The Use of Economic Instruments in Nordic Environmental Policy 1999-2001

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Nordic Council of Ministers
Store Strandstræde 18
DK-1255 København K
Phone (+45) 3396 0200
Fax (+45) 3396 0202

Nordic Council
P.O.box 3043
DK-1021 København K
Phone (+45) 3396 0400
Fax (+45) 3311 1870

Homepage: www.norden.org

The Nordic Co-operation on Economy and Finance
Nordic co-operation in the area of economy and finance includes consultations on stabilisation policies, studies and discussion of strategies for structural policies, evaluation of adjustment policies for the European economic integration process as well as support to the economic transformation process in Eastern- and Central Europe. The work in this area is governed by the Ministers of Finance and Economy and they are assisted by a Nordic Committee of Senior Government Officials.

The Nordic Council of Ministers
was established in 1971. It submits proposals on cooperation between the governments of the five Nordic countries to the Nordic Council, implements the Council's recommendations and reports on results, while directing the work carried out in the targeted areas. The Prime Ministers of the five Nordic countries assume overall responsibility for the cooperation measures, which are co-ordinated by the ministers for cooperation and the Nordic Cooperation committee. The composition of the Council of Ministers varies, depending on the nature of the issue to be treated.

The Nordic Council
was formed in 1952 to promote cooperation between the parliaments and governments of Denmark, Iceland, Norway and Sweden. Finland joined in 1955. At the sessions held by the Council, representatives from the Faroe Islands and Greenland form part of the Danish delegation, while Åland is represented on the Finnish delegation. The Council consists of 87 elected members - all of whom are members of parliament. The Nordic Council takes initiatives, acts in a consultative capacity and monitors cooperation measures. The Council operates via its institutions: the Plenary Assembly, the Presidium and standing committees.

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FOREWORD

This is the fifth time that The Working Group on Environment and Economics (WGEE) under the Nordic Council of Ministers presents a report on the use of economic instruments in Nordic environmental policy. The report includes information about instruments which are in force or are decided on as well as a summary of evaluations of some of the instruments which have been into force for some years.

Consultant Annika Olofsdotter has prepared the report based partly on contributions from the members of the WGEE, who are representatives from the Ministry of Environment and the Ministry of Economic Affairs and Finance in the Nordic countries. The chapter on evaluation of economic instruments is based on several studies in the Nordic countries.

It should be noted that the Nordic governments in office do not necessarily support all views and considerations that appear in the report.

The members of the WGEE hope that the report will be of interest to policy-makers, as well as to the general public, interested in environmental policy implementation in the Nordic countries.

More information about the Working Group on Environment and Economics is available at the group's homepage http://odin.dep.no/fin/nordisk_ministerrad/.

Oslo, November 2002

Chairman

The Working Group on Environment and Economics

Oppsummering

Økonomiske virkemidler har vært benyttet i de nordiske landene i over ti år som redskap for å oppnå miljømål, i tillegg til den utbredte bruken av administrative virkemidler. De mest vanlige virkemidlene er forskjellige avgifter og gebyrer for å redusere luftforurensing. Nordiske miljøavgifter på fossile brensler består grovt sett av grunnavgift på olje/gass og avgift på karbondioksid og på svovel, selv om hvert enkelt land har sitt eget spesifikke miljøavgiftssystem. Industrien er gitt forskjellige fritak fra skatt for å ivareta internasjonal konkurranseevne. Avgift på utslipp av karbondioksid i de nordiske landene har vært vurdert i over 60 undersøkelser. Både metodene og forutsetningene er ulike i undersøkelsene, men de konkluderer med at avgiftene reduserer bruken av fossile brensler og dermed de innenlandske utslippene av CO_2.

Det er pålagt avgifter på elektrisitet i alle nordiske land unntatt Island. Avgiftene er lagt på forbruk, og brensel brukt i kraftproduksjon er fritatt fra beskatning i alle landene.

Av hensyn til miljøet har bensinavgiftene vært differensiert på grunnlag av blyinnhold i alle de nordiske landene siden siste halvdel av 1980-årene. Dette har bidratt vesentlig til et skifte i forbruk fra blyholdig bensin til blyfri bensin. Avgifter på motorkjøretøy ble gjennom 1990-årene endret i alle de nordiske landene for å fremme bruken av miljøvennlige kjøretøy.

Bruken av økonomiske virkemidler for å redusere vannforurensning har ikke blitt brukt i samme grad som for å redusere utslipp til luft. Sverige og Danmark har imidlertid avgift på nitrogen i kunstgjødsel, og nesten alle landene har avgiftsbelagt sprøytemidler. Finland har innført en differensiert avgift på fraktfartøy, og Danmark har introdusert et avgiftssystem som skal redusere utslippene fra anlegg som behandler kommunalt avfall og industriavfall.

Når det gjelder avfall, benyttes vanligvis brukeravgifter for å finansiere avfallsbehandling, men det er også forsøkt innført virkemidler for å begrense kildene til avfallet. For nesten alle typer av glassflasker, som øl-, sprit- og brusflasker, finnes det pante- og retursystemer. Noen land har også returordninger for motorkjøretøy. Økonomiske virkemidler er brukt for å få kontroll over ulike typer giftig avfall, som batterier og smøreolje. I de fleste landene legges det avgifter på avfall som leveres til deponering eller forbrenning.

Det er liten praktisk erfaring i de nordiske landene når det gjelder handel med naturressurs- eller utslippskvoter. Et unntak er Island som benytter omsettelige fiskekvoter. I de andre nordiske landene blir systemer for handel med utslippsrettigheter diskutert og analysert i forbindelse med det forestående internasjonale handelssystemet igangsatt i Kyoto Protokollen. Norge har vedtatt å innføre et nasjonalt system for omsettelige klimagasskvoter fra 2005.

Frivillige avtaler er inngått hovedsakelig i Danmark, Finland og Norge, og omfatter i hovedsak ulike former for avfallsbehandling.

Rapporten er organisert på følgende måte:

Resten av kapittel 1 drøfter egenskaper ved økonomiske virkemidler. I kapitlet sammenlignes økonomiske virkemidler med direkte reguleringer og fordeler og ulemper ved begge typer virkemidler omtales.

Kapittel to oppsummerer utformingen av de økonomiske virkemidlene i de nordiske landene. Det beskriver de viktigste utviklingstrekkene de siste årene, basert på kapitelene om de respektive nordiske landene, kapittel tre til syv. Disse fem kapitlene gir en oversikt over de miljørelaterte virkemidlene som er tatt i bruk. Kapittel to drøfter også hvordan EUs lovverk om handel og konkurranse, som de nordiske landene har akseptert gjennom EU- og EØS-avtalene, påvirker rammene for miljøpolitikken i de nordiske landene. Kapittel to gir også en oppdatert oversikt over EUs lovverk når det gjelder økonomiske virkemidler.

Kapittel åtte tar for seg evalueringer av økonomiske virkemidler i de nordiske landene. Evalueringene omfatter hovedsakelig avgifter på utslipp av karbondioksid.

1. Introduction and summary

1.1 Summary

Economic instruments have been applied in the Nordic countries for over ten years as tools to achieve environmental aims in addition to the continued predominant use of administrative regulations. The most common economic instruments employed are various taxes and charges, which above all are introduced to reduce emissions to air and / or to reduce the use of fossil fuels. Roughly, Nordic taxes directed towards fossil fuels can be divided into a basic energy tax, a tax on carbon dioxide and a sulphur tax, even though each country has its own specific environmental tax system. The industry sector is allowed different exemptions from tax in order to safeguard conditions for international competition. The taxes on carbon dioxide emissions in place in the Nordic countries have been evaluated in over 60 studies. The methods, as well as underlying assumptions, differ between these evaluations but they result in the conclusion that CO_2 taxes do limit domestic CO_2 emissions.

Electricity taxes are levied in all Nordic countries except Iceland. The taxes are levied on consumption, and fuels used in the production of electricity are exempt from taxation in all countries.

Charges on gasoline have, for environmental reasons, been differentiated according to lead content in all the Nordic countries since the latter half of the 1980s. This has contributed significantly to the shift in consumption from leaded to unleaded gasoline. Charges on motor vehicles have been adjusted in the 1990s so as to provide incentives to promote environmentally sound vehicles in all the Nordic countries.

The use of economic instruments for reducing water pollution has not been expanded to the same extent as for the protection of the air, but Sweden and Denmark apply taxes on nitrogen in fertilizers and almost all countries tax pesticides. Finland applies a differentiated tax on cargo vessels, and Denmark has introduced a tax system with the aim of reducing the discharge of waste products from municipal and industrial treatment plants.

In the area of waste, the most commonly used charges are user charges for the purpose of financing the management of waste, but there are also instruments introduced to reduce the origin of waste. Most types of bottles made of glass, such as beer, liquor and soft drink bottles are subject to deposit and refund systems. Some countries also have deposit systems for motor vehicles. Economic instruments are applied to control certain kinds of toxic waste, such as batteries and lubricating oil. Waste disposal taxes are levied on waste supplied to landfills and incinerators in the majority of countries.

Practical experience of trading in emission quotas or natural resource quotas is quite limited in the Nordic countries, with the exception of Iceland, where tradeable fish quotas on the domestic level have been introduced. In the other Nordic countries, the system of tradeable permits is being discussed and analysed for the forthcoming international trade system initiated in the Kyoto Protocol. Norway has decided to introduce a domestic

greenhouse gas commission trading system from 2005.

Voluntary agreements have been reached mainly in Denmark, Norway and Finland and are usually related to different categories of waste management.

This report is organised as follows:

The rest of chapter one deals with properties of economic instruments. It compares economic instruments to command and control policies and describes the pros and cons of both instruments.

Chapter two consists of a summary of the policies of economic instruments in the Nordic countries. It presents the main developments in this area during the last few years and is based on the chapters on the respective Nordic countries, chapters three to seven. These five chapters provide overviews of the environment-related instruments applied. Chapter two also includes a discussion on how the EC legislation on trade and competition, which the Nordic countries have accepted through the EU and EEA agreement (the Agreement on the European Economic Area), influences the scope of the Nordic countries to pursue environmental policies. Chapter two also provides an up-to-date review of EC legislation in the broad area of economic instruments.

Chapter eight deals with evaluations made of environmental instruments in the Nordic countries. These consist mainly of studies on carbon dioxide taxes.

1.2 Properties of economic instruments[1]

Environmental problems are often explained by the fact that people perceive environmental resources as free goods. If, on the other hand, the cost of environmental degradation were reflected in the price of commodities or services, people would integrate environmental concerns into their ordinary decision-making. This may be achieved by using economic instruments, such as emission charges, deposit and refund systems and tradeable emission permits. The idea behind an economic instrument is that the market agents themselves have the best information regarding their own cost functions, and therefore are in the best position to decide on how to reduce the pollution they generate, or how to manage the natural resources they use.

During the 1990s, the use of economic instruments in environmental policies has developed rapidly in many countries, especially in the Nordic area, but reliance on command and control policies still remains high.

Under certain conditions, economic instruments and administrative regulations are equivalent, but in most cases they will differ in both economic and environmental consequences. Comparing an emission standard and an emission tax can illustrate the differences between administrative and economic instruments:

An administrative regulation like an emission standard prohibits emissions above a certain level. If the plant exceeds this level penalties can be expected; therefore the polluter must

[1] Material used from The Use of Economic Instruments in Nordic Environmental Policy 1997-1998, Tema Nord 1999:524

comply with the standards, irrespective of the costs of reducing emission.

With an emission tax, the polluting plant would reduce the emissions until the costs of further pollution reduction equal the tax, (i.e. the level where the marginal abatement cost equals the unit rate of the tax). If it is cheaper to reduce emissions than pay the tax, the company will decide to reduce emissions further. If the abatement costs are higher than the tax, the firm will prefer to pay the tax. In this way, the pollution reductions will be executed at plants with low reduction costs while firms with higher abatement costs will pay taxes instead. The instrument is said to be cost effective, which means that a given policy objective is achieved at the least cost to society.

Another property in favour of economic instruments before regulation is that they often give companies incentives to develop and apply new and cleaner technologies in order to avoid tax payments. This is referred to as dynamic efficiency. This can be achieved by the companies if new technology both reduces abatement costs as well as taxes. The use of economic instruments may also reduce the amount of bureaucracy, which is necessary for regulatory approaches.

However, economic instruments should not be favoured before regulations in all cases, even though they may contribute to more efficient solutions. The choice of instrument depends on the nature of the problem and the surrounding context in which the instrument will function. The following five criteria presented in Bojö et al[2] may be applied when choosing between different instruments:

- *Static efficiency* concerns the cost of achieving a desired environmental improvement by applying a certain instrument. The lower the cost, the more attractive the instrument.
- *Dynamic efficiency* concerns the ability of the instrument to cope with changes and with incentives to develop new and better technical solutions.
- *Information requirements*. In order to exploit different environmental policy instruments, the policy maker needs different information for implementation. The instrument becomes more attractive depending on the greater availability of information.
- *Measurement and monitoring costs*. Different instruments require various forms of monitoring, which is both costly and sometimes even impossible.
- *Ethical and political feasibility*. An example of this is that different instruments can have different impacts on income distribution.

A few further criteria when designing policies and tools may include the need for clear objectives and practicability. These were highlighted among those mentioned above, at the Stockholm Conference of 2002[3].

The Stockholm Conference concluded that a lot of experience has been gathered during the

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[2] Bojö Jan, Karl-Göran Mäler and Lena Unemo, Environment and Development: An Economic Approach, 1992 Kluwer Academic Publishers

[3] Conclusions from the conference "Stockholm 30 years on", seminar on "New tools required after thirty years of carrot and sticks in sustainable efforts".

30 years of using environmental policy instruments, both positive and negative, and this experience could be shared by countries that have less experience with such instruments. However, it was argued that a direct copying of instruments is not to be recommended between countries and sectors because of the differences in the context in which the instrument will function. The instruments must be adapted to the user context, for example, to the site and the situation, the role of governments, NGOs, business and industry, and the stages of environmental awareness. Policy makers must also be aware that instruments applied in different areas might be contradictory. It was also mentioned that when designing future instruments to achieve the aim of sustainable development, priority ought to be given to overcoming obstacles to this aim, and in particular the phasing out of environmentally harmful subsidies and tax provisions. Combinations of instruments were also recommended, as well as evaluations analysing the effectiveness of the instruments used.

2. Summary of the policies of economic instruments in the Nordic countries and EC legislation

2.1 Introduction

The Nordic countries have set relatively ambitious objectives for environmental protection and economic instruments are applied in several fields as tools in the process of achieving these objectives. Besides economic instruments, environmental policies in the Nordic countries are largely based on administrative regulations. Economic instruments that have effects on pollution or use of natural resources have been introduced in the Nordic countries either specifically for environmental purposes or via a combination of fiscal and environmental purposes. In general, all instruments affecting the relative prices of products and services will have an impact on the environment. The predominant instruments exerting such an impact in the Nordic countries are various types of taxes and charges. These have traditionally been introduced largely for other purposes, but the policy trend since the end of the 1980´s has involved changes towards charge systems with environmental profiles. Environmentally motivated charges introduced in the Nordic countries are above all related to transboundary air pollution.

This chapter summarise the use of economic instruments in the Nordic countries and the main developments during the last few years. A more detailed description of the various instruments applied is given in the country-specific chapters.

An update of relevant EC regulation is made along with each specific instrument. If no further legislation has been proposed or introduced since the last report by the Nordic Council of Ministers in 1997-1998[4], reference is made to that report.

[4] The Use of Economic Instruments in Nordic Environmental Policy 1997-1998, Nordic Council of Ministers, Tema Nord 1999:524

All charge rates in the summary are given in Euros as a yearly average of the value in 2001[5], Euro 1 being:

DKK 7.4521

FIM 5.9457

ISK 87.4173

NOK 8.0484

SEK 9.2551

From 1 January 2002, The Finnish mark is substituted by the Euro.

2.2 The influence of EC legislation on environmental policy-making[6] in the Nordic countries

Through the EEA agreement, (the Agreement on the European Economic Area) the EFTA[7] Countries and the EU have concluded an agreement based on the "four freedoms" – free movement of goods, services, capital and people. Fundamental to this agreement is that there should be no national special regulations which obstruct import or export of goods, so called technical barriers to trade. The agreement implies that the EEA countries accept the EC legislation on trade and competition, but it excludes them from EC fiscal and agricultural policies.

EC legislation influences how member states and EEA countries design their national legislation in the environmental field. When it comes to economic instruments, several parts of the legislation affect the countries' ability to choose and design instruments. These include the EC regulations governing fiscal and competition policies, state aid and environmental policies.

The Treaty of Rome forms the basis for the environmental policies of the EU, and it is supplemented by the Single European Act and the Treaty on European Union. General aims on protection of and improvement in environmental quality and human health are stated, as well as the principle that the polluter should pay and that environmental protection should be integrated into all other EU policy areas.

EC competition legislation is fundamental when individual countries pursue environmental policies based on norms and standards for different products. The competition rules are based on legislation that prohibits quantitative restrictions and other measures with the same effect. The rules aim to establish uniform regulations between member countries when it comes to standards and norms, because harmonised legislation strengthens the single market and facilitates trade between countries. Exceptions for individual countries

[5] Yearly average estimated by the Bank of Sweden

[6] Material collected from 'EU, EES och miljön, Betänkande av EG-konsekvensutredningen Miljö', SOU 1994:7 and 'EG och energin', NUTEK B 1991:8

[7] European Free Trade Association

may hamper free trade and competition can be distorted among enterprises operating within the Union. During the 1990s the Union identified a large number of barriers to the market in the form of special regulations for individual nations and technical standards for products and replaced these with common legislation.

The harmonised rules for different products imply that individual countries wishing to strive further than the majority of member states to achieve a good environment will not, in general, be permitted to impose harder standards on products sold in their country than those stipulated by the common legislation. An individual country may not, for example, prohibit certain hazardous substances or place harder restrictions on use than the rules set by the common legislation for that chemical product. Another example is exhaust emission control devices where individual countries cannot introduce stricter rules than those set by the Union. In certain cases a so-called 'environmental guarantee' can be claimed which means that a country, based on environmental concerns and under certain conditions, is entitled to keep, or possibly also to introduce, more stringent demands than the common rules. This option is applied very restrictively.

When no common legislation exists for certain products, the national standards apply. But according to the EC rules, national restrictions or prohibitions may not arbitrarily discriminate between domestic and foreign products or imply trade restrictions.

An important component of common competition policy is the prohibition of state aid that influences competition in the single market negatively. Individual enterprises, industries or producers of certain goods are not to be favoured through national support. State aid includes, above all, direct subsidies and tax reductions. However, supportive monetary aid to environmental investments and production subsidies to promote environmentally sound production may be accepted under certain conditions, even though competition might be hampered.

The environmental legislation of the EU distinguishes between products that are traded across borders and environmental standards for stationary production plants. In the case of setting standards and environmental norms on industrial facilities and energy production plants, the legislation takes the form of directives with minimum standards. This allows member states to lay down stricter standards than the common legislation on domestic industry to protect the environment.

The Commission has, in many situations, expressed a wish for more extensive use of economic instruments in environmental policies. Furthermore, the Council of Ministers has adopted a positive attitude to the instruments. These good intentions have nevertheless been impossible to put into practise when it comes to taxation of environmentally harmful substances in products, for example, because decisions in the fiscal area must be taken by a unanimous Council of Ministers. Tax policies are considered by most countries to be a national concern. In the area of energy there are common rules on taxation of mineral oils but the minimum taxation levels are so low that they hardly make any significant difference from an environmental perspective[8]. However, most EU countries apply higher taxes than the minimum levels for fiscal purposes and this may have an environmental effect in practice. The Commission has put forward several proposals to revise the directive on mineral oils, but it has not been possible to reach consensus on the matter[9]. EU

[8] EU, EES och miljön, SOU 1994:7 Betänkande av EG-konsekvensutredningen miljö.

environmental legislation has therefore mainly resulted in administrative regulations.

Of importance when using economic instruments in the energy field, are the rules stipulated in the mineral oil directive, which does not permit individual countries to apply different tax levels for use in different areas. However, some of the Nordic countries have been granted certain exceptions to the rule which entitles them, for a limited time, to apply lower tax levels for industry and greenhouse cultivation, as well as the option of differentiating the tax levels in order to apply environmental classification systems for transport fuels.

According to EC legislation, member states may use economic instruments to accelerate the implementation of stricter environmental standards based on common decisions. The economic incentives may, however, not be higher than what is economically motivated, i.e., an eventual tax relief may not be higher that the costs for the more environmentally sound alternative.

In areas where the Union lacks common legislation, member states may use the taxation instrument so long as it is not discriminating and does not demand any form of border control.

2.3 General sales charges – VAT on energy

All the Nordic countries have levied general sales charges in the form of value added taxes (VAT) on most energy products. The charge rates currently range from 22-25 per cent in the Nordic area which means that they have a substantial impact on energy prices. General VAT rates in the Nordic countries in 1999/2002 are in Denmark and Sweden 25 per cent, Finland 22 per cent, Iceland 24 ½ per cent and in Norway 24 per cent. Fuels, electricity and heat are subject to the full general tax rates in all the Nordic countries except for the three northernmost counties of Norway which are exempt from VAT on electricity.

2.3.1 EC-legislation - VAT

The EC VAT system is regulated by the Sixth VAT Directive from 1977[10], which was amended most recently in January 2001[11]. The Directive extends the length of time for which the standard rates of VAT are applicable. From a decision made every other year, the next decision on Common standard rates will be set after five years, which means 31 December 2005.

In June 2000 the Commission proposed a new strategy in the VAT field[12], which focuses on simplification and modernisation of current rules, more uniform application of current rules and a new approach to administrative co-operation. Interesting from the environmental viewpoint is the Commission's argument that value added tax in the future

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[9] The last proposal on a revision of directive 92/81/EEC on mineral oils was launched by the Commission in 2001, concerning tax reductions for biofuels used as transport fuels. COM 2001/547

[10] Sixth VAT Directive (77/388/EEC),

[11] Council Directive 2001/41/EC of 19 January 2001

[12] COM (2000) 348

could be used as a measure for environmental protection. When discussing reviewing and rationalising the rules of derogations, the Commission writes that particular attention will be paid to the VAT rates applied to virtual products compared with traditional products and the use of reduced VAT rates in Community policies (e.g. to help protect the environment, promote employment, etc).

2.4 Economic instruments related to air pollution abatement

2.4.1 Taxes in the Nordic countries

Combustion of fossil fuels, such as petrol, fuel oils, coal and natural gas, is one of the primary sources of emissions into air of i.a. CO_2, SO_2, NO_x, VOC and lead. The Nordic taxation systems consist of different charge components levied on these fuels with the aim of bringing the emissions and/ or the use of fossil fuels down. Roughly, these charges can be divided into a basic energy tax, a tax on carbon dioxide and a sulphur tax, even though each country has its own specific environmental tax system.

2.4.1.1 Energy taxes

Energy/basic taxes were historically introduced for fiscal purposes but in Denmark and Finland there have, during recent years, been changes in the composition of these taxes to reflect environmental aspects as well. In Denmark an attempt is being made to let the basic energy tax mirror the gross energy content of the fuels, except for fuels used as propellants.

In Sweden the basic energy tax is still a fiscal tax with no connection to the energy content of the fuels. In Sweden, the energy tax varies depending on the use of the fuel, the user and the geographical area where the fuel is bought – in the north or the south of the country. Iceland has levied a tax only on gasoline. Norway does not have any energy taxes, but taxes electricity consumption and heating oil.

2.4.1.2 CO_2-taxes.

In the beginning of the 1990s all Nordic countries except Iceland introduced CO_2 taxes on fossil fuels. Finland was the first country in Europe to impose a CO_2 tax in 1990. Norway and Sweden followed suit in 1991 and Denmark in 1992. The tax is generally imposed on fuel oils, propellants, coal, gas and peat but divergences occur, for example: Denmark does not directly tax CO_2 from gasoline, but the CO_2 tax is included in the basic energy tax on gasoline.

However, Denmark taxes electricity from the view of carbon dioxide, due to the country's high level of coal-based electricity production. This is not the case in any of the other countries.

In Sweden and Norway, the CO_2 tax rate is automatically changed each year in accordance with the rate of inflation in order to secure the real value of the tax, while in Finland the tax rate is annually set in the State budget and has remained unchanged since 1998.

Carbon dioxide taxes in the Nordic countries in 2001, Euro per tonne emitted CO_2

Finland 17.15

Denmark 13.42

Sweden 68.07

Norway Petrol 38.64

Mineral oil 12.26-22.61

Coal 24.48

2.4.1.3 Sulphur taxes.

Sulphur taxes are basically product taxes, where the fuel is taxed at the time of combustion or sale. In Norway, Denmark and Sweden the tax on sulphur is levied if the content exceeds 0.05 % in all fuel oils, coal and diesel. The tax is levied per each commenced 0.25 per cent sulphur content by weight in Norway and by each commenced 0.1 per cent in Sweden. In Denmark the tax also applies for natural gas as well as wood, straw, waste and other sulphur–bearing fuels. In Norway, Sweden and Denmark the tax is refunded to industrial facilities that extract and preserve the sulphur during combustion or industrial processes. In Finland the sulphur tax is included in the basic tax, but is only levied on diesel oil.

2.4.1.4 Finnish stockpile fee

In Finland a strategic stockpile fee also applies on certain commodities that are vital in an emergency situation, such as fuel oils.

2.4.1.5 Exemptions, reductions and refund schemes.

All the Nordic countries that apply high taxes on fossil fuels have different ways of making exemptions from all or part of the tax for industry for reasons of competition.

Firstly, Finland, Norway and Sweden exempt the use of fossil fuel from taxation if these are used as raw materials in industrial processes. In Denmark only the energy taxes, and not the CO_2 tax on fossil fuel, is exempted when used as a raw material in industrial processes.

In Denmark reductions of the CO_2 tax for industry is achieved by agreements with industry to perform energy saving measures. The tax reduction depends on the specific energy use of the industry; it differs between space heating, light and heavy processes. All revenue deriving from industry's carbon dioxide tax is recycled back to industry.

In Sweden, the manufacturing industry receives a 30 per cent reduction in CO_2 tax as from 2002 and is totally exempt from energy tax. The most energy-intensive industries have further reductions, which are based on the CO_2 tax, paid in relation to the value of sales.

In Norway there is no general reduction in CO_2 tax for industry, except for the pulp- and paper industry and the fishmeal industry, which pay half of the normal CO_2 tax. A reduced CO_2 tax is imposed on mineral oils used in the domestic aviation sector, activities on the continental shelf, the supply fleet in the North Sea and ships transporting goods for domestic trade. Certain sectors are excluded from all CO_2 tax (for example fishing and natural gas used on the mainland).

Finnish companies can apply for a refund if the total taxes paid add up to a certain percentage of their value added.

2.4.1.6 EC legislation – Communication on priorities in tax policies

A communication was issued by the Commission in May 2001 on priorities in tax policies

for the Union. In its work to gradually introduce the 'polluter pays' principle into the tax system, the Commission will be working on other measures besides making proposals for directives. This includes a more pro-active use of infringement proceedings in the tax field and an increased use of non-legislative solutions. It is also the Commission's view that a move to qualified majority voting for certain tax issues is indispensable.

2.4.1.7 EC legislation – Reduction in taxes – State aid guidelines

In early 2001, the Commission adopted Community guidelines on state aid for environmental protection[13] (see also chapter on state aid). The guidelines include the criteria that the Commission will use when approving reductions and exemptions from taxes for certain enterprises.

According to the guidelines there is an option for member states to allow firms or associations of firms tax exceptions for up to 10 years. The firms or industries must then comply with certain demands in, for example, binding agreements on environmental protection such as reductions in energy consumption, reductions in emissions or any other environmental measure.

Reductions in taxes for firms can be achieved, in cases where only national legislation is laid down, if the firms still pay a significant proportion of the national tax. This option also applies in cases where harmonised Community rules exist, if the reduced national tax on the firms still exceeds the tax level laid down by Community legislation.

Another possibility for tax reductions, according to the new guidelines, is to apply an aid scheme which is strictly digressive. This means that the aid has to be reduced by a specific shave during av specified time period.

2.4.1.8 EC-legislation – Limit values for pollutants in the air

In spring 1999, the Council decided on a directive for limit values for different polluting agents in the air[14]. It establishes limit values and thresholds for the concentration of sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead into the ambient air. Limit values and thresholds for carbon monoxide and benzene have also been decided by the Council and the Parliament in autumn 2000[15]. The Commission is working on daughter directives on ozone as well as polyaromatic hydrocarbons (PAH), nickel, arsenic and cadmium. The Commission is expected to put forward a proposal in 2002.

2.4.1.9 EC-legislation – National emission ceilings

The Council and the Parliament jointly decided on a directive for national emission ceilings for certain atmospheric pollutants in 2001[16]. By the year 2010 at the latest, Member States should limit their annual national emissions of sulphur dioxide, nitrogen oxides and volatile organic compounds.

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[13] Information from the Commission – Community guidelines on State aid for environmental protection, Official Journal C037, 03/02/2001 page 3-15

[14] Council Directive 1999/30/EC of 22 April 1999 relating to limit values for sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead in ambient air, OJ L 163 of 29 June 1999 p 41

[15] Council Directive 2000/69/EEC of the 16 Nov 2000, OJ L 313, 13.12.2000

[16] 2001/81/EC of 23 Oct 2001, Directive of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants.

2.4.1.10 EC-legislation – Large combustion plants

In the same phase as the directive on national emission ceilings, a revised Directive on emissions from large combustion plants has been decided[17]. It implies stricter rules for new, as well as for existing plants.

2.4.1.11 EC-legislation – Integrated Pollution Prevention and Control - IPPC

A proposal for a Directive amending Directive 96/61/EEC on the IPPC-directive was put forward by the Commission in January 2001[18]. The IPPC Directive concerns highly polluting industrial activities and defines basic obligations to be met by new or existing installations, like emission limit values for pollutants.

In the proposal there are requirements for permit applications to include an outline of main alternatives studied by the applicant. There are also amendments to ensure that the public concerned get opportunities to participate in the decision-making process for granting permits.

2.4.2 Taxes on fuel oils

2.4.2.1 Nordic taxes on fuel oils

All the Nordic countries except Iceland tax fuel oils to promote environmental concern. The taxes differ between light and heavy fuel oils, where heavy fuel oils in Denmark, Norway and Sweden are taxed slightly heavier due to their higher sulphur content. In Finland, heavy fuel oil is not subject to a basic/energy tax and the total tax is somewhat lower than for light fuel oil.

Table 2.1: Taxes on light fuel oil applicable to residential use, Euro/1000 litres in 2001

Country	Basic/Energy	Sulphur	CO_2 component	TOTAL
Denmark	238.85	1)	36.23	275.08
Finland	18.33	-	45.41	63.74
Norway	47.46	8.70[2)]	59.64	107.1 [4)]
Sweden	74.33	2.92[3)]	164.99	239.32 [4)]

1) Euro 2.68 per kg S more than 0.05 per cent.

2) Per 0.25 per cent sulphur. Oil with less than 0.05 per cent S is considered sulphur free.

3) For each tenth of percentage by weight of sulphur. Oil with a sulphur content of a maximum of 0.05 per cent by weight is exempt.

4) 4. Excluding the sulphur tax.

[17] Directive 88/609 EEC on the limitation of emission of certain pollutants into the air from large combustion plants

[18] COM (2000) 839

2.4.2.2 EC legislation – Mineral oils

In April 1999 the Council formally decided on a new directive concerning the sulphur content in certain liquid fuels such as heavy fuel oils and gas oils[19].

2.4.2.3 EC-legislation – Sulphur in heavy fuel oil in Baltic and North Sea freight.

The International Maritime Organisation IMO has decided to restrict the sulphur content in heavy fuel oil used as propellant in ships operating in the Baltic as well as the North Sea. This decision forms part of EC-legislation from now on.

2.4.2.4 EC-legislation – 8:4 exemptions

The European Council made a decision in May 2001 to continue the Nordic derogations concerning charges on mineral oils (article 8:4 of Directive 92/82/EEC) (see the report by the Nordic Council of Minister 1998 for further details). The derogations will not be automatically prolonged but will end latest by 31 December 2006, unless the Commission does not put forward a proposal for continuation prior to this date.

2.4.3 Nordic taxes on coal and petroleum coke

All the Nordic countries have levied environmental taxes on coal used for energy purposes. In Finland and Norway only a carbon dioxide tax applies, while Denmark and Sweden have a basic excise tax in addition to the CO_2 component. In Denmark, Sweden and Norway, a sulphur charge based on the same principles as the sulphur charge applicable to fuel oils in each country is also levied on coal. In Norway, refineries and factories which use coal and coke for energy purposes, were levied a sulphur tax between 1999 and 2001. This tax, however, was removed from 2002.

A great proportion of the total coal consumption in Norway and Sweden is not for energy purposes but is used as a non-taxable reducing agent or as raw material in industrial processes, primarily in the metal industries. In Norway, for instance, the amount of coal applied for such purposes accounts for almost 90 per cent of the total consumption, and less than 1 per cent of the total consumption is liable to CO_2 taxes, because coal used for energy purposes within the cement and leca industries is exempt from tax. In Denmark the use of coal for energy purposes is more significant. As in the rest of the world, Danish electricity production is largely coal based. In Finland, the carbon tax has a significant effect on the cost of heating.

Table 2.2: Taxes on coal/coke in Euro/tonne 2001

Country	Basic/Energy	CO_2 Component	Sulphur	Total
Denmark	165,71	32.47	2.68/kg S emitted	198,18 +S-tax
Finland	-	41.37	-	41.37[1)]
Norway	-	59.64	0.38 Euro/kl SO_2	59.64 +S-tax
Sweden	31.66	143.60	3.24/kg sulphur in fuel	175.26 +S-tax

[19] 1999/32/EEC, 26 April 1999

[1)]A strategic stockpile fee of ECU 1.17 per tonne is excluded

2.3.4 Taxes on natural gas

2.3.4.1 Nordic taxes on natural gas

Most Nordic countries levy taxes on natural gas. However, in Finland, natural gas is subject to only 50 per cent of the full duty in order to make it more competitive and in Norway only the offshore activities are liable to pay the tax on natural gas.

Table 2.3: Charges on natural gas in Euro/1000 m^3 in 2001[20]

Country	Basic/Energy	CO2 Component	Sulphur	Total
Denmark	274.84	29.93	-	304.77
Finland	-	17.32	-	17.321
Norway	-	89.46	-	89.462
Sweden	24.09	123.61	4)	147.7

1) Excluding the stockpile fee of Euro 0.84

2) Emissions from gas used onshore is exempted from the CO_2 tax

3) In Sweden the same rates apply for methane and natural gas; different rates for use in transport and industry.

4) Gaseous products with a sulphur content of a maximum of 0.05 per cent by weight are exempt.

2.4.4.2 EC legislation - Natural gas

Common rules for the internal natural gas market are laid down in a directive from 1998[21]. The Commission has put forward a proposal for revision of the directive in May 2001 with the intention of speeding up the opening-up of the market. The Commission wants all customers except households to have open access to the market from 2004. From 2005 households would also be part of the open market. The proposal is written considering the viewpoints of both electricity and gas, cfr, section 2.4.6.2.

2.4.5 Other taxed fossil fuels in the Nordic countries

In Sweden liquefied petroleum gas (LPG), or propane and butane, is also taxed as well as methane, and the fuels are differentiated according to use as propellant and other uses. Methane is taxed by the same amount as natural gas.

The Swedish LPG tax in 2002 is Euro 219.12 per tonne for other purposes than as a propellant. Use as a propellant is taxed at Euro 140.25 per tonne. In Denmark LPG was taxed at Euro 232.15 per 1000 litre in 2001.

[20] Norway uses the unit Sm3 while Denmark and Finland use Nm3

[21] 1998/30/EEC

2.4.6 Electricity taxes

2.4.6.1 Nordic electricity taxes

Electricity taxes are levied in all Nordic countries except Iceland. The taxes are levied on consumption and fuels used in the production of electricity are exempt from taxation in all countries.

Because of its high dependency on fossil fuels in electricity production, above all coal, Denmark applies a CO_2 tax for all consumption of electricity. In the other Nordic countries, where dependency is not as high, the carbon content is not an ingredient in the taxation of electricity. The total electricity tax in Denmark is also considerable higher than in the other countries.

In Denmark, electricity for heating residences is taxed lower than other electricity use.

In Sweden the tax is lower in the northern part of the country than in the south, while the northern parts of Norway are totally exempt from electricity tax.

All countries apply reductions or exemptions from taxation for industry. In Denmark electricity taxes paid by industry are partially or fully reimbursed. In Finland, besides a lower rate for manufacturing industry and greenhouse cultivation than for households, energy-intensive industry also receives refunds for part of the taxes paid if these exceed a certain percentage of the value added. The Norwegian and Swedish manufacturing industries, as well as the mining industry in Norway, are exempt from all electricity tax.

In order to avoid creating competitive disadvantages to renewable energy forms used in electricity production, there are different models between the countries on how to promote these production methods. In the case of Denmark, this is a way of compensating renewable production forms for the carbon dioxide tax levied on consumption. Besides investment subsidies there are tax reductions or exemptions.

In Denmark, the promotion system consists of a subsidy equivalent to the CO_2 tax on electricity produced by wind turbines, biogas, straw and other carbon dioxide free fuels. A subsidy is also given to combined heat and power plants (CHP) using natural gas.

In Finland, the corresponding promotion system consists of a refund of the taxes by the lower rate of the electricity tax. However, wind power production is entitled to a subsidy equal to the higher tax rate.

Electricity produced by wind power units in Norway are subsidised by the equivalent of half the electricity tax and in Sweden wind power is totally exempt from electricity tax. Other small-scale electricity production can also get subsidies per produced kWh.

Both Finland and Sweden tax the nuclear energy industry in order to safeguard future financing of waste management in the nuclear sector.

Table 2.4: Charges on electricity, Euro/MWh in 2001

Country	Basic/Energy	CO_2 Charge	Total
Denmark			
Heating purposes	65.21	13.42	78.63
Other purposes	73.94		87.36
Finland			
Household & services	6.90		6.90
Manufacturing industry	4.20		4.20
Norway	14.04		14.04
Sweden			
Northern part	13.51		13.51
Rest of Sweden	19.56		19.56
Elect., gas, heat, water supply	17.07		17.07

2.4.6.2 EC legislation - Excise tax on electricity

The Directive on the *internal market of electricity*[22] from 1996 establishes common rules for production and operation of electricity transmission and distribution systems. The Commission put forward a proposal for revisions to the directive in May 2000. Among other things, the Commission wants to accelerate the opening-up of the electricity market and proposes that all customers except households should have open access to the market from 2003. Households will also have access from 2005. The Commission proposes that the option for Member States to authorise negotiable access to the grid will be redrawn. Only regulated access will be permitted. The Single Buyer System, which has been applied alongside the Negotiated Third Party Access System, will also be abolished according to the proposal. The Commission also proposes an independent authority that will supervise each Member State and decide or approve tariffs in advance for the transmission and distribution of electricity.

The proposal includes stricter rules on national independent grid operators concerning separation in a legal sense as well as in organisational terms and in the decision-making area. Stricter rules on split accounts in production, transmission, distribution and trade in firms on regional and local levels are also proposed.

Member States may also authorise grid operators to prioritise access to the grid to producers of renewable energy, waste or combined heat and power.

2.4.6.3 EC-legislation - Renewable energy sources

In order to promote renewable energy sources in electricity production, the Commission put forward a proposal for a Directive[23] in autumn 2001. The aim is to double the share of

[22] 96/92/EEC

[23] COM(2000) 279 final, 10.5.2000, "Proposal to the European Parliament and the Council Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market".

renewables in prime consumption by 2010 at the latest. This means that the Union will have reached 12 per cent of the prime consumption of energy and 22 per cent of the electricity production in 2010. The Directive puts pressure on the Member States to set up goals for the share of renewables to be used in electricity production in the future.

2.4.7 Nordic charges on gasoline

Charges on gasoline have, for environmental reasons, been differentiated according to lead content in all the Nordic countries since 1986, except in Iceland where the differentiation was introduced in 1989. The lead component in gasoline charges has contributed significantly to the shift in consumption from leaded to unleaded gasoline. For example, the market share of unleaded gasoline in Iceland changed from 50 per cent in 1990 to 87 per cent in 1995. From 1996 only unleaded gasoline was sold in the country. In Norway there is no leaded gasoline for sale on the market any longer and in Sweden leaded petrol has been prohibited since 1995 after the market share had dropped rapidly as a result of the higher taxation of leaded fuel. Differentiation has also been applied between gasoline with other environmental characteristics in Denmark, Sweden and Finland. Due to this differentiation, the grades with better environmental qualities have fully displaced the normal grades in the markets of these countries.

Today the basic energy tax in Finland is differentiated from the aspect of lead and reformulated grades with lower environmental impact.

Norwegian taxation of gasoline is divided between a gasoline tax and a carbon dioxide tax.

Kommentar: Is this right? Don't you mean energy tax?

In Sweden the energy tax is differentiated into two classes depending on the environmental quality of the product. A CO_2 tax also applies.

In Denmark the tax consists of a basic energy charge and to this is added a tax differentiation on vapour recovery installations in fuel supplies. There has also been a lower tax rate for gasoline with a smaller content of benzene during the years 2000 and 2001. The benzene differentiation was abolished in 2002 in favour of a tax differentiation for fuels from petrol stations that are in line with new regulations for petrol stations. In addition, a CO_2-tax is added for diesel oil but not for gasoline to compensate for the energy charge being higher on gasoline compared to diesel oil.

In Iceland, the two-part tax based on import price and a fixed regulated element was abolished in favour of a fixed charge in the autumn of 1999.

Table 2.5 compares the different taxes on gasoline in the Nordic countries. The basic energy taxes in Denmark and Finland are converted in order to mirror unleaded fuels. Normally the charge on lead is included in the basic energy tax. The column for total amount of taxes in these countries gives figures for leaded gasoline.

Table 2.5: Charges on unleaded gasoline 2001,Euro/1000 litres

Country	Basic/ Energy	Lead	CO_2	Other	TOTAL
Denmark[1)]	532.73	87.22			619.95
Finland	511.97[2)]	75.68			593.39
Stockpile fee				6.73	
Iceland	567.39				567.39
Norway	464.68		89.46		554.14
Sweden	352.24 [3)]		133.98		486.22

1) Vapour recovery rebate of Euro 4.03/1000 litre, Low benzene rebate of Euro 2.68/litre

2) Reformulated, for normal grade Euro 520.37/1000 litres.

3) Environmental classification 1

2.4.8 Charges on diesel fuels

2.4.8.1. Nordic charges on diesel fuels

Diesel oil used as propellant is subject to higher taxes than light fuel oil used for stationary purposes, i.e. heating, in all Nordic countries except Iceland, even though both oils are classified as light fuel oil. Iceland has no tax on fuel oils, including diesel.

In Denmark, Sweden and Finland, the taxes consist of a basic charge to which a charge based on the carbon content of the fuel is added. In these countries the diesel oil tax is differentiated to promote the use of low sulphur fuels as well. This differentiation is in the basic energy charge. Of the three environmental classes in Sweden, there is in practice only one quality sold, and that is the one with highest environmental quality, class 1. Norway has a CO_2 tax on diesel as well as a sulphur tas which is differentiated according to the content of sulphur in the fuel.

Table 2.6: Charges on diesel, used as propellant, Euro/1000 litres, 2001

Country	Basic/	Sulphur	CO_2 Component	TOTAL
Denmark (Light fuel oil)	356.95		36,23	393,18
Finland	254.97	25.23	45.24	325.44
Norway	337.96	39.75[1)]	59.64	437.35
Sweden	163.37[2)]	56.95 [3)]	164.99	328.36[2]
				385.31[4]

1) Diesel containing more than 0.05% sulphur. In practice, most diesel used for road transport contains less than 0.005% sulphur per litre.

2) Environmental classification 1,

3) Difference between environmental class 1 and 3.

4) Tax on environmental class 3, the "standard" class

2.4.8.2 EC legislation - Excise tax on transportation fuels: diesel and gasoline

A proposal completing Directive 98/70 on the *quality of petrol and diesel fuels* was launched by the Commission[24] in 2001. It proposes stricter limits on the sulphur content in transportation fuels.

The Commission also put forward a proposal in 2001 on minimum levels of biofuels in fuels used for transport both gasoline and diesel from 2005[25]. The proposal also includes a draft revision of the Mineral oil Directive[26], in order to give Member States the option of allowing tax reductions for these fuels.

2.4.9 Charges on motor vehicles

2.4.9.1 Nordic charges on motor vehicles

In Finland, Norway and Sweden, the charges on motor vehicles have been adjusted in the 1990s to include incentives to promote environmentally sound vehicles. In practice, the charges are constructed in such a way as to favour lighter cars which normally use less fuel and therefore are not as harmful to the environment.

The charge in Denmark is based on fuel efficiency, which also intends to strengthen the environmental incentives for customers.

Iceland's differentiated import levies on vehicles favour lighter and more fuel-efficient cars.

Table 2.7: A comparison of the Nordic countries in terms of charges on acquisition and ownership of motor vehicles in 2001

[24] COM/ 2001/241

[25] COM 2001/547 Final, Nov 11th 2001

[26] Dir 92/81/EEC

Instrument	Denmark	Finland	Iceland[2]	Norway	Sweden
Excise charge on new vehicles (sales charge)		Taxable value of car minus Euro 617	30-75 % on product value (cif) classified according to motor volume	Based on weight, motor effect and motor volume.	
Registration charge on all vehicles (new and second-hand)	105 % of gross value below Euro 7421+180% of the remainder. Lower tax in the case of second hand cars		A fixed amount which is lower in the case of second hand cars		
Catalytic converter discount		Euro 757			
Scrapping deposit	Annual fee of DKK 90 and a refund on DKK 1500 if scrapped through an authorised firm		No deposit	Euro 186 (3)	Euro 75.6 for vehicles<7 years, Euro 129.6 between 7-16 years, Euro 183.7 for vehicles >16 years.
VAT	25 %	22 %	24,5 %	24 %	25 %
Annual ownership charge on gasoline-fuelled vehicles	Based on number of kilometres per litre of fuel. Based on weight for cars with first registration before July 1, 1997	Euro 118	Differentiated based on weight.	Euro 287 passenger cars 2)	Varies according to type of vehicle, weight fuel, number of axles and environmental performance
Annual ownership charge on diesel-fuelled vehicles	Based on number of kilometres per litre of fuel. Based on weight for cars with first registration before July 1, 1997	Based on i.e. weight[1]	Based on weight	Based on weight for heavy vehicles	As above. Road charge on heavy vehicles

1) In addition to weight the annual charge is based on characteristics such as type of vehicle and number of axles.

2) Figures for 1998

3) The year 2002

2.4.9.2 EC legislation - Charges on motor vehicles

The emission limit values for *heavy-duty vehicles and buses* equipped with diesel engines are laid down in a directive from 1988[27] but the Council agreed in 1999 on a directive for stricter emission limits for mainly nitrogen oxides and particulates[28]. The directive introduces a 30 per-cent reduction of the former limits. It also includes mandatory limits for 2005 and, in the case of nitrogen oxides, for the year 2008.

New type-approval test cycles for gaseous and particulate emissions and smoke opacity have been introduced in the legislation. Furthermore, from October 2005, new types of vehicles, and from October 2006, all types of vehicles, shall be equipped with an on-board diagnostic system (OBD) or an on-board measurement system (OBM) according to the Directive. These devices monitor the emission levels of vehicles in service and warn the driver should an anomaly occur.

According to the Directive, Member States may make provision for tax incentives for vehicles which, in advance, comply with the limit values set out in the Directive.

2.4.10 Other Nordic charges for abatement of air pollution

2.4.10.1 Tax on certain chlorinated solvents (Denmark and Norway)

With the purpose of reducing the use of chlorinated solvents and to prevent an eventual increase in the use of these solvents, which could be the result of the ban on ozone-depleting CFCs, Denmark and Norway tax tetrachlorethylene and trichlorethylene. Denmark also taxes dichloromethane. In Denmark, where the tax rate is Euro 0.27 per kilo, the consumption of these three solvents has dropped by 2/3 since the tax was introduced. In Norway the rate is considerably higher: Euro 6.51 per kilo.

In the Nordic countries, there are several other economic instruments in the air pollution area which were introduced by a single country only. Here, we will just mention their existence and refer to each country-specific chapter for more information.

2.4.10.2 EC-legislation - Charges on ozone-depleting chemicals

A new regulation concerning restrictions of ozone-depleting chemicals was introduced in summer 2000 by the Council[29, 30]. The regulation and its two "co-regulations" strengthen the limit values set for controlled substances which were set in the former Regulation[31].

2.4.10.3 Aircraft noise - Norway

Airlines are through a noice-differentiated surcharge given incentives to use the least noisy aircrafts to certain Norwegian airports through a noise-differentiated surcharge.

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[27] 88/78/EEC, amended by Directive 91/542 and Directive 96/1/EEC.

[28] 1999/96/EEC

[29] Council Regulation EC 2037/2000, 29 June 2000

[30] Council Regulation EC 2038/2000 28 Sept 2000 and Council Regulation 2039/2000, 28 Sept 2000

[31] Council Regulation (EC) 3093/94

2.4.10.4 Environmental landing charges - Sweden

Landing charges in Sweden are differentiated according to emissions of hydrocarbons and nitrogen oxides from the aircraft.

2.4.10.5 EC-legislation - aircraft

New EC-legislation on *noise from aircrafts* was put forward in 1999 when the Council decided on a Regulation[32] restricting certain noisy older aircraft from being permitted to land at airports within the Community. The new rules have met international opposition and therefore the Commission plans to put forward a new proposal in 2002.

2.4.10.6 Nitrogen charge on combustion - Sweden

A nitrogen oxide charge is levied in Sweden on combustion and incineration plants for energy generation. The charge is refunded in proportion to energy generation.

2.4.10.7 Tax on certain greenhouse gases – Denmark

Since 2001, Denmark has applied a tax on PFCs, SF6 and HFCs and differentiated these according to their respective greenhouse effects.

2.4.10.8 Tax on PVC and certain plasticisers

Denmark introduced a tax in 2000 to provide incentives to use less harmful plasticisers and to reduce the PVC waste as well as phthalates..

2.5 Economic instruments related to water pollution abatement

Whereas several economic instruments for reducing air pollution are implemented in the Nordic countries, the use of economic instruments for reducing water pollution has not been expanded to the same extent. In addition to more broadly implemented instruments, such as user charges on sewage and product charges levied on certain characteristics in artificial fertilizers, there are but a few examples of economic instruments that have been introduced to give users and customers incentives to make environmentally thoughtful choices.

2.5.1 Nordic user charges on sewage and water

All the Nordic countries have levied user charges on the treatment of sewage. These charges, which are set by the local authorities according to the prime cost principle, are usually flat rate and thus do not necessarily entail sufficient economic incentives to reduce pollution.

However, in Denmark, a use-dependant tax on tap water came into effect in 1994 and was gradually phased in until it reached the intended level at Euro 0.67/m3 in 1998. The tax serves both fiscal and environmental purposes since it gives incentives for restricted take-out of the water resources. Vat-registered enterprises and firms are exempted from the tax.

Denmark also introduced a tax system in 1997 with the aim of reducing the discharge of

[32] Regulation 925/ 99

waste products from municipal and industrial purification plants. It concerns all discharges into lakes, rivers and the sea. Nitrogen is charged at Euro 2.68 per kilo, phosphorus at Euro 14,76 and organic matter is taxed at Euro 1,48 per kilo.

In Finland the sewage charge is calculated according to the amount of water consumed. In some cases, such as for industrial facilities, the tariffs may be modified in order to reflect the quality of the wastewater.

2.5.2 Oil pollution charge – Finland

Finland applies a tax on cargo vessels (see the country chapter on Finland) which is diffenrentiated on the basis of the environmental safety of the tankers..

2.5.3 EC legislation - Framework Directive for water resources

The European Parliament and Council laid down a framework Directive for water resources in 2000[33]. In this Directive, emission limit values and quality objectives are combined from previously having been split into over 20 separate directives. Most of the earlier directives are still valid which include for example limit values for pollution. However, the Directive introduces environmental quality objectives in the water field. The Directive takes an integrated approach, taking into account all elements of the hydrological cycle and interrelations. It also integrates the water protection policy into other environmental legislation and other policy areas.

The Directive introduces water charges. Member States shall by 2010 have introduced full cover of the prime costs for services connected with the use of water.

2.6 Economic instruments related to agriculture and natural resources

2.6.1 Nordic charges on artificial fertilizers

Leakage of nitrogen and phosphorus, mainly from agriculture, contributes to the eutrophication of inland watercourses, the Baltic Sea and the North Sea. In order to reduce the leakage of nutrients, Norway introduced a tax on artificial fertilizers in the late 1980s. This charge did not succeed in reducing fertilizer intensity and was removed in 2000. It was replaced by a mandatory environmental plan on every farm which also includes a fertilizer plan.

Denmark introduced a tax on nitrogen on households, gardens and parks in 1998. The rate is Euro 0.67 per kilo. Farms and forestry are exempt because they are required to carry out accounting and planning of fertilization.

In Sweden, the phosphorus tax was removed when the use of the nutrient had been reduced by 50 per cent which was the national goal. The current tax corresponds to Euro 0.19 per kilo of nitrogen if the fertilizer contains more than 2 per cent nitrogen. Sweden is the only Nordic country that applies a tax on cadmium. The rate is Euro 3.24 per gram of cadmium

[33] European Parliament and Council Directive 2000/60/EEC, 23 Oct 2000, OJ L 327, 22/12/2000 p 1-73

if the content exceeds 5 grams per tonne phosphorus.

2.6.2 Nordic charges on pesticides

Charges on pesticides in the Nordic countries are intended either to finance administrative costs or to provide incentives for reducing consumption. The systems chosen in each respective country are quite different from each other.

The Danish taxes are based on the maximum retail price and they are not differentiated according to toxicity.

In Norway the charge is based on the "standard area doses". The environmental levies are differentiated according to a classification of health and environmental risk characteristics of the product, as well as the degree of exposure.

In Finland the charge on pesticides is 3.5 per cent of the previous year's turnover. A non-recurring charge of Euro 940.9 is collected for registration of new pesticides with the purpose of covering registration costs.

The tax rate in Sweden is Euro 2.16 per kilo of active ingredient.

2.6.3 Tax on growth promoters (Denmark)

In 1998, Denmark introduced a tax on growth promoters, which are used as additives in fodder in order to increase the growth of animals. The aim is to reduce the use of growth promoters by 50-70 per cent. The tax, which is a product tax, is imposed on domestic as well as imported products, and corresponds to the net economic gain of the use of growth promoters in, for example, pork production.

2.6.4 Nordic taxes on rock resources

In order to reduce the increasing extraction of sand, stones, granite, and lime, which are used in building and construction activities, Denmark and Sweden have imposed taxes.

The Danish tax is paid in conjunction with extraction and import of natural resources such as sand, gravel, clay, chalk etc., to a rate of Euro 0.67 per m3.

The Swedish tax of Euro 0.54 is to encourage the conservation of gravel resources and to provide incentives to use alternative materials such as crushed rock.

2.7 Economic instruments related to different types of waste

The first charges for environmental protection introduced in the Nordic area were related to consumer waste and were levied on beverage containers in the early 1970s, prompted by problems of littering in the countryside.

However, the most commonly used charges in the area of waste are simple user charges for the single purpose of financing the management of waste.

On certain products, well-functioning deposit/refund schemes are in effect in the Nordic countries. Most types of bottles made of glass, such as beer, liquor and soda bottles are subject to this kind of economic instrument. Some countries also have deposit systems on

motor vehicles. Economic instruments are also applied to control certain kinds of toxic waste such as batteries and lubricating oil.

2.7.1 Nordic user charges on municipal waste

User charges on the collection and treatment of municipal waste are applied in all the Nordic countries. They are to be defined as a payment for a service. The user charges may usually not be set higher than the local authorities' prime cost, and hence they may vary between municipalities within the respective countries. Normally, the user charges are flat rate.

In Finland, however, the charge must encourage waste producers to reduce and /or recycle the waste and to produce less hazardous waste. Hence, the charge is normally determined on the basis of the quality and quantity of the waste and the frequency of collection. In Sweden, the municipalities may choose to differentiate waste management charges in order to promote separation of waste by type and source.

The fee levels to Danish households are to a limited degree dependent on the quantity of waste. For example, the fees can depend on the size of the bin. Some municipalities have also introduced weight-based fees.

Iceland differs from the rest of the Nordic countries by letting most municipalities impose the waste tax as a surcharge on real property taxes, in direct proportion to these. Other municipalities charge the amount of garbage as well as the frequency of the pick-up.

2.7.2 Waste taxes

2.7.2.1 Nordic waste disposal taxes

Waste disposal taxes are levied on waste supplied to landfills and incinerators in all the Nordic countries, except Iceland. Denmark was the first country to impose charges in 1990, followed by Finland in 1996. Norway and Sweden followed suit in 1999. In Finland the tax is restricted to municipal landfills, which means that industrial waste dumps are not taxed. In Denmark, Sweden and Norway the tax applies to both conventional and industrial waste.

Denmark differentiates the taxes in order to promote incineration before landfill dumping. In Norway the tax on incineration plants is divided into a basic tax and an additional tax, where the latter is reduced by the degree of energy utilisation in the incineration plant.

In Finland and Sweden the waste tax only applies to waste brought to landfills.

Table 2.8: Charges for landfill sites and incineration in 2001, Euro/tonne

				Total
Denmark	Landfill			50.32
	Incineration			44.28
	Incineration with CHP			44.28
	Recovered waste			0
Finland	Municipal landfills			15.14
Norway 1)	Landfills			39.76
	Incineration	basic charge	9.94	
		additional	29.82	39.76
Sweden				31.12

1) Figures for 2002

2.7.2.2 EC-legislation - Landfills

The Council decided on a *Directive on landfill of waste*[34] in 1999. It provides rules to prevent or reduce the negative effects of waste landfill on the environment. It represents the first harmonised rules in this area for the Community. The Directive particularly concerns the pollution of surface water, groundwater, soil, air and the global environment including the greenhouse effect, as well as the resulting risk to human health, over the entire life of the landfill. The provisions are based on the principle of classification of the landfills according to the types of waste.

Member States are to ensure that all the costs involved in the setting up and operation of a landfill site shall be covered by the price charged by the operator for the disposal of any type of waste at that site.

2.7.2.3 EC-legislation – Electrical and electronic equipment

The Commission has adopted a final proposal for a *Directive on Waste from Electrical and Electronic Equipment (WEEE)* and a proposal for a Directive on the restriction of the use of *certain hazardous substances in electrical and electronic equipment*[35]. The proposal addresses all electrical and electronic equipment used by consumers and currently not treated before going to incinerators or landfills, such as refrigerators, toasters, TVs and toys. It also covers a wide range of professionally used electrical and electronic equipment, such as information technology (IT) and telecommunication equipment which is not sufficiently recycled today.

[34] 1999/31/EEC

[35] COM)/2001/315

2.7.2.4 EC-legislation – Incineration of waste

A new Directive concerning *incineration of waste* was approved by the Parliament and Council in 2000[36]. The new Directive replaces two earlier Directives on the prevention and reduction of air pollution from municipal waste incineration plants[37], and the Directive on hazardous waste, which are all thereby repealed. The reason for combining the older Directives is that a single text will improve legal clarity and enforceability. The new Directive establishes minimum requirements through setting emission limit values for waste incineration and co-incineration plants[38]. The limit values in the new Directive are stricter than in the former legislation as well as including more pollutants and more types of waste.

2.7.2.5 EC-legislation – End-of-life vehicles

In year 2000, the Council adopted a Directive[39], which makes vehicle dismantling and recycling more environmentally sound. It sets clear quantified targets for reuse, recycling and recovery of vehicles and their components and encourages producers to manufacture new vehicles also with a view to their recyclability.

2.7.3 Nordic charges on hazardous waste

Iceland has had a systematic charge system on imported and domestically produced damaging chemical waste since 1997. The charges differ according to products, for example, photography and printing material is charged between Euro 0.34- 2.68 depending on the strength of the solution. Other chemical waste taxed include batteries, wood-treatment chemicals, halogen chemical compounds, refrigeration fluids etc. In Denmark and Finland, hazardous waste is subject to full cost recovery and the fee depends also on the type of waste.

Norway has had a recycling system since 1999 for scrapped electrical and electronic products where the costs are distributed down the purchasing chain, whereby the consumer pays the fee at the end of the line.

2.7.4 Batteries

2.7.4.1 Nordic battery charges

Denmark has applied a charge on nickel-cadmium batteries since 1996. For single cells, the

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[36] 2000/76/EEC

[37] 1989/429/EEC and 1989/369/EEC

[38] The Directive distinguishes between incineration plants which may or may not recover heat generated by combustion and co-incineration plants such as cement kilns, steel or power plants whose main purpose is energy generation or the production of material products.

[39] 2000/53/EEC

charge is Euro 0.80 per piece in 2001 and for battery packages and attached batteries, it is Euro 4.83 per package. Enterprises that participate in the collection scheme are entitled to a refund of Euro 16.10 per kilo of batteries returned, which more or less corresponds to the charge.

The battery charge in Iceland is Euro 2.29 per kilo for batteries containing mercury or nickel-cadmium (for different types of batteries see the chapter on Iceland).

In Norway a private company appointed by the battery importers is responsible for making arrangements for battery waste. The cost of this is included in the battery price.

In Sweden, all batteries are collected due to the difficulties for consumers in separating environmentally harmful batteries and non-harmful ones. Environmentally hazardous batteries are charged at Euro 32-54 per kilo battery depending on content.

2.7.4.2 EC-legislation - Batteries

In January 2000 the rules concerning the mercury content of certain batteries[40] were tightened.

2.7.5 Nordic charges on lubricant oil

Product charges on lubricant oil were introduced in Finland in 1987 and in Norway in 1988. The environmental problems of lubricant oil do not arise during consumption but at the disposal stage, which is why the charge in Finland is labelled “waste oil charge”. The revenue yielded by the duty is used to cover the expenses of collecting and treating oil waste. The rate of the duty is Euro 0.04/kg.

The charge in Norway is refunded when waste oil is collected and treated in an acceptable way.

2.7.6 Nordic taxes on beverage containers

Taxes on beverage containers are applied in Norway, Finland and Denmark. In Denmark the tax rate depends on the volume and the material of the container.

Containers used for beverages that are likely to be used outdoors are taxed in Norway and the tax is differentiated according to the material of the container; glass, aluminium or cardboard. The tax is reduced if the container is included in a recycling system. Non-refillable containers are also levied with an additional tax of Euro 0.11 in the year 2002. Containers for milk products are exempt.

Finland taxes beer and soft drink containers that are not recycled or reused by Euro 0.67 per litre. If the package can be re-used as raw material but is not refillable the tax is Euro 0.17.

2.8 Deposit-refund systems

Deposit surcharges are placed on the sale of potentially polluting products such as beverage containers and car hulks. The surcharges are refunded when the used products or waste is

[40] 98/101/EEC amending Directive 91/157/EEC

deposited within a collection system.

2.8.1 Nordic systems for beverage containers

Certain beer, soft drink, wine and liquor bottles are subject to deposit charges which are refunded on return in all the Nordic countries. One effect of these deposit systems, which are governed by the industries concerned in the respective country, is that returnable bottles have attained a large market share in all the Nordic countries. In Iceland this rate of return is about 85 per cent while it is around 90 per cent in Sweden.

In Sweden the deposit-refund system is voluntary for glass bottles while it is mandatory for aluminium cans and PET-bottles. The refund rate of glass bottles of 33 cl is Euro 0.05 in Sweden while it is Euro 0.08 in Finland. Finland will soon modify its system to comply with the EC legislation.

2.8.2 Nordic deposits on car hulks, snowmobiles and functioning cars

Norway and Sweden have deposit systems in effect for motor vehicles. The environmental purpose of the car hulk charge is to prevent car hulks from being dumped outdoors. A deposit is paid upon acquisition of the vehicle (in Norway also on snowmobiles) and a refund is received when the vehicle is deposited by the final owner with an authorised scrap car firm for scrapping. These deposit systems contribute considerably to high return rates of old vehicles in these countries. The current refund in Sweden is Euro 75.6 per car if the vehicle is no older than 7 years, Euro 129.6 if the car is between 8 and 16 years and Euro 183.7 if the car is older than 16 years. In Norway the charge is Euro 186,34, no matter what the age of the car.

2.9 Market creation

2.9.1 Tradeable permits

Practical experience with respect to emissions trading is quite limited in most countries with perhaps the exception of the USA. Iceland is the only Nordic country to have introduced tradeable permits on the domestic level. In the other Nordic countries the system of tradeable permits is being discussed and analysed for the forthcoming trade system on an international basis initiated by the Kyoto Protocol. Norway has decided to introduce a domestic greenhouse gas emission trading system from 2005. The system is confined to emission sources which are not subject to the CO_2-tax, thus stimulating further cost-effective actions in Norway. From 2008 the plan is to link the emissions trading system to the Kyoto protocol and expand it to include all sectors where this is possible in practice.

2.9.1.1 Tradeable fisheries permit (Iceland)

Iceland has a governmentally imposed fishing quota on nearly all species caught within the Icelandic economic zone. In addition, it has concluded numerous agreements with other fishing nations on the fishing of various species on the Icelandic land shelf as well as in adjacent waters. Fisheries quotas are tradeable within certain limits.

2.9.1.2 Tradeable production quotas in agriculture (Iceland)

Certain mutton and milk products that the Icelandic Government wants to subsidise are

included in a production quota system where the quotas are tradeable within certain limits.

2.9.1.3 Baltic Sea Region Energy Co-operation - BASREC

The countries around the Baltic Sea have joined in a project on a 'testing ground' for flexible mechanisms according to the Kyoto Protocol. The intentions are to set up an investment fund for projects of so-called 'joint implementation'. The Nordic Environment Finance Corporation, NEFCO, has so far presented a proposal on the structure of the fund. A handbook of guidelines for joint implementation projects will also be written.

The Baltic co-operation will also run a simulation game of trade of emission reduction credits. Ministries, authorities and interested private actors in the countries around the Baltic, such as energy producers for example, can participate. The aim of the simulation, which will be held in 2002, is to raise awareness and knowledge of flexible mechanisms. The International Energy Agency (IEA) is coordinating the project.

The testing ground project will eventually also include a real trade area for emission reduction credits. Only the Nordic countries will participate in this but there is still no final proposal for what the trading system would look like.

2.9.1.4 EC-legislation – Greenhouse gas emission trading

The Commission has put forward a proposal for a directive for greenhouse gas emission trading within the Community[41]. The aim is to restrict the emissions of greenhouse gases to the limits set by the Kyoto Protocol to the lowest possible costs. The proposal requires participation energy production installations. Installations are those covered by the IPPC-directive: energy intensive industries, as well as power- and heat installations between 20-50 MW. (Emissions from processes in the chemical industry are excluded). Only emissions of carbon dioxide will be included in the scheme from the start.

2.9.2 Nordic investigations on systems of green certificates for "renewable" electricity

Investigations have also been conducted in Denmark, Norway and Sweden concerning green certificate systems to promote electricity production based on renewable energy sources. This market-based system would largely or completely replace other forms of promotion systems for this kind of electricity production. In Sweden, there are plans to put forward proposals to the parliament during 2002.

2.9.3 Nordic voluntary agreements

Voluntary agreements have been used mainly in Denmark, Norway and Finland and usually concerning different categories of waste management. The agreements can represent the single instrument to establish responsibility, but can also be used as one of several environmental instruments.

In Norway, Finland and Denmark voluntary agreements have had the purpose of making industry responsible for establishing collection and recycling systems for various waste

[41] COM (2001) 581

categories.

To date, the agreements in Norway have regulated collection and recycling systems for car batteries and car tyres, and six different agreements regulate the industry's responsibility for packaging waste. There is also an agreement on regulating collection and recycling systems for electronic scrap as well as one agreement on the reduction of greenhouse gas emissions from the primary aluminium production sector.

In Finland the agreements concern end-of-life vehicles, discarded tyres and waste recycling.

In Denmark the agreements regulate collection and recycling systems for car batteries and car tyres.

2.9.4 Joint implementation by the Nordic countries

Sweden and Norway have actively participated in the pilot phase of Activities Implemented Jointly within the United Nations Framework on Climate Change. Around 70 projects have been implemented by Sweden in the Baltic Sea region and eastern Europe to a cost of Euro 7.24 per reduced tonne of carbon dioxide. Norway has pursued projects in, among other places, Central America, Poland, India and China to a cost of about Euro 3.73 per tonne of carbon dioxide. The projects have concerned, for example, fuel switches and energy conservation.

2.9.5 Nordic environmental labelling

The Nordic ecolabel, the Swan label, is a voluntary ecolabel for products and services. It has the role of an official ecolabel in the Nordic countries. The Swan label has managed to position itself in the Nordic markets as a generally well-recognised and credible seal of environmental performance.

Through the EEA Agreement, Norway also takes part in the EU eco-labelling scheme "The Blue Flower".

2.10 Environmentally motivated subsidies

Denmark, Finland, Norway and Sweden have different systems to promote energy efficiency and production of renewable energy. There are, for example, investment grants for electricity production based on renewable energy sources. To this can be added production subsidies in the form of tax reductions or direct subsidies. There are also grants for development of cleaner technologies. Energy efficient products can be promoted by competitive technology procurement, such as in Sweden.

Different methods have been introduced in the Nordic countries to reduce the leakage of nutrients, maintaining the landscape and sustaining biodiversity. Among different measures for information, legislation and counselling, organic farming is granted aid in Norway, Finland and Iceland, while less intensive production methods are promoted by funds in Sweden. In Norway, measures for reduction of erosion and area drainage is also supported.

2.10.1 EC legislation - Guidelines on state aid for environmental protection

In 2001 the Commission adopted new guidelines on state aid for environmental protection[42]. It forms the criteria that the Commission will apply in deciding whether or not aid measures planned by the Member States are compatible with the common internal market.

If the state aid serves as an incentive to achieve levels of environmental protection, which are higher than those required by Community standards, the aid can be justified under certain conditions. The aid can be either investment aid or operating aid.

The Commission takes the view that state aid for renewable energy sources qualifies for special treatment because of the difficulties these sources of energy have sometimes encountered in competing effectively with conventional sources.

2.10.2 EC-legislation - sixth Environmental Action Programme

A proposal establishing the sixth Environmental Action Programme, known as "Environment 2010 our future, our choice" has been put forward by the Commission[43]. The programme defines priorities and objectives of Community environmental policy up to 2010 and beyond, and describes measures that would help implement the sustainable development strategy of the Community. It continues to pursue some of the targets from the fifth Environment Action Programme which came to an end in 2000. However, the new programme underlines that, to be able to deal with future environmental problems, the Community needs to use a whole range of instruments and measures in addition to a strict legislative approach.

[42] Information from the Commission – Community guidelines on state aid for environmental protection, Official Journal C037, 03/02/2001 page 3-15

[43] COM (2001) 31 final

2.11 State revenue and share of GDP

Table 2.9: State revenue of different economic instruments and share of GDP, Euro million, 2000

		Energy taxes	Tax on fertilizers & pesticides	Tax on waste deposits and incineration	Vehicle tax
Denmark	State revenue	4427	54.2	134.1	3124 (6)
	Share of GDP	2.51	0.03	0.07	1.77
Finland	State revenue	2270.0	1.68	33.6	1692.0
	Share of GDP	1.7	0.001	0.025	1.28
Iceland	State revenue	86.4		1.76 (3)	43.1
	Share of GDP	1.8 (2)		0.22	
Norway	State revenue	3223.4 (1)	6.6	60.1	
	Share of GDP	1.84	0.004	0.034	
Sweden (4)	State revenue	6208.2	45.4	107.5	840.8 (5)
	Share of GDP	0.46	0.02	0.05	0.36

1) Excl. tax on lubricating oil which in part is refunded

Incl. SO_2 tax: Euro 14.5 million

2) Excise tax on petrol & weight tax on diesel vehicles

3) Charges on chemical waste only

4) Expected year 2002 revenue

5) Incl. road charges for heavy vehicles: Euro 70.7million

6) Incl. road charges for heavy vehicles (41,3 million euro), excl. car insurance tax (194.6 million euro)

3. Denmark

3.1 General sales charges – VAT on energy

A value added tax (VAT) applies to sales of products and services. VAT is 25 per cent of the product price, normally including other taxes, and is not differentiated between products/services. It is a broad-based tax levied on most goods and services. Commodity price parts that include excise duties on e.g. fuels and energy sources are also subject to VAT. The tax rates listed in the subsequent sections do not include VAT.

3.2 Economic instruments related to air pollution abatement

3.2.1 Introduction

The total Danish primary energy consumption has remained fairly constant over the last decades; in 1999 it amounted to 807 PJ compared to 825 PJ in 1972. Although energy consumption has remained fairly constant, the share of various primary energy sources has changed markedly. Denmark has gone from being nearly totally dependent on imported oil, which accounted for 92 per cent of the energy consumption in 1972, to the present situation (1999) with a diversified energy supply based on oil (43 per cent), coal (25 per cent), natural gas (23 per cent) and renewables (9 per cent). Nuclear energy is not an option in Denmark due to a decision in the parliament in 1985. The transformation of the Danish energy sector over the last decades have, to a large extent, been a centrally planned process using a combination of administrative regulations and targeted economic instruments.

Until 1978 Denmark had no taxes on energy, apart from a tax on gasoline, which was introduced in 1927. In 1978 a tax was introduced on electricity, and later that year a tax was introduced on light and heavy fuel oil. The first energy taxes on oil and electricity were modest in size, and were introduced because of the two oil crises in the 1970s, although there were also fiscal grounds for the taxes. The purpose was to boost financial incentives for saving energy and hence reduce the balance of payments deficit and reduce the dependency on imported oil. In 1982, duties on pit coal and lignite were introduced in order to level prices on heat consumption. In 1986, after world prices on oil products had hit another low, the Danish Parliament, Folketinget, voted to raise excise duties on energy substantially in order to combat the potential effects of the price drop on consumption. These increases were prompted by fiscal and energy policy purposes. In recent years, environmental concerns have become an important factor in energy taxation as well. Despite this, industries and other VAT-registered companies - with a few exceptions - were

practically exempted from the duties, as all energy taxes paid (except on gasoline) were refunded. The Danish taxation on energy comprises three elements:

- Energy taxes on oil, coal, gas and electricity, where an attempt has been made to balance the rate for the different fuels according to the gross energy content of the fuels.
- A CO_2 tax on energy, where the rate for the different fuels is balanced according to the fuels CO_2 emissions on combustion. The duty corresponds to DKK 100 per tonne of CO_2 emitted.
- A SO_2-tax on energy, where the rate depends on the S-content of the fuels or net SO_2 emission on combustion.

The *CO_2 charge* on energy was decided by a majority in Folketinget in 1991. The duty, which came into force on May 15, 1992, covered fuel oils, gas (except natural gas), coal and electricity. The duty was, however, not intended to increase prices and the basic excise duty (the energy tax) was at the same time lowered correspondingly. A revised CO_2-tax was decided in 1995.

A tax on the *sulphur* content of fossil fuels (mineral oil, coal, and natural gas), which contain more than 0.05 per cent sulphur, was phased in during the period 1996 - 2000 by reducing a tax-free basic allowance for the sulphur content in the various fuels. A tax is also levied on the sulphur content of wood, straw, waste and other sulphur-bearing fuels, which are combusted in plants with an output of more than 1000 kW.

The tax is collected from the suppliers of coal, oil and natural gas, whilst it is the companies which use wood, straw or waste which have to assess and pay the tax. Companies can choose to pay the tax based on the actual sulphur emission (companies which measure their actual SO_2-emission). Companies which limit their emission of sulphur by means of smoke purification, or by binding the sulphur to other materials, can thereby have the tax on the amount of sulphur refunded.

3.2.2 Exice duties on fossil fuels

3.2.2.1 Excise duties on fuel oils, natural gas, coal etc

Energy tax, CO_2 tax and SO_2 tax is levied on fossil fuels like light and heavy fuel oil, coal and natural gas.

An energy tax of DKK 0.01 and a CO_2 tax of DKK 0.22 per Sm^3 was imposed on natural gas in 1996. Since the consumer price of natural gas has been tied to the fuel oil price including all energy taxes, this will not mean an extra increase in the price of natural gas, but merely reduce the revenue of the gas distribution companies. It is noted that after these duties are paid, the price of natural gas contains a "shadow energy charge" of DKK 1.63 per Sm^3 compared to the fuel oil price before tax.

The tax on sulphur in fuel oils, coal and natural gas is 20 DKK/kg sulphur. The tax was phased in gradually during the period of 1996 - 1999. During that period, taxes were only imposed on sulphur content above specific lower limit values, see the table below. For very energy intensive coal-based enterprises, there is a scheme for further deductions in general terms.

Table 3.1: Limit values for deductions in liable SO_2 taxes

Year	1996	1997	1998	1999	2000
Kg SO_2/GJ	0.20	0.15	0.10	0.05	0.05

For industrial use, there is a reimbursement scheme, which is dealt with in chapter 3.3.2.2.

Table 3.2 shows the development in the charges on selected fuels levied on households.

Table 3.2: Duties applicable to households use of selected fuels 1985-2001

	1985	1990	1995	1999	2000	2001
Light fuel oil, DKK/l	0.36	1.49	1.49	1.70	1.73	1.78
CO_2, DKK/l			0.27	0.27	0.27	0.27
Heavy fuel oil - DKK/l	0.41	1.98	1.66	1.91	1.95	2.00
CO_2, DKK/l			0.32	0.32	0.32	0.32
DKK/kg						
pitcoal			0.77	1.25	1.30	1.35
CO_2, DKK/kg			0.242	0.242	0.242	0.242
Crude oil			0.845	1.311	1.550	1.625
CO_2, DKK/kg			0.323	0.323	0.323	0.323
Lignite			0.57	0.910	0.950	0.990
CO_2, DKK/kg			0.178	0.178	0.178	0.178
Natural gas	-	-	-			
DKK/Nm^3				1.47	1.60	1.96
CO_2, DKK/Nm^3				0.22	0.22	0.22

3.2.2.2 Taxes to industry

In 1995, it was decided that industry should contribute more to fulfil the agreed environmental target with regard to reduction of CO_2 and SO_2, and that the energy-related taxes on industry, therefore, should be increased to the level paid by households during 1996-2000.

The revised CO_2 tax has been designed to ensure that the competitive power of Danish enterprises is not significantly weakened. The tax is differentiated according to the specific use. The scheme differs between energy used for space heating, for heavy processes, and for light processes. The tax is implemented gradually, providing a certain adjustment time for the enterprises. Enterprises are entitled to enter an agreement if they meet one of two criteria:

"Process list enterprises". These enterprises undertake energy-intensive processes that are categorised in an appendix to the tax law. Enterprises have the option of entering an agreement with the Energy Agency, which obliges them to undertake certain behavioural and investment actions to reduce energy use. In turn they are given a further tax reduction.

"Proms-enterprises". These enterprises fulfil the so-called "Proms-criterion". The criterion implies that the total financial strain of the taxes must exceed 3 per cent of the value added generated in the enterprise. If these enterprises enter an agreement, they are given a reduction in their CO_2 tax.

Table 3.3: CO_2-tax rates 1995 - 2001 for different categories of energy use (DKK per tonne CO_2)

Use category	1995	1999	2000	2001
Households	100	100	100	100
Space heating (industry)	0	100	100	100
Light process				
With agreement	50	58	68	
Without agreement	50	80	90	
Heavy process				
With agreement	3	3	3	
Without agreement	5	20	25	

As shown in table 3.3 there is a new reimbursement scheme for certain energy-intensive processes. It is only the part of the energy used for space heating, that will eventually be fully taxed with energy and CO_2 taxes from 1998 at a rate averaging DKK 600 per tonne of CO_2, including the (recalculated) basic excise charge on energy. All revenue from the energy taxes on industry will be recycled back into industry.

3.2.2.3 Excise tax on transportation fuels: diesel and gasoline

Vehicle fuels have been taxed since 1927. Border-trade concerns related to the Single European Market have limited the scope of action for the Danish Government in this field. The taxes are considered as part of the energy tax system.

The prime objective is two-folded: to generate revenue and to control imports of fuels. However, over the last decade, environmental concerns have become steadily more integrated into the vehicle fuel tax scheme. By increasing the fuel price, the tax can be expected to reduce the demand for vehicle fuels and diesel with a consequently positive impact on the environment (reduced exhaustion, noise and congestion).

The tax on vehicle fuels is calculated as a fixed amount per litre of the various types of fuel: gasoline, diesel, LPG and natural gas. Industry became liable for the tax in 1991 thus households and VAT-registered entities are liable to the fuel taxes, whereas public transport receives a 100 per cent refund.

Environmental concerns first entered the vehicle fuel tax scheme explicitly in 1986 when unleaded petrol became subject to a lower level of taxation than leaded petrol. The level of tax differentiation was changed a number of times. In the 1990s, the differential typically resulted in a consumer price difference of about 7 per cent and in 2001, the tax differentiation was DKK 0.65/l. Tax differentiation was thus used as an explicit means of attaining an environmental improvement (the phase-out of lead in gasoline). Today, tax differentiation due to environmental concern is also used in favour of fuels supplied with the use of vapour recovery installations (in 2001 the tax differentiation was DKK 0.03/l) and for fuels with a content of benzene less than 1 per cent (tax differentiation DKK 0.02/l). The latter differentiation has been abolished and replaced with a tax differentiation

from 2001 for fuels from gasoline stations that are in line with new regulations for gasoline stations.

Table 3.4: Duties applicable to gasoline and diesel, DKK/litre, 1985-2002

Fuel	1985	1990	1995	1999	2000	2001	2002
Gasoline							
Basic excise charge	2.265	2.90	3.67	4.42	4.52	4.62	4.72
Unleaded – rebate			0.65	0.65	0.65	0.65	0.65
Filling stations with vapour recovery – rebate			0.03	0.03	0.03	0.03	0.03
Low content of benzene – rebate					0.02	0.02	
Diesel							
Basic excise charge	0.36	1.76	2.00	2.35	2.58	2.76	2.76
Light diesel – rebate			0.10	0.10	0.10	0.10	0.10
LPG				1.45	1.61	1.73	1.73

3.2.3.4 Excise tax on electricity

The assessment basis for the electricity tax is electricity consumption in Denmark outside of the electricity plants and the electricity supply utilities. This electricity consumption is calculated on the basis of sales of electricity for which invoices are made out. The electricity supply utility adds the tax to the price and is responsible for paying the tax to the state. The same electricity tax is levied regardless of whether or not the electricity is produced in Denmark or abroad. The tax is also exactly the same regardless of how the electricity has been produced (coal, nuclear power, hydropower, natural gas, wind turbines, etc.) when the electricity is supplied via the electricity network.

Fuels used for the production of electricity are exempted from taxation. This is, however, conditional on an electricity tax being paid on the electricity. Tax is not levied on electricity produced at small electricity plants for the producers' own consumption and supplied without using the normal electricity network. However, the tax may be levied on the fuels in this case.

Electricity sold abroad is tax-free. The electricity used at the electricity supply utility for the actual manufacture of electricity is also tax-free. The electricity is exchanged tax-free between electricity plants, to electricity supply utilities, and to and from other countries. The tax only becomes payable when it is sold to customers outside the electricity supply system. The tax is collected at the time the invoice is sent to the consumer. No tax is therefore levied on network losses arising before the customers' meters.

There are two tax-rates: electrical heat (this rate can be used for consumption over and above 4,000 kWh annually in permanent residences which are registered as being heated by electricity) and electricity for other purposes, which is taxed at a higher rate.

An attempt has been made to balance the tax on electrical heat with the tax on coal so that the tax rate corresponds to a fuel tax on the fuels used in producing electrical heat.

Considerations were discussed as to whether CO_2 taxation should be levied on the fuel or on the electricity. After weighing up the same considerations regarding problems with the border equalisation of taxes as for the energy taxes, it was decided to levy the CO_2 tax on electricity and exempt the fuels used in Denmark. This solution was then supplemented with a subsidy scheme for electricity plants using fuels with little or no CO_2, and not linked to other environmental burdens.

A subsidy equivalent to the CO_2 tax on electricity produced by wind turbines, biogas, straw and other fuels that have no CO_2 is therefore given to electricity producers per kWh produced. A subsidy is also given to electricity produced at decentralised Combined Heat and Power Plants (CHP), which use natural gas. These decentralised CHPs were originally heating plants which were ordered to produce electricity at the same time and which are rewarded for using the surplus heat for the production of electricity via the subsidy scheme.

This subsidy scheme provides basically the same incentives with regard to the use of sustainable sources of energy and fuels that have little or no CO_2 as could have been achieved by a fuel tax.

Table3.5: Duties applicable to electricity, DKK/kWh, 1985-2001

	1985	1990	1995	1999	2000	2001
Electricity						
Used for heating				0.456	0.471	0.486
Used for other purposes	0.155	0.27	0.33	0.521	0.536	0.551
CO_2 tax			0.10	0.10	0.10	0.10

3.2.4.5 Charges on motor vehicles

The taxes on motor vehicles are comprised of a registration tax and an annual, fuel economy based tax. The main and original purpose of these taxes is to raise revenue. Today, the registration tax also explicitly aims to reduce the number of vehicles in Denmark and to provide an incentive to use smaller vehicles with better fuel economy.

The registration tax is a tax on the purchase of the vehicle. The presentation below applies to passenger cars. Heavy-duty trucks are excluded. Further exemptions and other variant schemes apply to light duty trucks and vans and other specified vehicles such as taxis. Basically, these vehicles are taxed lower than passenger cars[44].

The Danish registration tax is very high compared to other countries. It amounts to 105 per cent of that part of the value of a new passenger car that is below DKK 55,300 (2001 level) and 180 per cent for the rest. The basis for calculation includes 25 per cent VAT, custom duties, and profit to the retailer. To encourage the import and use of safer vehicles, vehicles equipped with ABS systems are entitled to a deduction in the tax of DKK 4,165 and cars with air bags can get deductions of DKK 1,280 per bag (up to four bags).

The annual tax is based on the fuel economy of the vehicle (as measured according to EU norms). Liability to the tax occurs once the possession of a vehicle has been registered in Denmark, and all vehicle owners are liable to the annual tax. Known as 'the owners green

[44] However, it should be noted that the registration tax for vans was increased in 1994 in order to reduce the private use of vans and to provide an incentive to buy smaller vans.

tax' in Denmark, the tax came into force in 1997 and applies to all new vehicles. Before 1997, the annual tax was based on the weight of the car. All vehicles sold before 1997 are subject to the annual weight based tax.

Examples from the annual tax based on fuel consumption:

Kilometre per litre (petrol):

- Above 20.0; annual tax DKK 500
- Between 15.4 - 14.3; annual tax DKK 2,420
- Between 10.5 - 10.0; annual tax DKK 5,280
- Between 7.1 - 6.7; annual tax DKK 10,060
- Under 4.5; annual tax DKK 16,920

3.3 Economic instruments related to water pollution

3.3.1 Sewage tax

Most sewage is cleaned at common (typically municipal) sewage treatment plants before being discharged into the sea, lakes and watercourses. Further, smaller amounts are discharged from: industrial enterprises that have their own discharge systems (with a discharge permit) from sparsely built-up areas with no sewage systems and from fish farms.

Sewage discharge and treatment is fully financed by the dischargers (users of the system) and has been since 1989. Prior to introduction of the tax in 1997, there was no payment associated with the environmental impact discharged treated sewage had on fresh and marine waters.

The tax was phased in so that in the first year (1997), the tax rates applied were 50 per cent of their proposed level. The full tax rates came into effect on 1 January 1998 and since then the rates have remained constant.

The tax rates apply to discharges of organic material (BOD - biological oxygen demand), nitrogen and phosphorus from direct discharges and dwellings not connected to the sewerage network. The standard rate of the tax is DDK 11 per kg of BOD, DDK 20 per kg nitrogen and DKK 110 per kg phosphorus. The owner of the treatment plant (municipalities and sometimes private industries) is liable to pay the tax. In the cases where households and industries are not connected to a treatment plant, the tax is fixed and depends upon how the discharge is treated.

The basis for calculating the tax is the multiple of the amount of discharged treated sewage and measured concentrations (content) of the above substances in the discharged sewage.

The amounts of discharged treated sewage may be calculated directly through the use of meters. The use of meters is mandatory for; 1) units where the discharge permit includes an obligation to measure the discharged amounts of water; and 2) individual discharges where the annual discharge exceeds 50,000 m^3.

In other cases, the discharged amounts may be assessed based on the water consumption of

the connected properties. This can be based on either metered consumption or estimated consumption following the rules for estimation that apply to user fees (also in the cases where user fee schemes do not apply).

For the calculation of the concentrations, the system distinguishes between treatment plants where more or less than 15 per cent of the sewage treated comes from households.

In the former case, there are two alternatives. The concentrations may either be measured, or the tax can be calculated using certain standard rates. In the latter case, the standard rates vary according to the treatment technology and processes applied. The rates vary between DKK 0.50/$m^3$and DKK 1.90/m^3 for various specified treatment facilities and methods. In other cases the standard rate is 3.80 DKK/m^3.

When more than 85 per cent of the sewage comes from industry, the calculation of the tax is based on actual measurements. There is one exemption to this. Plants that discharge less than 50,000 m^3 of treated sewage per year have the option of applying the standard rate of 3.80 DKK/m^3.

Exemptions:

The tax allows exemptions for six types of industrial processes, which can have their tax reduced by 97 per cent and 70 per cent respectively of the annual proceeds liable to payment above DKK 20,000. Industries producing organic pigments, pectins or vitamins are eligible for a 70 per cent reduction. The fish processing, cellulose and sugar beet industries are eligible for a 97 per cent reduction in liability for the tax. In both cases eligibility for exemption applies only if more than 80 per cent of their tax payment is related to production of the products mentioned. Seawater, fresh water and salt-water fish farming are fully excluded from the tax. The exemptions were primarily motivated by concerns over competitiveness and sectoral distributional effects, and in the case of fish farming the exclusion was also motivated by concerns over difficulties in measurements.

3.3.2 Tax on tap water

The tax is a result of the 1994 tax reform. The current rate of the tax is DKK 5 per cubic metre of tap water. The implementation was phased in gradually with a successive increase of DKK 1 per year from 1994 to 1998. The tax corresponds to around 15 - 20 per cent of the average price on water (including sewage fees and taxes).

The tax serves both fiscal and environmental purposes. Groundwater is the predominant source of water supply in Denmark, accounting for 99 per cent of total water supply. The current consumption does not pose a threat to the groundwater resources. Still, there are regional differences in Denmark. In some parts of the country, e.g. Zealand, extraction has lowered the level of the groundwater and affected the flow of water in watercourses.

The tax provides an incentive to reduce the consumption of tap water. Reduced use of tap water will also reduce the amount of discharged sewage, thereby reducing the pollution of seas, lakes and watercourses (the treatment plant typically treats the sewage down to a pre–established concentration level of pollutants).

The tax is levied on the water companies based on metered water delivered to consumers. However, if metered water amounts to less than 90 per cent of the quantity abstracted by the water company, the latter will be subject to the remaining tax. This mechanism is meant to provide an incentive to reduce leakages from water pipes. The companies in turn collect

the payment from households.

For competitive reasons, the tax applies neither to industry nor agriculture.

3.4 Economic instruments related to agriculture

3.4.1 Tax on fertilizers

Leakage of nitrogen and phosphorus from agriculture contributes to the eutrophication of inland watercourses, lakes and the sea surrounding Denmark. The second Action Plan for the Aquatic Environment from 1998 includes a tax on fertilizers from August 1998 but excludes taxation of nitrogen used on farms and in forestry when fertilization accounting is required. Therefore, the tax will only be levied on fertilizers used in households, gardens, parks, etc. The tax rate is DKK 5 per kilogram N.

3.4.2 Pesticides

The current pesticide tax is part of a larger pesticide regulation first launched under the National Pesticide Action Plan in 1986. A wholesale pesticide charge used to finance the administration for registration of pesticides was raised to 3 per cent in 1986 to finance the activities of the plan. A tax aimed at providing incentives to reduce the use of pesticides was introduced in 1996, see the table below.

The tax base for insecticides, fungicides, herbicides and growth regulators is the retail price. This is defined as the maximum retail price for every single pesticide. The fact that the tax is based on retail prices requires forceful monitoring of retail prices. This is achieved through a price label system which indicates a maximum selling price. Pesticides must not be sold at prices that exceed the maximum price. Retailers who sell at a price lower than the maximum price, or who offer a rebate, will not be entitled the corresponding tax refunds.

Table 3.6: Development in Danish pesticide tax rates 1986 - 2000 (% of retail price

including the tax but excluding VAT)

Year	Tax development	Change in average pesticide tax level (% of retail sales price)
1986	Introduction	3% of the wholesale price of all pesticides
1996	Rate increase (insecticides, fungicides, herbicides, growth regulators)	Pesticide tax increased to on average 15% of the retail price. Insecticides: 27% of retail price, fungicides, herbicides and growth regulators: 13% of retail price; other pesticides e.g. microbiological agents no changes in tax rate: 3% of the wholesale price
1998	Rate increase	Pesticide tax increases to on average 37% of the retail price (53.85% of retail price, excl. tax). Insecticides: 37%; fungicides, herbicides and growth regulators: 25% (33.33% of retail price, excl. tax); other pesticides 3% of the wholesale price

The intention of the pesticide tax is to increase incentives to optimise use at farm level and thereby reduce total pesticide consumption. Although the pesticide tax is targeted at agriculture it applies to all plant protection products covered by the Danish authorisation schemes for pesticides. Due to difficulties of measurement, the tax is not differentiated between pesticides according to toxicity or other indicators of the relative health and environmental impacts of the different pesticides. Insecticides are taxed heavier than other pesticides. This merely reflects the fact that insecticides are relatively cheap. Therefore, insecticides should be imposed with a larger tax in order for the tax to have an effect.

3.4.3 Tax on growth promoters

Growth promoters are used as additives to fodder in order to increase the growth of animals. A tax on growth promoters came into force on September 1, 1998. The tax aims to reduce the use of growth promoters by 50 - 70 per cent, thereby contributing to the establishment of the conditions for a sound agricultural production. Furthermore, it provides an incentive for the users to make voluntary agreements to stop the use of growth promoters.The tax on growth promoters is a product tax. It is imposed on "pure" growth promotion substances and on imported products that contain growth promoters. The table below illustrates the tax levels and the types of growth promoters covered by the tax.

Table 3.7: Tax levels for dutiable promoters

Substance	Tax level, DKK/gram
Zinkbacitracin, spiramycin, virginiamycin, Monensin natrium, carbadox, olaquindox	1
Salinomycin	0.83
Tylosinphosphate, avilamycin	1.25
Flavophospholipol	2.5

The tax rates shown in table 3.7 imply that the cost of producing one porker would increase by DKK 4. This corresponds to the net economic gain from the use of growth promoters. Consequently the tax has removed the economic incentive to use growth producers in porker production. Porker production accounts for the major share of the use of growth promoters.

3.5 Economic instruments related to waste

3.5.1 User charges

Waste management is the responsibility of the municipalities by law. The legislation, among other things, includes the obligation to organise the collection and treatment of waste. Most municipalities form municipal waste companies which in most cases are inter-municipal.

The user charges are decided by the local authorities according to the prime-cost principle, whereby the charge must cover all costs related to the waste management system.

The user fees are imposed and collected from all users. For households, the fee levels are typically only to some degree dependent on the quantities produced[45]. User fees may vary from one municipality to the other.

3.5.2 Waste tax

The tax on waste and raw materials has been in force since 1990. Since then, revisions have been undertaken and the rates applied have increased. The tax was last revised in 2000.

The purpose of the tax is to reduce resource use and to support the Danish waste hierarchy. It emphasises first and foremost recovery and recycling. The Danish priorities are: 1) waste prevention; 2) recovery and recycling; 3) incineration with CHP production; 4) other incineration; and 5) final disposal.

The tax provides 'waste producers' with an incentive to increase recovery and recycling. The incentive is first and foremost strongest for industry. As opposed to many other economic instruments in environmental protection in Denmark, the waste tax applies 100 per cent to industry. Large enterprises are typically not part of collection schemes and have therefore the possibility of reacting to the price signals of the waste tax. Especially for the heavier waste fractions such as demolition waste, the waste tax has been important in promoting recovery and reuse. Households on the other hand do not, in most cases, pay in full accordance with the specific amounts of waste they produce.

The tax provides waste companies with an incentive to recover as much waste as possible (recovered waste is liable to a tax rate of 0). The tax further favours incineration rather than disposal. Consequently, there is an incentive to establish incineration (with heat recovery and preferably also with power production) facilities.

The waste tax applies to waste delivered to a waste treatment plant. The registered weight of the waste constitutes the basis for calculation of the tax. Initially the tax rate was 40 DDK/ton. Over time it has been substantially increased. Furthermore, tax differentiation has been added to the scheme.

Table 3.8: Waste tax rates 1987 - 2001

[45] User fees can be dependent on the size of the bin. Some municipalities have introduced weight-based user fees.

Waste tax, DKK/tonne	1987	1990	1993	1997	1998	2001
Landfill/disposal	40	130	195	335	375	375
Incineration	40	130	160	260	330	330
Incineration with CHP	40	130	160	210	280	330
Recovered waste	0	0	0	0	0	0

3.5.3 Hazardous waste charge

Hazardous waste is disposed of at special treatment plants, e.g. the inter-municipal hazardous waste treatment plant "Kommunekemi". The treatment of hazardous waste is subject to full cost recovery. The fee, which is exempt from the waste tax, varies depending on the type of hazardous waste.

3.5.4 Battery charge

The tax on NiCd-batteries (nickel-cadmium batteries) has been in force since April 1996. The tax constitutes a component in the efforts of the government to reduce pollution from used lead batteries and NiCd-batteries. Lead batteries are covered by a special recycling scheme that constitutes part of a voluntary agreement. Batteries that contain mercury have been phased out.

The tax on NiCd-batteries should be seen in conjunction with a collection scheme, administered by the Danish EPA. The batteries are collected in order to ensure that they are safely disposed of (recovered).

The purpose of the tax is twofold. The tax aims to reduce the use of NiCd-batteries, and to increase recovery rates of used batteries. To pursue the latter, the revenue from the tax is used to provide the financial basis for a collection scheme for the collection and recovery of used NiCd-batteries.

The tax only targets domestic use of NiCd-batteries, thus it does not apply to export of NiCd-batteries. The tax is levied on both used and new NiCd-batteries. The tax amounts to DKK 6/battery (single cells) and DKK 36 per battery package (at least DKK 6 per cell).

Enterprises that participate in the collection scheme are entitled to a refund of DKK 120 per kilo of batteries returned, which by and large corresponds to the level of the tax. The entitlement to a refund is conditional on the provision of proof that the batteries have been weighed on arrival to a recovery plant.

3.5.5 The Danish packaging tax

The tax on packaging introduced in 1999 replaced another, much more narrowly defined tax, which only applied to bottles and jars. The former tax was volume-based and applied only to liquids such as drinks, vinegar, edible oil and methylated spirits.

From 1999 up until 2001, the packaging tax was broadened so as to also be based on weight when it came to taxation of sales packaging and multi-packs with volumes of less than 20 litres for the packaging of specific articles. Initially the aim was to treat packaging

with fiscal equality irrespective of the character of the packaging material.

Table 3.9: The weight-based tax; tax rates, 1 January 1999- 31 March 2001

	Tax, DKK/kg
Flexible fiber-based	19.50
Non-flexible fiber-based	7.50
Non-flexible fiber-based, recycled	6.00
Rigid plastic	7.50
Rigid and filled plastic	4.50
Rigid and UN approved plastic	6.00
Flexible plastic	30.00
Aluminium	11.25
Tinplate/steel	3.75
Tinplate/steel, UN approved	3.00
Glass and ceramic	0.75
Laminate	15.00
Wood	6.00

The aim of fiscal equality between materials was changed in the revision of the taxes in 2001, when the government decided that the environmental impact of different packaging materials should be reflected in the tax rate. The taxes were differentiated on the basis of an index of environmental impact, carbon dioxide emissions, primary energy and fossil resources, illustrated in table 3.10.

Table 3.10: Index for primary materials based on "Glass at present" = 1.00

	Environmental effects	CO_2 - emission	Primary energy	Fossil resources	Waste

Cardboard	-0.44	-0.91	2.77	-0.02	-0.02
Glass	1.00	1.00	1.00	1.00	1.00
HDPE	4.38	6.08	6.56	9.02	-0.17
PP	4.49	5.53	6.96	9.86	-0.16
LDPE	5.03	4.04	7.48	8.60	-0.19
PET	7.36	6.29	8.38	9.93	0.01
PS	8.96	8.41	9.21	12.02	-0.11
EPS	20.04	10.14	12.04	14.72	-0.06
PVC	19.69	5.60	7.48	6.86	1.39
Tinplate/steel	4.72	5.15	4.45	3.03	12.06
Aluminium	19.45	17.30	19.18	8.80	5.77

The revised tax on certain types of packaging, bags, disposable tableware and PVC foils came into force on 1 April 2001 and these are shown in table 3.11 and 3.12.

Table 3.11: Volume based tax rates for certain retail containers. DKK per item, 1999-2002

Material	Vol <10cl	10cl < vol < 40 cl	40 cl < vol < 60 cl	60 cl < vol < 110 cl	110 cl < vol < 160	Vol > 160 cl
Carton, laminates	0.15	0.30	0.50	1.00	1.50	2.00
Other materials	0.25	0.50	0.80	1.60	2.40	3.20

Table 3.12: Weight based tax rates on certain retail packaging. DKK per kg, 2001

Material	DKK per kg

Cardboard and paper, primary materials as well as textiles	0.95
Cardboard and paper, secondary material	0.55
Plastic (except EPS and PVC), primary material	12.95
Plastic (except EPS and PVC), secondary material	7.75
Plastic (except EPS and PVC), filled	7.75
Plastic (except EPS and PVC), UN approved	10.35
EPC and PVC	20.35
Aluminium	33.30
Tinplate and steel	9.25
Tinplate and steel, UN approved	7.40
Glass and ceramic	1.85
Wood	0.55

The packaging tax included a tax on bags manufactured of paper of DKK 10 per kg and plastic having a volume up to the handle or similar of at least 5 litres. The plastic tax amounts to DKK 22 per kg. The packaging tax includes a tax on foils manufactured of pliable polyvinyl chloride (PVC) for packaging food items and a tax on disposable tableware. The tax on packaging also includes a tax on disposable tableware. The tax rate is DKK 19.20 per kg for disposable tableware and DKK 20.35 per kg for PVC-foils.

3.5.6 Charges on ozone-depleting chemicals

A charge on CFCs was introduced on 1 January 1989 as part of the action plan to reduce the use of CFCs according to the Montreal Protocol. The use of CFCs has been prohibited since 1 January 1995 except for a few applications such as certain laboratory analyses. Therefore, the revenue has been almost zero for a number of years.

3.5.7 Tax on certain chlorinated solvents.

The tax on chlorinated solvents came into force on January 1, 1996. The tax applies to the three most commonly used chlorinated solvents (tetrachloroethylene, trichloroethylene, dichloromethane). At the time of implementation, it was estimated that the use of these chlorinated solvents together accounted for 95 per cent of the total domestic use of chlorinated solvents.

The purpose of the tax is to reduce the use of chlorinated solvents. Furthermore, the tax is motivated by the need to prevent an occurrence that may result from a ban on the use of the ozone-depleting CFCs. That is, the need to prevent the increase in the use of chlorinated solvents (that in some cases can be substitutes for the CFCs).

The tax rate is DDK 2 per kg and applies to chlorinated solvents in their pure form as well as chlorinated solvents in other goods if their concentration exceeds 1 per cent weight.

The consumption of the three chlorinated solvents has dropped by 2/3 since the tax was introduced. This indicates that the tax has had quite a substantial effect on the use of chlorinated solvents.

3.5.8 Tax on certain greenhouse gasses.

A tax on certain greenhouse gases was introduced on March 1, 2001. The tax applies to perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and hydroflourocarbons (HFCs). These gases were added to the gases CO_2, CH_4 and N_2O under the 1997 Kyoto Protocol. The tax will supplement the CO_2 tax on fossil fuels.

The tax rates for the different gases are based on their greenhouse effect ($C0_2$ equivalents) using the general tax rate for CO_2 (CO_2-equivalent = 1) at DKK 100 per tonne as basis. Since some of the gases have rather high CO_2-equivalent values the maximum rate is DKK 400 per kg.

3.5.9 Tax on PVC and certain plasticisers

A tax on PVC and certain plasticisers came into force on July 1, 2000. The tax provides an incentive to use other (less harmful) plasticisers and to reduce the use of PVC and thereby reduce the amount of PVC waste to incineration or landfill and reduce emissions from phthalates.

Disposal of PVC waste causes problems as PVC contains chlorine which by incineration produces hydrochloric acid. Purification of the hydrochloric acid produces chemically contaminated chalk. Phthalates are used as softeners in various products, for instance in PVC. Some phthalates are suspected of having unwanted effects on the aquatic environment and are found to be carcinogenic for animals.

Due to administrative concerns only those products where the amount of PVC and phthalates can be calculated on the basis of the average content of PVC and phthalates are covered by the tax. The tax rates are calculated on basis of a tax at DDK 2/kg for PVC and DDK 7/kg for phthalates.

3.6 Economic instruments on the use of natural resources

3.6.1 Tax on raw materials.

The tax on raw materials has been in force since January 1, 1990. The tax has been fixed at DKK 5.00 for each m^3 of raw material extracted. The tax is levied on the following raw materials that are commercially extracted (and permission is required in accordance with the Act on Raw Materials), or commercially imported:

- Stones, gravel, sand
- Clay, limestone, chalk
- Peat, top soil
- And similar deposits

Tax exemptions exist for:

- Raw materials extracted for coastal projects to protect the beaches against erosive action
- Sea floor materials which originate from maintenance and capital dredging projects and which are utilised as raw materials

- Residual products and waste products which are extracted from already closed depots
- Top soil and mould which are delivered without payment
- Raw materials commercially extracted or imported by a business when the annual amount is less than 200 m^3 of raw materials

3.7 Deposit refund systems

3.7.1 Deposit on reusable beverage containers

Bottles for beer, mineral water, soft drinks and wine are included in the deposit-refund systems regulated by the relevant industry. The system implies that a deposit is paid upon purchase of beer and carbonated soft drinks. The deposit is refunded upon return of the container in question.

The purpose of the system is to maximise the reuse of beverage containers and thereby reduce the generation of waste and consumption of raw materials. On average a glass bottle may be re-used 35-40 times.

4. Finland

4.1 Introduction

The programme of the present Finnish Government, which took over in 1999, indicates that economic instruments such as environment-related taxes and fees are an important means to achieving Finland's environmental goals, with due regard being paid to international competition and competitiveness. This will include the implementation of the EU minimum tax directive. The programme also states that the level, distribution and impact of environment-related taxes will be clarified.

Economic instruments can play an important role in combating climate change. Finland's national climate strategy states the principles, targets and measures required to meet the national greenhouse gas reduction goals. These concern various sectors of the economy, including energy production and consumption, transport, agriculture, forestry, waste management, town and urban development, and economic control measures such as taxation and financial support systems, regulatory control, voluntary agreements and the encouragement of consumer activity.

According to the national climate strategy, energy taxes will be used to increase the use of energy sources producing smaller carbon dioxide emissions and to control the growth of energy consumption. Motor vehicle taxation will be reformed so as to reduce fuel consumption; energy subsidies will be used to improve energy efficiency and to increase the generation and use of renewable energy. The present tax subsidies for renewable energy will be maintained in the energy taxation system. The possibilities of expanding current energy saving schemes and systems in industry and in the energy sector will be investigated so as to reduce greenhouse gas emissions.

4.2 General sales charges - VAT on energy

Value added tax (VAT) is a general multi-stage, non-cumulative tax on consumption, levied on most goods and services. VAT is collected at each stage of the production and distribution of goods and services. A deduction system prevents the accumulation of the tax.

As a member of the European Union, Finland has harmonised its VAT system to comply with EU regulations by amending the VAT Act. The amendments removed the support given to some forms of energy through VAT. In the former VAT system, a special tax deduction was granted to wood- and peat-based biomass, meaning that the primary energy component of biomass was exempted from the tax at all stages of production and use. A

similar deduction previously also applied to natural gas. The removal of these forms of support is now partly compensated in the excise duties on energy.

The standard VAT rate on products and services is 22 per cent. The Finnish system of reduced VAT rates was simplified at the beginning of 1998 to better correspond with the European systems, so that the earlier three reduced VAT rates (6, 12 and 17 per cent) were replaced by two reduced VAT rates (8 and 17 per cent). Fuels, electricity and heat are subject to the full 22 per cent tax. Commodity prices that include excise duties on fuels and energy sources are also subject to VAT.

4.3 Economic instruments related to air pollution abatement

4.3.1 Introduction

In 1990, Finland introduced the first ever CO_2 tax in Europe, alongside the fuel duty. The tax was imposed on fossil fuels according to carbon content. In 1994, this taxation was amended so that all primary energy sources were taxed according to their energy content. In addition, fossil fuels were also taxed according to their carbon content.

In 1997, the structure of Finnish energy taxation had to be amended when the Nordic energy markets opened. Finnish electricity producers were not able to compete with other Nordic producers because, in Finland, the energy tax was levied on production, whereas in the other Nordic countries taxes were levied on energy consumption. In the current system, energy taxes are levied on electricity consumption, no longer on primary energy production. Fuels used for heat production are taxed according to their carbon content.

The fuel duty consists of a basic duty and an additional duty. The basic duty is essentially a fiscal tax set annually in the State Budget. The additional, environment based duty is determined on the basis of the carbon content of the fuel.

4.3.2 Excise duties on fuel oils, natural gas and coal, etc.

The basic duty as well as the additional duty apply to fuel oils, natural gas, coal, peat and pine oil. Since the beginning of September 1998, the additional duty on liquid fuels and coal has been FIM 102 per tonne of carbon dioxide. For natural gas, the CO_2 rate is reduced by 50 per cent. A specific reduced rate is applied for milled peat.

A strategic stockpile fee is levied separately on these fuels. It affects certain commodities which are vital in an emergency, such as liquid fossil fuels. The revenue goes into a special fund. The purpose of this fee is to transfer to users of these commodities the costs incurred by the state for the maintenance of a strategic stockpile for the economy as a whole. In 1999, the revenue from the fee amounted to FIM 147 million.

Table 4.1: Fuel duties in Finland since 1.9.1998 FIM/kgCO_2

	Basic duty	Additional duty	Strategic stockpile fee
Light fuel oil (p/l)	10.9	27.0	2.1
Heavy fuel oil (p/kg)	-	32.1	1.7
Coal (FIM/t)	-	246	7
Natural gas (p/nm^3)	-	10.3	0.5
Milled peat (FIM/MWh)	-	9.0	-
Pine oil (p/kg)	32.1	-	-

4.3.2.1 Exemptions

Aviation fuel and kerosene used in aviation, methane, liquid petroleum gas, and light fuel oil used by vessels are exempt from the duties on fuel oils.

Fuels used as a source of energy in oil refining processes, and fuels used in industrial production as raw materials or auxiliary materials, or consumed as immediate inputs in the industrial manufacturing process of goods, are also exempted from taxation.

4.3.2.2 Reduced rates

The additional duty levied on natural gas is 50 per cent lower than the full duty in order to make it more competitive. For similar reasons, the tax rate for peat is somewhat lower compared to the tax based on carbon content, although in September 1998 the tax rate on peat was raised considerably.

4.3.2.3 Refund schemes to energy intensive industry

The energy tax legislation of September 1998 introduced a new element, a refund scheme for energy-intensive industry. This new tax regime applies to companies that have paid more than 3.7 per cent of their value added in energy excise duties, allowing firms to apply for a refund of 85 per cent of the taxes paid. The refund only applies to sums exceeding FIM 300,000, however. Yearly, some FIM 85 million is refunded to energy-intensive industries. In 1999, 12 companies received these tax refunds.

4.3.3 Excise duties on transport fuels: diesel and gasoline

The duty on transport fuels consists, as for all other fuel oils, of a basic duty and an additional duty. The additional, environment-based duty is determined on the basis of the carbon content of the fuel. The basic duty is differentiated to promote environmental protection so that, in the case of gasoline, the tax on unleaded and reformulated grades is lower, and in the case of diesel oil, the desulphurised grade has a lower levy. Due to the differentiation, the grades with better environmental characteristics have fully displaced the normal grades in the market.

Table 4.2: Transport fuel duties in Finland since 1.9.1998

	Basic duty	Additional duty	Strategic stockpile fee
Unleaded gasoline p/l			
- normal grade	309.4	23.9	4.0
- reformulated	304.4	23.9	4.0
Leaded gasoline p/l			
- normal grade	354.4	23.9	4.0
- reformulated	349.4	23.9	4.0
Leaded-unleaded blend p/l			
- normal grade	331.9	23.9	4.0
- reformulated	326.9	23.9	4.0
Diesel oil p/l			
- normal grade	166.6	26.9	2.1
- low sulphur content	151.6	26.9	2.1

4.3.4 Excise duties on electricity

The energy tax system was revised in early 1997. The earlier model whereby electricity production was taxed, was replaced by an electricity consumption tax. The electricity tax falls into two classes: a lower rate (2.5 p/kWh) for the manufacturing industry and professional greenhouse cultivation, and a higher rate (4.1 p/kWh) for households and the service sector. Electricity taxation does not depend on the carbon dioxide content of the used fuel.

Table 4.3: Electricity taxes in Finland since 1.9.1998

Electricity p/kWh	
- category 1 *	4.1
- category 2 **	2.5

* households and the service sector

** manufacturing industry and professional greenhouse cultivation

Those producing electricity with nuclear energy are responsible for nuclear waste management. In order to guarantee the future financing of the liabilities in all circumstances, they have to pay a nuclear waste management charge into a special nuclear waste management fund, administrated by the Ministry of Trade and Industry. The liabilities include both managing nuclear reactors after their operating time has expired, and managing nuclear waste. The payments into the fund in 2001 were FIM 200 million, and the total assets were approximately FIM 6.93 billion. It is worth noting that in the future, the need of provisions and consequently the payments of the companies as well as the total

assets in the fund will gradually diminish as the actions of waste management are completed.

4.3.4.1 Refunds to electricity based on renewable energy forms

Since the new tax model adopted in the beginning of 1997 resulted in an electricity tax being levied on all electricity, regardless of the production method, the renewable energy sources lost competitiveness. This made it necessary to introduce supportive measures for these energy forms. To improve the competitiveness of renewable energy sources, the tax on electricity produced by wind, wood and wood-based energy became refundable. Energy producers, producing electricity with:

1)wood or peat in heat power plants producing less than 40 Mega Volt Amper (MVA);

2)small water power plants (less than 1 MVA);

3)waste gases from metallurgical processes; or

4)wood/ wood-based fuels

were entitled to a tax subsidy which equalled the amount paid in electricity tax (category 2 tax, 2.5 p/kWh). Those producing electricity with wind power were entitled to a tax subsidy which equalled the amount of category 1 electricity tax (4.1 p/kWh).

Table 4.4: Energy taxes in Finland 1990-2000.

	1990	1995	1999	2000	2001
Gasoline, p/l	128	268.30	328.30	328.30	328.30
Diesel oil, p/l	100	163.50	178.50	178.50	178.50
Light fuel oil p/l	2	17.98	37.90	37.90	37.90
Heavy fuel oil p/kg	2	18.55	32.10	32.10	32.10
Coal FIM/t	16	116.10	246	246	246
Natural gas p/m3	1	5.60	10.30	10.30	10.30
Peat FIM/MWh	2	3.50	9	9	9
Electricity, class 1 p/kWh			4.10	4.10	4.10
Electricity, class 2 p/kWh			2.50	2.50	2.50

4.3.5 Charges on motor vehicles

Road traffic taxation falls within the scope of state taxes. Motor vehicles and fuel used in road traffic are subject to the taxes listed below. VAT is levied at the standard rate of 22 per cent on the sales value of vehicles and fuel.

4.3.5.1 Car tax

The car tax is levied at a value equivalent to the taxable value of the car minus FIM 4,600. The tax is always at least 50 per cent of the taxable value of the car. Motorcycle taxes are charged on the basis of engine capacity, so that the rate of tax varies between 20 and 70 per cent of the taxable value. The tax value of passenger cars with low exhaust emissions is reduced by FIM 4,500 (the so-called catalytic converter discount). For vans designed exclusively for the transport of goods the tax may, in given circumstances, be imposed at

35 per cent. Car tax revenue amounted to approximately FIM 6,295 million in 2000. Receipts in 2001 are estimated at about FIM 5,300 million.

4.3.5.2 Vehicle tax

Vehicle tax is levied on the use of the vehicle. It is payable for all registered motor vehicles that have a maximum unloaded weight of 3,500 kg. It is the responsibility of the owner of the vehicle to ensure that the tax is paid. Certain special car types remain exempt. The tax amounts to FIM 500 for vehicles taken into use before the end of 1993, and FIM 700 for newer vehicles. The tax period is one year. The vehicle tax has been collected since 1994**.** Vehicle tax revenue amounted to FIM 1,306 million in 2000 and is estimated at FIM 1,345 million for 2001.

4.3.5.3 Fuel fee

If light heating oil is used in a diesel vehicle instead of diesel oil, the owner of the vehicle is liable to pay a fuel fee for each day the car is used in Finland. The fee amounts to FIM 3,000 for lorries, FIM 2,000 for buses, FIM 1,500 for vans and FIM 1,000 for cars.

4.3.5.4 Tax on diesel-driven vehicles

The tax on diesel-driven vehicles is levied annually on all vehicles using fuels other than gasoline, i.e. diesel oil, kerosene, liquefied petroleum gas or electricity, as well as on vehicles equipped with gas-producing equipment. The rates for passenger cars are FIM 150/100 kg of the total weight or a fraction thereof, and for motor caravans and delivery vans FIM 27-63/100 kg. For lorries and special purpose vehicles, the rates depend on the number of axles and certain other features. Motor vehicle tax receipts amounted to FIM 1,074 million in 2000 and are estimated at FIM 1,190 million in 2001.

4.4 Economic instruments related to water pollution

4.4.1 Sewage and water charges, wastewater charges

Water services consist of the supply of fresh water and treatment of wastewater. In Finland, local government bears the primary responsibility for providing these services. Water services are financed mainly by collecting user charges. Water and wastewater tariffs are set by the local authorities, the user charges being based on the amount of water used. In general, the tariffs are the same for all users, but in some cases, such as for industrial facilities, the tariffs may be adjusted so as to better reflect the quality of the wastewater. Besides user charges, water charges also include a connection charge designed to cover local government investment costs in water service management.

Water charges are based on the full cost principle. This means that the total costs for the water services are paid by the users. On the whole, the principle applies fairly well, but for individual water or wastewater plants, the situation may differ to some extent, for example, because of state subsidies for water management.

In 1999 the average *consumption* fee for fresh water in Finland was FIM 4.34/m^3. The preliminary fee for year 2000 is FIM 4,94. For the average *wastewater* fee only preliminary figures are available. In 1999 it was FIM 7.56/m3 while in the following year it amounted to FIM 7.84.

4.4.2 Oil pollution control charge

This charge is differentiated on the basis of the environmental safety of cargo vessels and levied at FIM 2.20/tonne of oil. The rate is twice as high for tankers without double hulls. The fee is collected in a fund that covers costs incurred in combating oil accidents and in preventing such accidents. The fund is not included in the State Budget and it is managed by the Ministry of the Environment. The Act on the Oil Pollution Control Fund came into force in 1974. The amount collected in this fund in 2001 was FIM 32 million.

4.4.3 Other

Under the former environmental permit system, factories and fish farmers paid a water protection charge which was used for water protection research. In accordance with the current Environmental Protection Act, these charges can no longer be included in environmental permits, as they conflict with the principle of Best Available Technology. Because some of the factories still have environmental permits, issued before the new Environmental Protection Act, revenue from the water protection charge will be collected until 2004. In 2000, some FIM 3 million was collected.

4.5 Economic instruments related to agriculture

4.5.1 Pesticides

The charge on pesticides is 3.5 per cent of the previous year's turnover. A non-recurring charge of FIM 5,000 is also collected for the registration of new pesticides. The purpose of the charge is to cover the registration costs. The revenue from these charges was FIM 10 million in 2000.

4.6 Economic instruments related to waste

4.6.1 User charges (covering costs for providing waste management services)

The local authorities are responsible for providing for the collection, treatment and reuse of municipal waste. The services are usually provided by the local authorities themselves, but private waste companies may also be contracted to meet the waste treatment obligations. The charges for waste services are determined and collected by the local authorities, to cover costs incurred in providing waste management services. In accordance with the Waste Act, this charge must cover investments in treatment plants and their operation costs, besides waste collection. In addition, the charge must encourage waste producers to reduce the amount of waste, to produce less hazardous waste and to recycle waste. The waste charge is determined on the basis of the quantity of waste and differs according to the quality of the waste.

There was a sharp rise in average waste charges from 1996 to 1997 mostly due to the waste tax on waste dumped at landfills or burned in incineration plants. Moreover, the new regulations on waste treatment on landfill sites have already to some extent raised waste charges.

Table 4.5: Municipal waste charges in 1996-1998

Waste type	1996	1997	1998
	Average, FIM/t	Average, FIM/t	Average, FIM/t
Municipal waste/ class [1)]	152	233	246
Municipal waste/ class [2)]	163	236	248
Municipal waste/ class [3)]	129	235	226
Municipal waste/ class [4)]	163	219	245
Biowaste	86	110	129
Special waste	321	333	341

1) Class 1 Municipal waste, transported in a garbage truck or waste container with compressing equipment

2) Class 2 Municipal waste, transported on a transportation platform

3) Class 3 Municipal waste, transported in some other way

4) Class 4 Industrial or construction waste classified as municipal waste

4.6.2 Waste charges (landfills, incineration)

The Waste Tax Act came into force in late 1996. In practice, the Act is a landfill tax, as it applies only to waste brought to landfill sites. The tax is restricted to municipal landfills, which means that this tax does not apply to private landfills, such as industrial waste dumps. The landfill site operator is responsible for paying the tax to the state. The tax rate has been FIM 90/tonne of waste since 1996 and does not vary according to the quality of waste. If the waste arriving at the site cannot be weighed, the weight is estimated based on its volume using a table of transformation coefficients. The Waste Tax Act contains a list of exemptions from the tax, such as soil and stone materials, recoverable waste deposited temporarily on the landfill site, separately collected organic waste and sludge, and others. The customs authorities are in charge of this tax system. The revenue from these charges was FIM 198 million in 2000.

4.6.3 Charges on lubricants

The oil waste duty is charged on lubricating oils and solid lubricants (greases) as well as lubricating preparations. The charge is levied on both domestically produced and imported products. The revenue is used to cover the expenses incurred in collecting, transporting, storing and treating oil waste. The duty is levied at a rate of FIM 0.25/kg. The revenue in 2000 was FIM 20 million.

4.6.4 Charges on beverage containers

This tax is levied on beer and soft drinks sold in disposable containers. For disposable containers which cannot be recycled or reused, the tax is FIM 4/l. Provided that the container is refillable and included in a recycling system approved by the Ministry of the Environment, no additional duty is payable. If the package can be re-used as raw material but is not refillable, the additional duty is FIM 1 per litre. The revenue was FIM 81 million in 2000.

4.7 Economic instruments pertaining to the use of natural resources

In Finland, fishing with a hook and line and ice-fishing are not subject to charges or permits. However, charges are levied and permits required for other fishing and for catching crayfish. Fishermen and crayfish catchers have to pay a state fishing charge, which is FIM 90 for one year. In addition, those who want to practise lure fishing have to pay a provincial lure fishing charge which totals FIM 150 for one year. In 2000, the revenue from the state fishing charge was FIM 28 million and from the provincial lure fishing charge FIM 10 million.

Hunters have to pay FIM 140 annually to the state as a state game protection payment. There is also an additional payment for moose hunting. Each moose felled costs FIM 600. The accumulated funds are used for developing game protection and hunting. In 2002, these charges are estimated to amount to some FIM 33 million.

4.8 Deposit systems

4.8.1 Deposit on reusable beverage containers

In Finland, the annual consumption of beer and beverages amounts to 650,000,000 - 680,000,000 litres. Over 90 per cent of these drinks are bottled in returnable, refillable bottles, beer in brown glass and beverages in clear glass and PET bottles. There are well-functioning industrial/commercial reuse systems for bottles. The breweries only use one type of beer bottle (1/3-, 1/2- and 1-liter), while all the breweries have filling systems for the same bottles. Consumers can return their bottles to any store with a deposit system and they will be repaid the deposit (FIM 0.5 for 1/3- and 1/2-litre bottles, FIM 1 for 1-liter bottles and FIM 2.5 for 1,5-litre PET bottles for beverages). The charges are determined by the Ministry of the Environment in connection with the approval of the recycling system for beverage containers. There is a deposit of FIM 1 for aluminium cans, and over 90 per cent are returned for recycling. This deposit system was started and is run by the industry. Finland will soon modify its system to comply with the EC legislation.

4.9 Market creation

4.9.1 Voluntary agreements

Voluntary energy conservation agreements were introduced in 1997 and are an important instrument. By the end of the year 2000, energy saving agreements had been signed with the Ministry of Trade and Industry for 80 per cent of industrial energy consumption, 90 per cent of power plants and 50 per cent of the municipal sector. The total estimated energy savings achieved through these agreements amount to 1.3 TWh/yr. It is now being investigated, in connection with the national climate strategy, whether these agreements could be linked to the promotion of renewable energy sources and to the reduction of greenhouse gas emissions.

4.9.2 Recycling of end-of-life vehicles

In Finland, work on a system for recycling end-of-life vehicles (ELVs) started as an experiment in 2001, in co-operation with the Finnish private company Kuusakoski, which specialises in industrial recycling of metals. The recycling process for ELVs consists of the following stages: reception of ELVs, separation of hazardous waste and reusable components, removal of wheels, shredding and separation of metals, utilisation of materials, disposal of non-recyclable materials and reporting. In the experiment, the costs of recycling ELVs amounted to just over FIM 1,000/car. At present, the value of the metal contents and reusable parts is not sufficient to cover the costs of recycling.

4.9.3 Recycling of discarded tyres

The principle of producer responsibility has been implemented in the Finnish Government's decision on discarded tyres which came into force in 1996. According to this decision, tyre producers must organise waste management of discarded tyres and provide relevant information and education. Tyre sellers must take back discarded tyres without charge.

In Finland, the systematic recycling of used vehicle tyres started in 1996 by the setting up of a company with the objective of taking care of the collection and utilisation of used vehicle tyres in Finland.

The recycling of used tyres is financed through a recycling fee, payable when new tyres are purchased. The recycling fees vary from FIM 11 each (Euro 1.85) for passenger car tyres (FIM 6/Euro 1.01 for retreaded passenger car tyres) to FIM 300 (Euro 50.46) for large machinery tyres.

The volume of discarded vehicle tyres in the Finnish market is approximately 30,000 tonnes, equalling 2.4 million car tyres a year. The target set in the government's decision was a 90 per cent recovery rate by the year 2000. Discarded tyres must primarily be reused or otherwise recovered as material, and secondarily used as an energy source. The 90 per cent recovery rate target was achieved on schedule and 90 per cent of the recovered tyres were used as material and a small proportion as energy in the year 2000. By the end of June 2001, Finnish Tyre Recycling had received 146,802 tonnes of discarded tyres in total.

4.9.4 Waste recycling

The new Waste Act emphasises preventive measures for minimising the waste generated and diminishing the harmful properties of waste. The Act also requires the recovery of waste if this is technically and economically feasible, primarily in the form of material and secondarily as energy. The waste tax (a landfill tax) and municipal waste charges are the economic instruments applied to achieve the objectives of waste policy.

The area around the town of Pietarsaari is a good example of how waste management and recycling can be efficiently organised and the private sector engaged in waste management and recycling activities. In the Pietarsaari area, several municipalities have founded a company called Ab Ekorosk Oy which offers waste treatment services to 70,000 people. Households sort their waste in dry (incinerable) and wet (biologically degradable) fractions. Directly recyclable waste such as glass, metal and paper are sorted separately from the bulk waste and taken to "eco-stations". The wet waste fraction is transported to the Stormossen biogas plant, which uses it in the production of biogas.

The dry waste is crushed and made into pellets at the Ewapower's pellet factory. Cardboard waste containing plastic from the local UPM-Kymmene pulp and paper factory is added to the dry waste in the pellet factory, which brings the heat value of the produced pellets close to that of coal. The produced pellets are then used as fuel in the local Alholms Kraft power plant which provides power to the UPM-Kymmene Wisaforest pulp and paper mill in Pietarsaari.

The wet fraction of waste recycled by Ekorosk in 1999 amounted to 10,000 tonnes and the dry fraction to 4,500. At the 150 ecostations, 200 tonnes of glass, 1,500 tonnes of scrap metal and 2,100 tonnes of recycled paper and 1,600 tonnes of cardboard were recovered and subsequently recycled.

4.10 Environmental subsidies and tax concessions

4.10.1 Development of clean technologies and recycling

According to a cabinet decision in 1996, the government can award grants for development, pilot, investment and renovation projects, which promote environmental protection. These projects can include waste management, recycling, or contaminated land restoration projects; projects, which aim to reduce harmful emissions or discharges; projects promoting the use of environmentally friendly products; projects developing new environmental technology; projects developing better discharge/emission treatment methods and so on. Development projects (so-called soft aid projects) can receive grants of up to 50 per cent, whereas the maximum limit for investment projects is 30 per cent. The grants are awarded by the Ministry of the Environment and the regional environmental centres. In 2000, FIM 32 million were awarded for these purposes.

4.10.2 Promotion of renewable energy and energy efficiency

In order to improve the competitiveness of renewable energy sources, taxes on electricity produced by wind, wood and wood-based energy have been made refundable.

Under its Energy Aid Scheme, the Ministry of Trade and Industry awards grants for development and investment projects that promote energy efficiency and the use of renewable energy or reduce environmental hazards associated with energy production. The Energy Aid Scheme aims in particular to encourage the introduction of new technologies. Both enterprises and organisations are eligible for energy grants. The maximum aid limit depends on the nature and purpose of each project. Development projects (so-called soft aid projects) can receive grants of up to 50 per cent, whereas the maximum limit for investment projects ranges between 25 and 40 per cent.

Table 4.7: Energy efficiency and renewable energy grants in 1995-2001. Million FIM

	1995	**1999**	**2000**	**2001**
Energy efficiency aid	6	15	15	15

Investment aid to renewable energy	37	120	120	150

4.10.3 Environmental investments in agriculture

The agri-environmental aid is aimed at reducing the environmental load caused by agriculture and preserving biodiversity and the farming landscape. The aid also aims to compensate for the extra costs incurred by farmers for mandatory environmental and landscape protection measures.

The agri-environmental aid, financed to 50 per cent by the EU and 50 per cent by the Finnish Government, consists of two parts: (1) general aid (GAEPS) based on the number of hectares under cultivation, and (2) supplementary aid to cover the costs of special measures aimed at reducing the load of agriculture on the environment. The conditions for obtaining the first kind of aid are compliance with certain environmental requirements. First of all, a Farm Environmental Management Programme has to be prepared for each farm by an authorised consulting organisation. Other requirements relate to fertilization and manure handling, improvement of plant protection methods, filter strips between fields and watercourses, minimum plant cover outside growing periods and maintaining landscape and biodiversity. The supplementary aid covers measures such as organic production, treatment of runoff waters, balanced use of nutrients in manure, increased agricultural production, and so on.

Table 4.8: Finnish agri-environmental aid in 1995-2000. Million FIM

	1995	**1999**	**2000**
General aid	1329.7	1387.5	1485.0
Supplementary aid	76.5	210.3	153.7
Total	**1419.9**	**1605.9**	**1642.3**

4.10.4 Other

4.10.4.1 Grants and loans for research and development

Environmental R & D grants and loans can be given to companies, communities and municipalities in order to promote investment projects and studies in environmental protection, use of natural resources, environmental technology and so on (for promotion of renewable energy and energy efficiency, see section 10.2). In addition, the government finances environmental research at universities and other research institutions.

Table 4.9: Environmental research and development financing in 1995-2002. Million FIM

	1995	**1999**	**2000**	**2001**	**2002**
Research and development total	**717**	**1038**	**1160**	**945**	**951**
Environmental protection	170	289	329	120	123
Natural resources use	119	178	190	183	168
Universities	204	251	261	281	298
Development of environmental technology	193	290	350	325	325
Other environmental research	31	30	30	37	37

4.10.4.2 Environment conservation loans and guarantee systems

The state-owned credit institute Finnvera yearly grants FIM 120-130 million in low-interest loans for environmental protection to small and medium-sized enterprises. The interest rate is usually about two percentage points lower than for normal investment loans. The loans mainly cover investments aimed at reducing the environmental impact of production processes and products. The amount of the loan is 50-75 per cent of the investment.

Finnvera also runs an environmental protection guarantee scheme catering for the manufacturing industry and similar activities. A guarantee may be granted as collateral for a domestic or foreign credit. The guaranteed credit may be used for domestic investment in water or air pollution control, as well as waste recycling, or for a similar foreign environmental investment, which significantly improves the state of the environment in Finland. The amount of loans in this scheme has been quite small throughout the 1990s.

4.10.4.3 Grants and loans for sustainable forestry

The government can promote sustainable forestry by awarding grants or loans to forestry practices which promote biodiversity, sustainability in timber production and the protection of forest environments. The maximum grant amount is 70 per cent of the project costs.

4.10.4.4 Grants for water management

In 2001, FIM 22 million from the state budget was channelled to water management investments. The grants are mainly used to promote municipal water services in rural areas and to improve the potential for using groundwater. The grants are largely used to subsidise investments in water and wastewater treatment equipment, including sewers.

4.10.4.5 Environmentally motivated tax concessions

Environmental protection is also supported through the taxation system. Accelerated depreciations can be applied to environmental investments.

4.11 State revenue from different economic instruments and the share of GDP

The table presents an overview of environment related taxes and charges in Finland. The table covers the tax revenues for the past few years and the estimated tax revenue for 2001.

Table: 4.10: Environmentally related state taxes and charges in Finland. Million FIM

	1998 R	1999 R	2000 R	2001 F
Additional tax on disposable containers (alcoholic beverages)	60	73	73	70
Additional tax on disposable containers (soft drinks)	9	7	7	7
Pesticide charge	10	10	10	10
Energy taxes	15306	15765	13497	15500
Oil waste duty	20	19	20	20
Car and motorcycle tax	5259	6115	6295	5300
Water protection charge	3	3	3	2
Oil pollution control charge	33	35	32	32
Vehicle tax	1198	1245	1306	1345
Diesel tax	1042	1101	1074	1190
National waste tax	182	202	198	200
TOTAL	**23122**	**24575**	**22515**	**23676**

R = revenue

F = forecast

In 1999 environmental taxes amounted to 3.4 per cent of the Finnish GDP.

4.12| Socio-economic effects of the use of economic instruments

The socio-economic effects of economic instruments used in environmental policy have so far not been extensively studied, but work on this aspect is starting. Here, some findings on the effects of environmental taxes on employment and the distribution of income between different groups and regions are discussed briefly.

A Finnish working group report published in 2000 states that in the l990s, the proportional tax burden seems to have shifted to lower-income households, as a result of the amendments of the environment related and energy taxes. Empirical studies show that both energy taxes and taxes on transport fuels are regressive, that is, they fall more heavily on lower income groups, which spend a larger proportion of their income on energy and transport than higher income groups. The higher tax levels also appear to have increased regional differences in income levels, as taxes on transport fuels, in particular, increase the

tax burden of people living in sparsely populated regions. This kind of side-effect can be mitigated by income transfers and tax refunds directed at lower income households and households in certain regions of the country, but there are severe practical difficulties in compensating for loss of income.

This question is also raised in the context of climate change policy. If new energy taxes based on the emissions of CO_2 are implemented, the tax burden on lower income households is expected to increase. Also, there are regional differences in energy consumption due to the colder climate and longer travelling distances in the north. Ongoing studies, to be concluded by the summer of 2002, explore the options for how to make use of energy taxation in the context of the Kyoto Protocol and the EU burden sharing agreement.

5. Iceland

5.1 Introduction

In recent years, Iceland has moved forward in the formation of an environmental policy for the country. The establishment of the Ministry of the Environment in 1989 brought matters related to the environment under one general co-ordinating body for the central government and also established a co-ordination body for the environmental policies pursued by municipalities. During the 1990s, a comprehensive toxic waste collection and return system was established, a deposit/return system for beverage bottles and cans was successfully implemented, a lead surcharge on petrol was instituted, leading to the disappearance of leaded petrol from the market. Control norms for exhaust fumes from motor vehicles were introduced and enforced. During the 1970s and 1980s, most of Iceland's space heating, i.e. the heating of homes and other premises, was converted to geothermal or electric heating, which are both clean, non-emitting energy sources.

The most prominent current issue is whether Iceland should sign the revised Kyoto Protocol and how it should adjust to the encumbrance of its obligations. Iceland has increased its emissions of greenhouse gases in recent years, both in absolute terms and on a per capita basis. This is partially sourced in communications (vehicular traffic), the fishing fleet and in the smelting industry (aluminium, ferro-silicon). Iceland's plans for expanding the smelting industry, even though clean hydro- and geothermal energy would be the prime source, will inevitably increase greenhouse gas emissions in the future. The following table shows greenhouse gas emissions in Iceland over the last decade:

Table 5.1: Greenhouse gas emissions, 1990-1999

Iceland: Greenhouse gas emissions		
	(Thous. tonnes, CO_2 equivalents)	
	Total	Per capita
1990	2982	11.7
1995	2860	10.7
1999	3410	12.2

5.2 General sales charges – VAT on energy

There is a general value added tax on all goods and transactions in Iceland. There are important exceptions, similar to those to be found in most countries (e.g. exports, health

services). VAT is levied on all carbon fuels, such as petrol and diesel fuel, marine fuel etc., at a rate of 24.5 per cent. The levy applies after other taxes have been applied (see 3 below). Since marine fuels are primarily destined for the fishing industry which primarily exports its final product, the output tax paid by the fishing fleet is indirectly recovered by the time the final product is exported. Since about 30 per cent of Iceland's emission of carbon dioxide is caused by the fishing fleet, the impact of the tax recovery is substantial. For electricity, a 14 per cent VAT rate applies.

5.3 Economic instruments related to air pollution abatement

Iceland has applied a tax on motor and engine fuels, chiefly for fiscal purposes, but these taxes have indirectly served as pollution abatement taxes at the same time. The taxation of fuels is twofold. For gasoline, the tax in 2000 amounted to ISK 49.6 per litre. In addition, it is also subject to 24.5 per cent VAT. This charge is fixed by law and does not depend on the gasoline import price. Up to October 1999, the excise tax on gasoline was in two parts. On the one hand, there was a 97 per cent ad valorem tax on the cif. import price and, in addition, a fixed charge that was changed from time to time by regulation. As of the said date, the ad valorem charge was converted into a fixed charge, partly to avoid the revenue of the Treasury fluctuating along with world oil market prices and also to avoid increasing import prices for gasoline having a cascade effect on pump prices. For diesel fuel and other engine fuels (including less refined marine fuel versions), there is no excise tax on the fuel itself. The 24.5 per cent VAT rate applies. For motor vehicles with diesel engines there is a weight tax which is scaled according to the weight of the vehicle. The following table shows the taxation of gasoline and diesel fuels. The tonnage of diesel oil is for the total use of the marine fleet, for space heating and for diesel vehicles. The weight tax applies only to diesel vehicles.

Table 5.2: Excise taxes, retail price and imports of gasoline and diesel, ISK million, 1985-2000

	Imports of gasoline, million litres	Excise taxes on gasoline ISK million	Excise tax per litre ISK	Retail price, excl. VAT	Retail price, incl. VAT	Excise tax in % of retail price incl. VAT	Imports of diesel oil million litres	Weight tax on diesel vehicles. ISK million
1985	121.5	856	7.0	24.0	30.0	23.5%	255.4	427.6
1990	168.6	3171	18.8	41.6	52.0	36.2%	335.8	1319.3
1995	173.4	6172	35.6	55.1	68.9	51.7%	296.0	2305.1
2000	202.0	7557	37.4	74.4	92.9	40.3%	427.9	4639.0

There is no excise tax on electricity. In areas that have no access to geothermal space heat, there is a subsidy to bring down the cost of heating by clean, hydro-generated electricity in order to prevent the use of heating oil.

5.4 Economic instruments related to water pollution

Many municipalities levy a water and sewage charge along with their property tax. The charge differs from one municipality to another. Some have no charge, especially in rural areas. Other municipalities that have been compelled to install sewerage systems and sewage treatment plants, have levied such charges usually on the basis of the property tax valuation or the space displacement of the real property in question. However, see section 5.5 below.

5.5 Economic instruments related to waste

5.5.1 Household waste collection charge

Municipalities levy a household waste collection charge. The charge differs between municipalities. Most often it is a surcharge on real property taxes in direct proportion thereof. Other variations are that municipalities charge by the amount of waste and the frequency of pick-up.

5.5.2 Charges on hazardous chemicals

Since 1997, there has been a systematic charge on the importation and domestic production of hazardous chemical waste as shown in the following table.

Table 5.3: Chemical waste disposal charges

	Legal Maximum	1997	1998	1999	2000
Batteries containing acid	60.00	26.00			21.00
Batteries without acid	60.00	36.40			29.40
Batteries in instruments	330.00-5280.00	143.00-2288.00			115.50-1348.00
Batteries in voltage transformers	200.00	26.00			21.00
Photography and printing chemicals	300.00	32.25-258.00			29.25-234.00
Other photography chemical production	300.00			258.00	234.00
Oil paint	16.00	2.00	6.00		10.50
Printing colours	16.00	2.00	6.00		
Organic chemical solvents	3.00	0.50	1.50		3.00
Batteries containing mercury or nickel cadmium	200.00	186.00			200.00
Alkaline button batteries	50.00				9.00
Wood-treatment chemicals	2.00	3.00			
Rot prevention chemicals	2.00	3.00			
Isocyanides	10.00	1.00			
Halogen chemical compounds	900.00		22.00		75.00
Oil compounds other than fuels	20.00			10.00	
Crude oil	0.10			0.00	
Refrigeration fluids	900.00			98.00	
Mercury compounds	900.00			900.00	

All prices are in ISK per kilo other than batteries in instruments and alkaline button batteries, at ISK each.

5.6 Economic instruments on the use of natural resources

5.6.1 Tradeable fishery permits

Iceland has a government-imposed fishing quota on nearly all species caught within the Icelandic economic zone. In addition, it has concluded numerous agreements with other fishing nations on the fishing of various species on the Icelandic land shelf as well as in adjacent waters. Fishery quotas are tradeable within certain limits.

5.6.2 Production quotas on certain agricultural products

Icelandic agriculture has production quotas on certain mutton and milk products that the government will subsidise. Such production quotas are also tradeable within certain limits.

5.7 Deposit refund systems

Deposit on reusable beverage containers. A deposit-refund scheme is in operation for aluminium cans and certain re-useable bottles.

5.8 Environmental subsidies and tax concessions

5.8.1 Development of cleaner technologies and recycling

The City of Reykjavik is participating in a joint scheme with Daimler Chrysler to test bus engines driven by hydrogen.

5.8.2 Promotion of renewable energy and energy efficiency

See section 3 above.

5.8.3 Environmental investments in agriculture.

There are ongoing efforts to encourage farmers to farm organically so that their produce is guaranteed to be free of all chemical fertilizers and all other chemical residue. There are no subsidies for this scheme but farmers receive a certificate if they meet specified standards for organic production and are allowed to label their produce as such. 5.8.9 State revenue of different economic instruments and the share of GDP

Table 5.4: State revenue and share of GDP, ISK million, per cent, 1985-2000

	Excise taxes on gasoline ISK million	Weight tax on diesel vehicles. ISK million	Excise taxes and weight taxes in p.c. of GDP
1985	856	427.6	1.1%
1990	3.171	1.319.3	1.2%
1995	6.172	2.305.1	1.9%
2000	7.557	4.639.0	1.8%

Charges on chemical waste, cf. section 6.2, amounted to a total of ISK 131.8 million in 1999 and ISK 154.0 million in 2000, equivalent to 0.16 and 0.22 per cent of GDP, respectively.

6. Norway

6.1 Introduction

The prevailing economic instruments in Norwegian environmental policy are product charges/charge differentiations. There are several examples of charges initially imposed to meet other objectives being altered and given a more environmental profile. In January 1999, Norway imposed green taxes. The purpose of imposing these charges is to increase duty on activities harming the environment and reduce duties on labour, thus achieving both a greener environment and increasing employment. The green taxes are a preliminary step towards Norway's climate obligations. The green taxes are related to air pollution and waste.

Norway has considerable experience of environmental taxes. The tax on gasoline was introduced as early as 1931 and the SO_2-tax was introduced in 1970. However, most of the environmental taxes came about in the period 1989-2000. Tax on pesticides and lubricant oils were introduced in 1989, the CO_2-tax in 1991, tax on beverage containers and auto diesel in 1993 and tax on final waste treatment in 1999. Tax on chemicals harmful to health and the environment and tax on heating oil were introduced in 2000.

6.2 General sales charges – VAT on energy

Norway has a general VAT rate of 24 per cent. This is levied on all sales of energy products. There is an exemption (zero rate) for the sale of electricity to households in northern Norway (counties of Nordland, Troms and Finnmark).

6.3 Economic instruments related to air pollution abatement

6.3.1 Introduction

Several commissions have been appointed since 1989 with the purpose of investigating how to use economic instruments in environmental policy as well as investigating how to change the tax system away from taxation of labour and towards activities that imply use of resources and harmful emissions[46].

In 1998 Parliament adopted the following changes in environmental taxes as a result of the work by the Green Tax Commission[47]:

- Extension of the CO_2-tax to include the supply fleet in the North Sea, air transport and coastal goods transport with a tax of NOK 100 per tonne CO_2. The processing industry and fisheries were not included in the extension. Parliament also required the government to appoint an official commission to deliberate a system for domestic greenhouse gas emissions trading, taking the Kyoto Protocol as the point of departure. Parliament emphasised that the system at least should include industries that are exempt from the CO_2-tax. A national tradeable permit system should also be compatible with an international tradeable permit system, joint implementation and clean development mechanism.
- The introduction of a state tax on final waste treatment was expected to reduce the emissions of the greenhouse gas methane from landfills. Waste delivered to landfills or combustion plants would be taxed at a rate of NOK 300 per tonne. Combustion plants that utilise waste for energy purposes would pay a lower tax (minimum NOK 150 per tonne).
- Extending the SO_2 tax to include sources that were not taxed. The tax rate for the new uses was proposed at NOK 3 per kilo. The SO_2 tax on mineral oils was NOK 17 per kg.
- The introduction of a tax on autodiesel oil used in buses. To avoid negative effects on public transport, the bus companies were compensated for tax increases.

Parliament's resolutions included new and expanded green taxes that were estimated to increase government revenue by NOK 1.4 billion. NOK 0.8 billion was decided to be used to reduce personal income tax. All the changes were implemented from 1 January 1999.

As a further follow-up of the Green Tax Commission, new and amended taxes were proposed in the budget for 2000. This contained a new tax on chemicals harmful to health

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[46] In the report, "NOU 1992:3 Towards more Cost-effective Environmental policies in the 1990s", one of the main conclusions was that environmental taxes are a cost-effective economic instrument. The Commission pointed out that the aim of environmental taxes is to contribute to better use of resources and presented several proposals on how to achieve this.

Green taxes – policies for a better environment and high employment", the NOU 1996:9, was presented in June 1996. An English summary is available from the Ministry of Finance. One of the main topics for the Commission was the CO_2 tax. The Commission pointed out that a cost-efficient climate policy implies that the CO_2 tax should be the same for all fuels, in all countries and all geographic areas and for all sectors in the economy. Furthermore, all climate gases should be subject to the same degree of policy restriction. It seems difficult to comply with the requirement that CO_2 taxes should be the same in all countries and Norwegian climate policy has therefore explicitly been motivated by the desire of the Norwegian authorities to be an international "instigator". This "instigator" role consists both of establishing acceptance that the problem exists and of ensuring that the problem will be alleviated by the adoption of cost-efficient international agreements.

[47] A "follow-up" of the Green tax Commission proposal: In April 1998, the Government Bill on Green Taxes [(no. 54 (1997-98)] was submitted to Parliament. The bill was a follow-up of proposals from a Green Tax Commission and was submitted to Parliament together with a white paper from the Ministry of Environment on the follow-up of the Kyoto Protocol. Both the bill and the white paper were passed by Parliament on June 17 1998.

and the environment, an increased tax on autodiesel oil and a new sulphur tax on autodiesel oil, a new energy tax on heating oil, increased taxes on lubricating oils and car wrecks and an increased import tax for combined automobiles. The budget also contained amendments to the tax system towards more environmental taxes for beverage packaging, on net tonnage for ships, for pesticides and for annual weight-based tax on heavy automobiles. The proposals were adopted by Parliament.

In the budget for 2001, the taxes on fuels were reduced due to high oil prices. In the 2002 budget, the SO_2 tax on coal and coke and refineries was abolished in favour of voluntary agreements with the processing industry.

Table 6.1: Green taxes in Norway. Year 2002

Tax	Tax-rate NOK	Estimated revenue NOK million	Introduced in year
Environmental taxes		**21 016**	
Autodiesel tax, per litre	2.77/3.10	3 930	1993
Gasoline tax, unleaded, per litre	3.81	8 772	1986
CO_2-tax		7 018	1991
Petroleum sector, per litre/Sm^3	0.73		
Gasoline, per litre	0.73		
Mineral oil, coal and coke[2], per litre/kg	0.49		
Reduced rate mineral oil, per litre	0.28		
Reduced rate gasoline, per litre	0.26		
SO_2-tax		98	1970
Mineral oil, per 0.25 per cent weight share sulphur and litre oil	0.07		
SO_2-tax reduced rate per 0.25 per cent weight share sulphur and litre oil	0.028		
Tax on lubricationg oil, per litre	1.53	97	1989
Tax on waste, per tonne		470	1999
Landfills			
Combustion plants	320		
Basic tax	80		
Additional tax (dependent of energy usage)	240		
Basic tax on non-refillable beverage containers, per unit	0.85	363	1999
Environmental tax on beverage containers made of		188	
Glass and metal, per unit	4.19		
Plastic, per unit	2.52		
Cardboard boxes, per unit	1.05		
Tax on pesticides, per decare	0-225[1]	40	1989
Tax on chemicals harmful to health and the environment, TRI and PER, per kg	52.4	40	2000
Taxes on energy consumption		**7 096**	
Tax on electricity consumption, per kWh	0.093	6 206	1951
Heating oil tax, per litre	0.389	890	2000
Sum environmental and energy related taxes		**28 112**	

Source: Norwegian Ministry of Finance

1) Dependent on the degree of damage caused to health and the environment

2) The pulp and paper and the fishmeal industry pay half the rate

6.3.2 Excise duties on fuel oils, natural gas, coal etc.

A tax on mineral oils - diesel, bunker oils, light and heavy heating oils, etc., was introduced in 1970. This charge has previously consisted of a basic rate per litre and a component differentiated on the basis of sulphur content. In 1993, the basic component of this tax was removed. Today the fuel charges are based exclusively on environmental characteristics (CO_2 and SO_2 taxes). This is also the case for coal, coke and natural gas.

In 1970 the sulphur component was NOK 0.002 per litre for each commenced 0.5 per cent sulphur content by weight. In 1988 the sulphur tax rate was NOK 0.015 per litre, and since then, the sulphur tax has been stipulated as a specific amount per litre for each commenced 0.25 per cent sulphur content by weight. No sulphur tax is paid for mineral oils with sulphur content less than 0.05 per cent.

By the introduction of the green taxes in 1999, the number of sectors exempt from the sulphur tax was reduced. Mineral oils used in the aviation sector, in production on the continental shelf and in the supply fleet in the North Sea are now liable to a sulphur tax of NOK 0.028 per litre mineral oil for each commenced 0.25 per cent sulphur content by weight. Ships engaged in foreign trade as well as fishing and hunting in distant waters are still not liable to a sulphur charge. The refineries and factories which use coal and coke for energy purposes, were exempted from the SO_2-tax as from 2002.

In 1991 a CO_2 charge on mineral oils, natural gas and petroleum combusted during production on the continental shelf was introduced. A CO_2 charge on coal and coke used for energy purposes has been in effect since 1992. The industry in general is not allowed any reduction of the charge, except the pulp and paper industry and the fishmeal industry, which pay only half of the normal CO_2 tax. Certain sectors are exempt from the CO_2 tax. The number of these sectors has been reduced since January 1999. A CO_2 charge of NOK 0.28 per litre is imposed on mineral oil used in the domestic aviation sector, activities at the continental shelf, the supply fleet in the North Sea and ships transporting goods for domestic trade. The sectors still excluded from taxation are ships engaged in foreign trade, the international aviation sector, coastal fishing, fishing and hunting in distant waters, natural gas utilised on the Norwegian mainland and coal and coke used as raw material or reducing agent within the cement and leca industries.

A basic charge was introduced on light fuel oil used for heating purposes in 2000. The reason for this was to discourage an increased use of heating oil when the tax on electricity was raised.

The developments in taxes and tax rates applicable to selected fuels are illustrated in Table 6.2.

Table 6.2: Taxes applicable to selected fuels in Norway. The figures NOK/litre do not include VAT of 24 per cent.

Fuel/applicable duties	Unit	1985	1990	1995	1999	2000	2001	2002
Fuel oils	**NOK/litre**							
Basic excise tax		0.026	0.31	-	-	0.19	0.382	0.389
CO_2-tax		-	-	0.415	0.46	0.47	0.48	0.49
SO_2-tax[1)]		0.007	0.05	0.07	0.07	0.07	0.07	0.07
Total light oil		0.033	0.36	0.485	0.53	0.73	0.932	0.949
Total heavy oil		0.047	0.46	0.625	0.67	0.87	1.072	1.089
Coal/Coke	**NOK/kg**							
CO_2-tax		-	-	0.415	0.445	0.47	0.48	0.49
SO_2-tax		-	-	-	3.00	3.00	3.09	-
Emissions from the Continental Shelf	**NOK/litre Sm^3**							
CO_2-tax[2)]		-	-	0.83	0.89	0.70	0.72	0.73
Electricity	**NOK/kWh**							
Electricity tax		0.029	0.0385	0.052	0.0594	0.0856	0.113	0.093
Production tax		-	-	0.0152	-	-	-	-

1)The sulphur tax is differentiated on the basis of the sulphur content in the fuel oil. The rate is currently NOK 0.07 per litre fuel for each commenced 0.25 per cent sulphurcontent (0.5 per cent in 1985). Fuel oils with less than 0.05 per cent sulphur content are not liable to the sulphur tax.

2) The CO2 tax applies to combustion on the continental shelf, and is constructed in such a way as to provide incentives compatible with an emission tax.

6.3.3 Excise duty on transportation fuels: diesel and gasoline

The gasoline tax was introduced in 1931. In the period 1980-84, the tax was differentiated between low-octane and high-octane gasoline owing to the lower lead content of low-octane gasoline. This differentiation was not, however, based on environmental concerns. Since 1986, the tax has been differentiated between leaded and unleaded gasoline, and in 1995 the tax was divided into three levels related to lead content. In 2002, the basic tax on gasoline is NOK 3.81. Today there is no leaded gasoline for sale in Norway. In 1991, a CO_2 tax was imposed on gasoline. In 2002, this tax is NOK 0.73 per litre.

Today diesel is taxed as a light fuel oil to which is added an auto diesel tax. Until 1 October 1993, diesel-fuelled vehicles were subject to a kilometre charge which was differentiated according to the weight of the vehicle. On 1 October 1993, the kilometre charge was removed and replaced by a diesel tax per litre and an additional annual tax based on the weight of the vehicle. As from 1 January 2002, the auto diesel tax is NOK 3.10 per litre of diesel with a high sulphur content and 2.77 per litre of diesel with a low sulphur content.

As from 1999, buses have also been subject to the auto diesel tax. In addition to auto diesel, a CO_2 tax and a sulphur tax are also levied. In 2002, the CO_2 tax is NOK 0.49 per litre and the sulphur tax is NOK 0.07 per litre. No sulphur tax is paid on oil products with a sulphur content less than 0.05 per cent. Approximately 90 per cent of the diesel oil used in vehicles has a sulphur content of less than 0.05 per cent. Cars that run on electricity and natural gas are not liable for use-dependent taxes. The developments in taxes and tax rates applicable to gasoline and diesel are illustrated in table 6.3.

Table 6.3: Taxes applicable to automotive fuels in Norway. The figures (NOK/litre) do not include VAT of 24 per cent.

Fuel	Applicable taxes	1985	1990	1995	1999	2000	2001	2002
Gasoline								
	Basic exise tax/unleaded	1.75	2.63	3.57	4.25	4.34	3.74	3.81
	CO_2-tax	-	-	0.83	0.92	0.94	0.72	0.73
	Total	1.75	2.63	4.40	5.17	5.28	4.46	4.54
Diesel								
	Basic excise tax NOK/litre	-	-	2.87	3.54	3.54	2.72/3.04[2)]	2.77/3.10
	CO_2-tax	-	-	0.415	0.46	0.47	0.48	0.49
	Total	-	-	3.285	4.00	4.26[1)]	3.20/3.52	3.26/3.59

1) In 2000 an additional charge was introduced for diesel with a sulphur content between 0.005-0.05 %. The tax rate was NOK 0.25 per litre.

2) In 2001 the diesel charge was differentiated according to the sulphur content of the fuel. This replaced the additional sulphur tax introduced the year before.

6.3.4 Excise tax on electricity

A tax on electricity consumption was introduced in 1951. From the beginning of 1993, electricity was subject to both a production and a consumption tax. The production tax was removed from 1 January 1998. Sectors exempt from a tax on electricity include manufacturing industries, mining and all electricity use in the county of Finnmark and the northern part of Troms. The electricity tax has probably contributed to the slow-down in further development of hydropower, and thus to less disruption of the natural environment. The tax in 2002 is NOK 0.093/kWh.

6.3.5 Taxes on motor vehicles

A purchase tax is applicable to new passenger cars and other motor vehicles with a total weight of less than 3.5 tonnes. Electrically powered vehicles are exempt from this charge.

On 1 January 1996, the purchase tax on new cars changed from being based on import value and weight to being based on weight, horsepower and piston displacement.

The structure of the purchase tax provides an incentive for consumers to buy smaller and lighter cars that are more environmentally friendly. The revision of the tax structure has

been combined with a reduction in the average tax level providing an incentive to faster replacement of older cars with new and more fuel-efficient cars with catalytic converters.

From 1 April 2001 the purchase tax was altered from an import tax to become a first time registration tax in the central motor vehicle register.

An annual road-tax is payable for passenger cars (NOK 2310 in 2002).

6.3.6 Charges on aviation

In 1990, a noise-differentiated surcharge on the landing charge was introduced at Fornebu and Bodø airports. In 1998, Fornebu was replaced by Gardermoen. The same surcharge is in effect at Gardermoen, in addition to a separate surcharge on air traffic by night. The intention of this surcharge is to induce the airlines to use their least noisy aircraft on the routes to these airports, which are the noisiest airports in Norway.

6.3.7 Road toll systems

Several cities in Norway have road-toll systems. Motorists must pay a charge when crossing the ring into the city centre. The purpose of the road toll is to finance road construction and is not intended to cause a reduction in road traffic. Parliament has, however, advocated the introduction of time-differentiated charges.

6.4 Economic instruments related to water pollution abatement

6.4.1 User charge on sewage and water

In Norway the local authorities charge their customers for management of sewage. The user charge may not be set higher than the local authorities' costs related to these activities (varying between NOK 500 and NOK 5,000 a year).

6.5 Economic instruments related to agriculture

6.5.1 Fertilizers

An environmental charge on artificial fertilisers was introduced in 1988. The charge was aimed both at generating income for financing environmentally friendly cultivating practices and at reducing the use of artificial fertilisers. This charge did not succeed in reducing fertilising intensity and was removed on January 1 2000 as part of efforts to reduce costs within agriculture. The charge is being replaced by a mandatory environmental plan on every farm (including a mandatory fertiliser plan).

6.5.2 Pesticides

Environmental levies on plant protection products were introduced in Norway in 1988, starting at 2 per cent of the wholesale value and increasing gradually to 15.5 per cent in 1998. The total charge consisted of an inspection charge, which financed the costs of inspection and approval of the preparation, and an environmental charge aimed at providing incentives for reducing the consumption of pesticides. In 1999, the charge was altered from being based on the price of the product to being based on "standard area

doses". The environmental levies were differentiated according to a classification of health and environmental risk characteristics of the product, and the degree of exposure. At the same time, levies were doubled from the 1998 level and further increased in 2000.

6.6 Economic instruments related to waste

6.6.1 User charges on municipal waste

The local authorities charge their customers for waste management. The user charges may not be set higher than the local authorities' costs related to these activities (vary between NOK 700 and NOK 2,500 a year.)

6.6.2 Waste charges

On 1 January 1999, an excise tax on final waste treatment was introduced. This tax covers waste delivered to landfills and incineration plants. In 2002, the tax rate for deliveries to landfills is NOK 320 per tonne. For deliveries to incineration plants, the basic tax rate is NOK 80 per tonne and the additional tax rate is NOK 240 per tonne. The additional tax is reduced by the degree of energy utilisation in the incineration plant.

6.6.3 Hazardous waste charges

On 16 March 1998, the Ministry of Environment promulgated regulations for scrapped electrical and electronic products, and since 1 July 1999, the practical recycling system has been in operation on a national scale. Importers and manufacturers of electrical and electronic products are obliged to organise a system, free of charge, for collection and recycling of EE-waste (re-use, material or energy recovery) from retailers and municipalities within the geographic areas where their products are sold. The collection obligation of the manufacturer/importer applies to the proportionate share of the EE-waste delivered. To cover the costs, the manufacturers and importers add an environmental fee to their invoices down the distribution chain making the consumer pay the fees at the end of the line.

6.6.4 Batteries

The company AS Batteriretur makes arrangements on behalf of battery importers to deal with waste deriving from products introduced onto the market by the industry, i.e. lead and nickel/cadmium batteries.

6.6.5 Charges on lubricant oil

In 1988, Parliament introduced a charge on lubricating oils, prompted by environmental motives. This charge is levied on the product, although its environmental impact is associated with the waste stage rather than the consumption process. From 1 January 1994, the charge is refunded when waste oil is collected and treated in an acceptable way.

Uses for foreign shipping, fishing in distant waters and by the supply fleet are exempt from taxation.

6.6.6 Charges on beverage containers

The system of environmental taxation of beverage containers distinguishes between products that are mostly used at home and other beverages that are more likely to be used outdoors. The system of environmental taxation of beverage containers was changed from 1 January 2000. The new system also distinguishes between different container materials. Containers used for beverages most likely to be used at home, such as milk and juice, are exempted from the environmental tax. Containers used for other beverages pay a tax according to the material they are made of such as glass, aluminium and cardboard. The environmental tax is reduced if the container used is included in a recycling system. The tax is reduced proportionately to the recycled amount of containers. If the recycled amount of a recycling system for a container type exceeds 95 per cent, the container type is fully exempted from tax. Each year the expected recycling rates for the following year are settled for every container type and this determines the tax rate payable for the containers for that year.

In addition to the environmental tax described above, all non-refillable beverage containers are levied a tax of NOK 0.85 (2002). This is a flat tax on non-refillable containers independent of recycling rates. Containers for milk and milk products and beverages made of cocoa and chocolate and concentrates of these are exempted from this tax.

6.8 Deposit refund systems

6.8.1 Deposit on reusable beverage containers

Bottles for beer and soft drinks are subject to deposit charges, which are refunded upon return. One effect of these deposit systems, which are managed by the industries, is that returnable bottles have attained a large market share in Norway.

6.8.2 Deposits on motor vehicles

Norway has well functioning deposit systems in effect for motor vehicles. A deposit is paid upon acquisition of the vehicle and a refund is received when the vehicle is turned in for scrapping. These deposit systems contribute significantly to the high return rates of old vehicles. In 2002 the refund is NOK 1,500.

6.9 Market creations

6.9.1 Voluntary agreements

Voluntary agreements between the authorities and industry to regulate environmental issues have mainly been used in the area of waste management and recycling. According to the Report to the Stortinget no. 44 (1991-92) relating to measures to reduce waste, increase recycling and ensure environmentally sound waste management, a central part of the government's action programme is to give business/industry more responsibility for solving waste problems through voluntary agreements. The purpose of such agreements is to make industry responsible for establishing collection and recycling systems for various waste categories. The agreements can either represent the only instrument for establishing such responsibility, or the agreements can be a supplement to other instruments such as

economic instruments or direct regulation. So far, the agreements have regulated collection and recycling systems for car batteries and car tyres, and six different agreements regulate industry's responsibility for packaging waste. In 1998, agreements to regulate collection and recycling systems for electronic scrap were signed, cfr. Section 6.3.

In 1997, the first voluntary agreement between the authorities and industry to abate greenhouse gas emissions was reached. An agreement was drawn up between the Norwegian Ministry of the Environment and the Federation of Norwegian Process Industries on the reduction of greenhouse gas emissions in the primary aluminium production sector. Emissions per tonne produced aluminium were to be reduced by 50 per cent by 2000 and by 55 per cent by 2005 compared to emissions per tonne in 1990. In 2001, the government also came to a voluntary agreement with the processing industry to reduce SO_2-emissions. The industry is obliged to reduce their emissions by 5 000 tonnes by 2010.

6.9.2 Tradeable permit system

A report from the Commission outlining a system for domestic greenhouse gas emissions trading[48] recommends that the system should be as broad as possible, including all sources and sectors where technically feasible. It is suggested that the system could include close to 90 per cent of total greenhouse gas emissions given the way these were distributed in 1997.

If there is a well functioning international market, the Commission recommended that the government sell those quotas that are to be sold directly on that market. In the absence of such a market the Commission recommended auctions.

The Commission was split regarding whether there should be any grandfathering of quotas (distribution of quotas for free). The majority was of the view that all actors should pay the full market price for the quotas, consistent with the polluter pays principle. A minority advocated grandfathering for the industries presently exempted from CO_2-taxes, and recommended that these industries should get free quotas corresponding to 95 per cent of their 1990 emissions. Another minority argued that deciding who will get free quotas and to what extent these will be issued is mainly a political choice. These members did not propose a recommendation.

If the use of grandfathering is politically approved, the whole Commission recommended that the allocation should be based on historical emissions, for example, that each plant could choose between 1990 and 1998 as the base year. The Commission's mandate said that new activities should not receive free quotas and the Commission takes that statement further to include activities that did not have emissions in the base year. The total amount of free quotas should be proportional to emissions in the base year.

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[48] Following the submission of the Government Bill on Green Taxes [no 54 (1997-98)], the Commission ("Kvoteutvalget") was appointed by Royal Decree on 23 October 1998. The Commission chaired by Adviser Eva Birkeland, Statistics Norway, presented their report, “NOU 2000:1 Et kvotesystem for klimagasser”, to the Minister of Environment on 17 December 1999. An English summary is available at the Ministry of Environment.

The Commission recommended that the quotas should be allocated and traded as certificates that grant the right to emit a certain quantity of CO_2-equivalents. The obligation to surrender certificates to the authorities should be put downstream at the polluter level where feasible, while for some sources it should for practical purposes be placed upstream on the producers or at importer or wholesale levels.

The state authorities will be responsible for the initial sales in the market. The Commission argued that the institutions needed to make an international secondary market work effectively, whereby one or more exchanges and/or brokers would be established without government intervention. If there are no limitations to countries' access to the use of the Kyoto mechanisms, all participants should be allowed to use these directly.

The Commission advocated that the main features of the system should be decided as soon as possible and in particular that the development of reporting and control routines start early. When and how the authorities should start allocating quotas for the first commitment period under the Kyoto Protocol should be closer examined, inter alia in light of what other countries do. Having considered the pros and cons in relation to achieving the Kyoto target for 2008-2012, the Commission does not see the need to establish a broad system for emissions trading for the years before 2008.

The Commission recommended a closer examination of whether it would be useful to establish a separate organisation to administer the assets that the state has been allocated through its assigned amount under the Kyoto Protocol. This administration would be subject to guidelines drawn up by the authorities.

In March 2002 the Government proposed ratification of the Kyoto Protocol. At the same time a proposal on domestic greenhouse gas emission trading from 2005 was presented to the Parliament ("Stortinget") together with a number of other measures for reducing the Norwegian greenhouse gas emissions. The proposed emission trading system is confined to emission sources which are not subject to the CO_2 tax, including energy intensive and emission intensive industry. Thus it will stimulate further cost-effective actions in Norway. The emission quotas will be issued free of charge in the time period 2005-2007. From 2008 the plan is to link the emissions trading system to the Kyoto protocol and expand it to include all sectors where this is possible in practice.

6.9.3 Systems of green certificates for electricity based on renewable energy sources

In August 2001, the Ministry of Petroleum and Energy initiated a study on a system for green certificates similar to those being developed in EU-countries, adjusted to Norwegian and Nordic conditions. The study consists of the following three projects:

- The use of measures in other countries, particularly the establishment of green certificate systems, to promote renewable resources.
- A system of green certificates as an effective measure to promote renewable energy resources.
- The possibility of establishing a green certificate system for "renewable" heat in Norway.

The study will form the basis for a proposal from the Norwegian Government to Parliament

in response to Parliament's recommendation on the issue of green certificates. The Ministry of Petroleum and Energy will present such a proposal in 2002.

6.9.5 Joint Implementation

Since the beginning of the 1990s and up to 2000, Norway has worked to identify possible Joint Implementation projects under the pilot phase of the Climate Change Convention both through multilateral co-operation with the World Bank and on a bilateral level. The aim was to achieve a geographical mix with regard to parties and projects. Norway made agreements with and implemented projects in Mexico, Poland, Costa Rica, Burkina Faso, the Slovak Republic, India and the People's Republic of China. In addition, Norway developed a co-operation on capacity building on climate change with South Africa, which can provide the foundation for future co-operation under the Clean Development Mechanism.

Kommentar: People's Republic of what? China, Korea? I am unaware of any country calling itself merely the People's Republic!

The projects include reforestation, energy efficiency and fuel switch measures and the building of CHP plants to replace industrial coal–based, low-efficient boilers.

6.10 Environmental subsidies and tax concessions

6.10.1 Development of cleaner technologies, promotion of renewable energy and energy efficiency

6.10.1.1 Subsidies

In 2001, the government granted approximately NOK 350 million for the promotion of production and consumption of renewable energy and to increase energy efficiency. In the period from 1997 to 2001, more than NOK 1 billion was allocated for this purpose.

Subsidies are granted for investments in waste plants, windmills, bioenergy plants, solar energy, heating pumps and in certain other renewable energy sources. As from January 1999, energy produced by windmills has been subsidised by an amount equivalent to half the electricity tax. In 2002 the level of aid is equivalent to 0.0465 NOK/kWh.

In the period 1997-2001, substantial government funds were spent on information on energy efficiency. These measures have mainly been directed towards the industrial sector and the building industry. In 2001, approximately NOK 18 million was spent on information on energy efficiency.

6.10.1.2 Tax exemptions

There are exemptions from the investment tax for environmental investments in waste plants, windmills, bioenergy plants, heating pumps, solar energy and in certain other renewable energy sources. The investment tax will be abolished from 1. October 2002.

6.10.1.3 Research and development

Most government research grants for developing cleaner technology are channelled through the Norwegian Research Council. KLIMATEK, the research council's 5-year programme for climate technology, was initiated in 1997. The total budget for the programme is NOK 615 million, of which government grants constitute approximately NOK 175 million. A

substantial amount of the funds available for the programme are directed towards research on CO_2 capture in connection with power generation from natural gas and on research into CO_2 storage.

6.10.2 Environmental investments in agriculture

6.10.2.1 Grants with the aim of reducing erosion and area drainage

Support is given to farmers who reduce the level of soil cultivation in the autumn when erosion in many areas is relatively high, and to the planting of vegetation that reduces erosion and improves drainage. In 2001, NOK 153 million was granted for this purpose. A total of approximately NOK 540 million has been granted in the period from 1998 to 2001 for the purpose of reducing erosion and drainage. In addition, support for environmentally motivated investments in agriculture is provided by a fund for agricultural development. The aim of the support is to increase investments to reduce soil erosion, area drainage and pollution from point sources. In the period from 1997 to 2000, approximately NOK 130 million from the agricultural development fund was granted for this purpose.

6.10.2.2 Grants for landscape conservation and organic farming

From 1997 to 2000, approximately NOK 360 million from the fund for agricultural development was granted for conservation of the agricultural landscape and for conservation of historical farm buildings.

In 2001, NOK 75 million was granted for the support of organic farming. In the period 1998-2001, approximately NOK 240 million was provided in support of organic farming.

6.11 State revenue of different economic instruments and the share of GDP

Table 6.4: State revenue of different economic instruments and the share of GDP. Year 2000.

Economic instrument	State revenue million NOK	Share of GDP (per cent)
CO_2 tax	6 567	0.46
SO_2 tax	117	0.008
Gasoline tax	9 762	0.69
Autodiesel tax	4 803	0.34
Basic excise tax on fuel oils	489	0.034
Electricity tax	4 205	0.30
Tax on lubricating oil	88[1)]	0.006
Pesticides	53	0.004
Waste tax	484	0.034

1) This is gross income. From 1994 the tax has been refunded when waste oil is collected and treated in an acceptable way.

7. Sweden

7.1 Introduction

The use of economic instruments such as taxes and charges has been part of Swedish environmental policy since the 1970s. However, by the end of the 1980s, the Swedish parliament decided to increase the use of economic instruments to implement environmental policy. Most of the environmental taxes and charges have served their purpose and led to reduced impact on natural resources.

Taxation of energy began as early as the 1920s and even today most environmental taxes are related to the production and use of energy. However, taxes are used in other fields as well, e.g. fertilizer tax, pesticide tax, landfill tax and tax on gravel. The main purpose of energy taxation has been to raise public revenue but since the late 1980s environmental concerns have become increasingly important. The taxes and charges serve to stimulate both increased energy efficiency as well as substitution to environmentally less harmful energy sources. Over time, energy taxes have been changed in order to better serve as environmental economic instruments, e.g. through environmental differentiation, and taxes based directly on harmful substances, such as sulphur, or emissions with unwanted environmental impact, such as carbon dioxide. Moreover, a sequence of green budget reforms, with increased taxes on energy and reduced taxes on labour, contributes to an increase in the overall efficiency of the tax system.

A variety of environmental taxes are used today to internalise external effects and finance environmental protection. Such charges are used for the protection of natural resources in the field of agriculture, forestry, hunting, environmental protection, chemicals, waste, and nuclear radiation. Moreover, the use of the new market-based economic instruments such as emissions trading and other flexible mechanisms as well as green certificates are being investigated.

7.2 General sales charges – VAT on energy

Since 1990, value added tax (VAT) has been levied on all kinds of energy consumption with the exception of fuels used for aviation. The tax rate is 25 per cent.

7.3 Economic instruments related to air pollution abatement

7.3.1 Introduction

The first taxes on gasoline were introduced in 1924. Further energy taxes on electricity, coal and fuel oil were introduced in the 1950s. The taxes were low and stable until the first oil crisis in the early 1970s. Previously the purpose of energy taxation had been to raise public revenue. However, the oil crisis increased awareness of the need to economise on the use of fossil fuels and also that taxes could be used as economic instruments to influence behaviour in this respect. Thus energy taxes were increased while at the same time particular reductions for energy-intensive industries were introduced in order to maintain competitiveness.

In the 1980s, increased awareness about environmental concerns led to further changes in energy taxes, e.g. environmental differentiation of fuel taxation for leaded and unleaded gasoline. Vehicle tax and environmental tax on domestic air traffic were introduced in 1989. In 1991, an extensive reform of the Swedish tax system was carried out which also involved a green budget reform of some Euro 1.8 billion. Energy taxes were increased whereas income tax and tax on capital were reduced. This reform also included the introduction of a carbon dioxide tax, sulphur tax, differentiation of taxation of fuels used as propellants or for heating purposes as well as VAT charge on energy products.

Swedish membership in the European Union necessitated changes in the substance of the Swedish energy taxation and as of 1 January 1995, a new Act on Excise Duties on Energy came into force in Sweden replacing all former acts on excise duties in the energy taxation field. With the new Act, Sweden implemented the general regulations and tax regulations regarding fuels covered in the relevant EC directives.

In the year 2000, the Swedish parliament decided to carry out another green tax reform involving some Euro 3 billion over a ten-year period. In the year 2001, this involved Euro 330 million of increased energy taxes and reduced taxes on labour. Moreover, a landfill tax was introduced. In the budget bill for 2002, another shift of some Euro 200 million was proposed. This green budget reform also involves further increased carbon dioxide taxes and relatively lower energy taxes.

Basic energy tax, CO_2-tax and sulphur tax

The energy tax is not based on the energy content of the fuels. The tax varies depending on whether the fuel is used for heating or as a propellant, whether it is used in households or in industry and whether it is consumed in the north or the south of Sweden.
The carbon dioxide tax is strictly based on the carbon content of the fuel and amounts to SEK 0.63 per kilo carbon dioxide from 2002.

The sulphur tax is levied only if the sulphur content exceeds 0.05 weight per cent, which means that the tax is paid for heavy fuel oil, coal and peat. Liquid fuels are charged at SEK 27 per kilo for each tenth of a per cent by weight of the sulphur content. The tax is SEK 30 per kilo for solid fuels. Parts of the sulphur tax are refunded to industry, as sources which reduce emissions are rewarded SEK 30 per kilo of sulphur extracted and preserved.

7.3.2 Excise duties on fuel oils, natural gas, coal, etc

In general energy tax, carbon dioxide tax and sulphur tax are levied on gasoline, fuel oil, kerosene, coal, petroleum coke, LPG, natural gas and methane. Sulphur tax is levied on heavy fuel oil, coal and peat.

Crude tall oil is subject to energy tax equal to the amount of the sum of energy tax and carbon dioxide tax levied on light fuel oil.

Table 7.1: Taxes on fuel oils, coal, coke, natural gas and LPG, 2002

Fuels light fuel oil	Unit	Energy tax	CO_2-tax	Total
- other use than as a propellant	SEKm^3	707	1798	2505
LPG				
- propellant	SEK/tonne	0	1298	1298
-other use	SEK/tonne	138	1890	2028
Natural gas and methane				
- propellant	SEK/1000 m^3	0	1067	1067
- other use	SEK/1000 m^3	229	1346	1575
Coal and coke	SEK/ton	301	1564	1865

7.3.3 Excise tax on transportation fuels: diesel, gasoline and alternative fuels

Energy tax and carbon dioxide tax is levied on propellants such as gasoline and diesel. The tax on diesel is higher when the fuel is used as a propellant than the tax on fuel oil used for heating. However, the tax for diesel is lower than for gasoline but, on the other hand, vehicle tax for diesel cars is higher than for gasoline cars. Natural gas and LPG are exempt from energy tax when they are used as a propellant (see table above).

Furthermore, a new tax strategy for alternative fuels will come into effect in 2003. This implies that alternative fuels should not be subject to carbon dioxide tax if their net contribution to greenhouse gas emissions is limited. Moreover, the government will continue granting exemptions from both energy and carbon dioxide tax for alternative fuels produced within the framework of development projects.

Table7.2: Taxes on gasoline and diesel oil, 2002

Energy form	Unit	Energy tax	CO_2-tax	Total
Gasoline				
- Environmental class 1	SEK/litre	3,16	1,46	4,62
- Environmental class 2	SEK/litre	3,19	1,46	4,65
- other	SEK/litre	3,84	1,46	5,3
Diesel oil)				
- Diesel environmental class 1	SEK/m^3	1323	1798	3121
- Diesel environmental class 2	SEK/m^3	1557	1798	3355
- Diesel environmental class 3	SEK/m^3	1865	1798	3663

7.3.4 Excise tax on electricity

In general, all fuels used for electricity production are exempt from fuel taxation. However, there is a production tax for nuclear power. The consumption of electricity is subject to energy tax instead. The tax is lower for residents in the north of Sweden than for residents in the rest of the country. The general energy tax for households amounts to Euro 0.0198 per kWh.

Table 7.3: Electricity taxes, SEK/kWh, 2002

Electricity SEK/kWh	Northern Sweden	Southern Sweden
-electricity, gas, heat, water- supplies	0.174	0.174
- other	0.140	0.198

7.3.5 Exemptions, reductions and refund schemes

Biofuels are not subject to any of the taxes mentioned above. Industry, agriculture, forestry and fisheries are exempt from energy tax and pay 30 per cent of the carbon dioxide tax. Energy-intensive industry is entitled to a tax reduction if the carbon dioxide tax paid by the company exceeds 0.8 per cent of the value of sales. The reduction is such that only 24 per cent of the excess tax burden is paid. The number of firms within industry entitled to a reduction of the CO_2 tax is around 50. If the carbon dioxide taxes paid amount to over 1.2 per cent of the sales value, no tax is paid for the excess amount. This applies only to a handful of industries. Moreover, fuels used for electricity production are exempt from taxation.

Tables 7.4: Duties applicable to propellants, SEK/litre, for the years 1985 - 2001.

Fuel	**Applicable duties**	**1985**	**1990**	**1995**	**1999**	**2000**	**2001**	**2002**
Gasoline (unleaded), Environmental class 1	Energy tax, carbon dioxide tax				4.43	4.47	4.5	4.62
Gasoline (unleaded), environmental class 2	Energy tax, carbon dioxide tax			4.01	4.5	4.50	4.53	4.65
Gasoline (unleaded), Environmental class 3			2.98	4.07				
Gasoline, other	Energy tax, carbon dioxide tax	2.33	3.22	4.60	5.08	5.13	5.16	5.30
Diesel, environmental class 1	Energy tax, carbon dioxide tax			2.42	2.65	2.92	3.04	3.12
Diesel, environmental class 2	Energy tax, carbon dioxide tax			2.63	2.87	3.15	3.27	3.36
Diesel, environmental class 3 or other	Energy tax, carbon dioxide tax	0.53	1.08	2.89	3.17	3.45	3.57	3.66
Natural gas (SEK/m^3)	Energy tax, carbon dioxide tax	0.31	0.35	2.22	2.45	1.03	1.04	1.07
LPG	LPG tax, carbon dioxide tax	0.92	0.92	1.41	1.55	1.26	1.26	1.30
Alcohols[1)]		0.80	0.80					

1) Since 1995, alcohols are taxed as similar propellants based on fossil fuels in accordance with the Mineral oil directive. However, reductions and exemptions granted by the government for pilot projects, in particular in relation to fuels from renewable resources, e.g. pure ethyl alcohol (ethanol) and in some cases rapeseed methyl ester (RME).

Table 7.5: Duties applicable for selected fuels and electricity (excl. VAT), 1985-2002 nominal values.

Fuel/duties	Unit	1985	1990	1995	1999	2000	2001	2002
Consumer								
Light fuel oil/kerosene Energy tax, carbon dioxide tax	SEK/m3	529	1078	1559	1785	1801	2215	2505
Heavy fuel oil Energy tax, carbon dioxide tax, sulphur tax (0.4% sulphur)	SEK/m3	529	1078	1667	1893	1909	2323	2613
Coal/petroleum coke Energy tax, carbon dioxide tax, sulphur tax (0.5% sulphur)	SEK/tonne	150	460	1249	1375	1386	1772	2015
LPG Energy tax, carbon dioxide tax	SEK/tonne	70	210	1136	1246	1257	1740	2028
Natural gas/methane Energy tax, carbon dioxide tax	SEK/1000m3	308	350	912	1024	1033	1367	1575
Crude tall oil Energy tax	SEK/1000m3	-	-	-	-	1801	2215	2505
Peat Sulphur tax (0.24% sulphur)	SEK/tonne	-	-	40	40	40	40	40
Electricity	SEK/kWh	0.072	0.0721)	0.09	0.151	0.162	0.181	0.198
Electricity, northern Sweden	SEK/kWh	0.062	0.0221)	0.037	0.095	0.106	0.125	0.14
Electricity, gas heat or water supply	SEK/kWh	0.072	0.0721)	0.068	0.128	0.139	0.158	0.174
Electricity, gas heat or water supply, northern Sweden	SEK/kWh	0.062	0.0221)	0.037	0.095	0.106	0.125	0.14
Electric boilers, > 2 MW, 1/11-31/3	SEK/kWh	-	-	-	0.151	0.162	0.181	0.198
Electric boilers, > 2 MW, 1/11-31/3, northern Sweden	SEK/kWh	-	-	-	0.118	0.129	0.148	0.164

Table 7.6: Duties on selected fuels and electricity applied to industry, agriculture, forestry and fisheries (excl. VAT), 1985-2002 nominal values.

Industry, agriculture, forestry and fisheries2)								
Fuel/duties	Unit	1985	1990	1995	1999	2000	2001	2002
Light fuel oil, kerosene Energy tax, carbon dioxide tax	SEK/m3	529	1078	803	525	529	534	539
Heavy fuel oil Energy tax, carbon dioxide tax, sulphur tax (0.4% sulphur)	SEK/m3	529	1078	9113)	633	637	642	647
Coal Energy tax, carbon dioxide tax, sulphur tax (0.5% sulphur)	SEK/tonne	150	460	3643)	606	610	615	619
LPG Energy tax, carbon dioxide tax	SEK/tonne	70	2101)	256	551	556	562	567
Natural gas/methane Energy tax, carbon dioxide tax	SEK/1000 m3	308	350	181	393	396	400	404
Crude tall oil Energy tax	SEK/m3	-	-	-	525	529	534	539
Peat Sulphur tax (0.24% sulphur)	SEK/tonne	-	-	40	40	40	40	40

1) Starting 1 March

2) Since 1993 differentiated tax for industry and households with no energy tax (E) and a reduced carbon dioxide tax (k). 1995 E=0, k=0.25, 1999-2000 E=0, k=0.5, 2001 E=0, k=0.35, 2002 E=0, k=0.30. Since 1 July 2001 these regulations apply to agriculture, forestry and fisheries as well. 3) The sulphur tax was introduced in 1991, however certain processes and sodium boilers are exempt from sulphur taxation.

7.3.6 Charges on motor vehicles

An annual vehicle tax is levied on most motor-driven vehicles and trailers according to the type of vehicle, weight, fuel and number of axles. Passenger cars, buses and lorries are classified according to environmental performance. Vehicles with a maximum weight of 3,5 tonnes which belong to the top class in terms of environmental performance, for example electric vehicles, are exempted from vehicle tax for the first five years.

Road charges for heavy vehicles with a maximum weight over 12 tonnes were introduced in 1998. The purpose of this charge is to finance repairs to the Swedish road network needed as a result of wear and tear. The charges are based on the emission standards of gaseous pollutants from diesel engines as set out in the EU directive 88/77/EEG.

7.3.7 Nitrogen oxide charge

In order to reduce acidification, a nitrogen charge was introduced in Sweden in 1992. It is payable irrespective of the fuel used and is levied at a rate of 40 SEK/kg NO_x. The charge applies to combustion and incineration plants for energy generation of at least 25 GWh per annum. The charge is refunded in proportion to energy generation and in inverse proportion

to emissions of NO_x. Thus, only plants with the highest emissions of NO_x per energy generated are net payers.

The scope of the NO_x-charge has been broadened during the 1990s. At the start in 1992, it applied to plants with an energy generation of at least 50 GWh, in 1996 the limit was lowered to 40 GWh and in 1997 to the present level of 25 GWh. Between 1992-1999, NO_x emissions have decreased from 402,000 tonnes to 263,000 tonnes. However, the main source of NO_x deposition in Sweden originates from other countries and only 17 per cent originates from plants in Sweden. In accordance with the principle agreement made in 1996 between the Swedish Maritime Administration, the Swedish Shipowners' Association and the Swedish Ports' and Stevedores' Association, maritime fairways and port dues are differentiated according to the ship-generated emissions of nitrogen oxides and sulphur.

7.3.8 Landing charges

As for aviation, a tax on nitrogen oxide (NO_x) emissions was introduced in 1989. The charge was applied to Swedish registered aircraft on domestic commercial flights and was intended to act as an incentive for airlines to minimise engine emissions. In 1991, a carbon dioxide (CO_2) tax was added to the original NO_x tax. Since then, the environmental taxes have been replaced by a surcharge system whereby landing charges are differentiated according to environmental classification, such as the emissions of hydrocarbons (HC) and nitrogen oxide (NO_x)

7.4 Economic instruments related to water pollution

In order to cover the costs of sewage management and fresh water supply, local authorities are allowed to charge industry and households for these services. The charges are set by the local authorities and often consist of a fixed rate in combination with one that varies with fresh water consumption.

7.4.1 Oil discharge sanction

Oil discharges are subject to economic sanctions if the discharges are classified as "significant". The sanctions are determined by the Swedish Coast Guard and are based on the gross tonnage and the size of the discharge.

7.5 Economic instruments related to agriculture

7.5.1 Fertilizers

Leakage from nitrogen and phosphorus mainly from agriculture contributes to the eutrophication of Sweden's inland watercourses, the Baltic Sea and the North Sea. As part of a strategy for reducing leakage, environmental charges on fertilizers were introduced in 1984. The current tax rates correspond to SEK 1.80 per kilo of nitrogen if the fertilizer contains more than 2 per cent nitrogen and SEK 30 per gram cadmium if the cadmium content in the fertilizer exceeds 5 gram per tonne phosphorus.

7.5.2 Pesticides

Charges on pesticides were introduced in 1984. The current tax rate on pesticides is SEK 20 per kilo of active substance.

7.6 Economic instruments related to waste

7.6.1 User charges

Local authorities are allowed to charge industry and households for waste management services. The charges are set by the local authorities and should cover the costs of refuse collection, transport, recycling and waste deposit.

7.6.2 Waste charges

In 2000 a tax on waste deposits was introduced. The purpose of the tax is to promote sustainable waste management. The tax rate amounts to SEK 288 per tonne.

7.6.3 Hazardous waste charge

Hazardous waste, for which there are as yet no other alternatives than to deposit it, is not subject to waste deposit charges. Radioactive waste is, however, charged in order to finance the costs of radioactive waste storage.

7.6.4 Battery charge

The first provisions relating to charges on batteries were introduced in 1987. Simultaneously, it was decided that used hazardous batteries containing lead, mercury or cadmium should be collected separately. The battery charge is intended to cover the costs of final disposal or recovery of used batteries and the information required to inform consumers about the need to collect batteries separately and how to dispose of used batteries. In the past few years, a large proportion of alkaline batteries have been replaced by batteries with no mercury or a very low mercury content. The battery charge has most likely only had a modest influence on this technological development. On the other hand, compulsory marking, combined with the threat of the introduction of a deposit system has probably had some effect.

As of 1 January 1998, all batteries are to be collected separately. This is due to the difficulties many people have in distinguishing batteries which are dangerous to the environment or health from those that are not. The local authorities are responsible for battery collection and also for sorting and transporting hazardous batteries. The collecting system is financed by an environmental charge on hazardous batteries.

7.7 Economic instruments on the use of natural resources

7.7.1 Charges on the use of raw material

In order to encourage conservation of gravel resources and stimulate the use of substitutes, a tax on natural gravel was introduced in 1996. The tax rate amounts to SEK 5 per tonne gravel. Natural gravel is defined as naturally sorted earth materials which consist mainly of

sand, gravel, cobble and boulder size fractions. The tax will act as an incentive to use alternative materials, especially crushed rock.

7.8 Deposit refund systems

7.8.1 Deposits on reusable beverage containers

Deposit-refund systems for aluminium cans were introduced in 1982 and for PET-bottles in 1991. The deposit-refund system for glass bottles is a voluntary system, whereas deposits for aluminium cans and PET-bottles are mandatory. In order to safeguard the competitiveness of domestically produced beverage containers, imported containers are levied with a charge equal to the deposit-refund of those produced domestically. The deposit-refund is included in the consumer price and the refund rates are generally SEK 0.5 per aluminium can, SEK 0.6 per glass bottle (size 33 cl) and SEK 4 per PET-bottle. The refund rates vary, however, with respect to material and size. The return percentage is generally high at around 90 per cent.

7.8.2 Deposits on motor vehicles

The deposit system for motor vehicles was introduced in 1975 under the Vehicle Scrapping Act. The vehicle disposal charge is payable by anyone registering a new car. Revenues accrue to the vehicle-scrapping fund which disburses a premium to the car owner when the car is handed over for scrapping. The scrapping premium applies to passenger cars, buses and lorries with a maximum weight of 3.5 tonnes. The premium amounts to SEK 700 per car if the vehicle is no older than 7 years, SEK 1,200 if the car is between 7 and 16 years and SEK 1,700 if the car is older than 16 years.

7.9 Market creation

7.9.1 Voluntary agreements

The Swedish government has looked into the use of voluntary agreements with the energy-intensive industry in order to achieve cost-effective reductions of greenhouse gas emissions. A first report was presented in October 2001, which contains a comprehensive proposal for long-term agreements. However, further work is required to set up actual objectives and targets. This work will continue during 2002.

7.9.2 Tradeable permit systems

A national committee has investigated the possibility of using flexible mechanisms including tradeable permits to reduce emissions of greenhouse gases. Early in 2002 another committee began working to investigate how to set up a system of flexible mechanisms in Sweden.

The Swedish government has presented a bill on a Swedish strategy to reduce emissions of greenhouse gases. The set target concerns the reduction of greenhouse gas emissions

without accounting for sinks and flexible mechanisms. However, the government also proposes that accounting for flexible mechanisms may be considered at the checkpoint in 2004 when progress made will be evaluated.

7.9.3 Systems of green certificates for electricity based on renewable energy sources

A national committee has investigated a Swedish system of tradeable green certificates to increase the production of electricity from renewable sources by 10 TWh. At present the production of electricity from renewable energy sources is provided with a variety of different investment grants and other support measures. In the energy bill presented in March 2002, the government proposes that this system be replaced by a system of green certificates beginning in 2003. Between 2003-2010, the consumption of a certain percentage of electricity from defined renewable sources will be compulsory for all consumers of electricity. Producers of electricity using renewable energy sources will be allowed to market the electricity produced as well as green certificates. The green certificate constitutes a warranty that a certified plant has produced a certain amount of green electricity. Since the consumption of electricity from renewable sources is compulsory and non-compliance will result in a penalty, the green certificate is expected to have a market value. The market value of the green certificate is meant to cover the additional production costs accruing to an electricity generator using renewable sources rather than conventional sources.

7.9.5 Joint implementation

Sweden has actively participated in the pilot phase of Activities Implemented Jointly (AIJ) within the United Nation's Framework on Climate Change. Around 70 AIJ projects have been implemented in countries in the Baltic Sea region and eastern Europe. The projects can be divided into three categories: conversion from fossil fuels to biofuels in the heating sector, investments in heating distribution systems and energy efficiency in buildings. The projects are expected to reduce carbon dioxide emissions in those countries by 4 million tonnes at a cost of SEK 67 per reduced tonne.

7.10 Environmental subsidies and tax concessions

7.10.1 Promotion of renewable energy and energy efficiency

Renewable energy and energy efficiency is promoted by a range of policies and measures. Investments for electricity generation from renewable energy sources is granted investment aid amounting to 15 per cent of cost for small-scale hydropower plants and wind-power plants, and 25 per cent for power plants using biofuel. Furthermore, aid is available for small-scale electricity production, lower than 1,500 kW, amounting to 0.09 SEK/kWh. Electricity from wind power is given additional aid through exemption from energy tax of 0.181 SEK/kWh. By 2003 this system is to be replaced by a system of green certificates. Grants are also provided for pilot and demonstration installations for testing new technology. The development of energy efficient products, such as refrigerators and washing machines, is promoted by technology procurement competitions.

Table 7.7: Total budget expenditure in 2002 on renewable energy, energy efficiency and energy-related research and development (SEK million)

	Budget expenditures (million SEK)
Total budget expenditures[1)]	**2132**
Of which	
Policies and measures to reduce electricity demand	251
Grants for promoting electricity generation from renewable energy sources	168
Policies and measures to promote energy efficiency	115
Research on energy technology	466
Policies and measures to promote and implement new energy technology	360
International co-operation on climate change	50
Grants for small-scale electricity generation	210
Compensation for costs related to the phase-out of a nuclear reactor at Barsebäck	384

1) Administration expenditure, which amounts to SEK 128 million, is included in this figure.

7.10.2 Environmental investments in agriculture

Sustainable development within the agricultural sector is promoted through different measures, such as legislation, information, counselling, education and training. Major efforts have been made to reduce leaching of ammonia, phosphorus and nitrogen in farming. Similar measures have also succeeded in reducing the consumption of chemical pesticides over the last ten years by 50 per cent. Funding is available, for instance to promote less intensive production methods and for preservation of biodiversity in the agricultural landscape.

Table 7.8: EU grants for environmental investments and management in the agricultural sector in 1999, SEK million, (Total figures where Sweden pays 50 per cent and EU 50 per cent).

Grants considering:	**Grants (SEK million)**
Maintenance of landscapes	612
Organic farming	351
Long-term pasture	439
Biological diversity and traditional landscape	518
Environmentally vulnerable areas	23
Traditional farming	94
Pasture restoration	3
Cultivation of black beans on Öland	2
House pet breeds under threat of extermination	3
Total grants	**2045**

7.11 State revenue of different economic instruments and the share of GDP.

Table 7.9: Expected budget revenues from energy and environmental related taxes in 2002 and as percentage of GDP.

	Budget revenues (SEK million)	**As % of GDP**
Energy and carbon dioxide tax	57 458	2.65
Special tax on electricity generation from nuclear power	1 863	0.09
Tax on waste deposits	995	0.05
Tax on fertilizers and pesticides	420	0.02
Vehicle tax	7 128	0.33
Road charges for heavy vehicles	654	0.03

8. Evaluations of market-based instruments

8.1 Introduction

Market-based instruments for the pursuit of environmental policies have been applied in the Nordic countries for more than 10 years. Over this period, considerable experience has been accumulated and statistical material has been gathered for the evaluation of such policies.

The evaluation of individual instruments is difficult since several instruments are often applied in the pursuit of the same objective. The efficacy of each instrument is therefore complicated and difficult to isolate. The taxes and charges are most often just part of a larger system, where the different parts affect one another. To cite one example: the carbon dioxide tax is but one tax that confronts households and polluting companies besides energy taxes, other taxes and different regulations in the environmental arena. The economy also develops over time, which entails changes in production processes and consumer behaviour.

The main aim of an evaluation is naturally to isolate the effect of the instrument on pollution activities. The costs of implementation, monitoring etc., are other areas for study. A comprehensive evaluation may also comprise a broader spectrum of the implications of environmental instruments, such as income distribution, competition aspects and technological development.

This chapter will review evaluations on carbon dioxide taxes performed in the Nordic countries. About 70 studies have been summarised in a report by the Nordic Council of Ministers[49] together with evaluations on pesticide charges. The authors have collected and described both ex-ante evaluations, which are carried out in advance of implementation of the taxes, and ex-post evaluations, which are based on actual historical data for adjustment of the taxes. This chapter will concentrate on ex-post studies, because we are mainly interested in the real outcome of the implemented instruments. The latter part of the chapter concerns other market-based instruments used in Finland and Sweden.

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[49] Mikael Skou Andersen, Niels Dengsøe Anders Branth Pedersen: An Evaluation of the Impact of Green Taxes in the Nordic Countries; Nordic Council of Ministers, Copenhagen 2001

The material on carbon dioxide tax evaluations in the following chapter is mainly gathered from this report. This is also the case for the material on different methods for evaluation of environmental policies.

8.2 Methods for evaluation of environmental charges

The method to be chosen when conducting an evaluation depends on the potential reactions the study aims to reveal and what basic data is available on taxes and the sector to be analysed.

The evaluations studied of carbon dioxide taxes show a considerable variation in the kind of models that have been used. There are, for example, interviewed-based studies with restricted statistical value of generalisation, and economic models with relatively exact values of the effects of the charges. The majority of evaluations are conducted through interviews.

The most satisfactory results are attained when a combination of quantitative and qualitative data is used.

8.2.1 Economic models

Most evaluations made in the Nordic countries are so-called *ex-ante evaluations*. The strength of these models lies in the possibility of estimating the effects of the green charges in advance of introduction where the results can point out the direction and the magnitude of effects that can be expected.

Economic models can be useful when the choice of instruments in, for example, greenhouse gas policies are to be made. For this matter, three groups of models, with a large variety of models within each, may be considered[50]. Macro forecasting models may be used for analysing short-term consequences of certain policy options based on historical patterns of economic responses to similar stimuli. Computable general equilibrium models can deal in a theoretical way with substitution and other responses created by increases in the shadow price of carbon emission, above all patterns of investment and disinvestments over time. The third group, energy-economic models, have the capacity to address the implications of both price and command-and-control policies on energy supply, transformation, and end-use at a more detailed sectoral and sub-sectoral level.

When choosing among the huge range of economic models that can be used to address the broad issue of the economic impact of greenhouse gas policies, no one type of model can adequately deal with all the important issues. Instead, a portfolio approach may be employed in which the results of different models are considered. In this work, energy-economy models with a reasonably detailed representation of the economy would be useful since the economic impact of greenhouse gas limitation policies will result from the impact on energy supply and demand. To identify the potential long-term economic impact of policies at a general level, more detailed computable general equilibrium models may be considered.

A drawback of ex-ante studies is that the results can fluctuate depending on the assumptions made of the development of the future economy. It is important to understand why the model comes to specific results and that the model can motivate the assumptions made. An example of a fluctuating outcome from the Nordic evaluations on CO_2 taxes is illustrated in two Danish evaluations, which achieved very different results when

[50] Expert meeting on the choice of modelling platform for carbon policy analysis, Raymond J Kopp and Michael A Toman, Resources of the Future, Report to the Office of Policy Planning and Evaluation, United States Environmental Protection Agency, Joel Scheraga Project Officer, April 1997

estimating carbon dioxide reduction. With the applied charges of 1999, one evaluation resulted in a 1.5 per cent reduction of carbon dioxide in the period 1988-2005 as an effect of the greenhouse gas policy, while the other study found a 15-16 per cent reduction during the same period, even though the same models were used. The different results can be assigned to the differences in assumptions in the trend of industry's energy savings and the development of the components of demand. In another example, the results of three Finnish ex-ante evaluations, showed that either FIM 230, 500 or 800 would be the necessary charges to make Finland live up to the demand for a stabilisation of the carbon dioxide emissions in the period 1990-2010.

Using *economic models* in *ex-post analysis* should be performed with discretion because of the assumptions, simplifications and restrictions that characterise the models. They demand sophisticated models for all relevant sectors, as well as calibration with historical data so as to make sure that the models produce valid results.

Ex-post evaluations drawn from economic models could most suitably be executed where an extensive base of data is at hand, which on the disaggregated level puts together economic or physical/environmental quantities. This will in practice easily restrict the use of models to the energy field, and to a certain degree also the agricultural area. Models might be the only way to evaluate the economic consequences but the evaluation of the environmental effects of a charge should be performed with discretion.

There are some alternative methods for ex-post evaluations which are more frequently used in the studies performed on carbon dioxide taxes, and these are described below.

8.2.2 Alternatives to economic models

8.2.2.1 Interview-based models

The predominant part of the ex-post evaluations on carbon dioxide taxes is based on interviews. A smaller number of firms have been chosen and their responses to a charge is obtained through in-depth interviews. An advantage of this kind of method is that it provides relatively precise information on how the individual firms have reacted to the tax situation. The information can be both qualitative, for example, by valuation of the administration, interaction with authorities etc, or quantitative, (data for development in production and environmental impact, key financial data, etc.). A disadvantage of the interview method is that it is hard to statistically generalise on the basis of the results because it is often difficult to make a representative choice of firms to include in the evaluation.

The interview method is difficult to use when there is a demand for a description of the extent of emission reductions due to a charge. In addition, it can only describe socio-economic and market adjustment effects in general terms.

8.2.2.2 Survey analysis and panel data with statistical tests

A more formalised version of the interview-based method can also be used - a survey, with collection of quantitative data from a set of respondents in a closely monitored random sample. Just like economic models, the survey requires extensive data material on a disaggregate level, but unlike the economic models, the survey often uses original data from the sources instead of statistical material. This can be a disadvantage because it is

hard to find proper data; relevant information for the survey is not always close at hand in the firms.

As a continuation of the survey, statistical tests, primarily regression analyses, can be used to view the effects of a charge.

8.2.2.3 Comparative methods

Comparative analysis is based on time series studies and is less demanding on data than the earlier methods. It produces simple time series for the development of the dependant variable – the emissions – and a number of independent variables. This method is not as sophisticated in terms of data as the economic models or panel databases but, on the other hand, it can extrapolate quite extensively from a relatively limited set of data. This kind of method may be used for comparison between, for example, countries or between different industries within a country.

8.3 Evaluations of CO_2 taxes in the Nordic countries

8.3.1 Summary

The methods, as well as underlying assumptions, differ between the evaluations of the CO_2 taxes in the Nordic countries. Therefore, there are difficulties in drawing conclusions on the effects of the policies. According to the evaluation report the evaluations do have one common feature: all the studies reach the conclusion that CO_2 taxes do limit domestic CO_2 emissions. However, the conclusion we draw here should be considered with discretion. Below, each of the relevant evaluations is described in brief.

In Denmark, energy issues have been a factor to reckon with for industry since the charges were introduced. The charges have been relatively low and have not had a great impact on the sectors evaluated up until 1996, when they were increased. According to the evaluation report, Denmark is the only country in the Nordic area with an absolute fall in CO_2 emissions, but only if emissions in electricity exports to the other Nordic countries are subtracted from the total. Energy saving measures have been conducted in industry and carbon dioxide emissions have been reduced, but some evaluations come to the conclusion that rather a large number of these measures would have been introduced even without the implemented instruments. The reduction of CO_2 emissions differs between evaluations. They show a 6 per cent decrease during the period 1988-1997 while the economy grew by 20 per cent, as well as 5 per cent just between 1996 and 1997 when the tax had been raised and the estimates are product revised.

The *Swedish* studies indicate emission reductions: One evaluation shows a decrease in total Swedish emissions by 3-5 per cent between 1991 and 1994 as a result of changes in taxes[51], while another shows a 11 per cent decrease as a result of taxes, between 1987 and 1994, but this excludes transport. The evaluations of the Swedish CO_2 tax begins in the rise in taxes for industry in 1991 and the following reduction for the sector in 1993. The tax reduction led to a total energy/CO_2 tax level for industry that was at the same level as during the 1980s[52].

[51] An evaluation of the impact of Green Taxes in the Nordic Countries, Tema Nord 2001:566

[52] see above

One conclusion that can be drawn from the evaluations is that industry's response to the reduction in tax in 1993 was to increase its fossil fuel use. This result can be seen in the energy-intensive forest industry where the industry has relatively fewer problems in substituting between fossil fuels and electricity at short notice. As the Swedish EPA writes: "The differentiated carbon dioxide tax has given incentives to the pulp and paper industry to sell its by-products to heating plants and instead burn low taxed oil itself."

The district heating sector has in turn increased its use of renewable bio energy because of the relative price change for this form of energy; the tax increase for fossil fuels for this sector and the exemption of bio fuels from taxation.

Of the handful of ex-post analysis made on CO_2 charges in *Norway*, the majority focus on the off-shore oil industry. The results of one of these show that there has been a 30 per cent reduction of emissions counted per produced unit between 1991 and 1996, because the tax had made measures profitable or brought attention to them[53]. Apart from the direct effects of the charge, which are analysed, the evaluations were also commissioned to promote discussions on the possibilities for emission reduction measures in the oil sector compared to other industries in Norway.

According to a *Finnish* estimation, carbon dioxide emissions have been reduced by a maximum of 4 million tonnes as a result of the carbon dioxide taxes applied during the period between 1990 and 1998. The reduction was partly explained by the increase in tax rates of fossil fuels during the time, and the structural as well as consumption changes in industry.

8.3.2 Denmark

The Danish energy tax system based on an electricity charge and a user charge did not include industry until 1996. The Danish energy tax system consists of a basic user charge, an electricity charge and a charge on carbon dioxide. Industry is exempt from the two former charges and paid, until 1996, only 30-50 per cent of the rate of the households' CO_2 tax level, which amounted to 100 DKK/ton. Industry was also able to obtain subsidies for energy efficiency measures.

A reformation of the energy tax system was made from 1996, when the charges were increased, while certain industries could get reductions if they agreed to bring down their emissions. There was also a differentiation of the tax levels for industry.

An evaluation by Krarup et al. in 1997[54] of 30 energy-intensive plants which stood for 32 per cent of the total emissions from industry in Denmark, produced results indicating that the average rebate of the carbon dioxide charge was very unevenly spread among the different plants. The plants found the differentiation of the tax levels illogical, random and

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[53] see above

[54] Krarup, Togeby and Johannsen, 1997, De første aftaler om energieffektivisering. Erfaringer fra 30 aftaler indgået i 1996 (arbejdspapir), Köpenhavn:AKF Förlaget. (The first agreement on energy efficiency. Experiences from 30 agreements made in 1996)

Krarup, Signe & Anders Larsen, 1998, Energieffektivisering gennem aftaler, Köpenhamn:AKF Förlaget, 1998. (Energy efficiency through agreements).

somewhat bureaucratic. Some received over DKK 10 million while others got less than 500, 000. Totally emissions were reduced by 50,000 tonnes/year.

Of the total reductions made, 75 per cent was accomplished in only five plants and most of the energy savings would have been made even without the agreements, but this would have taken more time.

Clasen conducted in-depth interviews in 1998[55], with seven different large and small energy-intensive and non-energy intensive plants in the most important industries. The evaluation used "best case scenarios", which meant plants which had proclaimed their interests in environmental matters and energy efficiency.

All those interviewed were of the opinion that the CO_2 charges were important in their decision-making process, but still only constituted one factor of influence. It provided incentives for reducing the use of resources, but at the same time some plants found the charge system too complicated and the officials from the tax ministry hard to co-operate with.

The results lead to the conclusion by the authors of the evaluation report that it is very hard to generalise from such a small evaluation. One has to separate different plants in a more detailed way because they react very differently from one another.

Björner et al made a comprehensive econometric analysis in 1998[56], which analysed how Danish policy instruments affected the use of energy in industry. A panel-database with data from over 5,000 different Danish plants is used. It includes factories with more than 20 employees and covers the period 1983-1996. Of energy used in industry, 90 per cent is represented in the database. Data on the micro level, like energy production, energy use, turnover, taxes and charges etc, is included. This model results in very different elasticities of electricity and energy than those resulting from so-called "pooled estimation". The first results from the evaluation results in indications that the agreements up till 1993 restricted electricity use by 7 per cent and total energy use by 13 per cent. If the plants with agreements had paid the charge instead, the effect would have been greater –electricity use would have been reduced by another 1 percentage point.

Enevoldsen made another ex-post analysis,[57] in 1998, which used a comparative analysis, based on qualitative interviews of policy strategies on CO_2 emissions from industry in Denmark, Austria and The Netherlands. His analyses showed that the product-revised CO_2 emissions were reduced by 5 per cent in 1997, after the charges had increased considerably in 1996 and industry had the option of signing up for agreements on emission reductions, instead of paying full CO_2 charges. The energy process was stable at the time, and could not therefore be a reason for the reduction. At the same time there was a rearrangement of decentralised electricity production where coal was substituted for other fuels, which brought down the CO_2 emissions from energy use. Natural gas was promoted, which is

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[55] Clasen Gesa, 1998, A framework for innovation: Cooperate Responses to applied Energy/CO2 Taxes in Denmark, Rotterdam: Erasmus Studiecentrum voor milieukunde.

[56] Björner, Thomas Bue, Mikael Togeby & Jan Christensen, 1998, Industrial Energy demand – a Micro Panel data Analysis, Köbenhavn: AKF Forlaget

[57] Enevoldsen Martin, 1998, Joint Environmental Policy-Making and Other New Abatement Strategies for Industrial CO_2 Pollution. Austria, Denmark and the Netherlands, Environmental Sociology Publication, Wageningen: Agricultural University

why one should not overstate the effects of the policy instruments, according to Enevoldsen.

The main aim of the Danish environmental instruments was to promote incentives for innovations around energy use. The results of the evaluation show that with the higher charges, industry started to think of them as a motivating factor when taking decisions on energy matters. This had not been the case before. However, the charges do not provide incentives for domestic production technology innovations and industry would rather invest in foreign equipment.

With the aim of isolating the independent effect of agreements with industry on energy efficiency activities, the Danish Energy Administration[58] made detailed case studies including interviews and regression analyses in 1999. According to the results, visits by energy consultants conducting overviews of individual industrial facilities, did not lead to new ideas on energy saving, but the visits by the consultants brought up the energy efficiency issue and placed it on the agenda of the firms. A positive effect was, among others, that focus was placed on the return from investments. Positive effects were also witnessed from the so-called special investigations where a thorough overview was made of projects as well as an assessment of energy management systems. However, the implementation of energy management systems was slow and the cost of the consulting work relatively high.

The regression analysis showed that large plants, as well as energy-intensive factories, the food industry and facilities with high priority on research and development, were more active in energy efficiency activities. Factories with agreements on energy savings were also more active than firms without agreements. The agreements led to a reduction of 1,4 per cent in energy use, but 34 per cent of this would have been implemented even without agreements.

In another evaluation from 1999[59], the Danish Energy Administration came to the conclusion that CO_2 emissions had decreased by 6 per cent during the period 1988-1997, despite the economy growing by 20 per cent over the same period. The energy intensity in the Danish economy had fallen which led to a reduction in carbon dioxide emissions by 1.4 per cent per year. Increased energy efficiency contributed–0.9 per cent /year and falling carbon dioxide intensity contributed–0.8 per cent per year. The unexpected increase in GDP during the period led, on the other hand, to smaller CO_2 reductions than expected.

Enevoldsen[60] et al. calculated in 2000 the public and private costs of administration and implementation. These costs were estimated to be between DKK 69-105 million per year. When put in relation to the aimed effect of a carbon dioxide reduction of 1.5 million tonnes per year, the cost would then be DKK 45-70 per tonne, which is lower than had been expected.

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[58] Energistyrelsen, 1999, The Danish Agreements on Energy Efficiency, Köbenhavn: Energistyrelsen

[59] Energistyrelsen, 1999, Opfölgning på energi 21. Status for energiplanlägning, Köpenhavn: Energistyrelsen

[60] Enevoldsen Martin &Stefan Brendstrup, 2000, ”Considering Feasibility and Efficiency: The Danish Mix of CO2 Taxes and Agreements” in Rolf Ulrich Sprenger &Mikael Skou Andersen (eds.), Market-based Instruments for Environmental Management, Edward Elgar, forthcoming.

The analysis also points to the high transaction costs connected with know-how in the context of investments in new technology. Industry needs to find information on the market which is costly and difficult. Hence, Enevoldsen et al. finds a co-operation organisation to be necessary which would communicate information on energy-related know-how to industry.

8.3.3 Finland

The Finnish tax system consisting of a carbon dioxide tax from 1990 was revised in 1994, when a tax on the energy content of fuels was introduced. Very few exemptions and relief options existed in the system. A new revision took place in 1997 where the carbon/energy tax based on fuel inputs in the electricity sector was abandoned and taxation on consumption of electricity was introduced. Taxes levied on the energy content of the fuels were abolished. Heating and transportation fuels were henceforth taxed only on their carbon content. The tax rates have been raised a few times.

A calculation of the effect on carbon dioxide emissions by Finnish taxes on energy and carbon dioxide has been performed by the Prime Ministers' Office[61]. VAT has also been taken into account where applicable. Besides the effect on emissions, effects on total energy consumption and relative consumption of different fuels and energy sources were examined. The study reveals that the taxes applied have led to a maximum reduction of 4 million tonnes of carbon dioxide emissions in 1998, i.e., the emissions would have been 4 million tonnes higher without the impact of taxes. The decrease breaks down equally between end-use and production. One of the most important factors in end-use was the decrease in gasoline consumption. The reduction was explained by a doubling of the already high 1990s taxes and the price elasticity, which was estimated to be substantial. Another important factor in end-use was the structural and consumption change in industry. The fuel substitution, especially the replacement of coal and heavy fuel oil by natural gas and some wood, is responsible for about two-thirds of the industrial decrease of emissions. Depending on the fuel, fossil fuel taxes increased 7-11 fold during the period studied. This led to a considerable decrease in energy demand in industry, even though the price elasticity in industrial energy demand is estimated to be small.

The findings should be viewed as maximum estimates of the impact of taxation because of uncertainties attached to them. Estimates on consumption changes depend to a large extent on the flexibility assumptions made, especially since demonstrated changes in the proportion of different fuels used, are affected by factors other than taxation only. Domestic fuels are also subsidised by investment subsidies and technology development support etc., and natural gas has advantages compared to competing fuels other than those of taxation.

8.3.4 Norway

When the carbon dioxide taxes were introduced in 1991, the level of the tax was NOK 257 per tonne for natural gas in the off-shore industry and between 97-113 per tonne for fuel oils. The taxes remained unchanged in real terms during the 1990s. At the same time, energy-intensive industries had large reductions or were totally exempt from tax.

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[61] Prime Minister's Office, Economic Council, Environmental and Energy Taxation in Finland - Preparing for the Kyoto Challenge, Summary of the Working Group, Prime Minister's Office Publication Series 2000/4

The consultants at ECON have made two evaluations on assignment for the oil industry interest organisation OLF, one in 1994 and the other in 1997[62]. The aim was to look at the economic effect of the CO_2 charge on oil and gas exploration on the Norwegian continental shelf and more specifically to look at the effects of the charge on the industry's maintenance and investment decisions.

The evaluations looked ex-post at the decisions that the industry had taken between 1991 and 1993 and the analysis was based on interviews and information from different organisations and national administrations.

The results from the first evaluation indicated that the emissions per unit of oil or gas fell by 8 per cent in the period as an effect of the decisions taken. Of these, 20 per cent were profitable due to the charges, (this is 1.6 percentage points). When all decisions were implemented, the emission reduction would amount to 9 per cent of which 30 per cent could be ascribed to the charge. Between 70 and 80 per cent of the measures would have been implemented even without a charge, but the firms admitted that the charge had speeded up the implementation because the charge brought attention to energy efficiency measures.

In the second study by ECON (1997) 9 measures implemented out of 20 were estimated to be profitable even without the charge, while 10 measures were profitable because of the charge. The emissions of carbon dioxide were 8 per cent lower than they would have been without the measures. Of these, 3 percentage points were caused by the charges. The emissions per unit produced were reduced by 30 per cent compared to the period before the charge was introduced.

There are uncertainties connected to this form of evaluation in that the plants interviewed had incentives to understate the CO_2 charge impact on investment decisions and to overestimate the costs for the same investments. An evaluation by CICERO (Centre for climate research) and the insurance company Det Norske Veritas (also on assignment for the oil industry interest organisation), states that the emission reduction in the ECON evaluations does not necessarily result from better technology, but could be an effect of changed patterns of production in this relatively aggregated sector.[63] The same evaluation comes to the conclusion that the costs of emission reduction measures in the oil industry differ on average between NOK 190 and 350 per tonne of carbon dioxide per measure, depending on which method of estimation was chosen.

Larsen et al. made a so-called counter-factual analysis with a partial economic model in 1999.[64] They evaluated Norway's energy use and carbon dioxide emissions between 1987-1993, and focus was placed on households and stationary sources in manufacturing and

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[62] ECON, Virkninger av CO2-avgift på olje-og gasutvinning i Norge. Delrapport 4: Sammendrag og hovedkonklusioner, Oslo:ECON

ECON, 1997, CO2-avgiftens betydning for CO2-utslipp på norsk sokkel, Oslo: ECON.

[63] Dragsund, E., K.Aunan, O. Godal, G.P.Haugsom & B. Holtsmark, 1999, Utslipp til luft fra oljeindustrien. Tiltak, kostnader og virkemidel, Oslo,: CICERO, Univerity of Oslo

[64] Larsen, Bodil Merethe and Runa Nesbakken. 1997, "Norwegian Emissions of CO2 1987-1994" pp 275-90 in Environmental and Resource Economics 9.

service industry (transport in industry was excluded as well as the off-shore oil industry). The industry model focused on the substitution between oil and electricity when the carbon dioxide charge was introduced, and the fact that a charge can lead to a reduction in energy use was deliberately excluded. The results showed that the effect of the charge differed a lot between different types of industry: if there had been no charge, the oil used for heating in the wood processing industry would have been 14 per cent higher in 1993. This is because of the high elasticity of substitution between electricity and oil in this sector, while other sectors have very restricted substitution options. Altogether, the effect of the charge to oil for heating purposes in industry was a reduction of 0.5 per cent in 1991.

The estimated effect of the charge on heating for households in the period was a reduction of between 0.1-0.5 per cent. The reason for this low figure is that oil use was rather small in the sector. However the analysis showed that private traffic would have been 2-3 per cent higher in 1991-1993 if there had not been a charge. The use of public transport increased during the same period by 0.5 per cent. The total effect of all the analysed sectors was 3-4 per cent less emission in 1991-1993.

8.3.5 Sweden

In Sweden, there was a general energy charge levied until 1991, which was the same for all sectors. Certain operations, however, had reductions.

In 1991, the general energy tax was halved and a carbon dioxide tax of SEK 250 /tonne was introduced. In total, the taxes were increased but energy intensive industry had a partial reimbursement. VAT for energy was also introduced. In January 1993 the tax system was reformed and the carbon dioxide taxation of the manufacturing industry was reduced so as to become 25 per cent of the tax of the other sectors. This sector was also granted exemption from the general energy tax. Totally, the manufacturing industry paid only between 16-20 per cent of the tax of the other sectors and this was a level which was lower than before the introduction of the carbon dioxide tax in 1991. For the other sectors, the general carbon dioxide tax was raised to SEK 320 /tonne CO_2.

The evaluations made of the effect of the carbon dioxide tax have been made for the first half of the 1990s.

The results from an ex-post evaluation by NUTEK, in1994[65], showed that the changes in taxation, made between 1991 and 1994, resulted in a decrease of the emissions of carbon dioxide by 3-5 per cent compared to what would have been the case if the taxes of 1990 had remained the same during the period. All sectors were included in the study. The evaluation by NUTEK was performed through an economic model[66], which simulated how development would have been, had the government not introduced the taxes in later years.

One year later, in 1995, NUTEK used elimination method, whereby the proportion of industry's increased use of oil that couldn't be explained by other factors, such as a drastic fall in oil prices and increased production, was counted as an effect of the lowered carbon

[65] NUTEK 1994, Utvärdering av styrmedel och stöd för begränsning av koldioxidutsläpp i Sverige, Stockholm: NUTEK (Evaluation of economic instruments and support for a restriction of carbon dioxide emissions in Sweden)

[66] The MARKAL-model

dioxide tax[67]. In rough measures, 0.7 TWh of the increased demand from industry was estimated to be the result of a lowered tax to the sector during the evaluation period. According to the evaluation, the carbon dioxide tax did not provide the politically desired results in industry, but the instrument should nevertheless be seen as effective, though it is probably changes in energy charges and the rules of repayment that have counteracted the effect of the carbon dioxide charge. The same evaluation also came to the conclusion that the increased tax for households raised the profitability of energy efficiency measures in the household sector and speeded up the technological development even though the effect of the taxes was limited.

Based on the evaluations conducted by NUTEK, the Ministry of Environment and Natural Resources in 1994[68] conducted independent interviews with 50 of 160 district heating plants and came to the conclusion that the taxes had been of major importance for the substitution of energy form of the plants. A problem highlighted in the report was that the forest industry's sale of biological waste products to the district-heating sector could lead to a halt in the incentives to make technological innovations by the industry for this form of renewable energy.

This problem was confirmed by the Swedish EPA in 1995 when the authority also made an evaluation based on the earlier NUTEK evaluations as well as using in-depth interviews, telephone surveys and model estimations by MARKAL[69].

In the same evaluation, the EPA came to the conclusion that carbon dioxide emissions had been reduced by 19 per cent between 1987 and 1994 in the district heating, industry, service and household sectors. Of this, 60 per cent was attributed to the tax. The emission reduction values were lower for the country as a whole due to the fact that the transport sector wasn't included in the evaluation.

The EPA evaluation also came to the conclusion that the district heating plants did change their behaviour due to the tax, but that this was not the case for industry due to the tax reduction in this sector. The tax did not provide enough incentive for the household sector to change behaviour either. One reason for the large total emission reduction during the period was also the choice of starting year – 1987, which was a very cold year and therefore emissions were higher than normal because more energy was used for heating. Other factors influencing the emission reduction were energy efficiency measures and the shift to district heating in the household and service sectors.

In the interviews by the EPA, it was mentioned that the most common view in industry was that the CO_2 tax had a fiscal purpose rather than being an instrument of environmental policy. If emission reduction measures were made in industry it should not be considered a result of the tax. The view was that the taxes were short-term; they were changed at short notice. Because of this, industry was of the opinion that it was hard to make long-term

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[67] NUTEK 1995, Instruments in the energy field, Stockholm: NUTEK

[68] Miljö och Naturresursdepartmentet, 1994 Så fungerar miljöskatter!m Stockholm: Fritzes. (This is how environmental taxes function!)

[69] Naturvårdsverket, 1995, Utvärdering av koldioxidskatten – har utsläppen av koldioxid minskat?, Stockholm, Naturvårdsverkets förlag. ("Evaluation of the carbon dioxide tax – has there been a reduction in carbon dioxide emissions?")

decisions on production technology based on the taxes.

After the tax had been lowered in 1993, carbon dioxide emissions started to rise considerably in industrial plants that used heavy fuel oil. An evaluation was performed through interviews by the County Administrative Board of Älvsborg in co-operation with Gothenburg University[70] and according to the results, the emissions of CO_2 had risen by 53.5 per cent during 1992-1994 in the plants studied. With regard to, for example, a rise in production and changes in the form of production, the result was that 61 per cent of the rise in emissions was due to the lowered tax. The largest proportion of the emissions originated from the paper industry, which had substituted electricity for oil. The analysts did not consider it unrealistic to assume that the conclusions could be generalised to Sweden as a whole.

In a 1997 evaluation report of different environmental taxes, the Swedish EPA once again studied the carbon dioxide tax. Because of the difficulties in separating the effects of the general energy tax and the carbon dioxide tax the EPA looked at the total effect of the two taxes.

The EPA notes that the *district-heating* sector has lowered the share of fossil fuels in the total production of district heating. Fossil fuels have been reduced from 36 per cent to 30 per cent. Bio fuels are exempt from energy as well as carbon dioxide tax, which led to a total price around half of the fossil fuel price for the sector; between 1990 and 1995 the use of renewables in district heating energy demand was doubled. As for industry, it increased its use of fossil fuels after the fall in carbon dioxide taxes in 1993, and the EPA can see no other reason for this than the lowering of the tax. The EPA refers to the evaluation of the County Administrative Board of Älvsborg and University of Gothenburg, and comes to the conclusion that the rise in the use of fossil fuel is mostly due to the pulp- and paper industry and its capability for fast substitutions between fossil fuel and electricity use in its production processes.

Households, on the other hand, have more difficulties in substitution between energy forms, because changes demand large investments, and therefore the consumption by households does not change to the same degree as in other sectors, especially not in the short term.

For the transport sector, the introduction of carbon dioxide taxes did not lead to a net increase in the taxation of gasoline and now the carbon dioxide tax forms a minor part of the total taxation of the fuel. The EPA concludes that the tax increase in 1993 might have limited the use of gasoline and that the use of diesel has been more affected by the increase in growth of the industry.

In its evaluation of 1994 (see above), the Ministry of Environment and Natural Resources also computed the cost of the administration of the tax to SEK 3 million per year, which was regarded as a very low amount. In the future, cost estimates show a reduction to SEK 2 million per year.

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[70] Carlsson Andreas, & Henrik Hammar, 1996, Energiskatters påverkan på industrins koldioxid- och svavelutsläpp, Vänersborg:Länstyrelsen i Älvsborgs län, Miljö- och planenheten. (Effect of energy taxes on emissions of carbon dioxide and sulphur from industry)

8.3.6 Evaluation of other market-based instruments

8.3.6.1 Finland

8.3.6.1.1 Energy conservation agreement

About 80 per cent of the energy consumption by industry is covered by energy conservation agreements introduced in 1997. The agreements are in force until 2005 and are framework agreements in which trade associations bind themselves to promoting energy savings and to adjoining their members to an energy conservation agreement. The participating companies and corporations bind themselves to carrying out energy audits or analyses of the real estate and production plants they own, drafting energy conservation plans and implementing profitable saving measures.

The agreements have contributed considerably to the growth of the volume of energy auditing. Of the energy audits performed between 1998 and 2000 the majority, and in industry nearly all of the audits, were projects by companies or corporations that have joined the agreement[71].

Energy audits and energy conservation investments that meet certain criteria have been supported by the Ministry of Trade and Industry and since 1997. The Ministry had granted investment aid for 31 different energy conservation technology projects to the amount of Euro 1.1 million totally.

The impact of conservation measures totals around 1.3 TWh per year. In addition, measures already completed are reported to have a saving potential of 0.35 TWh /year. Conservation measures still under consideration are estimated to have a saving potential of 0.35 TWh /year.

8.3.6.1.2 Impact of instruments in waste management

A study on the impact, effectiveness and development needs of instruments in Finnish waste management was finalised in 2000[72]. The study concluded that as a result of regulation and voluntary action by companies and other actors, waste utilisation increased during the 1990s, and that the waste management infrastructure has taken major steps forward. A drawback is that the instruments do not sufficiently prevent waste from being produced.

The costs of waste management have increased considerably in the 1990s, according to a waste management survey[73]. Annual waste management costs have risen from roughly Euro 655 million to approximately Euro 1.1 billion during the decade and are estimated to reach Euro 1.6 billion by 2005. The main reason for the cost increase is the rise in annual waste volumes.

8.3.6.2 Sweden

The following evaluations of different economic instruments in Sweden were made by the

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[71] Product and Capital Market Reforms in Finland, Ministry of Finance, November 2001

[72] See above

[73] See above

Swedish EPA in 1997.

8.3.6.2.1 Sulphur tax

The Swedish tax on sulphur was introduced in 1991 with the aim of reducing the emissions of sulphur in the combustion of oil, coal and peat. The sulphur tax is basically a production tax but works in practice as a tax on emissions of sulphur due to the reimbursement of the tax if sulphur is not emitted.

The amount of sulphur dioxide was reduced from 71,000 tonnes to 35,000 tonnes between 1989 and 1995. The parliamentary objective for a reduction of emissions by 80 per cent from 1980 to 2000 has been reached. The reduction is due partly to reduced use of fossil fuels, and partly to a lower sulphur content in, above all oil, and is partly due to increased sulphur removal.

The Swedish EPA comes to the conclusion that the tax on sulphur already had an effect during 1990 and that the tax is responsible for nearly 30 per cent of the total reduction of sulphur dioxide during 1989 and 1995. This corresponds to 19 000 tonnes of sulphur dioxide or 20 per cent of the total emissions in 1995. The tax does not lead to any significant side effects.

The EPA states that sulphur reduction can be accomplished in many different ways and that the circumstances differ a lot between refineries and users of the fuels. This leads to the conclusion by the EPA that it would have been very hard and less cost-efficient to accomplish the same reductions in such a short time with an administrative instrument.

The administration of the tax system approves deductions directly in the tax returns, which reduces the cost of administration considerably compared to repayment. The total costs for both the government and the firms is estimated at SEK 200,000 or 0.1 per cent of the revenue from the tax.

8*.3.6.2.2 Nitrogen oxide charge*

The charge on nitrogen oxides, which is an example of an emission charge, was introduced in 1992 to reduce the emissions from combustion plants at a faster pace than was expected by minimum emission limits and licences for specific plants. The charge system includes only large plants (see the chapter on Swedish instruments) but there is a reimbursement of the charges, excluding the administrative costs, in order to prevent placing large plants in a weaker competitive position compared to smaller plants outside the charge system. The repayment is made in proportion to the combustion plants' share of the total utilised energy production. This means that plants which perform the emission reduction well will receive a net income from the system and plants with high emissions will pay in the end.

The effect of the instrument has been greater than expected according to the EPA.

The government had estimated that 5,000-7,000 tonnes of lower emissions would be the effect of the charge compared to a situation where no charge had been introduced. Instead the real emission reduction caused by the charge is estimated at 10,000 tonnes. Without the charge, the emissions of nitrogen oxide would have been 80 per cent higher from the taxed plants. 10,000 tonnes corresponds to 25 per cent of the emissions of nitrogen oxides from combustion in energy production, or nearly 3 per cent of the total emissions in Sweden.

A side effect of the charge is higher emissions of, among other things, carbon monoxide and N_2O (laughing gas), which are not regulated by charges.

The administrative costs of the charge per kilo of nitrogen oxides are estimated to have been SEK 1.85, or SEK 18.5 million totally.

8.3.6.2.3 Tax on artificial fertilizer

The aim of the charges on fertilizers, introduced in 1984, was to increase their price so as to reduce demand as well as to finance a programme of measures to decrease the negative impact on the environment of agriculture. The charge on nitrogen has been changed several times and in 1995 it became a tax.

Estimates indicate that the tax has reduced the optimal amount of nitrogen by approximately 10 per cent. An indirect effect of the charge is also obtained when the income from the charge (before 1995) was used for information projects in order to reduce the leakage of plant nutrients.

The charge on phosphorus was abolished in 1994. Since then, its use has increased considerably. The charge was only 8 per cent of the price of phosphorus and therefore had less impact on use. The charge on cadmium also has a direct impact but the charge is relatively new and no evaluations have been made yet.

The EPA estimates that the costs of administrating the charge amounted to less than 0.8 per cent of the total income of the charge in 1994.

8.3.6.2.4 Charges and taxes on pesticides

The environmental charge/tax on pesticides was introduced with the aim of reducing the risks to the environment and health. The charge was introduced in 1984 and the income has been used to perform research and disseminate advice in order to reduce the use of pesticides. The charge amounted to SEK 4 per kg active substance but was doubled four years later. In 1995 the charge was changed so as to become a tax and the income was not any longer earmarked for advice.

The total amount of pesticides used in 1995 was reduced to 35 per cent of the average amount used between 1981 and 1985. The greater part of the reduction is due to lowered weed control use and to a large part by using lower doses of the substance. Weed control substances represent about 75 per cent of pesticides used in agriculture and horticulture in 1994. The use of fungicides and insecticides has remained the same during the 1980s but has started to fall in recent years. However, the EPA states that the charge has had a curbing effect on use, but argues that this is mostly the indirect effect of the charge in the form of income used for advice, research and development, which led to the reduced amount of pesticides.

The cost of administration amounted to just SEK 4,000 per year, which corresponds to approximately 0.01 per cent of the total revenue from the charge in 1994/1995.

The Swedish Board of Agriculture argued in an evaluation of 1992 that the pesticide tax has a restricted effect on use due to the low level, as well as the lack of substitutes for pesticides.

8.3.6.2.5 Vehicle scrap premium and scrap charge

The political aim of the car-scrapping *premium* was to counteract the dumping of used cars in the environment. This was one of the very first economic incentives introduced in

Sweden and it started in 1975. When the premium was increased in 1992 another aim was included –Parliament wanted to speed up the scrapping of older cars with lower standards of emission control in order to reduce pollution from traffic.

The aim of the car scrapping *charge* is to finance the payment of the premium.

The aim of counteracting the dumping of used cars in the countryside is estimated by the EPA to have been very well accomplished. No other type of regulation would have had the same effect at such a low cost, according to the EPA. The aim of speeding up the scrapping of older cars is not considered a cost-efficient instrument, however. The premium of SEK 1,500 is considered to have played too small a part in the decision-making process when people decide whether to continue using their old car or whether to buy a new one. The increase in the premium also led to increases in the price charged by the car-scrapping merchants, especially in smaller towns with less competition in the business, with the result that an even smaller part of the premium was given to the motorists as incentives to buy new vehicles.

The administrative costs are hard to separate from the total registration costs, but the premium and the charge is estimated to cost 1-2 per cent of the turnover of the system.

8.3.6.2.6 Differentiated gasoline and diesel oil

Sweden has used differentiated taxes for leaded/unleaded gasoline and environmentally sound gasoline and diesel. These fuels make relatively homogenous commodities. The price information to consumers is also good and, along with the location of the gas stations, crucial for the consumer's choice. Economic instruments are therefore a very strong instrument to influence the use of different fuels.

The lead/unleaded-differentiated tax was introduced in 1986 and differed by SEK 0.16 per litre between the different types. Unleaded gasoline gained market share very rapidly but the increase flattened because of the relatively low number of cars with catalytic converters running at the time. The Swedish EPA concludes that the fast substitution was an effect of the tax. In 1994, leaded gasoline was abolished from the Swedish market due to the invention of alternative engine lubricants. The quick development was considered to be a result of response from both consumers and industry, where the consumers chose the unleaded alternative, and the oil companies responded to incentives to develop and sell new unleaded qualities for older cars.

Even the *environmentally classed diesel oil*, which was introduced in 1991, saw a rapid substitution between the three different classes. Environmental class 1, which was the most environmentally sound fuel, had a rebate on the standard tax of SEK 0.35 per litre and class 2 had a rebate of SEK 0.15. Class 3 was considered standard. As early as 1992, class 1 and 2 were responsible for half of the diesel sold for vehicle use. Large quantities of environmentally classed light fuel oil for heating purposes were also sold on the market. This oil didn't exist on the market before the introduction of class 2.

As a result of the environmental benefits of better quality of fuel for heating purposes being restricted due to more even and complete combustion, Parliament didn't find the environmental benefits reasonable compared to the large loss of revenue from the lower tax of the fuel. In 1993 the tax paid per travelled kilometre was abolished in favour of a tax on diesel. For fuel used in vehicles, this tax was much higher than if the fuel was used for heating purposes and by moving the tax differentiation from the energy tax to the diesel tax, the rebate for light fuel oil disappeared. The effect of the change in the tax system was

fast and the light fuel oil in class 1 and 2 vanished from the market.

The substitution towards class 1 has continued and represented approximately 85 per cent of the sale of diesel in 1995[74].

From December 1994 the *gasoline tax* was differentiated into two environmental classes. Environmental class 3 was the standard fuel with normal tax and 2 was of a environmentally better quality, for which the EPA, the oil companies and the car industry had unanimously decided upon stricter standards for emissions of sulphur, nitrogen oxides, volatile hydrocarbons, benzene and carcinogenic substances. The standards for Environmental class 1 would be decided on later. The tax difference between class 2 and 3 was SEK 0.06 per litre.

The substitution to environmental class 2 was very rapid. In the first half year of 1994 class 2 gasoline's share of the total gasoline market was 6 per cent. From July to November, its share rose to 16 per cent and in December, when the tax differentiation came into force, it rocketed to 85 per cent. In 1995, substitution to the more environmentally sound fuel was complete[75].

The EPA discusses the possibility of substitution already having begun before the introduction of the new tax differentiation, but finds it uncertain how long the transition would have taken and how far it would have reached without the differentiation. It is plausible that it would have been possible to compete with a cheaper but environmentally worse quality for a longer period.

The administration of the differentiation of the different fuels has not led to considerably higher costs. The EPA concludes that it would be hard to find an administrative regulation that could reach the same environmental effect this fast or cost effectively. Different refineries and oil companies have had different opportunities to introduce the new fuels of better environmental quality and it would have been hard to enforce strict general regulations. The economic incentive has also been a driving force for technical development. New qualities of unleaded gasoline were developed for older car engines as a result.

8.3.6.2.7 Tax on natural gravel

In 1996 a tax on natural gravel of SEK 5 per tonne was imposed in order to encourage conservation. The EPA evaluated the tax in the year 2000[76] and the results show that the tax had an effect on the use of gravel. The price of natural gravel increased by 11 per cent when the tax was imposed, and the proportion of gravel decreased related to the total amount of ballast in the order of 5-15 percentage points. This corresponds to a substitution towards crushed rock of about 5.6 million tonnes in 1997 and 6.6 million tonnes in 1998.

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[74] In 2002 only class 1 diesel is sold.

[75] The introduction of environmental class 1 has been achieved and in 2002 almost all gasoline sold is of this quality.

[76] Naturgrusskatten – utvärdering av skatteeffekterna. Naturvårdsverkets förlag 2000, Rapport 5077. (The tax on natural gravel – evaluation of the effects of the tax)

The evaluation also saw that the transport volume did not increase as a result of the tax. According to the analysts, this can be explained by the total economy for the buyer of the gravel, to whom the transport costs are of major importance. The natural gravel, which is less expensive than crushed rock, would on average be transported slightly farther than crushed rock. The buyer chose crushed rock over natural gravel if the transport distance was shorter and, in total, the transport activity measured in tonne-kilometres will decrease.