overall interest, are not the focus of this study or this case study. The focus is on the narrower definition of resource taxes, focused on soil, land, minerals, metals, water, forests, fish and other natural resources and stocks.

#### Case Countries

For this case study, on the impact of natural resource taxation, Latvia and Finland have been chosen for detailed study. Latvia is one of the few countries which explicitly taxes natural resource use (they introduced legislation for the first time in 1991), while Finland was the first to introduce a natural resource-type tax (carbon, in 1990). Both countries have a strong resource-dependency, and a strong incentive to create an effective resource-management system, although the individual approaches differ. This makes it an interesting, and widely applicable comparison. The differences in the composition of the countries impact the distributional effects of the taxes. As shown in Table 51, both economies are more reliant on the extractive industries than the EU27 average.

**Table 51 Key information Latvia and Finland**

| Indicator | Latvia | Finland | EU27 |
|---|---|---|---|
| **Natural Resources** | Peat, limestone, dolomite, soil, surface and ground water (and other resources) | Timber, iron ore, copper, lead, zinc, chromite, nickel, gold, silver, limestone | - |
| **GDP (EUR millions at current market prices) 2010** | € 17 970 | € 180 295 | € 12 279 033 |
| **As % of EU total** | 0.15% | 1.47% | 100% |
| **GDP (EUR per capita at current market prices) 2010** | € 8 000 | € 33 600 | € 24 500 |
| **Year of membership in the EU** | 2004 | 1995 | - |
| **Value of extractive industries* - GVA 2009 EUR millions** | € 630 | € 4 588 | € 253 288 |
| **As % of whole economy GVA** | 3.8% | 3.1% | 2.4% |

Source: Eurostat, https://www.cia.gov/library/publications/the-world-factbook/geos

* current basic prices, gross value added of NACE rev 1.1 codes A,B, C.

## *4.9.2 Latvia – Natural Resource taxation*

### Frame of Latvian Environmental Taxation

The Latvian natural resource tax, in place since 1991 and updated regularly, is an interesting case study because it is specifically oriented towards the use of natural resources. This is a commendable approach, partly because of Latvia's status as one of the lesser developed states in the EU, and partly because of the environmental circumstances surrounding the tax. A study of the distributional effects of the tax would be interesting for further application in Eastern European countries.

### Organisation

The tax on natural resources was adopted by the Latvian Parliament (the *Saeima*) and signed into law by the President. The purpose of the tax is to *"restrict ineffective use of natural resources and pollution of the environment, reduce manufacturing and sale of environment polluting substances, promote implementation of new and improved technology which reduces environmental pollution, support the strategy of sustainable development in the economy, as well as to ensure a financial basis for environmental protection measures."* (On Natural Resources Tax, 2000). The tax revenues generated from the policy are intended to be used for environmental protection, inter alia in the recovery of the waste and effective disposal of environmentally harmful waste.

## Natural Resource Taxation

### *Delimitation*

This case study focuses on the tax on Natural Resources introduced in 1991, and has been amended regularly since. The tax forms part of a broader package of fiscal instruments, including real estate taxes, waste charges, fuel duties and extraction licensing.

## Context

### *Reason for introduction of taxes*

Following independence in 1991 the Latvian government had charted a plan towards EU membership. It was also acknowledged that by joining the EU it would be subject to the rules and regulations of the Union. In environmental terms this meant overall commitment to sustainable development and at a more practical level it also meant higher environmental protection standards, changes to waste management practices and moves towards less polluting and lower carbon energy generation. Alongside these new commitments there were also the environmental protection and pollution problems left as a legacy of the Soviet era. Together these factors provided a strong basis for action, but one that nevertheless required commitment and determination from the Latvian government to formulate and implement policies.

Accession to the EU in 2004 confirmed this need for compliance with EU environmental regulation, including the meeting of targets on emissions, renewable energy, water and waste management. For example, waste management was required to meet certain recycling targets, which in themselves had been set to incentivise the development of more efficient systems. As part of the strategy to meet these targets a focus was brought to natural resources, with a tax understood to be a way of promoting greater resource efficiency in industry, which significantly lagged behind EU15 countries. It was also a step at the top of the waste hierarchy to incentivise reductions in resource use. Without sufficient investment in natural resource management, it is unlikely it would have been possible for Latvia to meet its recycling targets.

## Instrument

Latvia's Natural Resources Tax uses a system of applying a permit, charge or tax on air and water pollution, waste disposal and natural resource extraction. The purpose of this is to restrict the manufacture and sale of environmentally harmful goods.

The tax mandate covers:

- any commercial activity connected with extraction of natural resources (gravel, peat, water etc.);
- environmental pollution - waste disposal, emissions into air, water;
  - This includes uses of subterranean depths, by the pumping into geological structures of natural gas;

- goods and products that are harmful to the environment (oils, oils filter, accumulators and batteries, ozone depleting products, tires, electrical and electronic equipment - WEEE);
- packaging of goods and products and disposable tableware and dishes;
- radioactive substances;
- vehicles to whom End-of Life Vehicles Management Law applies; and
- coal, coke and lignite (brown coal).

A selection of the items taxed under the natural resource tax rate is presented in the following table, although it should be noted that many of these rates are scheduled to increase in the next few years:

**Table 52 Natural Resource Tax Rates**

| Resource | | Tax Rate (Latvian Lats) | Tax Rate (Euro) |
|---|---|---|---|
| **Natural Resources** | Soil (cubic metre) | 0.25 (2010) | 0.35 |
| | Sandy loam and clay loam (cubic metre) | 0.04 (2010) | 0.06 |
| | Quarz sand (cubic metre) | 0.2 | 0.28 |
| | Sand (cubic metre) | 0.08 (2010) | 0.11 |
| | Sand gravel (cubic metre) | 0.15 (2010) | 0.21 |
| | Clay (cubic metre) | 0.10 (2010) | 0.14 |
| | Dolomite for decoration (finishing) (cubic metre) | 0.25 | 0.35 |
| | Dolomite (cubic metre) | 0.09 (2010) | 0.13 |
| | Limestone (cubic metre) | 0.13 (2010) | 0.18 |
| | Freshwater limestone (cubic metre) | 0.10 | 0.14 |
| | Travertine (cubic metre) | 1.00 | 1.41 |
| | Gypsum (cubic metre) | 0.25 (2010) | 0.35 |
| | Field stones (cubic metre) | 0.20 (2010) | 0.28 |
| | Pigmentary soil (cubic metre) | 0.10 | 0.14 |
| | Peat (ton) | 0.20 (2010) | 0.28 |
| | Organic sapropel (ton) | 0.50 | 0.71 |
| | Other sapropel (ton) | 0.10 | 0.14 |
| | All types of curative mud (ton) | 0.5 | 0.71 |
| **Extraction of water** | Surface water (cubic metre) | 0.006 (2010) | 0.01 |
| | Underground water - according to its quality (cubic metre) | 0.01-1.00 | 0.71 |
| | Medical mineral water (cubic metre) | 0.10 | 0.14 |

Source: http://ec.europa.eu/taxation_customs/taxinv/getcontents.do?mode=normal&kw1=*&kw2=-&kw3=-&year=2010&coll=LV+-+Natural+resources+tax

Note: Lats converted to Euros using 2010 exchange rate from Eurostat (0.7087 Lat = 1 EUR)

Other resources or items were also taxed, including waste disposal, hazardous waste, emissions to air (including Greenhouse gases), packaging and disposable items, plastic bags and coal.

The purpose of the tax is to incentivise efficient use of the resources, and to ensure responsible consumption, by using the tax to try to internalise the negative externality costs of consumption and/or use. The tax rate is seen by some[288] to be below the rate which is estimated to be required to

[288] Speck et al (2006)

match the long term environmental costs of the resource utilisation. Though as a relatively pioneering measure, and one where the range of resources covered and the tax rates have both been amended regularly, there appears to be a continual learning process at work.

The taxes are levied on the amount of the natural resource extracted rather than on the amount actually used, in order to ensure that resources are used as economically as possible (Speck et al., 2006). Exemptions are given to organisations or entities involved in environmentally beneficial, or protective, activities. For example this includes the provisions that if a company complies with corresponding legislative requirements and ensures the recycling of waste, the Law offers a possibility to receive an exemption from payment of the tax for several taxable items. This system is created for another objective - to provide motivation for recycling, because the primary purpose of the natural resources tax is to foster environmental protection rather than to supply financial resources for the state budget and special environmental protection budget of local governments.

Part of the requirement for exemption from taxes related to waste is that firms demonstrate as part of their waste management plans a communication strategy with wider society. Through this feature firms themselves run active educational and information campaigns to change behaviour.

40% of revenues for the extraction or use of natural resources or environmental pollution are given to the general state budget for central environmental management. The remaining 60% is distributed into a special budget for local environmental management in the local government region that the tax was levied.

*Non-compliance*

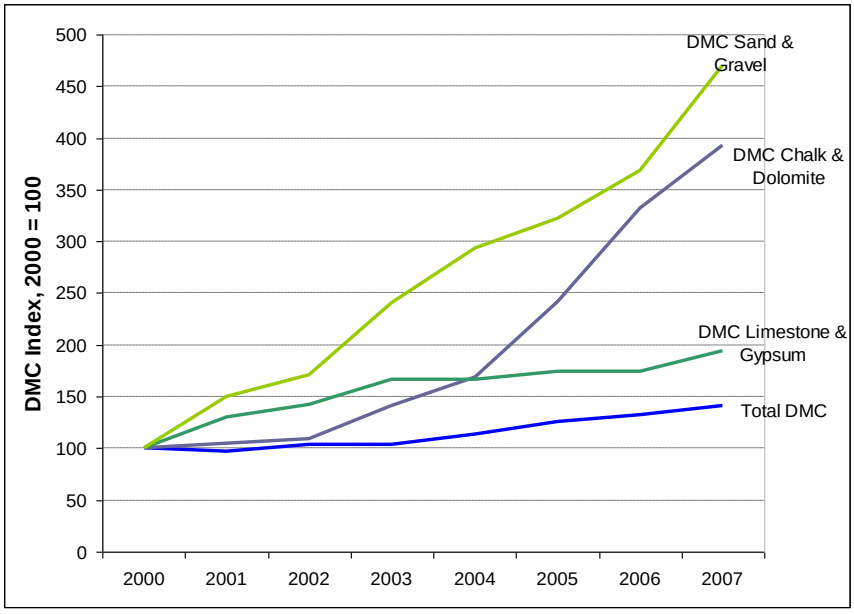
Unreported extraction or non-compliance with the natural resource tax is met with a fine equal to the amount of the tax applied equal to twice the amount of the tax deemed liable. The tax for extraction or use of natural resources or for pollution emitted into the environment above the volume specified in limits is calculated by applying the tax rate tenfold.

### Evolution of natural resource use in Latvia

Focusing on a selection of natural resources covered by the tax it is possible to provide some analysis of overall impacts. Figure 62 charts Domestic Material Consumption (DMC), that is; the volume of the resource in tonnes, consumed in the economy, including imports, but less exports. This is consistent with the application of the tax either on extraction or at the point of usage. This shows that total DMC in Latvia grew by approximately 50% from 2000-2007. Meanwhile DMC in 3 of the resources subject to the natural resources tax, chalk and dolomite, sand and gravel and limestone and gypsum, grew much faster than the total, over 450% in the case of sand and gravel.

It is impossible to know exactly what impact the tax has had, if any, on the levels of consumption of these resources. What is clear is that the tax has not prevented significant growth in their consumption in the most recent years for which data is available. It is notable that in the years for which DMC data is available (2000-2007) the tax rate was not changed, but in subsequent years, 2008 and 2009, the tax rate was increased. Follow-on analysis of changes in these years may shed more light on the tax effects and the extent which the original rate may have been too low to promote sustainable extraction.

**Figure 62 Index of Domestic Material Consumption of Selected Resources, 2000-2007, Year 2000=100**

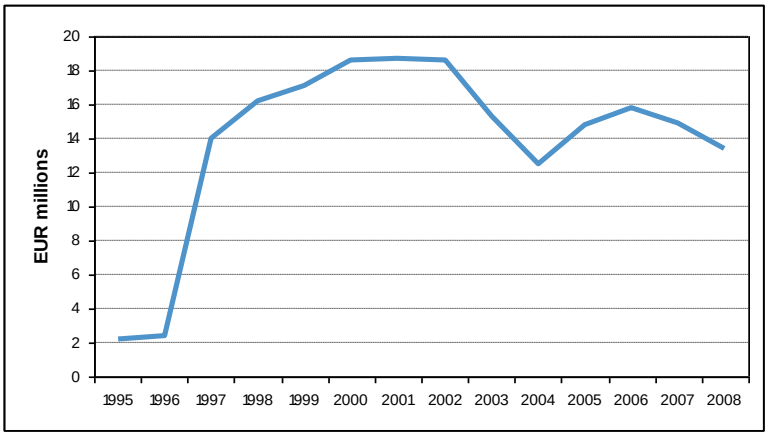



Source: Ecorys based on Eurostat data

## Revenues

The tax revenues from the natural resource tax are presented in Figure 63. It should be noted that this is the total tax revenue from all items subject to the tax, not just the resources listed in Table 52, and so therefore also includes the various other items such as packaging, coal, radioactive waste for which a charge is also made. The figure shows that tax revenues from the natural resource tax remained stable until 1996, and then increased rapidly until 1997. Between 1997 and 2002 the increase was less rapid, but present nevertheless. Since 2002 the revenues have been declining, with a small recovery between 2004 and 2006.

**Figure 63 Tax Revenues from Latvian Natural Resource Tax, EUR million**

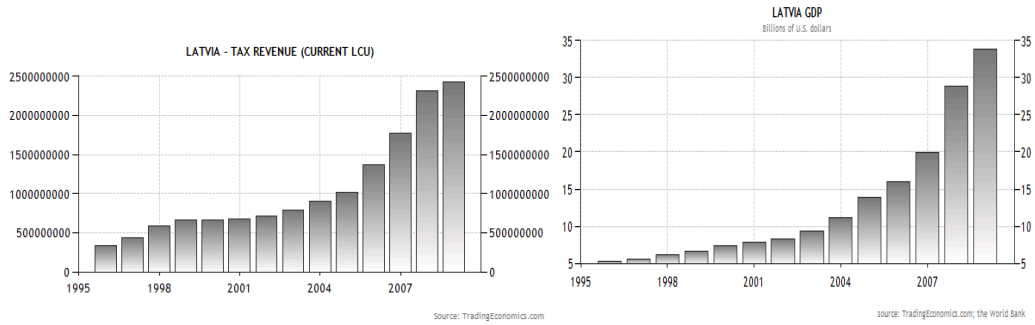



Source: Ecorys based on http://ec.europa.eu/taxation_customs/taxinv/getcontents.do?mode=normal&kw1=*&kw2=-&kw3=-&year=2010&coll=LV+-+Natural+resources+tax

* Revenues are given in current prices and converted from Latvian Lats to EUR using the Eurostat average annual exchange rate data. Overall trends in either currency are consistent, such that the exchange rate effect is largely the same over time.

These changes in tax revenue can be placed in the context of a rapid growth in the tax base and GDP in Latvia over the same period as is shown in Figure 64. This shows that total tax revenue in Latvia increased, to a certain extent, in proportion to GDP between the years of 1995 and 2009. Specifically though the tax base showed a rapid increase between 1995 and 1998, followed by relative stability until 2002, both trends consistent with the revenues from the natural resource tax. Subsequently, total tax revenues increased rapidly until 2008, where growth slowed as the financial crisis hit, that natural resource tax revenues diverged from this trend reflects a diversification of the tax base and that economic growth has been faster in other sectors.

**Figure 64 Comparison: Total tax revenues to GDP - 1995-2009**




Source: www.tradingeconomics.com

Speck et al. (2006) explain that the current administrative tax system makes it difficult to identify the effects of the tax on the environment and society in Latvia. This is currently undergoing a change, but there is insufficient evidence to draw a comprehensive conclusion on the benefits of the tax.

In summary, there has been evidence of a decrease in revenues from the natural resource tax. Sources attribute this to the modernisation of production processes, introduction of cleaner technologies and the establishment of waste management systems. Therefore, it can be

concluded that the natural resource tax is on its way to achieving its goal; the efficient use of natural resources and pollution reduction (Speck et al., 2006).

The tax is subject to regular amendment, with rates being adjusted regularly to maintain or improve its perceived impact, for example on the 1st January 2012 new, higher tax rates for the extraction of natural resources, waste landfilling and air pollution (including PM10 particulates) will be applied. Additionally, tax rates for PM10 particulates into the air have already been increased recently, due to high emission rates.

### *Use of revenues*

The tax revenues from the natural resource tax for the extraction or use of natural resources or environmental pollution are distributed on a 60:40 basis, with 40% going into the general state budget and 60% to a special environmental protection budget of the local authorities in the location where the tax is levied.

The rules governing this special local environmental protection budget state that *"the funds shall only be used for the financing of such measures and projects which are related to environmental protection, for example, education and instruction in the field of environmental protection, environmental monitoring, preservation and protection of biological diversity, air protection and climate changes, protection and restoration of soils and the ground, strengthening of the performance of environment protection institutions, waste management, radioactive waste administration. Local government may also use the special environmental protection budget resources of local government or the resources of the environmental protection fund established by local government as compensation to residents residing in an area subject to the impact of a waste landfill site."*[289]

## Administrative Burden

The Ministry of the Environmental Protection and Regional Development and its services manage the allocation of permits and data regarding extraction of resources. They supply this data to the state revenue service which then collects the tax revenues as part of general tax collection. No separate data for the cost of administering the tax is available but it is believed that the administrative burden is not particularly large. On the contrary, in the past few years, the tax has been generating revenues which have been effectively ploughed back into environmentally-friendly investments, which has helped towards reaching the environmental targets set by the EU upon Latvia's accession.

The administrative burden which is present has been tackled by amendments to existing laws (such as the Law on Pollution, September 2009) (Environment Policy Review, 2009). These amendments use measures such as reduction of bureaucratic processes (such as declaration filing, etc.) to reduce administrative burdens on firms and government.

[289] From the English translation from Latvian law received from the Latvian Ministry for the Environmental Protection and regional Development

## Assessment of the effect of the instrument

The law on Natural Resource tax is regarded by the Latvian Environmental Protection and Regional Development Ministry as successful. It is subject to frequent review and amendment to main the integrity of its purpose, to create a disincentive for resource use that has a negative impact on the environment, particularly in terms of inefficient resource use.

Environmental laws in Latvia are given a relatively high degree of importance. Latvia is on track to meet its target of an 8% decrease in GHG emissions by 2012. Additionally, the adoption of the climate and energy package in April 2009 drew attention to Latvia's interest in increasing the proportion of renewable energy sources in generating energy, and in reducing its energy dependence by diversifying its energy supply and increasing self-provision of electricity (Environment Policy Review, 2009).

Discerning specific impacts of the tax on resource use and environmental protection is impossible given the wide scope of the tax and the multiple variables that determine the consumption of individual resources. Looking more broadly at the resource productivity of the Latvian economy can give some idea of how the tax on natural resources has translated into increased resource efficiency. Between 2000-2007, resource productivity in Latvia showed steady improvement from 0.24 EUR per kg of DMC in 2000, to 0.31 EUR per kg in 2007, an increase of over 29% and one of the fastest rates of improvement in the EU. It could be argued that, at this macro level at least, that the natural resource tax system is contributing to improved resource efficiency in Latvia. This is to be balanced against continued increases in DMC and particularly high increases in consumption of taxed items, as demonstrated previously in Figure 62.

Feedback from the Ministry of Environmental Protection and Regional Development stated that there was an understanding that the tax indirectly provides an incentive for greater recycling and a focus on better waste disposal practice among taxpayers. In addition to this, the tax on water resources also incentivises more efficient water use. The part of the tax applied to plastic bags is also believed to had a significant impact on their use.

In economic terms the tax has imposed additional costs on some industries, particularly the extractive sector. The impact of this is not clear from the data. One effect of the tax may have been to boost the recycling and pollution control sectors, with the tax exemptions that are available directing more funds into these industries.

## Conclusion

The natural resource tax in Latvia was set up to reduce inefficient usage of natural resources, to place a monetary price on environmental damage caused by that resource use, and to thereby limit the environmental damage by creating an immediate disincentive. The tax has managed to draw attention to the problem, but the results are difficult to accurately quantify, therefore while it is thought to be a success and a central part of policy in Latvia, it is not entirely clear what kind of impact the tax is having

in terms of promoting resource efficiency and / or alleviating environmental damage.

In the overall context of resource efficiency in Latvia the natural resource tax appears to be a central element of the Governments environmental programme. With the recent development of a National Sustainable Development Strategy setting out the long-term strategies for sustainable development until 2030, there is evidence that environmentally-friendly policies will continue to enjoy some prioritisation in Latvia. This is important to continue to develop the tax system towards a state where it can make a bigger and clearer contribution to environmental objectives, as the evidence so far suggests that the tax rates are below the social and environmental costs of resource utilisation in Latvia.

### *4.9.3 Finland – Natural Resource Taxation*

**Frame of environmental taxation in Finland**

Finland is a heavily resource-dependent economy (Blomstrom & Kokko, 2002). To a large extent, it owes its economic prosperity to the abundance of natural resources, and their intelligent exploitation. However, there is a strong environmental movement within Scandinavia, with many people recognising the importance of sustainable resource exploitation. Reflecting this, the aim of Finnish environmental policy is to stimulate economic development under circumstances of environmental sustainability, while increasing energy security.

In many respects Finnish environmental policy is felt to be well-designed, with good performance against a variety of eco-indicators. For example, according to the Environmental Policy Review (2009), Finland enjoyed the largest relative reduction in greenhouse gas emissions (-10.2%) in the world, between 1990 and 2008. It has also pioneered many advances in cogeneration methods, for fossil fuels and biomass. In 1990, Finland was the first country to introduce a tax on fossil fuels, based on their carbon content; in effect, a carbon tax (Ministry of the Environment, 2010). This tax was expressly designed to combat climate change by providing a negative incentive to emit carbon. Finnish environmental taxation has traditionally focussed strongly on the energy market, and continues to do so. In addition to energy taxes, environmental taxes and charges can be divided into three categories; waste disposal, pollution emission and natural resource use. It has been recognised that Finland's natural resource management is still too fragmented for maximum efficiency (Natural Resource Management Strategy, (2009). Steps are being taken to remedy this.

*Organisation*

Finland's Ministry of the Environment has overall responsibility for environmental management. Previously, the Ministry of Agriculture was responsible for the management of some resources, such as peat and wood. In October 2008, in order to reduce the fragmentation of

environmental management, these two ministries combined to form the Environment and Natural Resources Consortium. The purpose of this organisation is to use a sectoral approach to natural resource management in order to maximise efficiency in all relevant sectors. The primary areas of focus of this consortium are:

- Forests
- Water and water reserves
- Soil

The purpose is to increase domestic wood use, and promote bioenergy, while reducing the load on the environment. As of now, there are no specific goals for the reduction of resource consumption, despite the fact that Sweden and Finland combined make up 30% of total biomass energy consumption in Europe (Environment Policy Review, 2009).

## Natural Resource Taxation

### *Delimitation*

Natural resource taxation in Finland covers three main areas; carbon, energy and forests/water/soil preservation. This is carried out through a combination of taxes and charges, designed to create negative use-incentives, or to generate state revenue for environmental management. The focus of this case study is on taxation related only to the natural resources encompassed by the final element, i.e. those related to forests, water, soil (land) and associated activities such as mining or resource extraction.

### *Context*

The intention of the environmentally-related taxes and charges are to decouple economic growth from negative environmental effects. The intended approach is laid out in the National Resource Strategy, created by the Ministry of the Environment (2009), in which 6 key areas of focus are identified:

- Stimulating and enhancing the bioeconomy;
- Managing the material cycle;
- Facilitating and supporting regional resource management;
- Directing international cooperation, to create a framework within which Finnish environmental management can function effectively;
- Creating administration and regulations to facilitate effective resource management; and
- Developing expertise and communication methods to identify areas of interest.

## Instrument

While energy and carbon taxes are the largest revenue earning and main environmental taxes in Finland, taxes and charges on natural resource use and management are also made. Table 53 lists the main items on which natural resources specific taxes are levied in Finland, as with other Member States taxes also levied on waste, energy and fuel use and also carbon.

**Table 53 Taxes on Natural Resources in Finland**

| | Resource | Tax Rate (EUR) |
|---|---|---|
| **Natural Resources** | Fish management charges | Determined case by case |
| | Water level management | Determined case by case |
| | Real Estate tax | 0.32%-3.00% of property value |
| | Fishing licence fees | 20-27 per year |
| | Hunting licence fees | 28 EUR game management fee + deer hunting fees 8-120 EUR per animal |
| | Mining fee | 6.75 per hectare to state + fee to landowner of 10 EUR per hectare, plus 20 EUR mining patent fee |
| | Municipal water charge | 1.15-1.27 per cubic metre (2008) |
| | Soil extraction fee | Varying |
| | Forest management fee | Varying |

The real estate tax was introduced in 1992 and among the main objectives of the tax is to facilitate building land availability. The general tax rate is charged at 0.60% to 1.35% of the value of property or for residential buildings at 0.32% to 0.75% of the property value. Higher rates of up to 3% are charged for non-built land in densely populated areas to particularly incentivise the use and re-use of land. Higher rates of up to 2.85% are also chargeable for power plants, excluding small-scale hydro and wind power. Further exemptions are available for forest land, agricultural land and bodies of water (lakes, rivers, etc;). This tax provided revenue of €974 million in 2009. The rationale behind the tax is to penalise property being left unused, by a cost still accruing to the owner of an unused property there is an incentive for them to sell or use the property, reducing the number of vacant properties and therefore the pressure for further building on other land resources.

The mining fee was introduced in 1944 and is currently charged at €6.75 per hectare claimed for mining activities. The revenues for this are paid to the state, estimated at only €0.75 million in 2010. In addition further fees are mandated to be paid to the landowners of the land being mined, this is at the higher rate of €10 per hectare, estimated total revenue of €1.11 million, plus a €20 mining patent fee. During the course of the case study it was found that the fee to the state is to be abolished as part of a Government bill of December 2009, the same bill also made provisions to increase the rate paid to the landowners.

Soil extraction fees were introduced in 1982 and are charged on a permit basis, with fees paid to the local municipalities. The fees paid, to purchase the permit and for supervision expenses, vary by case.

Forest management fees, were introduced in 1952, and are paid on the basis of the forest area owned and the value of the standing timber in this area. The fees are paid to the associations of forest owners. Revenues are used for forest management services which take into account guidance for ecologically sustainable forestry.

## Evolution of natural resource use in Finland

In the 19th Century, Finland was not an advanced economic power. The discovery around 1850 of uses for the country's vast natural resources (minerals and timber) triggered the evolution of their industrial competitiveness. By expanding their industries based on domestic raw materials, they managed to diversify the structure of their economy – and consequently their risk – and also to build a solid base for their sustainable, long-term development (Blomstrom & Kokko, 2002).

Finland's industrial growth has had several consequences. It fuelled economic growth, and population growth, but also contributed strongly to infrastructural growth. Although resource-based growth is often seen as unsustainable, Finland, with a relatively small population and high resource wealth has managed to avoid this trap so far. It has consolidated its development by investing in education, health care and social security. Today, it is a wealthy country, and the development of the Natural resources strategy demonstrates how it is seeking to find sustainable ways of managing its natural resources, particularly valuable renewable resources such as timber, while also contributing to climate change mitigation and environmental protection.

Figure 65 shows the cycle of material use in Finland. Linked to this, around 1/5 of the Finnish labour force is still employed by forestry and metals, and their supporting industries. Such an extensive dependence on the natural resource base requires policies directed towards their preservation and management. In order to maintain competitiveness, Finland must become more resource-efficient, and yet sustain its economic growth.

**Figure 65 The Material Cycle in Finland**

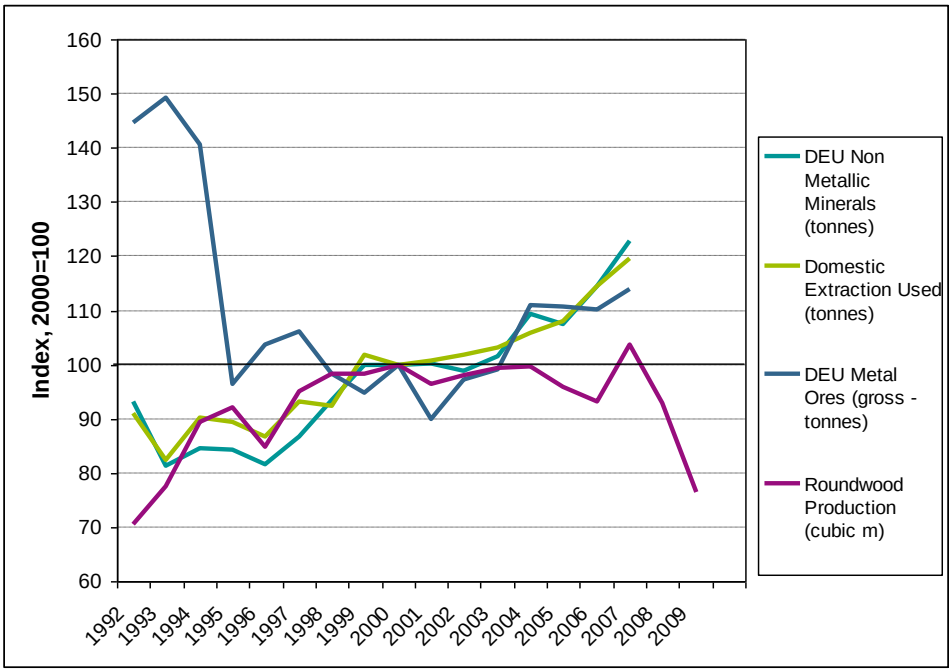

*Figure 1. Material flows in Finland 2005. The material cycle includes flows of both materials and energy. (Source: ENVIMAT 2009, Finnish Environment Institute)*

Looking at the production and extraction of certain natural resources it is possible to put together a picture of trends in natural resource usage, although it is not possible to separate out any specific impacts of the tax. Figure 66 provides an overview of these trends for roundwood production,

important to Finland as a major timber producing country, and also as an aspect of the tax regime. This shows that an increasing trend in production continued until around 2004, when a declining trend has emerged. Given the decadal type time-scales under which much wood is produced it is hard to discern the causes of these effects, indeed the nature of the industry is such that decisions are taken on a very long-term basis in comparison to other industries.

The figure shows that total Domestic Extraction Used (DEU), i.e. the resources extracted and used in the domestic economy, has steadily increased over the period and by 2007 was 20% above its level in 2000. This shows increasing domestic resource use fuelled by increasing domestic extraction, for own use and export. It is unclear if this was part of a deliberate policy drive to increase domestic production and consumption. The trend for DEU of non-metallic minerals closely followed this overall trend. In contrast DEU of metal ores decreased significantly from a peak in the early 1990s to a low in 2001, since then DEU of metal ores has also mirrored the wider trends in DEU and steadily increased.

**Figure 66 Index of trends in natural resource production and extraction, selected resources, Finland 1992-2009, Year 2000=100**




*Source:* Ecorys based on Eurostat

## Costs and benefits

Table 54 presents the revenues received by the Finnish government for the various natural resource tax elements where known. This shows that among the revenues collected, the largest revenues were received from the Real Estate tax and, as already referred to, the other energy and carbon taxes. Unfortunately clear data on two of the most directly relevant natural resources - soil extraction and forest management – is unavailable, although it could be understood that these revenues are relatively small.

**Table 54 Natural Resource Tax Revenues in Finland**

| Tax measure | Revenue category | Revenues (EUR) | Purpose |
|---|---|---|---|
| Fish management charges | Fish management | 2.3 million (2008) | Financing management |
| Water level management | Water protection charge | 0.18 million (2008) | Financing protection |
| Real Estate tax | Real estate tax | 974 million (2009) | Facilitating land availability |
| Fishing licence fees | Fishing licence fees | 8.9 million (2008) | Financing fishing management |
| Hunting licence fees | Hunting licence fees | 13.86 million (2008) | Financing game management |
| Mining fee | Extraction | 0.75 million (2010 budgeted) | General Financing |
| Municipal water charge | Water & Wastewater treatment | 371.4 million (2008) | General Financing |
| Soil extraction fee | | Unknown | Financing – municipality |
| Forest management fee | Forestry | Unknown | Financing – forest owner associations |
| Other | Carbon tax | Ca. 500 million p.a. | Reduction incentive |
| | Excise duty on fuels and electricity (incl. carbon tax) | 3 251 million (2008) | Financing management |
| | Car tax | 1 266 million (2008) | Financing management |
| | Vehicle tax | 611 million (2008) | Financing |

Source: Ministry of the Environment http://www.environment.fi/default.asp?contentid=279489&lan=en&clan=en

It is understood that revenues, unless otherwise specified, e.g. mining fees to landowners, forest management fees to management services, are provided to the state and are used as part of general tax revenues.

## Administrative Burden

There is limited information available on the administrative burden of the tax. What could be argued is that for many of the most relevant charges, i.e. the mining fee, the revenue received is quite low, therefore the proportional effort expended for collection may be quite high.

## Assessment of the effect of the instrument

The evidence on the impact of the natural resource tax is limited, particularly for the most directly relevant natural resources. The ability to detect the direct effects and compare to other countries is complicated by the fact that the taxes have often been in place for decades, and it is therefore impossible to analyse trends pre- and post-implementation. The situation in natural resource use across countries is also highly complex, with the endowment of resources and other local factors having much stronger impacts.

Nevertheless, Finland has not introduced any new environmentally-related taxes since 2000, perhaps indicating a switch in policy objectives away from environmental taxes. This would be consistent with the increasing trends in domestic resource extraction since this time. Although it can be argued that this is compensated by the fact that EU guidelines must be

kept, the recognition of the level of fragmentation of current resource management policy and regimes suggests that it would be useful to tackle it with a stronger, more directed approach, such as the one intended by the Environment and Natural Resources Consortium.

Across the four main natural resource taxes, real estate, mining, soil and forests, some limited assessment of the effects can be made.

The largest revenue earner among the four is the real estate tax, drawing revenue of almost €1 billion in 2009. While land is an important resource, it is unclear by which metrics resource efficiency could be judged in a country with low population density such as Finland. Interestingly, anecdotal and market evidence suggests that property and land values are relatively high, particularly around Helsinki, representing a scarcity of developed land. This may indicate that the tax does not sufficiently incentivise construction on suitable land, to increase supply, which could provide an argument for higher rates. Alternatively it could equally be argued that the tax is a minor policy element but that it can contribute to increasing price pressure, which should drive increased efficiency of land resource use, i.e. in the construction of higher density buildings. The level of revenues generated by the tax suggest that it does have some impact on the market, whether this is more general economic and social rather than environmental and resource efficiency is unclear from the evidence found.

It is clear from the level of mining fee revenues of approximately €1.86 million (state + landowner), that when compared to sector GVA of €550 million in 2009[290], that they represent only a tiny amount of the value of the mining sector in Finland. At this level it seems unlikely that they have any kind of effect on resource efficiency in the mining industry. Perhaps the only influence they may have is on restricting the land area covered by mining operations, although at such low rates (€6.75+€10 per hectare) this is unlikely to be a consideration in site scaling decisions. Indeed, the ineffectiveness of the tax may be a factor in the decision to abolish part of it, particularly as the revenues gathered may be outweighed by the administrative effort required.

It is not possible to make any estimate of the effect of the taxes on soil and forestry based on levels of revenue or on pre- and post- introductory trends. It is most likely that other regulations and market factors play a more important role in determining the efficiency with which these resources are used. Although, in the case of forestry, revenues are recycled back to the sector and could be used to support more sustainable resource use.

Looking more broadly at the resource productivity of the Finnish economy over time can give some idea of how the tax on natural resources has translated into increased resource efficiency. Between 2000-2007,

[290] From Eurostat – NACE revision 1.1. category C

resource productivity in Finland showed only a small improvement from 0.76 EUR per kg of DMC in 2000, to 0.79 EUR per kg in 2007, an increase of 3.9%, and only around half of the EU average improvement of 7.4%. This data supports an argument that the natural resource taxes and charges in Finland are contributing little towards improving resource efficiency, indeed that improvements are lagging behind the average. This is primarily a function of increasing DMC, with DMC growth rates in Finland among the highest in EU15 member states, implying that economic growth in Finland is in particularly resource intensive sectors and possibly also that there is scope for further or increased resource taxes to incentivise efficiency.

**Conclusions**

The natural resource taxes charged in Finland address many of the key natural resources, particularly renewable resources that require sustainable management to maintain stocks for both economic and ecological value. The main elements of the tax have only weak levels of data available, which strongly limits the conclusions that can be drawn on their overall impact and relation to resource efficiency trends.

Trends in resource use appear to have remained independent of the taxes, with overall extraction increasing over time in-line with GVA, only in wood production has this not been the case. Trends in overall materials productivity show that Finland is improving its resource efficiency, but more slowly than the EU average, with rapidly increasing domestic material consumption the main contributor.

The main findings seem to suggest that the natural resources taxes in Finland provide very weak market based effects and therefore in-turn generate few economic or environmental benefits. Part of this is due to the level of the taxes and revenues generated, only in the case of real estate (land) taxes is significant revenue generated but while this may directly serve social and equity functions, it appears to have little or no direct effect on resource efficiency.

### *4.9.4 Comparison*

**Conclusions**

The two case studies presented above have differences, as well as similarities, which can provide information on ways of using market-based instruments to improve resource efficiency.

Unfortunately one of the key similarities is a lack of data on the specific revenues generated by the taxes and any follow up monitoring that could assist in examining the resource efficiency and other impacts of the instruments.

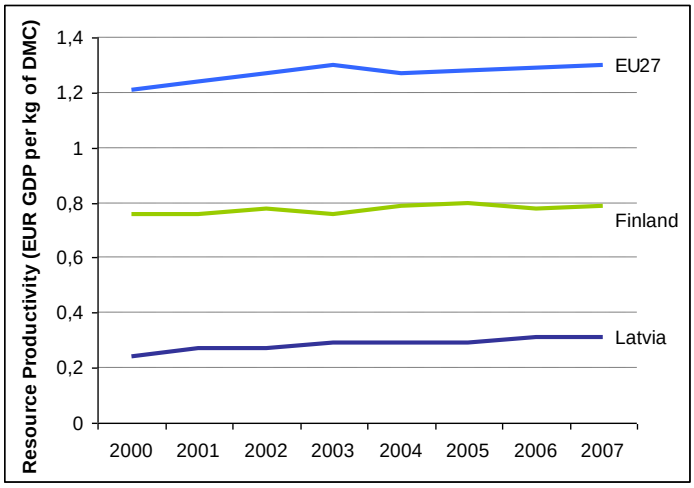
What can be said from the cases is that both Latvia and Finland are heavily resource dependent, for GDP as well as industrial growth. Both Latvia and Finland have also shown some commitment to resource taxation, although it is difficult to judge the relative level of the taxes

overall. The natural resources tax in Latvia is a comprehensive and integrated measure, and although the Finnish system is less integrated and has been adopted piece-by-piece over time, both systems largely cover the same resources.

The tax in Latvia is collected as a whole, under the natural resource tax umbrella, this is significant as 60% of the total revenues from the extraction or use of natural resources or environmental pollution are then allocated to local authority budgets for environmental purposes. This can be important for promoting sustainable practices and there is some scope for it to be invested in ways that may improve resource efficiency, particularly in terms of waste generation and disposal streams. In Finland, the taxes are administered separately and revenues used in different ways, only in relation to the forestry management fees is there an apparent scope for revenues to feed back into investments to improve sustainability and resource efficiency.

The impact of the taxes in both countries is hard to judge, resource productivity has increased in both, and faster in Latvia than in Finland, but both lag significantly behind the EU27 average as shown in Figure 67. While Latvia's performance has improved significantly over the period, Finnish improvement has been sluggish, which for one of the wealthier and typically more innovative economies in the EU is interesting. There may be some contribution from resource taxes in Latvia being more effective than in Finland but the effect is likely to be small, overall it is impossible to attribute the changes in productivity to the taxes.

**Figure 67 Resource Productivity - Latvia, Finland, EU27, 2000-2007**




Source: Ecorys based on Eurostat

Overall in both countries the effects of the natural resource taxes on resource efficiency appear small or non-existent. There is more scope for effect in Latvia than Finland, given the set-up of the taxes, i.e. that they offer exemptions for firms with high environmental compliance and demonstrated performance, and also that they recycle revenues into environmental protection and associated activities that may support sustainability in industry. However, beyond a belief in the success of the

tax from the ministry of Environmental Protection and Regional Development there is little hard data to back this claim.

*Learning for wider application*

The case studies are inconclusive on the value of natural resource taxation in promoting resource efficiency. A lesson from this is that improved monitoring and/or further specific research would be needed to identify and attempt to quantify any impacts and to make a case for wider application of such instruments.

What can be said is that the Latvian tax scheme appears to offer a more efficient implementation approach, under one umbrella, this reduces some of the administrative complexity and costs of the tax. The targeted exemptions from the tax for high performing firms also appear to offer incentives for more sustainable and resource efficient behaviour, though these exemption levels may need to be reviewed periodically to avoid tax and environmental performance erosion.

The role of specific resource based taxes is interesting and is likely to vary by Member State and the availability and type of resources. For all Member States, and particularly those with significant resource endowments, it can be a delicate matter to manage the economic exploitation of these resources, alongside their environmental impact. Powerful groups on each side of the equation can make this a sensitive issue, with industry particularly likely to argue against introducing new, or increasing existing, taxes.

## 4.10 Summary

This chapter presented 8 case studies of market based instruments in contexts relevant to improving resource efficiency. Although many of the instruments were fiscal (tax) type measures they varied considerably in the resources, products, countries and sectors they addressed. The case studies presented the findings on the particular application of the instruments in each country, but they also attempted to draw out the global lessons from this to help inform wider use of such measures to improve resource efficiency. The key global findings identified can be summarised as follows:

**The effectiveness of an instrument is significantly impacted by consumer behaviour**

This is manifested in a variety of ways. Consumer perception of the problem and the solution can be vital to the success of a measure. If the issue of resource use is not perceived as a problem a measure will be difficult to gain support for. This was evident in the plastic bag issue in Denmark and Ireland, with greater perception of a plastic bag litter problem in Ireland contributing to more support for the measure and more successful results. It was also evident in relation to pesticides where evidence for a need for reductions isn’t strong but the perception of pesticide use as a problem is.

The abundance or scarcity of a resource plays an important role in perception too, as shown by water taxes in the Netherlands and Cyprus, both countries understanding the importance of either too much or too little water. History plays a role in this perception and acceptance, the prior existence of voluntary container deposit schemes in Germany and Denmark, a factor in their high return rates and effectiveness. Habits can also be a hindering factor that should be accounted for, such as farmers use of pesticides, or the use of particular materials (aggregates) in construction. In addition perceived abundance of a resource, as could be expected in Finland and the extractive industries, also has a bearing on how consumers/producers react to an instrument. Abundance potentially creating a perception that supports exploitation and is against factors, such as MBIs, that make this more difficult.

Perception of the instrument itself is also important, for its effective function. This is particularly important for fiscal measures, which, to continue to be effective, require periodic revisions to the rates. This typically requires some level of political support. The plastic bag case in Denmark provided an example where support for this is low due to a feeling among consumers of profiteering by retailers at their expense. This was partly a result of the gap between the tax being applied to producers and its eventual, inflated price impact on consumers. A more transparent and direct approach as employed in Ireland, eliminated this gap and much wider support has been retained, this has enabled successful revisions of the measure.

### Education and awareness raising can be powerful supporting tools

The pesticides tax case provided powerful evidence of the value of education and awareness raising in magnifying the effect of market based instruments. By allocating some of the revenues towards educating farmers in efficient and effective use of the resource (pesticides), significant improvements were made. To some extent awareness was also a positive factor in improvements in the water charging case.

### Substitution effects can have unintended consequences…sometimes leading to lower resource efficiency

Instruments that address one particular resource or activity can lead to substitution effects. This can be desirable, for example in the case of plastic bags or aggregates. Where a switch to items that were re-usable or could be more easily sourced locally can be regarded as positive changes. Yet as shown in Sweden, the switch from one aggregate resource, natural gravel to crushed rock, has led to increased energy use in rock crushing. Alternatively a tax on one resource may lead to substitution to a less environmentally friendly resource or one that is less efficient on a life-cycle basis. The wider impacts of an instrument can be difficult to predict but it is important to recognise that resource efficiency can, in some circumstances, conflict with overall environmental objectives.

### Administrative burdens vary considerably, but for container deposit were very high

Across the case studies data on administrative burden was limited. For the public authorities in most cases it was not monitored specifically and only external estimates were available. The available estimates of administrative cost ranged from lows of around 0.3% of revenues for the aggregates levy in the UK to estimates of 3% of revenues for effluent charges in Germany. The one case that stood out in this respect was the container deposit scheme. The design of the schemes is such that it is not intended to generate revenues, only deposits to be returned. This means that the cost of schemes in both Denmark and Germany is almost fully borne by retailers, administrators and consumers. With the administrative costs estimated in both Denmark and Germany to run into tens of millions of euros this is a significant burden.

Data on the administrative burdens to business was even more limited. Positive examples were noted in Ireland for the plastic bag tax being integrated with existing retail tax collection structures and in Latvia for natural resources where administrative burdens for firms were reduced through the potential for exemptions from the tax based on size and / or resource efficiency and environmental performance.

### The type and objectives of an instrument tax can be crucial to its impact on resource efficiency

The case studies found a variety of objectives behind the instruments, not all directly targeting resource efficiency. Indeed many of the instruments were primarily targeted on general environmental goals such as pollution reduction (effluent charging in DE & FR), litter prevention (plastic bags in IE) or human and environmental health (pesticides in DK and SE). Revenue raising was also a primary objective of many of the instruments.

For those more directly targeted at resource efficiency the driver was often other EU legislative targets such as through the waste and packaging or water framework directives. With instruments for physical resources seeking to boost recycling rates as much as reduce or incentivise more efficient resource use.

This is an important consideration in instrument design, while instruments with objectives other than resource efficiency can still have a positive impact, for example the plastic bag tax in Ireland, it is more typical, such as the effluent charging case, or natural resources taxes in Finland (revenue objectives), that their impact on resource efficiency is much less. Indeed by not focussing on resource efficiency the result may be a focus only on mitigating impacts, e.g. clean-up or end-of-pipe measures, where resource use remains unchanged.

The type of tax can also be important to its effect on resource efficiency, quantity based taxes – on units produced or consumed – can reduce these quantities. This may indirectly lead to resource efficiency gains but is not the main effect of the measure. Taxing by quantity of resource may provide a more direct and effective stimulus for resource efficiency

improvements. This was evident in the water charging, aggregates, pesticides (SE) and plastic bag (DK) cases. The trend in plastic bags in Denmark was towards lighter and thinner bags, more efficiently using the same amount of resources.

One problem with this type of measure is that by deploying only by weight the actual impact of the resource is not considered. An extreme example would compare 1kg of wood v 1kg of mercury, obviously the mercury has a much greater environmental impact. These types of trade-offs can exist for other materials, where the availability and impact of resources are not accounted for by a weight-based measure. This can be particularly important for other environmental issues such as pollution and biodiversity. The pesticides case and effluent charging in Germany offer a path to mitigate this weakness of weight-based measures by weighting or grading the impact by weight and adjusting the tax accordingly.

### Setting the tax at the 'right' level is central to its impact

Across the cases consumers and producers reacted in different ways and to different extents to the price signals coming from the instruments. Evidence from the water charging study suggests that with price changes being similar, those with higher incomes respond less to price signals than those on lower incomes with the reasons being two-fold, for consumers with higher incomes it represents less impact on their income than for lower income consumers, and also that higher income often means that many of the easiest measures have already been taken, i.e. the cost of further improvement is high and therefore price signals must accordingly also be higher.

Elasticities also vary considerably by the value or nature of the resource, contrasting low price elasticities in water use, in part due to its essential nature, with the very high price elasticities of plastic bag use.

What is clear from many of the cases is that there is evidence that the tax measures are often set too low to have a significant impact. This was evident in water charging in the Netherlands, pesticides use in Denmark, aggregates levies in the UK and Sweden, effluent charging in Germany and France and Natural Resource Taxation in Latvia and Finland. In each case some progress was achieved but the role of the tax instrument in this was thought to be limited. One part of this that bears further investigation is the rate at which taxes do become effective, obviously related to elasticity, some cases (water charging in NL, pesticides in SE, aggregates in UK and SE) found tax rates of 10-20% of product price to be too low to give significant impact.

### The impact of tax measures will erode over time, but revenues typically continue to increase

Linked to the previous lesson there is some evidence that static tax instruments will have their impact erode over time. At first introduction of the tax quite drastic reductions in consumption can be observed, the plastics bags cases a very clear example of this effect. Yet in this case and others such as aggregates use in the UK and pesticides use in

Denmark and Sweden, this effect can slowly erode over time as the rate becomes proportionally less effective. Consumption often begins to creep back up, eroding the gains. This tends to have the effect of increasing tax revenue but reducing the environmental and resource gains. Further revisions to the tax rate, or introducing automatic indexation, can help to maintain and/or recapture the effect, while taxing on a percentage basis can avoid this problem.

### Market based instruments are part of a wider system of instruments that they need to work with to be successful

In each case the instruments were part of a wider system of regulation, this complicated the task of defining the specific impact of the market based instrument. What it also did was highlight that the instruments rarely work in isolation. They work within in a legislative, cultural and market framework that also has a major bearing on their effectiveness. Ensuring this framework all supports the desired changes one of the best ways to ensure improvement. This was true of water charging in the Netherlands, working in concert with water efficiency measures in homes, it was true of pesticide taxes working in tandem with education programmes in Denmark and Sweden and it was also true of aggregates charging in the UK working with other waste taxes and research funds.

Where instruments were less effective often the framework had competing interests and the structural mechanisms did not adequately resolve these in favour of resource efficiency. The effluent charging cases in Germany and particularly France provided evidence of this. Both systems taxing effluent but also providing subsidies or exemptions to polluters, sometimes polluters could be rewarded, while others could be paid to adopt solutions they would adopt anyway, in either case the incentives were misaligned. This was then further complicated by the institutional arrangements in both, with different governance levels involved or competing stakeholders, leading to decisions becoming time-consuming and politically sensitive and inertia creeping into the system.

### Monitoring and data relating to market based instruments is typically weak

A final point across the cases is that monitoring and evaluation of impact of the instruments is relatively weak. Quantities and revenues sometimes only being able to be derived from the tax returns and this data being subject to aggregation, confidentiality and other issues, reducing its usefulness for assessing impact. For instruments with a solely revenue raising objective this may be sufficient, but for policies with other objectives this lack of follow-up and understanding is a weakness.

# 5 Findings: optimising resource efficiency MBIs

The findings from the case studies presented in chapter 4 provide insight into the impact of market based instruments in various contexts. While a number of lessons can be drawn from the case study analysis, it is also interesting to look more deeply at the wider quantitative effects. Through modelling the macro-economic effects this chapter analyses the wider effects of policy changes. This can give deeper understanding of the potential impact from the wider deployment of market based instruments.

## 5.1 Modelling inputs

### *5.1.1 Introduction*

#### Overview

In this chapter we provide an assessment of the eight policies that were considered in the case studies. Our approach is a quantitative one, making use of the available data and then, where possible, using this as inputs to a modelling exercise. Of the eight policies that were considered, six have been modelled to some extent.

The assessment covers the economic, social and environmental impacts of the policies in which they were implemented, drawing on the model results where appropriate, and providing a more qualitative judgment in other cases. Given the current economic climate, the issue of fiscal balances is also considered in the analysis.

#### Structure of this chapter

The next section describes the E3ME model that was used to carry out this assessment. The following sections discuss the policies on a case-by-case basis:

- Water consumption charge
- Pesticides tax
- Aggregates levy
- Land contamination – Tree protection charge
- Container deposit scheme
- Plastic bag levy
- Effluent charges
- Natural resources tax (incl. ecosystems and biodiversity)

For each one we first outline the assessment methodology that was used and then provide an estimate of the impacts from each one (in each country in which it was implemented).

The final section concludes and briefly discusses the policies in a pan-European context.

### 5.1.2 Modelling approach

## Introduction

As part of the policy assessment we use the E3ME model (see www.e3me.com). E3ME is a computer-based model of the EU's economies, which also includes the physical consumption of energy and material resources. The model is used for forecasting and policy evaluation within Europe, both at the Member-State and Europe-wide levels.

E3ME is well-suited to this type of analysis because it offers a detailed level of sectoral disaggregation, with 42 economic sectors defined at NACE 2-digit level. For energy demand, 19 users of twelve fuel types are defined. The more recent expansion of the model to include six types of material inputs (food, feed, wood, construction minerals, industrial minerals and ores) was carried out as part of the Matisse project (http://www.matisse-project.net/projectcomm/) under the EU's sixth research framework programme (see Pollitt, 2008).

E3ME's database covers the period 1970-2009 and the model projects forward on an annual basis up to 2050. The current version of the model has been tuned to provide a full endogenous solution over the period 1996-2050. The main data sources are Eurostat and the IEA. E3ME is an econometric model, meaning that its behavioural parameters are formed on an empirical basis and reflect the actual data rather than relying on theoretical assumptions or the judgment of the model operators (see Mitra-Khan, 2008). Assumptions that are common in macroeconomic models, such as perfect competition and rational expectations, are not a feature of E3ME.

A longer description of the model can be provided on request. For further information, including the full manual, the reader is referred to the E3ME website given at the start of this chapter.

## Ex-post scenarios

Our assessment is ex-post in nature, meaning that it is an evaluation of the policies as they were implemented and in the countries in which they were implemented. The actual outcomes are compared to a counter-factual case, which is a scenario in which the policy had not been implemented. The impacts of the policy are given as the (percentage) difference between the two sets of results.

E3ME has previously been applied both for ex-post and forward-looking ex-ante analysis. In the FP6 COMETR project (http://www2.dmu.dk/cometr/) E3ME was used to determine the impacts of environmental tax reform (in this case meaning taxes on energy consumption and emissions) in the 1990s. Barker et al (2009) provides a description of the findings from this exercise.

## Scenario design for this project

The following sections in this chapter provide a description of the assessment that was made of each of the policy cases. All of the policies are examples of Market-Based Instruments (MBIs), which usually fit better into the structure of a macroeconomic model than regulatory policy.

However, in most cases, the level of detail required to provide a full assessment goes beyond the capabilities of a macroeconomic model, so it is necessary to make specific assumptions in the assessment. These assumptions draw on the findings from the case studies; details of them are provided in the following sections, with a discussion of their influence on the final results.

## 5.2 Modelling results

### *5.2.1 Water consumption charge*

#### Introduction

The case study discusses two water charging schemes, in the Netherlands and in Cyprus. The Dutch scheme has a long history, but this assessment focuses on the more recent past. The charges in Cyprus were introduced in 1991 and developed in particular form 2004 onwards. Both these schemes are modelled with E3ME. Although the model has equations for water consumption they are not used due to a lack of historical price data. Instead we have made the changes directly with our own imposed price elasticities, based on the results of the case studies. As in the other case studies, a counterfactual case has been set up in which there were no water charges.

#### Water charges in the Netherlands: Introduction

This assessment focuses on the period post-2000, specifically we have set up a counterfactual scenario in which the water charges are removed in 2003. The reason for choosing 2003 is that it covers the period when we have the most information available from the case study and allows us to look at longer-term impacts in the years before the economic crisis. However, as consumption patterns are fairly stable the results should not be particularly dependent on the choice of years of analysis.

The first task is to choose a price elasticity to use in the exercise. Ideally we would have an empirical basis for this (as we do for aggregates, see Section 5.2.10) but data limitations prevent this. We have therefore made a judgment based on the commentary in the case study, to use long-term elasticities of:

- -0.4 for businesses
- -0.1 for households

This means that a 1% increase in the price of water for businesses leads to a 0.4% reduction in consumption. We assume that there is a four-year adjustment to the 'long-term' outcome.
The second assumption is the increase in prices caused by the charges. Given the limited degree of accuracy we are using we have taken this to be around 25% (groundwater tax, tap water tax plus VAT on tap water tax), which is a rough average from the case study, although it ignores the differences in prices paid by business and households.

Putting these together, we would expect to see a 10% reduction in water consumption by business and a 2.5% reduction in consumption by households; this is roughly in line with the findings of the case study, although it is noted that there other factors involved.

The revenues from the taxes are held by the Dutch government and **are not recycled back to the economy.**

#### Water charges in the Netherlands: Economic impacts

Table 55 summarises the economic impacts of the water charges in the Netherlands. There is a small cost to the economy overall, but this must be taken in the context of the additional revenues to the Dutch government (i.e. the use of these revenues could offset the GDP reduction). There are also losses to profitability in most economic sectors, because the increases in water prices to business are greater in magnitude than the reductions in consumption.

Real household spending is also reduced as the price increases through charges to households are absorbed (households have a smaller price elasticity so absorb nearly all the additional costs). The additional costs to business are spread across all economic sectors as all of them use water to some extent. However, even though the increases in water charges are quite large, there are almost no competitiveness impacts, with only a very small change in net trade. This is because water makes up a very small share of total production costs at the NACE 2-digit level, so the impact on sectors' final prices is also small. The case study has not highlighted any particular firms or types of firms that are highly dependent on water costs.

**Table 55: Summary of the economic impacts of the Dutch water charges**

| Impact | Scale |
|---|---|
| GDP | -0.010% |
| Employment | 0.000% |
| Household expenditure | -0.025% |
| Exports | -0.001% |
| Imports | +0.001% |
| Inflationary effects | +0.10% for whole economy (exc. water) |
| Government balance (current price) | +€360m pa |
| Main sectors affected | Water supply (-5.0%) |
| Distributional effects | Small but regressive |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy, in 2007.

Sources: E3ME, Cambridge Econometrics.

## Water charges in the Netherlands: Social impacts

The results show very little change in employment as the main sector that is affected, water supply, is not labour intensive. We would only expect to see changes in the nature or types of jobs in a few very specific cases.

There may be some negative distributional effects from an increase in water prices, as low-income households in the Netherlands spend a slightly larger share of income on water. According to the Eurostat household expenditure survey (2005), the lowest income quintile spent 3.1% of income on water and related services, compared to 2.3% in the fourth quintile.

## Water charges in the Netherlands: Environmental impacts

The modelling does not add any insights to the environmental impacts beyond those already discussed in the case study. We would not expect to see any changes in energy demand or greenhouse gas emissions from the changes to water charges.

## Water charges in Cyprus: Introduction

The water charges in Cyprus were introduced in 1991 and increased in 2004. Our scenario considers a situation in which there are no water charges in 2004; the model results thus show the full effect of the rates as they were in that year.

With only limited data available, we face the same issues in designing the scenario as for the Netherlands. The first assumption is that we have used the same elasticities for business (-0.4) and household users (-0.1) of water as in the Dutch case, again with a four-year adjustment path[291].

[291] This is for consistency purposes. It is noted in the case study that rather high price elasticities for domestic use have been estimated although these do not cover all sources of supply. If the elasticities for Cyprus were higher in absolute terms the reduction in water consumption would be higher. The economic impacts would be on

The second assumption is that we have set the charge rates so that the gathered revenues match those in the case study (around €25m per annum). The same percentage increase in prices is applied to all users. Finally it should be noted that E3ME is not able to offer a regional disaggregation to reflect the different prices across Cyprus, nor the possible effects of desalination plants.

The revenues from the charges are held by government and not recycled back into the economy.

## Water charges in Cyprus: Economic impacts

Table 56 summarises the economic impacts of the water charges in Cyprus. Although there are some larger short-term impacts due to adjustment, the longer-term impacts (which is a better representation given the gradual introduction of water charging in Cyprus) are in the range of -0.02% of GDP. As in the Dutch case, this reduction must be taken in the context of an increase in government revenues of €25m per annum, which could be used to offset the reduction.

The primary driver of the results is household expenditure, which falls in response to higher prices, particularly in the early transition period. However, in the long run, there is not much impact on household expenditure.

Although the water supply sector sees a reduction in output of 5%, there are no significant reductions in output in other sectors. As with the Dutch case, the cost increases are too small to lead to notable competitiveness impacts, with only a small increase in imports towards the end of the assessment period.

**Table 56: Summary of the economic impacts of the Cypriot water charges**

| Impact | Scale |
|---|---|
| GDP | -0.04% improving to -0.02% |
| Employment | -0.01% |
| Household expenditure | -0.06% improving to zero |
| Exports | 0.00% |
| Imports | -0.01% changing to +0.01% |
| Inflationary effects | +0.10% for whole economy (exc. water) |
| Government balance (current price) | +€25m pa |
| Main sectors affected | Water supply (-4.5%) |
| Distributional effects | Small but regressive |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy, in 2004-08.
Sources: E3ME, Cambridge Econometrics.

## Water charges in Cyprus: Social impacts

The results for Cyprus are similar to those for the Netherlands. There is a small reduction in employment, which follows the slight reduction in GDP. The water supply sector is not labour intensive, preventing larger falls. There are no major shifts between sectors and we would not expect significant changes in working conditions.

Again, as with the Dutch charges, there are possible distributional impacts. The Eurostat household expenditure survey for 2005 suggests that households in the lowest quintile in Cyprus spend almost twice as large a share of income on water (and related services) than households in the highest quintile; however, in all cases the share is less than 1.5% of total income. The revenues that are gathered from charges could be used to address this issue.

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a similar scale with the main difference being a larger fall in output for the water supply sector.

## Water charges in Cyprus: Environmental impacts

First it should be noted that, using the assumed elasticities above, the modelling results do not suggest that the reduction in water consumption is as big as that presented in the case study. This could be because the elasticities that we have used are too small in magnitude (see comment above) or it could be because the non-price instruments (information, training, regulation, etc.) also had a significant impact on consumption levels. Unfortunately it is difficult to draw firm conclusions from the data available, other than the fact that the price instruments are likely to have had some impact as part of a broader package of measures.

The main environmental impact, other than the direct reduction in water consumption, is the impacts on water desalination plants; this is beyond the level of detail offered by E3ME. To carry out a comprehensive assessment this would require a 'bottom-up' approach to determine the impact of a 10% reduction in water consumption on energy consumption at a desalination plant. Reductions in greenhouse gas emissions could then be determined.

## Conclusions

This assessment considered two water charging systems, in the Netherlands and in Cyprus. A modelling approach was used for both cases, although it was necessary to make assumptions about the model inputs, in particular the increases in prices and the expected responses (i.e. elasticities) to these prices.

The results in both cases suggest that a reasonably large reduction in water consumption is possible (particularly in business, although that may reflect our assumptions) and that the economic impacts of this are small, outside the water supply sector, and could potentially be offset by revenue recycling from the additional tax receipts. This is because at the NACE 2-digit level, water does not make up a large share of costs in any sector, so competitiveness effects are limited, although all sectors see costs rise to some extent. The water supply sector itself is not usually subject to international competition.

If the charges were increased, it is possible that there may be more negative economic effects in terms of GDP and sectoral output. However, unlike in the case of carbon, this 'leakage' effect may simply reflect a shift in production to a place where water supply is more plentiful and will not have negative environmental consequences. It is also noted that the water supply sector is not a major employer so the labour market effects of the water charges are limited.

The possible negative distributional effects of water charges should be taken into account when designing policy, as the Eurostat figures show quite large differences in consumption patterns between income groups (bigger than for energy). This could be addressed by using a share of the revenues that are generated from the charges.

### *5.2.2 Pesticides tax*

## Introduction

The case study on the use of pesticides covered two countries: Denmark and Sweden. In both countries an MBI was introduced that increased the effective cost of pesticides (although, as discussed, this did not always result in a higher price for pesticides).
There are two possible modelling approaches to carrying out an assessment of this policy, each with its own advantages and disadvantages:

- A specialised agricultural model would be able to provide detail on pesticide use, its costs and how it relates to the types and amounts of crops grown. It would be able to give quite detailed estimates of the impacts of the MBI on the agricultural sector and on final food prices. It would not, however, provide an estimate of the impacts on households or the rest of the economy.
- A macroeconomic model is not able to provide detailed estimates of impacts of the tax on the agricultural sector itself, beyond aggregate estimates on the sector as a whole. On the other hand, this type of model is able to provide an estimate of the wider and secondary impacts on other sectors and on households.

E3ME falls into the latter category, as it covers the wider economy, but agriculture is represented as a single sector, with no disaggregation into crop type or livestock share. Our estimated impacts are therefore averages for the whole sector, while we note that there are parts of the sector that are likely to be affected much more than others.

## Pesticides tax in Denmark

Details of policies regarding pesticide use in Denmark are provided in Section 4.3 A tax was introduced in 1996 and the rate was increased in 1998. The revenues from the tax are used to reduce land tax (75%) and to fund action plan programme activities and research.

The case study finds that retailers absorbed much of the price increase meaning that they saw lower levels of profitability on the sale of pesticides. This makes it difficult to apply a macroeconomic model for analysis, as the price signal is effectively zero. The economic impacts are in fact a transfer of profits from the retail sector to the agricultural sector and, to a lesser extent, to the government (which then redistributes through the action plan programmes and research). This is summarised in Table 57.

**Table 57: Impact on profits and government balance of the pesticides tax in Denmark**

| Sector | Impacts | Direction |
|---|---|---|
| Agriculture | Pays the same price for pesticide | Neutral |
| | Lower land tax | Positive |
| Retail | Pays more to buy pesticides but receives the same price for selling them | Negative |
| Government | Tax revenues from pesticides tax | Positive |
| | Lower land tax revenues | Negative |
| | Funding for action plan programmes and research | Positive |

The social impacts of the policy follow from this result. There are benefits for farmers and possible benefits for rural communities depending on how the additional profits are used. However, the scale of the changes is likely to have been very small and no specific impacts were identified in the case study.

The tax revenues are provided by the case study, reaching around €60m in 2010. These revenues are recycled through lower land taxes and action plan programmes, meaning that the overall impact on the net government balance is neutral.

As discussed in the case study, the environmental impacts of the tax are difficult to determine. Pesticide use in Denmark varied over the period, with initial reductions potentially driven by the tax, but it may have been due to other factors, in particular the training programmes that were running

at this time. The lack of a price signal supports this view. However, it is also possible that the introduction of the MBI added to this level of awareness, leading to a reduction in consumption despite their being no change in the prices paid for pesticide. Such 'announcement' effects are notoriously difficult to identify and isolate (see Cambridge Econometrics et al, 2005, for a discussion), especially when there are other policy changes being implemented concurrently.

## Pesticides tax in Sweden: Introduction

A tax on the use of pesticides in Sweden was introduced in 1984/85, set at the (equivalent) rate of €0.4kg per dose. Over 1986-92 a price regulation charge of €3.2kg per dose was in place but this was ended with deregulation in 1992.

The case study suggests that the price elasticity of demand for pesticides is low, with the tax leading to a reduction in use of 2% (see Section 4.2.3). Using the figures from the case study this suggests that the agricultural sector spent around €4m per annum less on pesticides as a result of the tax. However, the direct cost of the tax is up to €50m.

The timing of the tax is before the current solution period in E3ME and while it would be possible to adapt the model, it would take substantial time and effort. We have therefore modelled a reintroduction of the price regulation charge in 1997 using the same approximate figures. The model results therefore show the impacts of tax being introduced compared to a situation in which there is no tax. We do not expect the exact timing to have a significant impact on results.

## Pesticides tax in Sweden: Economic impacts

Table 58 provides a summary of the economic impacts of the pesticides tax. The main impacts come from the agriculture industry, which passes on the costs leading to higher food prices in Sweden (in the range of 0.1%). This mild inflationary impact leads to a small reduction in real incomes and a loss in GDP of around 0.004%, which could be offset by the additional revenues.

The chemicals industry also sees a small loss of output, due to the lower demand for pesticide. This is estimated to be in the region of 0.02%. There is no change in exports and a very small reduction in imports, due to lower demand for imported pesticides.

All of these effects occur in the year of introduction (1997) except for the employment effects which lag by a couple of years. All the effects are permanent.

**Table 58: Summary of impacts from pesticide tax in Sweden**

| Impact | Scale |
|---|---|
| GDP | -0.004% |
| Employment | +0.003% |
| Household expenditure | -0.012% |
| Exports | 0.000% |
| Imports | -0.006% |
| Inflationary effects | +0.1% (on food prices) |
| Government balance (current price) | €50m |
| Main sectors affected | Agriculture (-0.1%) |
| | Chemicals (negative) |
| Distributional effects | Small but regressive |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy.

Sources: E3ME, Cambridge Econometrics.

## Pesticides tax in Sweden: Social impacts

Despite the fall in GDP, the model results suggest that the tax could have led to a small increase in employment in the agriculture sector (around 150 jobs), due to a substitution effect from chemicals to labour. There is a very small reduction in employment in the chemicals sector (less than 10), giving a very small increase overall. However, at this level of detail the results should be checked from a 'bottom-up' perspective to see if these substitution effects are realistic and practical.

It should also be noted that, as one of the main impacts is an increase in food prices, there could be a small regressive impact on income distribution (as poorer households spend a larger share of income on food). This is particularly likely to be the case as it is the more basic staple foods that will see the largest relative increase in prices. Overall, however, the effects are not large.

## Pesticides tax in Sweden: Environmental impacts

The case study provides an estimate in the reduction in the use of pesticides (2%) in Sweden. The modelling and supplementary analysis do not suggest that there are should be further environmental impacts.

## Conclusions

The pesticides taxes that were introduced in Denmark and Sweden were both quite small in magnitude and were accompanied by other measures. This makes it quite difficult to isolate some of the impacts, particularly the reductions in pesticide use that were caused by the tax.
In Denmark the results from the case study showed that there were few economic impacts from the tax, because the retail sector absorbed the cost. There was thus a redistribution of profits from that sector to the government and to agriculture (through the reduction of land taxes).

In Sweden we modelled the possibility of a reintroduction of the tax in the late 1990s (although similar results would have been obtained if we had used a start year of 2011). The results showed a small but permanent negative impact on the two main sectors involved, agriculture and chemicals. However, the results also show a small increase in employment in the agricultural sector. Overall the effect on GDP is slightly negative but this should be viewed in the context of higher government revenues; if these were recycled through other tax reductions the net impact would be close to zero.

Finally it is worth noting that there are some small negative distributional impacts from a pesticides tax, as it leads to an increase in the cost of food. This could, however, be compensated by using a share of the additional revenues that are accrued by government.

In summary, the impacts from these schemes were small but could be scaled up by charging a higher tax rate. There is a mixture of positive and negative outcomes from the tax and new policy should be designed to take maximum advantage of the benefits. The results do not suggest any economic reason why a pesticides tax could not be implemented at European level and, as much of agriculture is subject to the same CAP conditions, there is an argument for coordination across Europe.

### *5.2.3 Aggregates levy*

## Introduction

The case study on the use of aggregates levies included the UK and Sweden. In the UK, the levy was introduced in April 2002 and was applied to all aggregates. In Sweden, the measure considered is the gravel tax, which was introduced in 1996.

Aggregates roughly corresponds to the material category 'construction minerals' in E3ME and we therefore apply the built-in sub-model for material demands in the assessment (see Pollitt, 2008). This includes a price elasticity of -0.8 which has been estimated empirically on European-level material flows data for construction minerals, implying that a 1% increase in price (for any reason) leads to a 0.8% reduction in consumption. This reduction could be due to behavioural effects or efficiency improvements, or substitution with recycled products.

For the UK, all of the construction minerals material group is covered by the levy, although there are exemptions (see below). For Sweden, only around 45% is included (the share of gravel in total aggregates) and the rates are scaled down accordingly; again this was subsequently scaled for a second time to take into account exemptions.

E3ME then determines the secondary impacts on the extraction sectors by automatically adjusting input-output coefficients in line with consumption patterns; we would therefore expect to see reductions in domestic output or imports in the extraction sector. Higher costs to the construction industry may be passed on to customers.

## The UK aggregates levy: Introduction

The methodology for assessing the UK levy is as described above, with the addition of a **revenue recycling component**. The revenues from the levy were used to reduce employers' social contributions, lowering the cost of employment. We would thus expect to see a small increase in employment as a result.

Our initial model run included all of the construction minerals group but this was found to result in revenues of more than double the £340m that is reported in the DG Taxud online database. We therefore excluded half of the materials that are included in the E3ME category to give a more accurate representation of the implemented measure.

The scenario that was modelled shows the impacts of the aggregates levy being removed in 2003 (the first full year of operation). The case study results suggest that this would mean a 20% reduction in the price of aggregates (i.e. removing a 25% surcharge). However, results are inverted so that the table and discussion in the following section provides an estimate of the impacts of the levy itself, compared to a counterfactual position where there is no levy.

## The UK aggregates levy: Economic impacts

Table 59 provides a summary of the economic impacts of the Aggregates Levy in the UK. Overall there is a small positive effect on GDP, and a larger relative effect on employment (as the reductions in employers' social contributions directly reduce the cost of employment).
The benefits to GDP come from two sources:

- Higher household incomes from increased employment levels lead to an increase in household expenditure
- A shift from imports of materials to domestic production improves the trade balance

There is also a negative impact from higher construction prices, which can act as a deterrent to investment, but these are outweighed by the positive factors listed above. Our results do show a small reduction in investment due to higher buildings costs.

At the sectoral level, the industries that lose out are those that produce aggregates and the extraction sectors. Output in construction itself also falls slightly in response to higher prices

charged, although the effect is quite small. Many other sectors gain by small amounts from higher levels of consumer expenditure; examples include retail, food and drink and hotels and catering. There is zero net impact on government balances, because the revenues raised from the Aggregates Levy are used to reduce employers' social contributions. Our estimate of revenues of up to €450m is set to be broadly similar with the reported revenues from the levy.

**Table 59: Summary of impacts from the aggregates levy in the UK**

| Impact | Scale |
|---|---|
| GDP | +0.015% |
| Employment | +0.02% |
| Household expenditure | +0.01% |
| Exports | 0.000% |
| Imports | -0.03% |
| Inflationary effects | Up to +0.15% (construction), +0.05% for the whole economy |
| Government balance (current price) | Zero net impact |
| Main sectors affected | Construction (-0.05% initially but recovers to zero)<br>Non-metallic minerals (-0.5%)<br>Other mining (-2.5%) |
| Distributional effects | None |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy, in 2010.
Sources: E3ME, Cambridge Econometrics.

## The UK aggregates levy: Social impacts

The increase in employment generally follows the pattern of increases in sectoral output, with the reductions in employers' contributions reducing labour costs in all sectors. This suggests a movement from more manual types of labour to service sectors.
As the levy is only applied to business there are no direct impacts on income distribution and the indirect impacts are not noticeable in size.

## The UK aggregates levy: Environmental impacts

The model results provide an estimate of the reduction in aggregates used, based on the E3ME equations and the estimated price elasticity. The results suggest an immediate short-term reduction of around 6m tonnes consumption, which almost exactly matches against the findings of the case study. The model results also show much larger longer-term impacts, with reductions in consumption reaching 20m tonnes, or 6%, in 2010. Although this has not been explicitly acknowledged in the case study, it is broadly consistent with the trends over time shown in the chart on use of construction minerals. The results suggest that it takes time for companies to adjust equipment and production processes to adapt to the increase in prices.

The impacts on energy use and emissions are not clear. A reduction in material consumption would be expected to save energy, although this may be compensated by higher consumption by the recycling sector. Overall we would expect the energy and carbon intensities of GDP to fall. However, a small increase in GDP could lead to a slight increase in energy consumption and greenhouse gas emissions, meaning that overall levels are unchanged.

## The Swedish gravel tax: Introduction

The Swedish gravel tax was introduced in 1996 and applied to the use of gravel. Our estimates from the case study and the current Eurostat figures suggest that gravel accounts for 40-50% of aggregates consumption by weight. Again, our model results suggest that there could be

exemptions (or differences in definition) that are not accounted for, so we have scaled the coverage so that the revenues match those outlined in the case study (€13-23m).

In the scenario we model there is no gravel tax, so the counterfactual has lower gravel prices than the baseline (with the difference becoming larger after 2003 when the tax rate increased). The results presented take the inverse of this difference to give an indication of the impact of the tax. One important point to note in the modelling is that the tax is applied to all new construction minerals, so the possibility of replacing gravel with other mineral inputs is not present in the model results.
Unlike the UK levy, **there is no allocated use of the revenues gathered**.

## The Swedish gravel tax: Economic impacts

Table 60 summarises the economic impacts of the Swedish gravel tax. It is immediately clear that the impacts are very small, at both the macroeconomic and the sectoral levels. However, this is not unexpected given the scale of the inputs and the annual revenues in the region of €20m.The results are consistent with the conclusion from the case study.

There is almost no inflationary impact, meaning that the negative economic effects are very small. The largest impact is in non-metallic minerals, where output falls by 0.3%.
Government revenues increase by up to €20m per annum, as found in the case study.

**Table 60: Summary of impacts from the aggregates levy in Sweden**

| Impact | Scale |
|---|---|
| GDP | -0.001% |
| Employment | -0.001% |
| Household expenditure | -0.001% |
| Exports | 0.000% |
| Imports | -0.002% |
| Inflationary effects | Negligible |
| Government balance (current price) | +€20m pa after 2003 |
| Main sectors affected | Construction (-0.004%) |
| | Non-metallic minerals (-0.3%) |
| | Other mining (-0.05%) |
| Distributional effects | None |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy, in 2005.
Sources: E3ME, Cambridge Econometrics.

## The Swedish gravel tax: Social impacts

There is a very small reduction in employment throughout the Swedish economy, but this is too small to be considered significant. As the tax only affects businesses there are no distributional impacts.

## The Swedish gravel tax: Environmental impacts

The modelling does not offer any insights into the environmental benefits of using crushed rock rather than gravel but it is acknowledged that a lower use of aggregates could lead to reductions in energy consumption and greenhouse gas emissions, as described above for the UK.

## Conclusions

In this section we considered two MBIs that are focused on the use of aggregates. In the UK a broad levy was charged on the use of all aggregates, while the tax in Sweden focused on gravel. As the case studies show, there were different reasons for the introduction of the two instruments.

The modelling showed that the tax in Sweden was too small to have much impact at the macroeconomic level. However, it is possible to draw some lessons from the assessment of the aggregates levy in the UK:

- According to our price elasticities estimated at the European level, the levy has led to a more efficient use of aggregates, which has increased over time.
- The levy has mainly affected construction companies which are not subject to international competition, meaning there are few competitiveness/leakage effects.
- The sectors that lose out as a result of the charge (extraction and non-metallic minerals) have high import ratios.
- The use of revenues to lower employment costs can lead to net social and economic benefits.

Overall, the UK's aggregates levy is found to be quite an efficient (in economic terms) means of reducing material consumption, although it should also be noted that the effects are still very small at the macroeconomic level. The main downside is a small reduction in investment due to the higher costs of buildings.

Finally, the relationship between minerals consumption and energy use should be noted. The extraction sectors and mineral processing sectors are fairly intensive users of energy, and the transport requirements for heavy minerals products can be large (these are not covered in our modelling results). Therefore, despite the possible negative investment effect there may also be co-benefits of reducing minerals consumption.

### *5.2.4 Land contamination charge – Tree protection*

#### Introduction

The case study on tree protection focused on urban tree protection in Vienna and forest tree protection in Lithuania. These are quite different schemes that in both cases we have only been able to provide a rather limited assessment. They are described in turn below.

#### Vienna urban tree protection

The protection scheme puts an economic value on trees within Vienna by requiring a payment fee for cutting trees above a certain size (plus compulsory replanting). This acts as a disincentive to reduce tree cover within the city.

The detail required for an assessment is well beyond that which is offered by the E3ME model (which operates at a national level and does not discriminate between the different household groups) but it is clear that the economic impacts of the scheme will have been very small (the revenues are approximately €1 for each city resident). At this scale it is possible that administration and transaction costs make up a reasonably large share of total costs so should be considered as part of the assessment (see case study).

The benefits should fall on all of the city's population as the trees are treated as a common good. The costs may fall disproportionately on land owners (who could be assumed to be high-income groups) but this is not completely clear.
However, the overall conclusion is that the economic costs and benefits will not be significant.

## Lithuanian forest tree protection: Introduction

The MBI in Lithuania is a tax on income from round-wood from Lithuanian forests. The revenues have been mainly used for activities related to forest protection. According to the case study the rate is set at 5% of sales, although there are certain exemptions. Revenues have been in the region of €2-3bn per annum.

Wood is one of the material products defined in E3ME, so the model could be applied to carry out an assessment of the tax. By adjusting the rate to match the annual revenues we could estimate an effective rate that includes the exemptions (as was done in the case of aggregates).

The main stumbling block to carrying out this assessment is that the current version of E3ME does not include materials consumption data for Lithuania as only EU15 figures were available at the time of the last update. The figures that are currently used in the model are estimates based on intensity rates for the rest of the EU; they could therefore give a misleading view of the size of the sector in Lithuania. A new data set, for all of the EU's Member States, is currently being prepared as part of a separate study for DG Environment.

## Lithuanian forest tree protection: Rough estimate of impacts

Based on our experience of using the E3ME model we can give a rough indication of the impacts we would expect to see if we were to model the 5% tax:

- Across Europe, wood has an average price elasticity of -0.18, so a 5% tax would lead to roughly a 1% reduction in consumption. In reality this would be slightly lower due to the exemptions.
- The sectors that use wood (wood and paper, also construction) will face marginally higher costs, which can be calculated as 5% of the share of wood in total costs (again minus the exemptions). In most cases this will not be high.
- Some of these costs will be absorbed by firms, resulting in a small loss of profitability, the rest will be passed on to customers through higher prices. There may be a small loss of competitiveness (although construction is not subject to international competition).
- This carries on down the production chain. By the time the price increases reach final products the price increases will likely be small, and the inflationary impact will likely be in the region of 0.1% or less.
- This will lead to a small reduction in real incomes and loss of GDP and employment. It is balanced against the higher revenues that the government collects from the tax.

As the use of revenues is not part of the MBI it would not be included in the modelling. However, it is not difficult to see how the revenues could be used for forestry-related activities that could offset the reductions in GDP.
In terms of social impacts, we would not expect to see specific impacts. The changes in employment are likely to be very small, but could include the loss of some manual jobs. The distributional impacts are also likely to be very small, if noticeable at all, as the changes to final produce prices will be limited.

The modelling results from E3ME would be unlikely to give much insight to further environmental impacts, as all wood is defined as a single category. Results would therefore not include any switching between types of wood, which could have specific environmental impacts. The modelling

would also not include the effects of forestry services and replanting, only the level of total consumption. It is noted, however, that there are specific forestry models that could possibly be used for this type of analysis.

In summary, with the correct input data for Lithuania it would be possible to model the tax in Lithuania. Although these data have recently become available from Eurostat they are not included in the current version of E3ME so we have not conducted a formal model-based analysis. However, it is likely that the economic impacts would be very small and that the reduction in the consumption of wood would be estimated in the region of 1%.

### 5.2.5 Container deposit scheme

#### Introduction

Two container deposit schemes are assessed in this section, in Denmark and in Germany. The Danish scheme was introduced in mid-2000 and the German scheme in 2003. The schemes are modelled as a switching of input resources from the metals, glass and plastics production sectors to the recycling sector (part of other manufacturing in E3ME). In addition there is an increase in drinks prices to consumers due to the higher costs of production (especially when the containers are not returned).

According to the results from the case study, the Danish scheme recorded returns of DKK842m (€113m) in 2008. We have used this as a proxy for the value of the containers that are included in the scheme. In the modelling we assume a constant return rate across the whole period 2001 (the first full year of operation) to 2008. We do not have an estimate of the impact on final costs to drinks producers but this figure compares to total revenues for the sector of €3,219m (Eurostat, including both alcoholic and non-alcoholic drinks). This means that if recycled containers cost double the amount of containers produced from virgin materials, the final costs would increase by 3.5%. We have used this value in the modelling, although it seems likely to be exaggerating the actual cost impact (it is bigger than in Germany). Finally, as the deposit is applied to all producers, we have assumed that all these costs are passed on to final drinks prices, leading to an increase in drinks prices of 3.5%.

The German scheme was introduced in 2003. The figures that fed into the case study are not easy to interpret, but we have assumed that in 2007 €646m in costs was transferred from the producers of new materials to the recycling sector. This assumption will not have a huge impact on the aggregate outcomes but will affect the sectoral results. The second assumption is more straight forward, that there is a net annual cost of €461m that is passed on to consumers in the form of higher drinks prices. This includes depreciation costs of the equipment used.

One important point to note when interpreting results from the German scheme is that the counterfactual case is one where there are no alternative schemes in place. This in reality was not the case in 2003 as there were other schemes already in place that were replaced with the single container deposit scheme. The results should therefore be viewed as an evaluation of the policy, not a set of alternative outcomes for Germany.

#### Danish container deposit scheme: Economic impacts

Table 61 provides a summary of the economic impacts of the container deposit scheme in Denmark. It is stressed that these outcomes should be viewed as upper boundaries because it is unlikely that in reality a recycled container costs twice as much as a new one.

There are two main impacts in the scenario. The first is a shift in production from basic materials to 'other manufacturing', which includes recycling. This may in fact have a small economic benefit as there is a shift from imported materials to domestic recycling. The model results suggest this for the aggregate sector, but it assumes that a share of packaging is imported; this result should be verified at a local level. It should also be noted that although the scale of the changes to the sectors involved is relatively large, these sectors are small in relation to the Danish economy as a whole.

The second factor is a reduction in demand for drinks in response to higher prices. This leads to a small reduction in GDP, due to the inflationary effects and erosion of household incomes.
The scheme has no impact on government balances as the transfer of revenues is not handled by government. As this is a charge on domestic consumption there is no impact on exports.

**Table 61 Summary of the economic impacts of the Danish container deposit scheme**

| Impact | Scale |
|---|---|
| GDP | -0.02% |
| Employment | Close to zero |
| Household expenditure | -0.07% |
| Exports | 0.00% |
| Imports | -0.01% |
| Inflationary effects | +0.10% for whole economy (drinks +3.5%) |
| Government balance | Unchanged |
| Main sectors affected | Food and drink (-0.05%) |
| | Rubber and plastics (-0.6%) |
| | Non-metallic minerals (-0.5%) |
| | Basic metals (-2.0%) |
| | Other manufacturing (+2.8%) |
| Distributional effects | Small but regressive |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy and should be viewed as upper bounds of estimated impacts (see main text).
Sources: E3ME, Cambridge Econometrics.

## Danish container deposit scheme: Social impacts

The deposit scheme could lead to a small increase in direct employment, if the recycling sector is more labour intensive than those that produce new containers (and especially if the new containers are imported while recycled ones are produced domestically). However, this is counteracted by the small fall in overall activity. In aggregate there is likely to be a fall in total employment levels, but it will be very small.

It should also be recognised that there may be a slight regressive effect when considering the distributional impacts. According to Eurostat figures for 2005, low-income households in Denmark tend to spend a larger share of income on non-alcoholic drinks, although a smaller share on alcoholic drinks; however, the packaging probably constitutes a larger share of costs in low-value drinks. It is unclear which social groups, if any, are most affected by being unable to return containers.

## Danish container deposit scheme: Environmental impacts

The direct impacts of the container scheme are provided in the case study and show a sharp reduction in the use of raw materials to produce containers. However, there are also impacts on energy consumption, if the recycling process is more energy efficient than that for producing new containers. E3ME is not an appropriate tool for addressing this issue, as its level of aggregation

means that the production of containers is mixed with production of other goods with different energy intensities. However, the model results show a small reduction in final energy demand of 0.09% in Denmark. There is a slightly smaller fall in $CO_2$ emissions (-0.07%).

## German container deposit scheme: Economic impacts

Table 62 provides a summary of the economic impacts of the German scheme. In most cases they are similar to the impacts of the Danish scheme even though the price increase in drinks is less (around 1.2%). The same two factors, a shift between sectors and an increase in consumer prices, are observed.

Overall there is a reduction in GDP which grows over time to be around -0.03% in 2010. This is mainly due to a combination of higher prices and lower employment levels leading to a reduction in real household incomes and consumer expenditure. The main reason that the impacts are bigger than in the Danish scheme is that Germany has larger domestic industries in the sectors that lose out (plastics, metals, etc.). Nevertheless it should be noted that the results are quite sensitive to import shares of both new and recycled materials and again this is something that should be considered at a more detailed level.
As with the Danish scheme, there is no impact on the government balance as the scheme is managed privately.

**Table 62: Summary of the economic impacts of the German container deposit scheme**

| Impact | Scale |
|---|---|
| GDP | -0.03% |
| Employment | -0.01% |
| Household expenditure | -0.04% |
| Exports | -0.003% |
| Imports | -0.02% |
| Inflationary effects | +0.10% for whole economy (drinks +1.2%) |
| Government balance | Unchanged |
| Main sectors affected | Food and drink (-0.2%) |
| | Rubber and plastics (-0.1%) |
| | Non-metallic minerals (-0.1%) |
| | Basic metals (-0.1%) |
| | Other manufacturing (+1.7%) |
| Distributional effects | Small but regressive |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy, in 2010 (due to lagged effects the differences grow slightly over time).
Sources: E3ME, Cambridge Econometrics.

## German container deposit scheme: Social impacts

The social impacts are the same for the German scheme as for the Danish one. There is a small reduction in employment overall, mainly from the basic manufacturing sectors that lose production, and an accompanying increase in unemployment. This is partly compensated by additional jobs in the recycling sector although again the effects are small (the modelling results suggest around 300 jobs).

The slightly regressive distributional effect is also present due to the higher shares of income spent on non-alcoholic drinks by less wealthy households (and as each unit that they buy is on average cheaper, the containers could make up a larger share of total price). Again it is unclear which groups would lose out due to being unable to return the deposits.

### German container deposit scheme: Environmental impacts

The case study results show the growing share of recycling in containers in Germany over time, but this includes other factors, in particular the other deposit schemes that were operating before 2003. Our results are a comparison of 'all-or-nothing' implying a much larger impact.

As is the case with the Danish deposit scheme there is also a possible reduction in energy use due to the shift from basic manufacturing production to recycling. Again, this should be considered at a much more detailed level than that offered by E3ME, but our model results do suggest that there could be savings to be made (-0.1% reduction) in final energy consumption and CO2 emissions (-0.2%).

### Conclusions

We have considered two container deposit schemes, introduced in Denmark (2001) and Germany (2003). Although the data relating to these schemes are difficult to interpret and several assumptions have been made, the impacts in the two countries are found to be quite similar. The principle economic effects are:

- a net increase in the price of drinks
- a shift in production from basic manufacturing (and extraction) to recycling

The first of these effects has a small negative economic impact, while the second can have a positive or negative effect, depending on import shares. For a full assessment this needs to be assessed at a more detailed level, but the modelling results suggest that the combined effects of these two factors lie in the range of 0.02-0.03% of GDP.

Employment effects are also expected to have been small but negative, with an additional redistribution across sectors in line with the changing patterns of production. When considering the different income groups the schemes show a small but notable regressive element as low-income households typically spend a larger share of income on drinks (and possibly types of drink where the packaging makes up a larger share of total cost). However, the question of which groups lose out through not being able to return the containers remains open.

Finally, the schemes are operated privately so there is no impact on government revenues beyond the administration costs identified in the case study.

## *5.2.6 Plastic bag levy*

### Introduction

The case study covered plastic bag levies in Ireland and in Denmark. In Ireland the levy was introduced in 2002 (first full year 2003) at a rate of 15 cents per bag, later expanded to 22 cents per bag in 2007. This was charged to consumers directly for the use of each bag. In Denmark, the levy was introduced in 1994 as part of a wider policy package and paid by retailers who buy plastic bags from wholesalers. The rate was set at DKK22 per kilo of plastic bags and retailers had the option of absorbing this cost or passing it on to customers.

The different nature of the schemes means that the modelling approach is slightly different for Ireland and Denmark, but there is one assumption that is required in both cases: the cost, without

the levy, of producing a plastic bag. There is no single answer to this, as costs vary by size and design among other factors. A quick internet search reveals a range of outcomes from 0.01p in the UK (wiki.answers.com) to 0.2 US cents (answers.yahoo.com). We have chosen to use an average value of 0.1 euro-cents per bag in the calculations.

## The Irish plastic bag levy: Introduction

The Irish levy was introduced in 2002 and set at the rate of 15 cents per bag. The results from the case study show that this caused a dramatic reduction in the use of plastic bags, with use falling from 1.3bn in 2001 to 69.5m in 2002. We have assumed that all of the costs of the levy are met by households rather than shopping made by businesses.
Using our assumptions this means that:

- Consumers pay €10.4m in taxes on plastic bags in 2002
- The retail industry spent €1.23m less on bags produced by the plastics industry in 2002

These figures are calculated for the period 2002-08 (the period for which we have data) and used as inputs to E3ME, creating a counterfactual case where there is no levy. The results are inverted in the table below to show the impacts of the levy (i.e. we compare the actual outcome to a case with no levy).

To test the assumption about the cost of plastic bags we checked the Eurostat supply and use tables (SUTs) to see if there was a noticeable reduction in purchases of plastic products made by the retail sector over 2001-02. However, the differences are too small to show up in the figures at the 2-digit level; the conclusion is that the cost is small although we do not know how small.

One interesting point to note is that the retail sector becomes very slightly more efficient (in economic terms) as a result of the policy because its costs fall from not having to buy so many bags. However, in reality this could be countered by the higher transaction costs for collecting payment.

**The revenues from the levy are collected by government and are not recycled back into the economy**. Although the case study finds that they are ring-fenced for environmental purposes we have not considered this to be part of the MBI and it is not included in the modelling.

## The Irish plastic bag levy: Economic impacts

Table 63 provides a summary of the economic impacts of the Irish plastic bag levy. Given the scale of the inputs it is not surprising that the economic impacts are small. Overall there is a reduction in GDP of around 0.01%, although this should be taken in the context of a small increase in the government balance that could be used to offset the reduction.

The impacts shown in the table are for 2008; they are smaller in earlier years when the rate used in the levy was smaller.

The main impacts come through reductions in household spending, as at a macro level the levy on plastic bags is effectively a small tax on incomes for those who use them. As the levy is purely on consumption there are no competitiveness effects, with exports unchanged and a small reduction in imports (mainly of plastics).

The sectors that are most affected are the plastics sector which supplies the bag, and the retail sector that loses out from a reduction in household expenditure (although retail does also benefit

from a small reduction in costs due to not having to buy plastic bags). Clearly individual firms that produce bags would have been impacted more severely. Other sectors that are also dependent on consumer spending (e.g. food, hotels and catering) lose out due to the reduced levels of household expenditure but again the effects are small.

**Table 63: Summary of the economic impacts of the Irish plastic bag levy**

| Impact | Scale |
|---|---|
| GDP | -0.012% |
| Employment | -0.002% |
| Household expenditure | -0.040% |
| Exports | 0.000% |
| Imports | -0.008% |
| Inflationary effects | Negligible |
| Government balance | Up to +€27m pa |
| Main sectors affected | Retail (-0.02%) |
| | Rubber and Plastics (-0.13%) |
| Distributional effects | Unclear |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy, in 2008.

Sources: E3ME, Cambridge Econometrics.

## The Irish plastic bag levy: Social impacts

There is only a very small change in employment at the macroeconomic level, which is concentrated in the rubber and plastics sector.

The distributional impacts are unclear as all income groups use the retail sector. A comprehensive analysis would require an assessment of which income groups are paying for plastic bags; there are two possibilities:

- Everyone is paying equally as bags are reused until they need to be replaced
- High-income groups are more likely to ignore the levy and use more new bags

Whether the policy could be considered progressive or regressive is dependent on which of these factors is the stronger.

## The Irish plastic bag levy: Environmental impacts

The modelling does not add much to the environmental assessment beyond that which was presented in the case study. We could expect to see a small reduction in energy consumption and environmental emissions in the chemicals sector, but the changes are too small to register at the NACE 2-digit level.

## The Danish plastic bag levy: Introduction

The Danish levy is paid by retailers on their purchases of plastic bags. This makes the scheme different in economic terms from the Irish one, particularly in relation to profits to the retail sector. In Ireland, if the retailer does not change prices except for collecting the levy, they see an increase in profits, as the costs for buying plastic bags falls. In Denmark, however, the retailer pays for the bags so there is a reduction in profits, unless the full cost of the plastic bags is passed on to customers (which does not happen in reality).

According to the case study the levy has raised an average of around €24m pa. The use of plastic bags fell by up to 450m which, using the same assumption on price as for Ireland means a

reduction in purchases from retail to plastics of €0.45m each year. This affects our estimate of costs to the plastics sector so is quite important as a model input. We performed a separate calculation based on tonnes of bags used and obtained an identical result; the calculation is outlined below:

- There are approximately 500 bags per kilogramme
- Meaning that 1kg costs €0.50
- From the case study results we can see that the use of plastic bags fell by 909,000 tonnes
- This suggests that the retail sector reduced purchases of plastic bags by €0.45m per annum

This is a lower reduction in costs than in Ireland (where it was €1.23m per annum) but it reflects the comparatively smaller reduction in use and the fact that far fewer plastic bags per capita were used in Denmark than in Ireland prior to the introduction to the levies.

In our model scenario we compare the actual outcome to a case where there is no plastic bag levy in the mid-1990s. As is the case for Ireland, the results are inverted so that the figures show an estimate of the impacts of the plastic bag levy. The model inputs that are subtracted from the base case are:

- The additional tax paid by retailers
- The reduction in purchases made by retail from the plastics sector

## The Danish plastic bag levy: Economic impacts

Table 64 provides a summary of the economic impacts of the Danish plastic bag levy. They are smaller than the impacts in Ireland, despite the revenues being on a similar scale (as a percentage of GDP). An important factor in this is that the retail sector does not pass on all of the costs, meaning lower profits for itself but limited economic impact elsewhere.

At a sectoral level the retail sector has the largest reduction (-0.02%), followed by the rubber and plastics sector.

However, as the retail sector is the one that is primarily affected it is not surprising that household expenditure is the main factor behind the reduction in GDP. As the retail sector is not generally subject to international competition there are almost not competitiveness impacts and no impacts on net international trade, beyond a small reduction in plastics imports.
Government revenues increase by a modest amount, which could cover the reduction in GDP. It is noted that a share of the revenues (although not a large share) was allocated to environmental projects but this was not considered as part of the MBI and was not included in the modelling.

**Table 64: Summary of the economic impacts of the Danish plastic bag levy**

| Impact | Scale |
|---|---|
| GDP | -0.003% |
| Employment | 0.000% |
| Household expenditure | -0.007% |
| Exports | 0.000% |
| Imports | -0.001% |
| Inflationary effects | Negligible |
| Government balance | +€24m pa |
| Main sectors affected | Retail (-0.020%) |
| | Rubber and Plastics (-0.015%) |

| | |
|---|---|
| Distributional effects | Unclear |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy, in 2000.

Sources: E3ME, Cambridge Econometrics.

## The Danish plastic bag levy: Social impacts

The model results suggest almost no overall impact on employment, as the macroeconomic effects are quite small. If the levy was higher we could see some small negative impacts in the retail sector, although it is unlikely that these would ever become large.

As is the case in Ireland, it is difficult to judge the distributional impacts of the plastic bag levy in Denmark as it could be quite dependent on some very specific factors that are not apparent in the available data.

## The Danish plastic bag levy: Environmental impacts

Again, as in the case of Ireland there could be an additional small benefit from reductions in energy consumption and emissions from the chemicals sector, but this will not be large. The main impacts are the direct ones that are discussed in the case study.

## Conclusions

In this section we have considered two examples of plastic bag levies that are quite different in design and scale. It should be noted that both have achieved their primary purpose of reducing the use of plastic bags by a substantial amount. However, it is not clear if this was due to the policy being an MBI through the price effect, or if it was instead due to a signalling effect and accompanying media coverage (although this coverage only happened because of the MBI). Even a detailed econometric analysis would struggle to separate these effects as the prices were zero to start off with; a well-constructed economic experiment may be a better approach to addressing this issue.

We modelled the two schemes in Ireland and Denmark as they were implemented, with the levies added to costs and a reduction in purchases made by retail from the plastics sector. The per capita use of plastic bags in Ireland was much higher than in Denmark before the levies were introduced, which led to bigger impacts, both in terms of the headline reductions in the use of bags and impacts on payments from the retail sector to the plastics sector. The different rates used ensured that the revenues were different in the two countries (in Ireland the rates also changed over time).

However, the biggest difference between the two schemes is perhaps the mechanism that was used. In Denmark it was the retailers that paid the levy while in Ireland it was the consumers. As well as missing the clear signalling effect, the Danish levy was also partially absorbed by retailers, leading to a reduction in profits. This meant that the overall economic impacts were smaller, but also probably contributed to a lower reduction in the use of plastic bags. However, there may be benefits to this approach in terms of political acceptability and lower transaction costs that are not included in the modelled scenarios.

### *5.2.7 Effluent charges*

## Introduction

The case study considers effluent charges in two countries, Germany and France. An effluent charge is an example of an MBI that is levied on the production of waste, a good with negative economic value.

In economic terms the charge could be applied as a tax on transactions between the polluting sectors and the waste industry. However, it is difficult to put a value on these transactions due to

the waste industry being badly defined in the NACE classification (in revision 1.1 it is split between manufacturing and services, although this will improve with revision 2.0). It is also not clear that the volume of discharges would decrease very much as a result of the levy, just that they would be less polluting

.

The modelling that we use in our assessment thus focuses on the taxation element and applies an increase in tax costs to the industries (and households) that had to pay the charge. The results therefore do not include the possibility that industry's waste bills may otherwise decrease.

## Effluent charges in Germany: Introduction

The effluent charges in Germany were introduced in 1981, with the rates gradually stepped up to reach (equivalent) €20.5 per unit in 1986 and the current rate of €35.6 per unit in 1998. Revenues in 1998 were €368.1m, which is around 0.02% of GDP in Germany.

In 1998 around 70% of the charges were levied on the power sector, with the rest split between chemicals and households (around 8% each) and the coal industry. Between 1998 and 2007 the power sector steadily reduced discharges of effluents with an overall reduction of 18% over this period. Other sectors also reduced discharges but the reductions were much smaller.

Our modelling scenario considers a counterfactual case in which there is no effluent charge in Germany in 1998. The reason for choosing 1998 is that it is the year for which we have the most data available and it was the year in which the current rate was introduced. If a later year had been chosen, the impacts may have been slightly smaller as it seems likely that effluent discharges were declining even without the MBI; however, the differences in results would have been relatively minor. As with the other case studies, the results are inverted to show an estimate of the impact of the charges.

The modelling is not able to provide any indication of the environmental benefits (or costs) so the focus is on the economic outcomes.

## Effluent charges in Germany: Economic impacts

Table 65 summarises the economic impacts of the effluent charges. The overall effects are small but negative, registering at the third decimal place. The most obvious impact is an increase in the price of electricity (the sector had a cost increase of €260m and a turnover of around €52bn so with 100% pass-through the price increase is estimated as 0.5%).

This leads to a small inflationary effect for the whole economy, which erodes real incomes. Households also lose out from the charges that they have to pay directly, so there is a reduction in overall consumer spending by 0.006%. It should also be noted that higher electricity prices could have a competitiveness effect on some energy-intensive sectors; this shows through the results here as a small reduction in exports (and a reduction in imports less than the fall in GDP) and may have had larger impacts at a more detailed level.

Aside from the electricity sector, the chemicals sector is directly affected by the charges. Other sectors that are dependent on household expenditure (e.g. retail, hotels and catering) are also likely to have lost out slightly.

The additional revenues that were collected by the German government could be used to offset some of these negative economic impacts.

**Table 65 Summary of the economic impacts of the German effluent charges**

| Impact | Scale |
|---|---|
| GDP | -0.004% |
| Employment | -0.002% |
| Household expenditure | -0.006% |
| Exports | -0.002% |
| Imports | -0.001% |
| Inflationary effects | +0.5% (electricity), <0.1% for whole economy |
| Government balance (current price) | +€368m |
| Main sectors affected | Electricity (-0.005%) |
| | Chemicals (-0.002%) |
| Distributional effects | Small but regressive |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy, in 2000.

Sources: E3ME, Cambridge Econometrics.

## Effluent charges in Germany: Social impacts

The modelling results suggest that the effluent charges led to a small reduction in employment, as a result of reduced rates of economic activity. The electricity sector, which is not a major employer, was most affected, but employment reductions are more likely to have been in consumer products and services, as a result of lower levels of household spending.

The distributional impacts of this charge are also worth considering as it seems likely that low-income households were affected the most. According to Eurostat data for 2005, households in the lowest income quintile spend 7% of income on household fuels, compared to 4% in the highest quintile. The effects of the charges levied directly on households are unclear, but if a similar amount in absolute terms was levied on all households, the relative cost to low-income households would again be disproportionately high. This could possibly be compensated by using the accumulated revenues.

## Effluent charges in Germany: Environmental impacts

The main environmental impact is the direct effect of reducing effluent discharges that is discussed in the case study. The only other impact that is worth noting is that, as the electricity sector bears a large share of the charges, there is a small reduction in energy consumption.

## Effluent charges in France: Introduction

The effluent charges in France were introduced in the 1960s, with the rates increased by 10% between 2000 and 2007, and nearly tripled between 1990 and 2007. Revenues in 2007 were €2.2bn, which is around 0.13% of GDP in France.

In 2007 40% of the total revenues generated from wastewater management, including wastewater treatment charges and water tariffs, came from households. Companies and pubic administration each contributed 30% of the total revenue. Total revenue increased by around 30% between 2000 and 2007, part of which is accounted for by the increase in rates. However, it is not clear how much of the change in revenue came from changes in volumes.

Our modelling scenario considers a counterfactual case in which there is no effluent charge in France in 2007. The reason for choosing 2007 is that it is the first year for which we have data for revenues that came directly from effluent charges. Even though revenue generated from effluent charges is only part of the revenue that generated from wastewater management, we assume that the relative contributions made by households, companies and public administrations in 2007 were the same, in response to the data limitations. For revenue that was financed by companies, there is

no information on which industries the charges were levied on. We therefore assume the sectors that were paying the charges in the German case (coal, chemicals and power supply sectors) were the ones that the charges were levied on in France.

As with the other case studies, the results are inverted to show an estimate of the impact of the charges. The modelling is not able to provide any indication of the environmental benefits (or costs) so the focus is on the economic outcomes.

## Effluent charges in France: Economic impacts

Table 66 summarises the economic impacts of the effluent charges. The overall effects are negative and relatively big (compared to Germany), given the relative size of the charges to overall GDP.

The increases in costs incurred by companies result in an increase in prices from industries which pay the charges directly (coal, chemicals and electricity), as a share of the costs are passed onto final prices. This leads to a small inflationary effect for the whole economy, which erodes real income. Households also lose out from the charges that they pay directly (40% of the total charges), so there is a reduction in overall consumer expenditure by 0.044%.Since household expenditure is the largest component of GDP, overall GDP is reduced by 0.023%. Similarly to the German case, an increase in electricity prices affects the competitiveness of the export sectors whose production is electricity-intensive. As a result, exports are reduced very slightly by .Based on our assumption, the coal, chemicals and electricity sectors are the ones that are directly affected by the charges. Other sectors that are dependent on household expenditure (e.g. retail, hotels and catering) are also likely to have lost out slightly.

As in the case of Germany, the additional revenues that were collected by the French government could be used to offset some of these negative economic impacts.

**Table 66 Summary of the economic impacts of the French effluent charges**

| Impact | Scale |
|---|---|
| GDP | -0.02% |
| Employment | -0.01% |
| Household expenditure | -0.04% |
| Exports | -0.00% |
| Imports | -0.01% |
| Inflationary effects | <0.1% for whole economy |
| Government balance (current price) | +€2.2bn |
| Main sectors affected | Electricity (-2.5%) |
| Distributional effects | Small but possibly regressive |

Notes: Figures show percentage difference in real terms from a counterfactual case with no policy, in 2010.
Sources: E3ME, Cambridge Econometrics.

## Effluent charges in France: Social impacts

The modelling results suggest that the effluent charges led to a small reduction in employment (0.01%), as a result of reduced rates of economic activity. Employment reductions are more likely to have been in consumer products and services, as a result of lower levels of household spending. For example, employment in one of the biggest employing sectors, retailing, is reduced by 0.02%. As is the case in Germany, the distributional impacts of this charge are worth considering as it seems likely that low-income households could be affected the most. According to Eurostat data for 2005, households in the lowest income quintile spend 6% of income on household fuels, compared

to 4% in the highest quintile. The effects of the charges levied on households could have a similar impact.

### Effluent charges in France: Environmental impacts

As is the case in Germany the scheme could lead to a small reduction in electricity consumption if it was the power companies that were paying the tax. Otherwise there are no environmental effects beyond the direct impacts discussed in the case study.

### Conclusions

This assessment considered effluent charges in both Germany and France. A modelling approach was used for both cases but it was necessary to make assumptions about the model inputs, in particular the industries that were paying for the charges in France.

The effluent charge in Germany was quite small in scale, with revenues accounting for around 0.02% of GDP (in 2000). The bulk of the additional costs fell on the electricity sector, which is usually assumed to pass all costs on to its customers. There were also some charges for the chemicals sector, households and coal producers.

The effluent charge in France was slightly bigger, around six times the size of the charge in Germany (compared to GDP), with revenue accounting for around 0.13% of GDP (in 2007). A slightly larger proportion (40%) of the additional costs fell on households. Companies and public administration shared equally the rest of the additional costs. It is assumed in the French case that coal, chemicals and electricity sectors were the ones that were paying the charges.

In both cases, the impacts mainly follow from higher electricity prices. This leads to a small fall in energy consumption and some negative macroeconomic effects through reduced household spending and competitiveness. The macroeconomic effects are bigger in the French case, given the relatively bigger size of the charge and the fact that households pay a bigger proportion of the charges than companies. However, these results must be considered in the context of the revenues that were raised, that could in reality have offset other charges.

The sectors that would be expected to have lost out are those that provide consumer goods and services. A small fall in employment, concentrated in these sectors, was estimated.

Finally the issue of distributional impacts is one that must be considered in an assessment of this policy as the charges on households and on the electricity sector could both have mild regressive effects.

## *5.2.8 Natural resources tax*

### Introduction

The natural resources tax case study considers taxation packages that were introduced in two EU Member States. In both cases the packages include a broad range of individual tax rates. Both are

at a level that is too detailed to be modelled, but a discussion of possible assessment methodologies is provided for each of the cases below.

## The Finland natural resources tax

The Finnish package covers a wide range of different resources, including land, fishing and hunting. The purposes of the taxes vary; some are aimed at behavioural change while others are revenue-raising. Ideally each of these taxes would be assessed individually as the impacts of each one are likely to differ in terms of size and sectoral effects.

If we exclude excise duties and vehicles taxes, the largest of the taxes is the Real Estate Tax, which has revenues of around €800m per annum, or around 0.5% of GDP. An assessment of the tax requires information about the split between residential and business revenues and which sectors are likely to bear the costs. This could then be translated to a set of household and sectoral tax rates and could form the basis for a set of model inputs to determine secondary and whole-economy impacts. A national model such as E3ME would not, however, be able to take into account regional differences in taxation rates.

Finland also has a carbon tax, with revenues of around €500m per annum. This can be assessed using a modelling approach and E3ME has been applied in the past in the COMETR project to give a very detailed analysis of the tax (see http://www2.dmu.dk/cometr/ and Barker et al (2009)).

The tax on landfill waste raises up to €57m each year. An assessment of this would require information regarding the amount of waste that is sent to landfill by business (by sector) and households. This could then be applied as a set of industry and consumer taxes to determine the indirect and whole-economy impacts. However, similarly to water charging, it is difficult to estimate a behavioural response to a change in price if there was no price previously.

Taxes on the oil industry could be modelled using standard methodologies defining the tax as energy taxes on oil consumption, under the assumption that the costs are passed on. As most of these taxes are for the purposes of financing, it is reasonable to assume that they do not result in any behavioural change by the oil companies.

The other charges relate to hunting and fishing activities and are quite small in scale. It is probably not realistic to provide a comprehensive assessment of these taxes using a modelling approach as they are a small part of the much larger agricultural sector. Hence the detailed changes are likely to get lost in the final outputs.

## The Latvian natural resources tax

Latvia's package of taxes covers:

- Use of materials
- Extraction of materials
- Disposal of waste
- Purchase of specific goods
- Packaging
- Plastics
- Radioactive substances
- Use of coal and solid fuel

The case study found a large number (>50) of different taxes that are all small in scale. The total revenues from the package amounted to 0.26% of GDP in 1998, but this share has since declined to 0.05% in 2008 as revenues have slowly fallen while GDP has increased.
Some of the individual taxes could be modelled explicitly, for example as taxes on materials or on specific sectors or consumer goods. However, in most cases the level of detail is well beyond that which can be offered by a macroeconomic model so a bottom-up approach may be more appropriate.

It also must be noted that the scale of the taxes is in most cases so small that is not realistic to expect any notable impacts at the sectoral or macro levels and this could make it inappropriate to apply a quantitative model (e.g. rounding errors could cause quite large distortions in results).

Another factor that should be considered when assessing tax policies that are this small in scale is the transaction costs. These are usually excluded from a model-based assessment as they usually have little overall impact on results, but in these cases they could comprise a reasonably large share of the total revenues.

The recommendation is thus to apply a more flexible and partial quantitative assessment that collects and takes into account transaction costs and the detailed data that are available on these material and product types.

## 5.3 Conclusions from Modelling

### Overview

This chapter has built on the results from the case study to provide an assessment of eight types of policy that could be defined as MBIs relating to resource efficiency. The E3ME model was used to provide a framework for quantitative assessment. The policies fell into four groups:

- Those that could be modelled relatively easily: Aggregates levy, Water consumption charge
- Those that could be modelled but where data are missing: Land contamination charge
- Those that can be modelled with suitable assumptions: Pesticides tax, Container deposit scheme, Plastic bag tax, Effluent charges
- Those that cannot be modelled due to the level of detail: Natural resources tax

For the first groups of policies, the model was able to give an estimate of direct impacts based on estimated price elasticities (although the case of water is complicated by a lack of pricing before the charges were introduced). In other cases, the direct effects were taken from the case studies using the information that was available over time. However, it is noted that it is not always possible to separate the impacts of the MBI from those due to other regulatory changes; for example in the case of pesticides taxes it is considered likely that the training schemes had a bigger impact than the MBI.

To fully understand these effects would require a separate econometric analysis with inputs from sectoral experts. This would, in most cases, require data beyond that which were available to us. Nevertheless, it is possible to imagine an equation in which pesticides use is determined by prices and different types of agricultural output could yield an estimated price elasticity. On the other hand a completely different approach would be required to estimate the effect of changing the price of plastic bags from zero to 15 cents.

The focus of the modelling exercise has thus been on providing estimates of the broader economic effects, social impacts and any supplementary environmental impacts. In each of the case studies we have aimed to be as clear as possible about the assumptions that have been made and how they could influence results. However, it should be noted that in most cases the approach is fairly approximate and each of the policies could constitute a study in its own right.

## Summary of economic impacts

All of the policies that were looked at aimed to provide incentives to reduce consumption of specific products that either use scarce resources (e.g. aggregates levy), or have negative environmental impacts (e.g. pesticides tax). In some cases there was also the goal of providing the government with revenues. All of the cases we looked at provided a price signal in an attempt to reduce consumption of these products. In most of the cases there appeared to be a reduction in consumption although, as discussed above, it is often difficult to separate the effects of the MBI from those of other policies and the awareness effect created by the announcement of the MBI.

It must be noted that most of the policies are small in macroeconomic terms, with the impacts typically less than 0.1% of GDP. This should not be surprising given the specific nature of many of the policies, and the instruments' revenues as a share of GDP. One could conclude from this that the policies have been by and large successful; for example Ireland managed to cut plastic bag use by 90% at a very small cost to GDP. However, this is not to say that there will not be very specific groups that lose out, such as the companies that produce plastic bags. Although the modelling also, interestingly, pointed to an increase in competitiveness by retailers as a result of the tax, as their costs for providing plastic bags were reduced, so economic effects may be more beneficial over the longer term for some affected sectors.

As many of the policies focused on final consumption, their competitive effects were limited. Furthermore, the sectors that were often most affected (e.g. construction, water supply, retail) are not subject to international competition. This means that, in contrast to climate change issues, policy makers can afford to think locally as both the environmental and economic impacts are domestic. The German effluent charge, which is likely to have led to increases in electricity prices, is a notable exception and water consumption charges could also be if the charges were high.

However, the use of revenues from the UK aggregates levy, to reduce labour costs, could provide competitiveness benefits.

## The MBIs as tax-raising instruments

All of the MBIs that were assessed raise revenues for government. In some cases the revenues were earmarked for particular uses, such as raising environmental awareness. In others they were used to offset other tax rates.

It is often stated that an MBI that aims to change behaviour and raise revenues at the same time is self-contradictory. Our results indeed suggest that tax revenues can decline over time as consumption is reduced. However, when comparing results to a no-policy counterfactual case we saw in all cases an increase in revenues alongside environmental benefits.

The issue of tax revenues comes back to price elasticities. If price elasticity lies between -1 and 0 then an increase in price will lead to an increase in revenues. For example, if a tax on plastic bags is increased from 10 to 15 cents, as long as use of plastic bags does not drop by 50% in response there will be an increase in revenue. Although price elasticities less than -1 do exist, they are

uncommon unless close substitute goods are available, so higher tax rates do usually result in higher revenues[292].

In the cases where revenues declined over time, this is more likely to have been due to non-price effects, such as education of training, or structural change that would have taken place anyway.

## Summary of social and environmental impacts

None of the policies that were assessed had direct employment impacts, except the UK aggregates levy which explicitly reduced labour costs. The employment impacts therefore generally followed the results for economic output.

From our results, the impacts were therefore small, but the results did also suggest that there could be significant impacts if the policies were scaled up (where it is feasible to do so). The reason for this is that some of the sectors that are most affected are labour intensive (e.g. construction, agriculture). There could also be specific localised impacts from the loss of low-skilled jobs in rural areas.

In forming policy it is also important to consider distributional impacts as our results suggested a consistent leaning towards small but regressive impacts (where there were any). This is partly because the products that are affected tend to be low-value ones with higher material inputs and lower labour inputs. In particular, distributional effects should be given consideration in any policy that increases the prices of food, water or electricity. The same is also true for any policy that places a fixed charge on households, regardless of income.
The environmental impacts of the policies tend to be quite limited to the direct effects. If there are substitution effects (for example in the Swedish aggregates levy from gravel to crushed rock) then it is beyond the level of detail offered by the model, and should be illustrated in the case study.
In some cases there could be some co-benefits from reduced energy consumption, for example in a switching from new to recycled packaging, or from reduced transport requirements of aggregates. The German effluent charge is likely to have reduced electricity consumption slightly through price effects. Although small in the case study results, the impacts could be larger if the policies were scaled up.

## The European perspective

In most cases the policies that have been considered in this chapter are domestic or local in nature. The environmental benefits generally accrue in the countries in which the policies are implemented and the competitiveness effects are limited. This suggests that intervention at the European level is not required.

Nevertheless, the modelling results do not provide any reasons that these policies could not be considered at the European level, for example in the context of the Resource Efficiency Initiative. The key issue is likely to be finding a consistent set of definitions to use across Member States so that the detailed policies are implemented on a consistent basis.

[292] In cases where the MBI is added to existing prices (e.g. aggregates levy, water charging) there is even more scope as a 50% increase in the tax rate does not result in a 50% increase in product price.

# 6 Conclusions and recommendations

This study conducted a review of the market based instruments used globally to improve resource efficiency. A selection of 8 instruments used in the EU was reviewed in-depth as case studies, each for two countries in which the same or similar instruments were implemented. Finally, the impacts of the schemes were modelled to understand the economic, social and environmental effects at the macroeconomic level. This chapter presents the main conclusions of this research and a set of recommendations for further development and deployment of market based instruments for resource efficiency within the EU and its Member States.

## 6.1 Conclusions

### *6.1.1 The current role of market based instruments*

**Most environmentally related market based instruments in use globally are fiscal (tax) instruments**
Our review of global MBIs found a sample of instruments, of which the great majority (85 of 110) were price-based, with the majority of these imposing a tax, levy or charge for specific consumption or production activities[293]. This trend was similar across countries, although there was little use of quantity or rights based instruments, such as tradable permits, in the EU. In the wider context quantity based instruments were most closely associated with emissions.

**MBIs are applied relatively rarely to resources: waste and emissions are the major focus of existing instruments**
Of the existing instruments around half were focused on waste and recycling or emissions (greenhouse or other air pollutants), neither of which was intended as a focus of this study. Water, mineral resources and energy received some attention but are a less common focus. This demonstrates that instruments concerned with resources and resource efficiency are not widespread and are poorly developed in comparison to other areas, providing a significant opportunity for improvement and wider deployment.

**Taking a closer look at environmental taxes…**

[293] It is clear that there are many more MBIs being employed globally that are related to the environment and resource efficiency, therefore this selection represents merely a sample of those discovered within the time and resource constraints of this study. Among the constraints was the exclusion of MBIs related to energy, and carbon, NOx and SOx emissions as these were felt to already be comprehensively covered. Market friction instruments were also decided not to be a major area of focus for this study.

***Pollution and resource taxation make up only a very small share of environmental tax revenue…***
Energy and transport based taxes constitute the biggest elements of environmental taxes and market based instruments in individual Member States (see Figure 5). Across the EU, environmental taxes provide just over 6.3% of tax revenue, but of these environmental taxes only 4% (or 0.26% of the total tax take) are directly focused on pollution and resources. This demonstrates that resource based instruments, outside of energy and fuel, are not high priorities for policymakers.

***…but Denmark and the Netherlands show that this can be successfully increased***
The case studies of Denmark and the Netherlands and their broader environmental tax base provide evidence that this can not only ensure tax revenues but also deliver improved environmental performance. This approach could be replicated elsewhere.

### *6.1.2 Lessons from implementation of market based instruments*

The case study review of market based instruments operating in the EU provides a number of insights into how these instruments can be more effectively developed, wider deployed and also what should be considered in the design of new instruments. These lessons include:

**To introduce an effective instrument, you need support for it**
Perception of the instrument itself is important, for its effective function. This is particularly important for fiscal measures, which, to continue to be effective, require periodic revisions to the rates. This typically requires some level of political support and consent.

Consumer perception of the problem and the solution can therefore be vital to the success of a measure. If the issue of resource use is not perceived as a problem then a measure will have less support. The abundance or scarcity of a resource plays an important role in perception too, as shown by water taxes in the Netherlands and Cyprus, both countries understanding the importance of either too much or too little water. History plays a role in perception and acceptance, the prior existence of voluntary container deposit schemes in Germany and Denmark a factor in their high return rates and effectiveness. Habits can also be a hindering factor, such as farmers use of pesticides, or the use of particular materials (aggregates) in construction. Abundance of a resource may also tilt support in favour of its exploitation and against use of instruments to manage it.

**Education and awareness raising can be powerful supporting tools**
The pesticides tax case provided evidence of the value of education and awareness raising in magnifying the effect of market based instruments. By allocating some of the revenues towards educating farmers in efficient and effective use of the resource (pesticides), significant improvements

were made in Sweden and, to a lesser extent, Denmark. The modelling also suggested that this educational impact was stronger than the price effect of the instrument itself. There was less evidence across the other cases studies, but targeted and intensive campaigns to a small group such as farmers, was successful, this could potentially also be applied on a sector level or to users of specific, strategic or high impact resources.

**Substitution effects can have unintended consequences…sometimes leading to lower resource efficiency**

Instruments that address one particular resource or activity can lead to substitution effects. This can, and usually is, desirable, for example involving a switch to items that are re-usable or that can be more easily sourced locally. Yet as shown by the aggregates case in Sweden, the switch from one aggregate resource, natural gravel to crushed rock, can lead to increased overall energy use – from rock crushing. Alternatively a tax on one resource may lead to substitution to a less environmentally friendly resource or one that is less efficient on a life-cycle basis. These substitution effects need to be taken into account in instrument design to avoid conflict with overall environmental objectives.

**Administrative burdens vary considerably, but for container deposit were very high**

Across the case studies data on administrative burden was limited (possibly because the burdens were often not large enough to merit attention). The available estimates of administrative cost ranged from lows of around 0.3% of revenues for the aggregates levy in the UK to estimates of 3% of total costs for effluent charges in Germany. The one case that stood out as being expensive in this respect was the container deposit scheme, while effective in ensuring very high levels of return and resource recycling, the administrative costs estimated in both Denmark and Germany ran into tens of millions of euros, constituting a significant additional burden to retailers, but one that may be argued to be consistent with some level of provider/producer responsibility regarding waste.

**The type and objectives of an instrument tax can be crucial to its impact on resource efficiency**

The case studies found a variety of objectives behind the instruments: many of the instruments were primarily targeted on general environmental goals such as pollution reduction, litter prevention or human and environmental health, which although relevant are only indirectly linked to resource efficiency. Revenue raising was also a primary objective of many of the instruments. Those with resource efficiency as an objective were more usually a result of specific scarcity circumstances, such as water charging in Cyprus, or driven by other policy such as the Waste and Packaging directive and its recycling targets.

Instruments with objectives other than resource efficiency can still have a positive impact against these other objectives, i.e. litter reduction, their impact on resource efficiency is indirect and often much less. In this sense they are often better at reducing the environmental impact of resource use,  bringing more economic value from less inputs.

The type of tax can also be important to its effect on resource efficiency Quantity based taxes – on units produced or consumed – can lead to a reduction in the quantities produced or consumed and only indirectly lead to resource efficiency gains. Taxing by the quantity of resource used (as an input) is a better way to provide a more direct and effective stimulus for resource efficiency improvements. This was evident in the water charging, aggregates, pesticides (SE) and plastic bag (DK) cases. It should be noted that taxing quantity using weight-based measures may not adequately take into account the other environmental impacts, such as pollution or biodiversity effects, from changes in production processes that improve productivity in weight terms.

**Setting the tax at the 'right' level is central to its impact**

Consumers and producers react in different ways to the price signals coming from market based instruments. Most commonly those with higher incomes have lower price-elasticities to resource efficiency MBIs than those on lower incomes, with the reasons being two-fold; for consumers with higher incomes it represents less impact on their income than for lower income consumers and that higher income often means that many of the easiest measures have already been taken, i.e. the cost of further improvement is high and therefore price signals must accordingly also be higher.

Elasticities also vary considerably by the value or nature of the resource, contrasting low price elasticities in water use, in part due to its essential nature, with the very high price elasticities of plastic bag use.

The cases suggest that tax rates are often set too low to have a significant impact. It is unclear what impact taxes at low levels have, as it is hard to separate their specific impact and the price signal may be lost as suppliers absorb the tax increases, e.g. the pesticides case in Denmark. The cases suggest that tax rates of less than 20% of product price are typically ineffective at significantly changing behaviour, though this finding is tentative and, to a degree, case specific, it bears further investigation.

**The impact of tax measures will erode over time, but revenues typically continue to increase**

It is often stated that an MBI that aims to change behaviour and raise revenues at the same time is self-contradictory. Linked to the previous lesson there was evidence that static tax instruments will have their impact erode over time. At first introduction of taxes quite drastic reductions in consumption were observed, the plastics bags cases a very clear example of this effect. Yet, over time, consumption creeps back up as the rate becomes proportionally less effective. This tends to have the effect of increasing tax revenue but reducing the environmental and resource gains. Modelling of the case studies also showed this effect compared to a no-instrument counterfactual. Further revisions to the tax rate can help to

maintain and/or recapture the effect, while taxing on a percentage basis can avoid this problem.

Price elasticities play a role in determining tax revenues, typically price elasticities are less than -1 (i.e. that a proportional change in consumption will not be more than the proportional change in price) show that an increase in price will lead to an increase in tax revenues. Where revenues decline over time, the effect is more likely due to non-price effects, such as education, training, or structural change that would have taken place anyway.

### Market based instruments are part of a wider system of instruments that they need to work with to be successful

MBIs are part of a wider system of governance and regulation, complicating the task of defining specific impacts of the instrument both qualitatively and through modelling. This highlights the fact that instruments rarely work in isolation. They work within in a legislative, cultural and market framework that also has a major bearing on their effectiveness. Ensuring this framework is coherent and supports the instrument objectives is important to achieve improvements in resource efficiency. Where this supporting framework is less coherent, with contradictory or competing goals, or loopholes or gaps in the system, then the intended resource efficiency effects can be weakened or lost.

### Monitoring and data relating to market based instruments is typically weak

Across the study it was apparent that the monitoring and evaluation of impact of MBIs is relatively weak. Quantities can sometimes only be derived from tax revenue data and with this being subject to aggregation, confidentiality and other issues, its usefulness for assessing impact is reduced. For instruments with a solely revenue raising objective this may be sufficient, but for policies with resource efficiency objectives this lack of follow-up and understanding is a weakness in successfully implementing policy.

### Fully understanding impacts would require more detailed econometric analysis

The modelling exercise provided a number of general macro-economic insights into the impact of the instruments, but to fully understand these effects would require a separate econometric analysis with inputs from sectoral experts and more detailed data sources. This study presents clearly the assumptions that have been made but it should be noted that in most cases the approach is fairly approximate and each of the policies could constitute a study in its own right.

### Economic impacts of the studied MBIs were estimated to be slightly negative, which could in many cases be offset by the revenues raised

From our modelling analysis of the case studies, most of the instruments had economic impacts that were small in macroeconomic terms, producing small negative impacts typically less than 0.1% of GDP[294]. Given the size of the policies and the revenues this type of impact is not unexpected.

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[294] It should be noted that unless the instruments we reviewed included a specific use of any revenues raised, the modelling did not consider tax recycling options, but these

The overall results represented bigger transfers in GDP between sectors, e.g. from retail or consumers to recycling, such that at the sectoral level the effects could be quite significant, particularly if the instruments were scaled-up. Employment trends followed similar patterns.

As noted, revenue from taxes can be, and was, used to support other policy objectives such as welfare or mitigation of distributional effects so the economic effects should not be considered in isolation. On a more general level it is clearly understood to be preferable for taxes to target resource use (encourage better use of scarce resources) than labour (discouraging employment). How these changes work in a specific economy varies, based on upon a number of factors, including the availability and sourcing (domestic / import) of materials and labour market conditions. It should also be noted that resource taxes may provide disincentives for resource intensive investments, e.g. roads, infrastructure, buildings, machinery, as effective investment costs increase, which could hinder economic growth over the longer term. Equally, this can also help trigger innovation and investment in developing more efficient technologies.

***A double-dividend from environmental taxation was achieved, but only in the UK***

The use of revenues from the UK aggregates levy, recycled to taxed firms to reduce labour costs, was one of the few examples of a direct attempt to secure a double dividend and this succeeded in improving competitiveness. The modelling results in the UK suggested the aggregates levy has led to a small increase in GDP and employment in the aggregates sector.

In the other cases the revenue was typically used as part of general government spend or for wider environmental policy (i.e. the plastic bag levy in Ireland) and no double-dividend was observed. This is consistent with the theory for a double dividend, where recycling of revenues back to the affected sector, in reduced taxes on labour, or other business costs, is necessary to stimulate an environmental AND economic gain. Latest EU tax data[295] suggests that, at the EU-level at least, trends in environmental, specifically real implicit energy, and labour tax rates, have been developing counter to achieving a double dividend since around 2004, though this has reversed in the final year of data (2009).

***Distributional impacts were typically slightly regressive***

By addressing consumption issues, impacts have a social effect, typically instruments that increase prices have regressive impacts by affecting lower income households proportionally more than higher income households. The modelling in this study backed this finding with consistent leaning towards small but regressive impacts (where there were any). This is partly because the products that are affected tend to be low-value ones with higher material inputs and lower labour inputs.

**Competitive impacts of the studied resource efficiency MBIs were estimated to be low**

Most of the studied MBIs focused on final consumption, therefore their competitive effects were limited. This is a result of the focus on households and also that the sectors most affected (e.g. construction, water supply, retail) are not subject to significant international competition.

**Signals for EU level MBIs are mixed**

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could have been used to offset the negative macroeconomic impacts and generate positive welfare effects. The qualitative evidence in the case studies tends to support the latter point.

295 Eurostat (2011) Taxation trends in the European Union: 2011 edition

The MBIs reviewed in this study were domestic or local in nature, with the environmental benefits generally accruing at this level too. Additionally, with only limited effects on international competitiveness, it could be argued that intervention at the European level is not required.

At the same time there was also little evidence from the case studies or modelling to suggest that EU level instruments could not be successful and effective, for example in the context of the Resource Efficiency Initiative. Indeed, in many cases the domestic and local MBIs were driven by EU legislation and policy. This signals that the EU role should continue, at the very least, to provide the framework conditions, information, drivers and support for greater use of MBIs to deliver resource efficiency at Member State level. EU level MBIs in other areas, such as the EU ETS in greenhouse gas emissions, illustrates how it can also be possible to successfully implement at EU level.

## 6.2 Recommendations

Based on the conclusions presented above a number of recommendations can be made to Member States and the Commission to improve the use of market based instruments for resource efficiency.

1. **There is strong potential for wider use of MBIs for resource efficiency:** the cases show how MBIs have been successfully used to deliver environmental and resource efficiency improvements in the respective sectors and MS. The balance of environmental taxation clearly shows that pollution and resource taxation is an area where much wider use of MBIs can be considered, mirroring the successful approaches of Denmark and the Netherlands.

2. **Consider a broader range of market based instruments:** to date, most MBIs have been price based measures, typically taxes. A broader range of instruments such as permit trading or market information and network tools are also available and can be successful.

3. **Remember to design instruments as part of a full package – MBIs are not a 'silver bullet':** MBIs should work in concert with legislative, institutional and cultural arrangements to improve their effectiveness and chance of success. This is also important to avoid unintended consequences, to create balanced incentives and avoid contradictory outcomes. It should also be noted that in some cases MBIs may not be the most efficient or effective option.

4. **MBIs for resource efficiency should have resource efficiency as a primary objective:** while each of the MBIs reviewed had a resource dimension not all had resource efficiency, delivering greater economic value from less inputs, as an explicit objective, with the focus often on resource efficiency through the reduction of environmental impact over a product lifecycle. Without this focus, instruments are likely to be focused on mitigating impacts rather than delivering real resource efficiency improvements.

5. **Price based measures should be set at a level that incentivises change:** if tax rates are set too low their effects are much less. Rates need to be tailored to the context, taking relative prices and incomes into account, with rates set high enough to encourage change but not become overbearing. Further research is needed in this area.

6. **Consider how resource taxes can incentivise efficient behaviour and expand the environmental tax base:** most environmental taxes have focused on energy and transport, the growing importance and scarcity of resources makes their efficient use an environmental and economic priority. Well targeted tax instruments can help incentivise more resource efficient production and consumption, those most successful in this area have focused on waste and water charges, these could be more widely applied across the EU.

7. **Tax measures should always consider if revenues can be recycled to companies or consumers to achieve a double-dividend:** To incentivise competitiveness and avoid the negative economic impact typically associated with tax measures, the way in which revenues are used should be closely considered. An economic and environmental double dividend is possible only if new revenues from resource and pollution taxes are used to shift tax burdens and away from labour and enterprise in the affected sector. The evidence is clear that this has not yet been happening in the majority of cases. From a competitiveness point of view it may also be useful to investigate how import taxes could be used, within trade rules, to provide incentives for resource efficiency to firms outside the EU, equivalent to the incentives firms within the EU face.

8. **Tax measures need to be dynamic or regularly reviewed:** the impact of a tax measure erodes over time if taxes are set at a nominal price level. In this situation tax-levels should be regularly reviewed to maintain resource efficiency incentives. Dynamic taxes, based on price or volume percentages reduce erosion effects and can be simpler to implement and more effective.

9. **Take consumer behaviour and perceptions into account in instrument design:** to maintain support and engagement with the MBI this is important. Transparency, awareness and designing the instrument to complement the geographic context are among the best ways to achieve this.

10. **Investigate how targeted education and awareness raising can be expanded:** the success in the pesticides sector points to significant resource efficiency and environmental gains being made from targeted campaigns. There is obvious potential to expand the pesticides example across the EU, but other sectors, with a small number of players but significant resource use and impact could also be targeted.

11. **Carefully consider the cost-effectiveness of container deposit schemes:** the evidence suggests that while these schemes are highly

effective in retaining resources through returns and recycling, they are also relatively expensive. More cost-effective alternatives may be available, such as household recycling collection.

12. **MBIs should link resource quantity and impact:** instruments based on simple quantity or volume (weight) measures do not always fully account for the specific impact, scarcity or importance of resources. Design of measures should try to take both factors into account, through wider use of quantity or weight volumes varying by resource or multiplied by risk/impact factors.

13. **Distributional effects of MBIs are typically not large, but should be considered:** in many cases the effects of new instruments are small but socially regressive, disproportionately impacting low-income consumers or other vulnerable groups. This is particularly sensitive on essential items such as food, water and energy. This should not be a hindrance to further use of MBIs but should be taken into account in the planned use of revenues, potentially to compensate those that lose out.

14. **MBIs should be based on a sound life-cycle basis to support real resource efficiency:** some of the measures appeared to be successful and effective, but their actual resource efficiency and environmental impact benefits could be debateable. Instruments that encourage resource switching and behavioural change should take into account the life-cycle impacts of the changes they promote to ensure the change is positive. This could involve some trade-off between resource efficiency and environmental goals, highlighting the importance of the full life-cycle to reflect on these dilemmas.

15. **Use consistent definitions and methodologies and improve monitoring and evaluation:** these were a weakness observed across the majority of instruments. This is needed to encourage clarity, consistency and sharing of best practice across the EU. This will enable better policy design and greater potential resource efficiency improvements.

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**Stakeholders contacted**

We have contacted the following; however their input is still pending:
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Norbert Selenz, Vienna City Administration, Dep. for Public Parks
Margit Cech, Vienna City Administration, Dep. for Public Parks
Werner Pillmann, Austrian Federal Institute for Public Health (ÖBIG)
Liana Sadauskienė, Lithuanian Research Centre for Agriculture and Forestry, Department for resources, economics and policy
Gediminas Macaitis Ministry of Environment, Lithuania
Gediminas Jasinevičius, Ministry of Environment, Lithuania
Marius Lazdinis, European Commission, DG Agri
Mr. Gintautas Cinga from Lithuanian University of Agriculture
Mr Valdas Vaiciunas, Director of Forestry Department
Mr Nerijus Kupstaitis Head of Forestry Policy Unit, Director of Forestry Department
Mr Algis Gaizutis - Head of Private Forest Owners Association in Lithuania

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# Annex I: Summary of MBIs – EEA and Non-EEA

## Case studies: best practices from EEA countries

### Proposal 1 – Austria: Environmental Fiscal Reform

In March 2003 the newly elected Austrian government published its plans about Environmental Fiscal Reform (EFR). Environmental Fiscal Reform is a broader approach than Environmental Tax Reform; it not only focuses on ‘shifting taxes from economic functions, sometimes called ‘goods', such as labour (personal income tax), capital (corporate income tax) and consumption (VAT and other indirect taxes), to activities that lead to environmental pressures and natural resource use, sometimes called ‘bads', but also on reforming economically motivated subsidies, some of which are harmful to the environment and may have outlived their rational.

The ecological elements are a tax on coal, a rise in the tax on mineral oil (gasoline- unleaded petrol, diesel and heating oil) and a rise in the tax on natural gas. Other environmental taxes/charges include a tax on electricity, a land contamination Vienna charge for tree protection, a waste deposit levy, a motor vehicle tax, a tax on motor vehicle insurance, a road transport duty and a safety levy (air passengers).

### Proposal 2 – Austria: Passenger Eco-Tax

The Austrian government intends to move forward on its "ecological air travel levy" that will begin March 30, 2011, for all departing flights. It is similar to the tax introduced in Germany for air travel from Jan. 1, 2011. Passengers boarding in Austria will be charged €8 for European flights, €20 for medium-haul flights and €35 for long-haul flights. The tax is expected to raise €60 million in 2011, rising to €90 million in successive years. Critics arise mostly from the airline representatives, accusing the Austrian government of following other EU states like Germany and the UK in using the environment as a thinly-disguised revenue earner. Speaking at the recent President’s Assembly of the Association of European Airlines (AEA), British Airways CEO and AEA Chairman for 2010 Willie Walsh said Europe’s airlines would not be able to compete abroad if weighed down by taxes and charges at home.

### Proposal 3 – Austria: Distance-based Heavy Goods Vehicle Charge (“LWK-Maut”)

From 1st January 2004, all heavy goods vehicles exceeding a total weight of 3.5 tons had to pay a toll, when using any kind of high speed route throughout Austria. As a preparation, all applicable vehicles were required to install a GO-box in the front of their means of transport between 2002 and 2003, by which a multi-lane free-flow toll system could check the driver’s status, using microwaves. The charge is quantity-based but at the same time, the toll for vehicles is differentiated depending on their axes. For 2004, the revenue is estimated at 600 million EUR and aims to

increase infrastructure cost recovery. All revenues go to the company charged with managing and expanding the motorway system. The revision of the Charge in 2009 resulted in a further differentiation of the existing toll applicable vehicles into EURO norms (European standards such as e.g. emission class). Coming into force on 1st January 2010, this revision is aimed at further reducing emissions and internalizing environmental costs into transportation businesses.

### Proposal 4 – Denmark: Danish Pesticides Tax

The purpose of the Danish Pesticides tax, which was introduced in 1996, is to reduce the consumption of pesticides. The pesticides tax is on 25-35 % of the retail price excluding VAT.
In the Danish Pesticide Action Plan 2004-2009, a number of additional instruments were introduced to reduce the use of pesticides in the Danish agriculture (including national information campaigns, R&D initiatives, etc.) The tax is imposed manufacturing and import level. This reduces the costs of control and administration, because the number of companies registered at this level is considerable smaller than at the retail level. Enterprises that produce or import dutiable pesticides must register with the customs authorities. The case can focus on the effect on the use of pesticides after the introduction of the tax.

### Proposal 5 – Denmark: Danish Green Accounting System

The Danish Green Accounting System, which was established in 2003, is an environmental accounting system covering 1000 enterprises. Around 85 % of the enterprises were obliged to enter into the accounting system. The purpose of the system is to provide information on companies' use of energy, water and raw material to the public. An assessment of the system divides the enterprises into three groups: 1) Companies that already had another environmental accounting system, 2) Companies that had little interest in environmental issues. These two groups considered the accounting system as a burden, where as group 3) Companies that had little knowledge of environmental performance but realised business opportunities from material efficiency. These companies had experienced improved efficiency in water consumption and better sorting of waste as an effect of the accounting system. This case will be based on the results from the already undertaken analysis combined with interviews of relevant companies in order to update the findings.

### Proposal 6 – Finland: Waste Tax

Recently (in 2010), Finland changed the waste tax scheme. The change in the waste tax implied that the tax rate is now mainly determined by the "quality" of the waste (i.e. the degree of recyclability and not by the source of waste. This means that that non-recyclable waste is imposed a higher fee compared with the same amount of waste that is not recyclable. As the change in the waste tax is recently introduces not much information is easily available however it could be interesting to interview relevant people to estimate the expected effect and change in behaviour for the case. Especially with focus on the administration and bureaucracy.

### Proposal 7 – Germany: *Umweltschutzplakette* – Environmental Zones in Cities

German cities, under a law passed in 2006, are acquiring environmental zones (*Umweltzonen*); an area into which you can't drive your car unless it bears a windshield sticker certifying that it has an acceptable emission level. There are three different stickers: a green one certifying that the vehicle is environmentally acceptable; a yellow one for less acceptable vehicles and a red one for those that are still less acceptable. Yellow and red stickers will eventually be phased out, after which all vehicles permitted in the environmental zones will need a green sticker. The stickers are hard to counterfeit and would be destroyed in any effort to remove them from the windshield.
Gasoline- and diesel-powered vehicles without catalytic converters will be unable to get any kind of a sticker and will not be permitted in the environmental zones. All gasoline-powered cars with catalytic converters will get a green sticker. So will the best of the diesel-powered vehicles. Diesels, however, present a greater pollution hazard, and many will only get yellow or red stickers.

Signs that tell you you're entering an environmental zone will picture the stickers that are allowed beyond the sign. If you have a red or yellow sticker and that sticker is not pictured on the sign you must turn around. Cars found in an environmental zone without an appropriate sticker are subject to a €40 fine. The fact that your car is eligible for a sticker is no excuse.

The first environmental zones were established on January 1, 2008 in Berlin, Cologne and Hannover. Others have since been established in Düsseldorf, Stuttgart and a group of smaller communities in the Stuttgart area. Many other cities were scheduled to come on board in 2008 and early 2009.

### Proposal 8 – Germany: The Blue Angel

The most well known product-related environmental policy instrument in Germany is the Blue Angel. It has been awarded for more than 30 years now and covers assessments of approximately 10,000 products and services. The Blue Angel is a guarantee for an environmentally friendly and functional product. It is awarded to companies on the base of standardized guidelines to reward their commitment for sustainable production. Producers use it to professionally promote their eco-friendly products in the market and promote environmentally-friendly consumption. Thus, it fits in well with the competition for the best possible ecological properties of products (except for foods) and services. The Blue Angel definitely helps to speed up the structural change of the economy towards a sustainable development.Since its review in 2009 the Blue Angel focuses even more on the environmental protection aspects of products. At present it is being awarded in the sectors climate, water, and health and resource protection.

### Proposal 9 – Germany: Container Deposit Scheme

In Germany container deposit legislation, known in colloquial usage as *Einwegpfand* (single-use deposit), was passed in 2002, and was implemented on January 1, 2003. However, its implementation was fought by lobbying groups of German bottling industry and retailers. This fight also included trials at the Federal Administrative Court of Germany and the Federal Constitutional Court of Germany, but all trials were won by the German federal government. The deposit legislation does not cover containers for Fruit Juice, Wine, Spirits/Liquors and certain dietary drinks. The standard deposit for all single-use containers (Cans, single-use glass and plastic bottles): € 0.25. The deposits for reusable bottles are not regulated by law since they are the private business of the individual beverage manufacturer and can therefore vary in rate. Nonetheless there are some standard rates that are widely used: glass-bottles for most beer and beer mixed drinks (usually up to 0.5 litre) : € 0.08; Reusable glass and plastic bottles for most soft drinks (usually up to 2 litres): € 0.15; Reusable glass bottles of a special kind and design (usually flip-top bottles for beer): between € 0.15 - € 0.50. Additional revenues from deposit-charged containers for retailers are estimated to be 50 million EUR per month. However, the implementation costs are estimated by the German Environment Ministry's to be €1 billion and running costs an additional €135 million per annum (published in January 2003).

### Proposal 10 – Germany: Automobile Battery Deposit

The German "Batterieverordnung" used to regulate the polluting effect of car batteries by imposing a deposit of 7.50 EUR on every car battery bought and controlling for harmful substances. This approach aims at increasing the recycling rate of car batteries and fostering the correct recycling/reuse of sensitive parts. Originally, the regulation was enforced in 1998. However, in order to correspond to the 2009 realization of the EU parliament's Directive 2006/66/EG, the "Batterieverordnung" was replaced in Germany by the "Batteriegesetz (BattG)", thus applying to all batteries and accumulators. The deposit-refund system is regarded as the most efficient mean in reducing hazardous waste and ensuring the safe use of batteries.

### Proposal 11 – Germany: Freiburg-Vauban – Eco-Neighbourhood

Vauban is a residential district of Freiburg, where a participatory approach shaped its planning, and was based on a vision where ecological, social, economic and cultural needs would be integrated.
Since the 1930s, Vauban had been a French army barrack. After the peace treaty in 1991, Freiburg city bought this 42-hectare area from the German government, and decided to make it a new residential area for 5,000 people to meet housing shortages in Freiburg. The plan was to provide good quality housing for young families, and to counteract suburbanization by recycling this site rather than eating into virgin land (it is thought that there is no need in Germany to do this anymore as there are enough disused industrial or military sites in its inner cities). The plan also included dense design, low-energy standards for housing, preservation of existing old trees and integrating them into the new

designs and large amount of green spaces, public transportation and access (trams), and further infrastructure such as schools.

From the beginning, the approach was *participatory*, and followed the principle of "planning that learns," which allowed for flexibility. More than 50 workshops were held, which included citizens, architects, a local non-governmental organization, engineers, financial experts and managers of co-building projects. *Funding* was provided through various institutes, the *city of Freiburg, the state government, and the German government in the form of tax breaks for co-building builders*. Technical resources were readily available as Freiburg has been committed to environmental sustainability since the 1970s. (Co-building, which has provided homes for 1,200 people, means a collection of housing units built together where members have input in the process and are designed for social interaction, i.e., with common spaces, meeting rooms, public gardens or kitchens, etc.) It was also made available to people of varying incomes.

A *car-free initiative* was also launched, and owners of cars must park them in multi-story lots outside the periphery of the district. Some 40% do not own cars, and other alternatives such as car-sharing also exist. The housing met all low-energy standards, many of which use solar installations and a new design of vacuum toilets for use in a biogas plant. A co-generation plant uses wood chips and natural gas. With this extended participation, people became more active in the community in general and started their own initiatives including a magazine, festivals, and other community events. The valuable points about this case is that the *ownership of the land by the city (and the variety of financial resources, tax breaks and technical resources, as well as the strong support of a non-governmental organization*), allowed the city to take responsibility for the entire planning without becoming dependent on private developers. It highlights the unnecessity of clearing natural land for new development since many decaying *industrial zones in Germany are available for "recycling."*

### Proposal 12 – Hungary: Car Battery Charge

As part of the LIII/1995 law on the general principles for the protection of the environment, the Car Battery Charge was introduced to reduce the negative impact of those products on the environment. Although producers of hazardous waste are obliged to take responsibility for the appropriate treatment, only 63 per cent do so. Inappropriate disposal is punished by a fee. The charge collects funds for the waste management related to use car batteries and thereby encourages the protection of the environment from dangerous substances such as lead and sulphuric acid or cadmium and alkali contents. Car batteries are increasing in number due to the rise in automobiles in Hungary and therefore are regarded as essential in the portfolio of product charges. The average collection rate corresponds to 100% in the field of car batteries.

### Proposal 13 – Ireland: Plastic Bag Levy

This is a price based – negative (tax) instrument implemented since 2002 in the Republic of Ireland. It imposes a levy of €0.22 on each non re-

usable plastic bag provided at point of sale and is the retailers' duty to charge. The scheme was hailed an overnight success, drastically reducing bag use by around 95% in its first year, though usage has since crept back up slightly. The levy provides revenues of over €20 million each year which are ring fenced into an Environment Fund. The levy is interesting as many nations have, or have considered, similar regulation on this highly visible litter item. There is also a broad range of opinion on the benefits / drawbacks of the levy – i.e. some champion the reductions achieved, others believe it has actually led to higher resource use as more intensive alternatives are used. Data availability is good as retailers are required to administer and report the levy.

### Proposal 14 – Latvia: Tax on Natural Resources

Introduced in 2000, the Law on Natural Resource Tax (NRT) aims at restricting the ineffective use of natural resources and pollution of the environment reduce manufacturing and sale of environment polluting substances. Further it is seen as a mean to promote the implementation of new and improved technology which reduces environmental pollution and support the strategy of sustainable development in the economy. The revenue collected flows into the environment protection special budget of the state and the local governments for use in recycling or processing of environmental harmful waste, protection, restoration of the environment and research or renewal of natural resources. This seemingly general approach to environmental protection probes to be an important step in Latvia's environmental legislation.

### Proposal 15 – Poland: Car Recycling Fee

The car recycling fee is levied on second-hand cars imported to Poland from the EU.

The recycling fee has been in place since January 1st 2006 and according to the law, funds raised this way, are supposed to help raise car recycling rates and standards. Every Pole importing a second-hand car from the EU must pay the so called recycling fee amounting to PLN 500 (EUR 148.8m). The funds are supposed to be spent to utilize old wrecks. However, it turned out that the funds collected have been too large and no one knew how to spend them. "There are 453 garages disassembling cars in Poland. In 2007, 85 of them received PLN 14.3m. This year, they got PLN 33.5m. The funds are used so scarcely because, first of all, EU limits concerning public subsidies. Besides, over 80 percent of cars withdrew are used illegally", Adam Malyszko, the CEO of the Car Recycling Forum FRS commented.The government has recently changed the law and it will spend the money for conferences, debates and banquettes. The environmental fund FOSiGW explained that over PLN 1bn has been collected already. Instead of being spent for recycling, the money will go for a UN climate conference held in Poznan in 2008. The government needed funds to provide for two-week-long stay of delegates from 190 countries and as many as over 10,000 guests are expected.

### Proposal 16 – Poland: Effluent Charges

In the 1970's, Poland introduced an effluent charge system being one of the leading countries in the region, together with Bulgaria and Hungary. However, in contrast to other Eastern European countries Poland is regarded the only country in which the fees may have reduced emissions (Stavins, 2010). Additionally, the country revised its emission fee system for pollutants in aviation in 1991 and thereby increased total charges significantly. Consequently, Polish effluent fees rose up to be among the highest in the world, reaching twenty times their level compared to Communist times. The structure of the Polish 'Effluent Charge' is as follows; first, there is a "normal fee" imposed on emissions below the regulatory standard, and second, an additional fee applies as punishment for excess emissions. This is on of the rare examples of a *non-linear effluent charge*. By and large, fees depend on ambient air quality guidelines and marginal abatement costs but in Poland, they also have been subject to political influence and revenue requirements (Anderson and Fiedor 1997). Annual revenues lie in the range of $450 to $500 million and are internalized by national and regional environmental funds (Stavins, 2010).

### Proposal 17 – Slovenia: Water Consumption Charge

First introduce in 1993, the user charge on drinking water (water taken from public water supply system) constitutes an important instrument to create economic incentives dedicated to the protection of drink water quality and conscious consumption. Charges differ from municipality to municipality depending on different factors (level of service provided and costs associated with providing service, population distribution and density, etc.). The rate is fixed for one year. It changes with the rate of inflation. In 1994 it amounted to 4.40 SIT/m3 (0.03 ECU/m3). The charge is levied on the use of water as a natural resource and partly for covering the costs of treating drinking water. The rent for the use of public infrastructure is earmarked revenue of the local community. It is used for the purpose of investment and investment maintenance work on that public infrastructure, for which it was charged.

### Proposal 18 – Sweden: Gravel Tax

The purpose of the gravel tax in Sweden was to address resource scarcity, improve water quality and preserve landscape. In 1996, when the tax on gravel was introduced, the tax was SEK 5/ton corresponding to 10 % of the prices on natural gravel. In 2003, this tax was raised to SEK 10/ton to improve the incentive effect. The consumption of natural gravel decreased and the use of crushed bed rocks increased significantly even before the gravel tax was introduced. This was due to changes in road building material, allocation of permits, consumer preferences and raising awareness. In this light it was concluded that it is difficult to separate the impact of the tax from the other factors. The tax apparently served to equalise the cost of using crushed rock and gravel.

### Proposal 19 – Sweden: MinBaS

The purpose of the MinBaS programme was to promote economic growth and sustainable development within the mining industry. More specifically,

the aim of the programme was to establish more resource efficiency production systems (achieve more efficient resource excavation), that entail optimal utilisation of resources with decreased energy consumption and environmental impacts. Furthermore, the programme should strengthen the product and market development. The work was carried out in 30 projects with 45 studies. In all, some thirty projects, comprising a range of subprojects, have been carried out as part of MinBaS. The results will have a direct impact on the sectors involved, but also on the industries that depend on MinBaS companies: pulp and paper, construction, chemicals, steel, non-ferrous metals etc. The Dahmén Institute has undertaken a process and outcome evaluation of MinBaS. One of the points highlighted in its report is that the programme has laid a foundation for cooperation in several directions in a highly diverse sector in which, in the past, collaborative traditions have been poorly developed. This cooperation spans different sub sectors, researchers, customers, suppliers and public agencies. It has given the sectors concerned a national platform for work both at the local level and in Sweden as a whole, as well as for future involvement in joint European projects. MinBaS has also made possible initiatives which would otherwise have been mounted on a very limited scale, if at all. The programme has had a total budget of SEK 49.3 million.

### Proposal 20 – The Netherlands: NOx Emission Trading Scheme

In 2001, the European NEC Directive has set national emission ceilings for every MS with regard to the substances NOx, SO2, NH3 and VOC. The Netherlands received a very stringent ceiling on NOx and SO2 emissions due to their inherited high population density and their susceptibility to acidification. The emission level of 393 kton of NOx in 2003 should be reduced to 260 kton in 2010 according to the EU Directive. In order to tackle this sharp reduction of NOx emissions, the Netherlands decided to use an emission trading scheme, allocating the allowed 260 kton on a national level to Mobile Sources (158 kton), Industry (55 kton), Consumers and services (19 kton) and Others and reserve (28 kton). In the industrial sector, the trading scheme covers 260 installations with a capacity exceeding 20 MWth. The Dutch NOx scheme differs from the international CO2 emission trading in the sense that it uses relative rather than absolute emission ceiling. Thereby the scheme allows for industry growth and non-Dutch companies can operate within the country's geographical area without having to buy allowances but by simply complying to the relative emission standard. Under this system, allowances are generated during operation according to Performance Standard rates (PSR). This sums up to a distinct ET scheme, called a "dynamic cap" system which has a higher uncertainty about the environmental outcome and implies higher administrative costs compared to the standard "cap and trade" system but at the same time is industry-friendly and more widely accepted.

### Proposal 21 – United Kingdom: National Industrial Symbiosis Programme (NISP)

This UK programme, launched in 2005, is a market fiction – enhanced information (producer) instrument that provides information, networking and matching service for firms. The purpose of the scheme is to match

firms waste products with other firms material needs, to bring a symbiosis between them improve resource efficiency, find new resources streams and improve competitiveness. The approach is understood to have been highly successful, an independent evaluation presented verified results of 7 million tonnes diverted from landfill, 6 million tonnes CO2 emissions avoided, 9.7 million tonnes virgin materials saved, 363,600 tonnes of hazardous waste eliminated, 9.5 million tonnes of water saved. It has also had a significant economic impact with estimated cost savings to firms of £156 million and new sales of £176 million. Creating 3,680 jobs and saving over 5,000 jobs. Administration of the programme through public money cost £27.6 million pounds over 5 years. This is interesting in its focus on industrial processes, treating waste as a resource and the scale of benefits claimed.

### Proposal 22 – United Kingdom: Aggregates Levy

This is a price based – negative (tax) instrument introduced in the UK since 2002. It imposes a levy of £2.10 on each tonne of virgin aggregates (gravel and stone) extracted, which serves to increase the average price per tonne by approximately 25%. In 2008/9 the levy raised approximately 334 million in tax revenue, 10% of which is provided to fund research into reducing the environmental impact of aggregates and their recycling and disposal. The levy is believed to have been the primary factor in a decrease of around 18 million tonnes of virgin aggregates use between 2001 and 2005, and also for aggregates recycling rates of around 25%. This rate is by far the highest in Europe, almost double the rate of the next best performing member state.

## Case studies: best practices from non-EEA countries

### Proposal 23 – Australia: Hunter River Salinity Scheme (water)

The Hunter River- North of Sydney drains large coastal catchments. Its water is used for several activities including irrigation for agriculture, pumping saline water from mining activities and generating electricity for cooling. All these uses increase the salinity concentration of the water which may reach unacceptable levels at times and affect the river's ecosystem. The Environmental Protection Agency set a salinity trading scheme according to which 1,000 salinity ‘credits’ were available. Each credit allows 0.1% of total salinity discharge per block of water. The credits have different life spans, allowing 200 to be reissued every two years and allowing new entrants to participate in the market. The credits have a lifespan of 10 years and are issued by auction, thus available for purchase by licence holders. Credits are tradable between participants.

### Proposal 24 – Australia: Environmental Stewardship Strategic Framework (land/ecosystem)

The framework involves investment in a number of projects, targeting priority high public value environmental assets in Australia. Despite the fact there exist a number of policy measures and incentives for land owners to achieve conservation outcomes; the scheme addresses some policy gaps by providing payments for long term protection of high value environmental assets. Under the scheme, the case of the “Mount Lofty

Ranges Southern Emuwren and Fleurieu Peninsula Swamps Recovery Program" is proposed for selection.

### Proposal 25 – Brazil: Environmental Conservation Scheme (biodiversity)

The environmental conservation scheme was established in 2002 as part of the National Protected Areas Systems. This latter is a law governing the National Protected Areas System. According to the scheme, every project with "substantial environmental" impact pays no less than 0,5% of the project value as a compensation for environmental damages caused by the project. The protected areas that allow for economic activities within their boundaries can receive these compensations.

### Proposal 26 – Canada: NO/SO2 Set Aside Allowance

The Set Aside Allowance is a Cap and Trade scheme. It consists of a one kiloton of NO and 4 Kilotons of So2 which are subtracted from the total allowance allocated to Ontario Power Generation (OPG) and are available for energy efficiency and renewable energy efficiency projects which displace fossil fuel-fired generation. These may be sold to capped emitters. The Port Albert wind farm consisted of a single 660 KW wind turbine which generates electricity (1056189 KWh for sale to Ontario Power grid. The emission free electricity could potentially be sold as "green power" thus achieving financial benefits for the farm and at the same time generates allowances under the trading scheme with another potential financial benefit. This double benefit was the first of its kind to draw attention to claiming a double benefit from such a scheme.

### Proposal 27 – United States of America: The Lead Trading Programme

This program was initiated by the US Environmental Protection Agency (EPA) in 1980 for the purpose of helping companies who had to comply with strict environmental standards by lowering the lead content of gasoline by 10%. According to the program, firms that could lower the lead content to less than the required amount could earn lead tradable credits. Trading was complemented by a "banking" component whereby the EPA created a program that would allow firms to "bank" these credits. Under this mechanism, gasoline refineries that used less than 0.5 gplg, but greater than 0.1 gplg in leaded gas in 1985 were permitted to use the same amount of lead between 1985 and 1988 in addition to the lead permits used during that time. Thus the banking mechanisms allowed the refineries additional time to comply with the stricter lead standards.

This program is a good example because it is known to have led to substantial reduction of lead content in gasoline and finally lead to the phasing out of lead in the USA. Additionally, the banking component of the scheme can be considered as an innovative approach in MBI which offered refineries further flexibility to comply with the strict standards. There is a considerable amount of literature about the program.

### Proposal 28 – United States of America: Improving Information and Finance

The "Clean Air Campaign" is a non-for profit organization that provides education to reduce traffic congestion and to improve air quality in metro Atlanta. Education is done through mass advertising,

public relations and community outreach. These include, smog alerts indicating forecasts for unhealthy air, where alerts are distributed via e-mails; usage of an informational website that provides information on air quality and commuting alternatives; a toll-free call centre, which serves as an information centre for the public; electronic news-letters; marketing and promotion of the region "free rideshare service" and "car-pooling". The scheme also offers financial incentives to employers and commuters who live in the region. This incentive is meant to defray the costs of selecting alternative commute options. The campaign uses "car pool reward" system, whereby the registered participants who carpool 15 or more days in a month are offered a monthly gas card for up to 12 months. The campaign also offers a "commuter recognition program".

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