REPORT

Economic Instruments in the Lithuanian Energy Sector

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Report Summary

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Summary
Different economic instruments have been important and often used tools for governments to improve and control the environmental performance in a country. Many different instruments exist and the application of them is often complex. The present study has been initiated to study and improve the economic instruments for environmental control in Lithuania. In the project the existing economic instruments in Lithuania and Sweden have been studied as well as an overview of economic instruments in other European countries. Economic analyses have been made of the different systems and improved systems for Lithuania have been proposed.

The project has been a co-operation between Sweden and Lithuania financed by The Swedish Environmental Protection Agency (Naturvårdsverket). The project has been performed by a team consisting of representatives from both Sweden and Lithuania.

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Executive summary

Introduction
Energy and environmental issues are today primary and essential question for all countries. The energy prices have increased significantly and so have also the environmental problems in all countries. It is also likely that the price of energy will continue to increase in the future. A modern society is more or less driven by energy. The supply of energy as well as saving of energy is thus an essential part of a strategy for the future. However, it is equally important to be able to provide a healthy environment for the population. Energy without a good environment gives only a limited life. The question is thus – how can we provide the sufficient energy to the society and also maintain or improve the environmental conditions? Of course the answer can in many cases be found in different technical solutions but is it possible to control the implementation of the technology? Can we encourage the use of new technology even if it means increased cost in a short perspective? How do we achieve a cost efficient implementation of abatement techniques?

The most common tool, from a society perspective, to control the energy use and the environmental conditions is to implement some kind of economic instrument. Different economic instruments have been important and often used tools for governments to improve and control the environmental performance in a country. Many different instruments exist and the application of them is often complex. The present study has been initiated to study and improve the economic instruments for environmental control in Lithuania. The project has been a co-operation between Sweden and Lithuania financed by The Swedish Environmental Protection Agency (Naturvårdsverket). The project has been performed by a team consisting of representatives from both Sweden and Lithuania. In the project the existing economic instruments in Lithuania and Sweden have been studied as well as an overview of economic instruments in other European countries. Economic analyses have been made of the different systems and improved systems for Lithuania have been proposed.

Lithuania is today in a so called transition period. A period where Lithuania is going from one economic system to another. In many ways this has been a difficult time but it is also a time with many possibilities. The society is rapidly changing and it is thus important to keep the control over the development and encourage sustainable, long term quality investments. For example in the building sector how do we encourage quality renovation (may be more expensive) of houses which will give low energy consumption in the future and good living comfort in contrast to cheap renovation with high future energy consumption. How do we promote energy saving installation and new abatement techniques when industries are improves or new build? How do we prepare the society for the future energy situation?

Economic instruments: a general perspective
There exist many different control instruments ranging from advanced market-based economic instruments to pure regulations. Legislation in the energy area have been in place at least from the beginning of the last century and legislation as well as regulation in the environmental field have a slightly shorter history but have in spite of that been in place since the 1960th. Several types of economic instruments exist such as taxes, charges, fees and market-based economic instruments. Market-based instruments refer here to instruments such as emission trading according to the Kyoto protocol or to the Swedish NO_X charge system. The first instrument to be used was different types of taxes. The experiences from different tax and charge systems are therefore relatively solid.

The efficiency criterion helps in demonstrating why markets fail to produce an efficient level of pollution control and in tracing out the effects of this less than optimal degree of control on the markets for related commodities[1]. It can also be used to define efficient (optimal) policy responses. Efficiency is achieved when the marginal cost of control (MC) is equal the marginal damage (MD) caused by the pollution for each emitter. If the limit were chosen precisely at the level of pollution where marginal control cost equals marginal damage (Q* in Figure A, left figure) efficiency would have been achieved. An alternative approach would be to internalise (see Figure A, right figure) the marginal damage (P0 to P1) caused by each unit of emissions by means of a tax (Pigouvian tax) or charge on each unit of emissions. Assuming linearity and proportionality between the quantity produced and the emitted quantities, the tax would imply a reduction of the quantity produced from Q0 to Q1 and thereby the emissions.

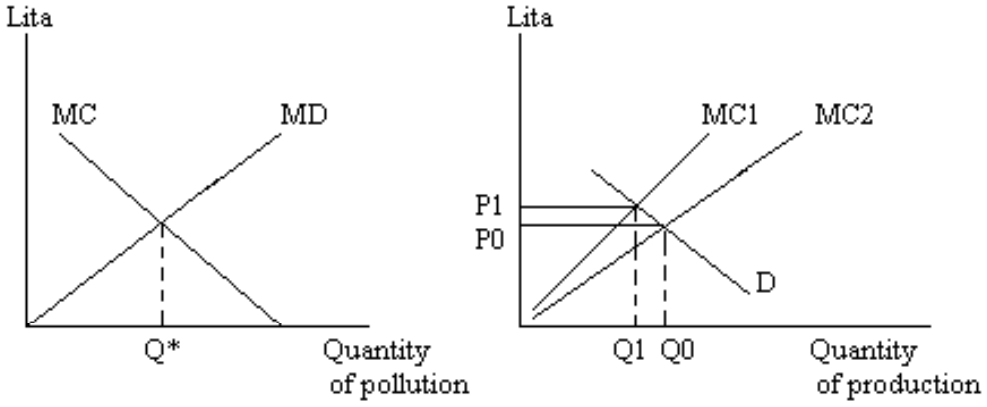

Figure A Left: Allocation of pollutant. Right: Internalisation of damage.

However, while the efficient levels of these instruments can be defined in principle, they are very difficult to implement in practice depending on the lack or scarcity of information related to MC and MD. Hence, the authorities often select specific legal levels of pollution based on some other criterion e.g., EU directives. Once the objective is stated in terms of meeting the predetermined pollution level at minimum cost, it is possible to derive the conditions that any cost-effective allocation of the responsibility must satisfy. These conditions can then be used as a basis for choosing among various kinds of instruments as shown in Table A. Yet, emission charges are sometimes applied instead of taxes. The charges are designed to reduce the quantity or improve the quality of pollution by making polluter pay at least parts of the costs of the harms they do to the environment. However, given the information problems associated with emission charges the next best alternative for the regulator is product charges. These take the form of fees or taxes levied on outputs or inputs that are potentially hazardous to the environment.

[1] Tietenberg, T. (1992) Environmental and natural resource economics. HarperCollinsPublishers.

Table A Various aspects on the choice of instruments[2].

	Regulation	Tax	Tradable emission permits
Dynamic efficiency with rapid technical change	None (or perverse) incentive	Yes	Yes (it depends)
Cost efficiency	No	Yes, specially with many agents with distinct technology	Yes If market not too thin
Goal fulfilment	(No) maybe at firm level not aggregate level	Inflation may be a problem	Yes Partly with irreversible damage
Administration costs	Best Control needed anyway but CaC* often simplest	Depends	Hard to administer with many/ few agents
Barrier to entry	Worst Required for new plants protect new ones	Neutral	Can be used by established firms
Polluter pays principle		Yes	Yes (it depends)
Opinion		"buy right to pollute"	(same as tax) or even more so
Public choice	Rent seeking (corruption)	Risk of waste	Neutral

*) CaC = Command and control.

The major advantage of economic instruments is that they incorporate environmental concerns directly into the market price mechanism of the economy. Therefore, these instruments have all the efficiency properties of the competitive market pricing. They generate actions both among producers and consumers that allow the achievement of given environmental objectives at the lowest costs. Therefore, the economic instruments if designed and implemented properly they would lead to sustainable growth. This is confirmed by experiences from OECD countries where the economic instruments helped for instance to[3]:

- provide flexibility to polluters in choosing the most cost-efficient and environmentally effective measures, thereby reducing compliance costs;
- change the relative prices of environmentally sensitive goods, leading to an allocation of resources towards more environmentally sustainable production and consumption;
- create incentives for environmental investments which generate profits and environmental benefits at the same time;
- promote technological innovation needed for more environmentally sustainable production and consumption; and raise revenues which governments can use for catalysing environmental investments of national priority, or for decreasing income taxes, profit taxes or social security contributions.

European Union directives and other international regulations

The use of economic instruments has been increasing rapidly in the European community in particular and the Western countries in general where an important reason for the increased use of economic instruments is related to the positive experiences gained. Generally, Countries have developed action plans for long-term programmes to implement their strategies. Some countries

[2] Adapted from Hanley N., Shogren J.F. and White B. Environmental Economics, London, Macmillan, (1997).
[3] Source: OECD

have specified objectives for air pollution abatement policies on the basis of the effects of those pollutants, while others based their air pollution abatement policy on BAT (best available technology). Some parties set emission reduction targets based on Protocol obligations or domestic policy, whilst others set goals and requirements for achieving national air quality standards. A mix of instruments is used in most cases though the different types of measures should be complementary.

In 2002, the *sixth action programme for the environment* has been adopted. It sets out the priorities for the European Community up to 2010. Four areas are highlighted: climate change, nature and biodiversity, environment and health and the management of natural resources and waste. Measures to achieve these priorities take the form of improving the application of environmental legislation, working together with the market and citizens and ensuring that other Community policies take greater account of environmental considerations.

A number of conventions, protocols, directives and programs are taking part in the regulation of pollutants in EU. According to the Treaty establishing the European Union, one of the objectives of Community policy on the environment is to promote measures at international level to deal with regional or world-wide environmental problems. Thus, some of the Conventions are global in scope, while others are regional. Among the global Conventions is the Vienna Convention for the Protection of the Ozone Layer, its Montreal Protocol on Substances, which Deplete the Ozone Layer, the UN Conventions on Biological Diversity and on Climate Change and the Aarhus Convention on Access to Information and Justice. The Community has also signed the Kyoto Protocol, which provides for measures and commitments to reduce greenhouse emissions. Regional initiatives are e.g. the ceiling directive "Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001" set national emission ceilings for certain atmospheric pollutants. This Directive is part of the follow-up to the Commission's communication on a strategy to combat acidification, which sought to establish, for the first time, national emission ceilings for four pollutants - sulphur dioxide (SO_2), nitrogen oxide (NO_X), volatile organic compounds (VOC) and ammonia (NH_3) - causing acidification, eutrophication and tropospheric ozone formation. Other initiatives are for example the Convention on Long-range Transboundary Air Pollution, the Gothenburg protocol or the "auto-oil" programme.

In 1997, the Commission put forward a proposal for a Community framework for the taxation of all competing sources of energy, including minimum tax levels (see IP/97/211). This was debated in the EU's Council of Ministers and was extensively changed before being adopted as directive.

The aim of this initiative is to:

- improve the functioning of the Internal Market,
- ensure greater respect for the environment, and
- combat unemployment by allowing Member States to compensate increased revenues from energy taxation with lower taxation of labour.

On 27 October 2003, the European Union's Council of Ministers adopted Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity.[4]

The Directive widens the scope of the EU's minimum rate system for energy products, previously limited to mineral oils, to all energy products including coal, natural gas and electricity.

The objective of this Directive is to:

- reduce distortions of competition that currently exist between Member States as a result of divergent rates of tax on energy products;
- reduce distortions of competition between mineral oils and the other energy products that have not been subject to Community tax legislation up to now;
- increase incentives to use energy more efficiently (to reduce dependency on imported energy and to cut carbon dioxide emissions); and
- allow Member States to offer companies tax incentives in return for specific undertakings to reduce emissions.[5]

Present status of economic instruments in Lithuania
There are a number of strategic documents related to the use of economic instruments in energy sector. In this report the most relevant strategies will be mentioned, in particular:

- Lithuanian Sustainable Development Strategy
- The National Long Term Development Strategy
- Environmental Economic Instruments Development Strategy until 2015
- The National Energy Strategy
- National Programme on Increasing of Efficiency of Energy Use
- Strategic action plan of the Ministry of Environment 2003-2005

The strategic framework is then converted into a legal framework comprising the laws that constitute the energy and environmental frames. The main laws are:

- The Law on Environmental Protection (1992, No. 5-75)
- Law on Tax Administration (28 June 1995 No.I-974)
- The Law on Pollution Charge (No. I X-720 as amended 22 January 2002)
- The Law on Natural Resources Tax
- Law on Taxes on Oil and Natural Gas Resources (22 April 2003 No. IX – 1527);
- Law on Excise Duty (30 October 2001 d. No. IX-569)
- Law on the Financing of Road Maintenance and Development Programme (12 October 2000 No. VIII-2032)

[4] COUNCIL DIRECTIVE 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity. Annexes with taxation levels and exemptions can be found in appendix 2.
[5] http://europa.eu.int/comm/taxation_customs/taxation/energy/energy_en.htm

Revenues generated by environmentally related taxes in EU member states constitutes 4-9 % of state budget tax revenue (OECD, database of environmentally related taxes, 2000). Major revenue in EU are gained from fuel and motor vehicle taxation, while main share of revenue from environmentally related taxes/charges in Lithuania is collected from emission charges. Motor vehicle taxation in Lithuania also creates considerable flow of revenues though taxes do not cover private passenger cars (annual circulation/recurrent taxes, registration taxes) and main share of revenues is generated from taxes which are not environmentally oriented. As in most of the other Central and Eastern European countries, larger proportion of revenue from environmental taxation is earmarked to environmental purposes in Lithuania. (In contrast to most of the western European countries where the environmental taxes goes straight into the state budget). Revenue generated is divided among various environmental funds (national, municipal, environmental investment) and disbursed in a form of grants, soft loans, interest subsidies etc. Allocation of revenues from environmental levies in Lithuania (2003) is shown in the figure below.

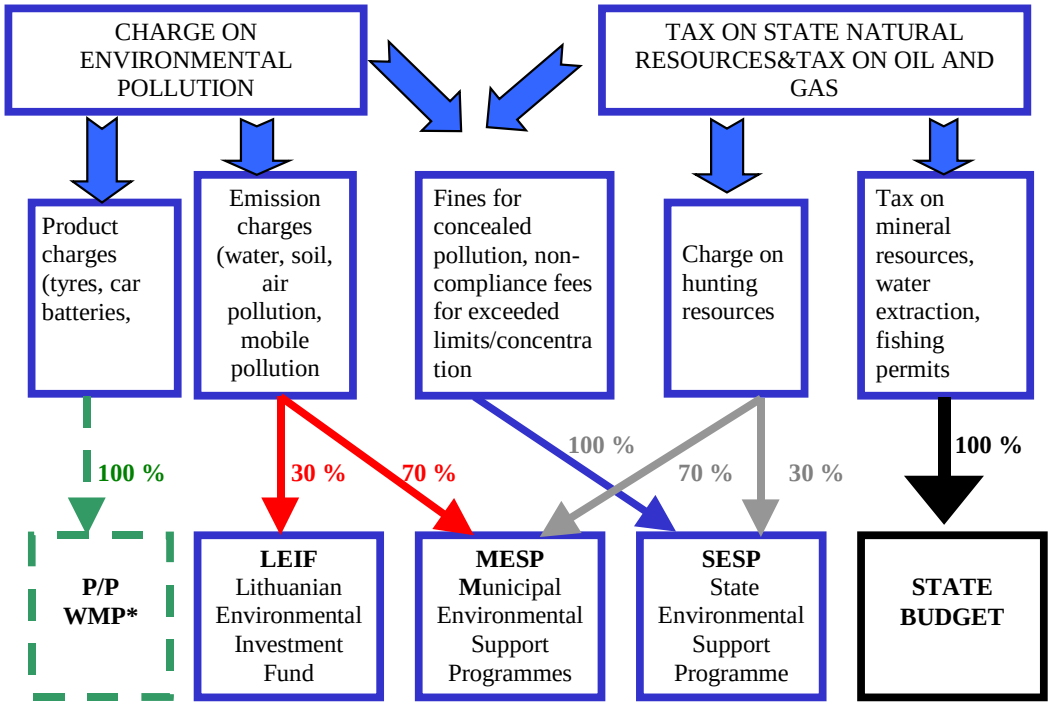

Figure B Allocation of revenue from environmental taxes/charges.

An analysis of positive and negative aspects of the current environmental economic instruments in operation in Lithuania today has been performed.

The positive features of the current system could be as follows:

1. *Raises of the governmental revenue that may be used for implementing national environmental programs and for compensating damage done to the environment.*
2. *Create an awareness of the environmental issues and stress the importance of reduction of specific pollutants.*
3. *Induce a small economic incentive for pollution reduction.*
4. *Energy saving effects due to Excise duty on fuels.*

The use of a specific set of economic instruments in the energy sector not only improves the state of the environment, but can also have weaknesses and negative aspects. The main drawbacks of the current set up of economic instruments are presented below[6].

1. *No financial incentives for economic actors to invest in the energy efficiency measures and environmental sound technology.*
2. *Violates polluter pays principle as the pollution charge on mobile sources is levied on mobile sources owned by the legal persons only.*
3. *Creates administrative costs of environmental charges.*
4. *Implies not reliable measurements of certain pollutants and NO_X in particular because of methodological and technical disadvantages.*
5. *Negative aspects of earmarking.*
6. *Partial internalisation of externalities.*
7. *Increases costs of goods and services production.*

Based on Lithuanian statistics from three sectors (district heating, transport and industry) economic models have been used to evaluate the current economic instruments in use in Lithuania. The main conclusions are summarised such as:

When analysing the economic instruments i.e. prices in the case of DH and taxes (charges) in the case of transport and industry sectors the general finding is that these instruments are not fulfilling their functions and they are not sending adequate signals to reduce emissions. They are "several" times lower than emissions fees and taxes designed to incentive purposes, such as in Sweden (SO_2, CO_2) and in Norway (CO_2). Indeed it seems that the rates of the Lithuanian pollution taxes (including charges and fees) are established on the basis of criteria unrelated to abatement costs. The rates for air emissions remain in the low range of marginal abatement costs, indicating that they provide some incentive to reduce emissions, but not enough to achieve efficient emission reduction.

[6] Drawbacks no. 1, 2 and 3 are listed first, as they are most specific for Lithuania and could be applied as the arguments to amend the existing system.

- Regarding DH and since the prices are both subsidised and they do not depend on the existence of individual heat metering, we would suspect they do not reflect the true prices the consumer is paying. Hence, it is not easy to unambiguously derive parameter estimates in order to suggest changes. Yet, and based on the estimations the subsidised prices are conceived to be less significant suggesting that increasing them (by certain percentage) would not reduce demand. Therefore we suggest a minimum price adapted to GDP per capita and/or a block tariff where households with lower income (or square meters) would pay lower price for the heating than households with higher income (and larger number of inhabited square meters). Further, metering heat at the household level would increase efficiency and fairness.
- In general, total industry production has increased during the years. The estimation results are not intuitive in the sense that there exists a positive correlation between both environmental and other taxes suggesting that producers conceive these taxes to be marginal. It is also suspected that the true value of emissions is not reported. Therefore, a better way to estimate the emissions should be based (especially in the case of NO_X) on reliable formulas.
- In the transport sector the volume of vehicles as well as the fuels consumed has increased strongly especially during the last decade. However, due to scarcity of data no analytical assessment was made. But, depending on the consumption rate of transport fuels one would suspect that their prices do not matter. Therefore, increases of both the gasoline price and the diesel price are suggested to at least EU minimum level.

Status and use of economic instruments in Sweden

The Swedish energy tax system has been developed over a long period of time. Of today's energy taxes the tax on gasoline is the oldest. It was introduced in 1929. The next step was that a special tax on electrical energy was introduced in 1951 in order to decrease the government's budget deficit. In 1957 a general energy tax was introduced. At its introduction, the tax liability comprised electrical energy, coal, fuel oil, motor fuel oil, gasoline and motor alcohol. The environmental taxes are however of later date.

A Swedish energy and environmental policy have been in place since many years and is continuously revised and updated. However, it is complex and formed by many different documents. In year 2002 a new government bill for energy was released. This government bill was mainly based on the former bill from 1997 but some new ideas were introduced:

1. Actions for an efficient energy use.
2. Proposed actions for strengthening of combined heat and power production in the energy system.
3. Proposed actions for the nuclear phase-out and energy production conversion towards a sustainable energy system.
4. Introduction of a quota-based electric power certificate system to promote environmental friendly and renewable electric power production.

The Swedish Parliament has established 15 environmental quality objectives, to guide Sweden towards a sustainable society. The objectives have been prepared by the Committee on Environmental Objectives which is a committee incorporating representatives of all the political parties in the Swedish Parliament. The costs associated with environmental problems are considerable. They stem not only from production losses and the destruction of materials but also from impaired health and the loss of both cultural heritage and biological diversity. The costs in Sweden have been estimated by the committee to well over SEK 20 000 million a year. The 15

environmental objectives will function as benchmarks for all environmentally related development in Sweden, regardless of where it is implemented and by whom. The challenge facing us is to hand over to the next generation a dynamic but sustainable society in which the major environmental problems have been solved. The overriding aim is to solve all the major environmental problems within one generation.

The work on Sweden's environmental quality objectives is based on five fundamental principles:

- promoting human health,
- safeguarding biological diversity,
- protecting cultural heritage,
- preserving the long-term productive capacity of the ecosystem and
- ensuring that natural resources are properly managed.

Based on the principles above 15 environmental quality objectives have been developed for Sweden.

1. Clean air
2. High-quality groundwater
3. Sustainable lakes and watercourses
4. Flourishing wetlands
5. A balanced marine environment, sustainable coastal areas and archipelagos
6. No eutrophication
7. Natural acidification only
8. Sustainable forests
9. A varied agricultural landscape
10. A magnificent mountain landscape
11. A good built environment
12. A non-toxic environment
13. A safe radiation environment
14. A protective ozone layer
15. Limited influence on climate

The Swedish legislation for regulation of emissions and other ecologically harmful activities from stationary sources are build on a traditional form of control with permits, terms of conditions and inspections. The Environmental Protection Law (1969:387, Miljöskyddslagen) was designed in the end of 1960th and was a very comprehensive environmental law at that time. The introduction of the Environmental Protection Law results in significant improvements of the Swedish environment especially concerning water emissions from households and industry and air emissions from large industrial plants. The basic idea with the Environmental Protection Law was that a certain amount of environmental effects could be acceptable if the activity had an appropriate geographic location, if the environmental effects could be acceptable and that appropriate actions were taken to protect the environment. Permits were released by a special authority "Koncessionsnämnden för miljöskydd" (Concession board for environmental protection). A decision could be appealed to the government.

In 1999 the new Environmental Code was introduced. In this way a number of environmental laws were aggregated into one code. The objectives and area of application of the Environmental Code is described in the code as follows:

The purpose of this Code is to promote sustainable development, which will assure a healthy and sound environment for present and future generations. Such development will be based on recognition of the fact that nature is worthy of protection and that our right to modify and exploit nature carries with it a responsibility for wise management of natural resources. The Environmental Code shall be applied in such a way as to ensure that:

1. human health and the environment are protected against damage and detriment, whether caused by pollutants or other impacts;
2. valuable natural and cultural environments are protected and preserved;
3. biological diversity is preserved;
4. the use of land, water and the physical environment in general is such as to secure a long term good management in ecological, social, cultural and economic terms; and
5. reuse and recycling, as well as other management of materials, raw materials and energy are encouraged with a view to establishing and maintaining natural cycles.

The procedures are similar to the old Environmental Protection Law but the Concession board is replaced by five environmental courts. The district courts so designated by the Government shall be regional environmental courts. The Superior Environmental Court shall be the Svea Court of Appeal. The final court of appeal shall be the Supreme Court. To give the new environmental code a certain amount of flexibility the code and laws were written as framework laws. The specific regulations are short and general. Instead, emission requirements and other regulations for specific industries are set up by a probation authority based on technical and economical possibilities and on what can be considered as environmental motivated. The procedure is integrated and all important environmental aspects are considered such as emission to air, water and soil, noise etc. All aspects are handled in one concession and one permit. This gives a comprehensive view of the case and many aspects of the case can be considered.

In the government bill in year 2000 a green tax reform for the period 2001-2010 was introduced. The available amount for the reform was estimated to 30 billion SEK. The term "green tax reform" has been used since the beginning of the 1980th and is not very well defined. However, usually we mean an increase of tax on natural resources, emissions and other environmentally harmful activities. The income from the increased environmental taxes is used to lower other taxes, usually taxes on labour work. A green tax reform can be seen as a tool to improve the environmental performance of the tax system but it can also be seen in a wider perspective in the development of a environmentally concerning tax system. From a Swedish government perspective a green tax reform is meant to be tax income neutral. The purpose is to increase element of environment in the tax system.

The Swedish tax and charge system for energy and the environment is in its base form relatively straight forward and clear. The main taxes and charges are:

- The energy and carbon dioxide tax.
- Tax on electric power.
- Tax on sulphur.
- CO_2 emission trading (in place with the EU trading system).
- The Swedish charge on nitrogen oxides.

However, many exemptions have been introduced and special solutions exist, which have made the system relatively complex.

Other economic instruments, related to energy and environment, are:

- Taxes on motor vehicles
- Pesticide tax
- Fertiliser tax
- Nuclear power tax
- Natural Gravel Tax
- Waste tax
- Building Regulations
- Aircraft fees

In principle, the administration of the Swedish economic instruments for environmental and energy control can be divided in to parts one that is administrated by the National Tax Board (Riksskatteverket) and one that is administrated by the Swedish Environmental Protection Agency. In addition, some special fees can also be administrated by e.g. the Swedish National Road Administration and the Swedish Civil Aviation Administration.

The main reason for the division of the administration is the type of control and inspection information that is needed for the different types of emittents. Amount of fuel used, amount of electric power produced etc. are all easily available figures that can easily be incorporated in the ordinary tax system. The same situation exists for the emission of CO_2 and SO_2. There is a direct correlation between the amount of carbon in the fuel and the CO_2 emission. In principle[7], all carbon will be converted to CO_2. The same situation exists for sulphur in the fuel where, in principle[8], all sulphur will be converted to SO_2. However, if SO_2 cleaning equipment is used or retainment of sulphur in e.g. ash or limestone can be excepted, measurements can be necessary.

This means that fuel data in most cases can be used to calculate the emissions. Those data can easily be implemented in an ordinary tax system and those taxes are also administrated by the National Tax Board (Riksskatteverket).

For the NO_X charge system the situation is somewhat more complicated. First of all the NO_X emission can not be calculated based on fuel data. The actual emission has to be measured in e.g. exhaust gases. The installation of a NO_X measurement system including measurement of both NO and NO_2 cost somewhat between 10000 – 30000 Euro. In addition there are also costs for operation, maintenance and independent calibrations. This limits the use of economic instruments for NO_X to larger plants and industries. The NO_X charge system is also more complicated than a tax and include not only measurement data but also refund systems, inspections etc. This means that it does not fit in so well in a normal tax administration system. In Sweden, the NO_X charge system is therefore administrated by the Swedish EPA. The following table shows a general overview of the Swedish administration system.

[7] Some carbon atoms form e.g. hydrocarbon and CO but those effects can be neglected in a CO_2 tax application.
[8] Some sulphur atoms form e.g. SO_3 and H_2S but those effects can be neglected in a sulphur/SO2 tax application.

Tax or charge	Administrated by (taxation authority)
Tax on electric power	National Tax Board (Riksskatteverket), Special Tax Office (Särskilda skattekontoret) in Ludvika. Administrated in the ordinary tax account system.
Energy tax	—"—
CO_2 tax	—"—
Sulphur tax	—"—
NO_X charge system	Swedish Environmental Protection Agency

Principles and proposals for new or improved instruments in Lithuania
Until today very little of advanced market-based economic instruments have been used for energy and environmental control in the western European countries. An example is the Swedish NO_X charge system, which can be characterised more as a charge-refund system where the charge is transferred back to the industry according to a specific rule. One of few examples of an economic instrument with emission trading possibilities actually in operation is the SO_2 allowance system in United States. The advantage with a system with tradable reduction credits is the possibility to improve the cost efficiency. Tradable credits gives the participants a possibility to reduce the emissions where it is most cost efficient i.e. not only in its own plant but also in another plant with another participant. However, a system can result in capital flows between the different participants, which can be interpreted as unfair. The specific design of the trading system is here very important. A trading system for CO_2 is also under development in EU as a preparation for the trading system, which is planned according to the Kyoto protocol.

Thus, the most common economic instruments for energy and emission control in the western European countries are traditionally tax systems combined with different charges and fees. Those taxes are usually refereed to as Pigouvian taxes[9]. The strategy for the proposed reformation work has thus been to use solid and well developed economic instruments as a base combined with options for implementation of more advances instruments to improve cost efficiency. Basic ideas have also been to develop individual and independent instruments for each type of control (energy, SO_2, NO_X etc.). The instruments should be as precise as possible even if interactions between instruments always exist. A reduction in energy consumption has for example a reducing effect on the NO_X and SO_2 emissions. A prerequisite is also that the developed instruments are in line with the EU directives.

As a rule of thumb the base should be to aim for precise taxes i.e. one tax for each substance or other aspect one want to reduce/control. Thus we should aim for separate taxes for energy, CO_2, SO_2, NO_X etc. The sum of all those taxes will be the final tax. This means e.g. that a good base for fuel taxes could be to have:

[9] A tax on an external cost, such as pollution, designed to use market forces to achieve an efficient allocation of resources. Named after Arthur Cecil Pigou (1877-1959) who 1920 presented the theory of pigouvian taxes in "The Economics of Welfare" where he studied the market failure of externalities and the internalisation of external costs into the market. An external cost caused by pollution, e.g. can be internalised if polluters pay a tax equal to the value of the external cost.

Energy tax based on energy content in the fuel.
CO_2 tax based on carbon content in the fuel.
SO_2 tax based on sulphur content in the fuel.

Sum → Total fuel tax

The sum of the taxes will constitute the total fuel tax. All taxes above can be calculated based on fuel content and can be added to the fuel price. The energy tax will control the energy consumption and energy efficiency, the CO_2 tax will promote use of less carbon rich fuel i.e. promote natural gas instead of coal, the SO_2 tax will promote the use of desulphurised oil and other low sulphur product. A question can be biofuels (wood). Usually there is no CO_2 tax for biofuels and the sulphur content is very low so there are almost no SO_2 tax. A question can be if one should have energy tax on biofuels. However, a very primary and important aspect is that the actual emissions are used in the economic instruments. If calculations are used these must be done in a correct way and if measurements are used these must also be performed correctly. It is also important to avoid misuse or cheating in the system.

Concerning CO_2 control we think that it is possible for Lithuania to keep the CO_2 tax even if the Kyoto agreement will be in place. A pressure is needed to guide the investments towards a low-CO_2 direction. The Kyoto protocol does not give this incitement to Lithuania so one needs to create such incitements.

Another question is to set a total tax level and an appropriate balance between energy, CO_2 and SO_2 tax. An EU directive together with transition rules regulates the minimum taxation level of energy tax.

With NO_X it is different compared to CO_2 and SO_2 because one need a measurement to have a correct value to use in a economic instrument. The purpose is such that one need to create an instrument that create a pressure to invest in low NO_X equipments (e.g. to chose a low NO_X burner instead of an ordinary burner when a company or other organisation invest in new equipments), to promote low NO_X fuels and to optimise there plants both for energy efficiency and NO_X. We think it is possible to develop a tool that is based on e.g. one yearly measurement by the inspectors. May be a tax or a NO_X charge system can be arranged. This is however only possible for larger plants. Small plants are difficult to control and cars need special regulations usually based on catalytic cleaning and yearly inspections of the cars. Today the NO_X charges are based on calculations or emission factors. NO_X can not be calculated in a correct way but one can of course use emission factors for example for oil boilers, natural gas boilers etc (e.g. mg NO_X/MJ used fuel). The problem is that if an owner of a boiler do an investment to reduce the NO_X emission he will still have the same tax. This creates no incitement to reduce the NO_X emission so therefore a change is needed. However, measurements require investments in measurement equipments and this is only reasonable for large plants. In the Swedish NO_X charge system the economy of the investment to install measurement equipment have to be weighted against the NO_X charge for all the participants in the system.

The other emittents (particles, PAH, the 300 list of other substances etc.) have the same problem as NO_X, one need to measure. Many of those are very specific for an industrial sector. One needs an active work with those substances. Many of those can also be harmful for human health (cancer risk etc). The tax system in Lithuania today gives actually no incitement to work actively with those questions. One just calculates the emission (which usually are not functioning formulas) and pay a

very small sum of money in tax. We think it is better to have a system where the industry (at least the big ones) have separate permissions for there operations where many problems are considered like emission levels, control and measurement programs, obligation to reduce some emissions etc. The permission can be granted for several years and can then be renegotiated. It is here of course important with rules so all the industries feel that they are treated equally by the authority. In Sweden this work is performed by local community environmental departments or by Swedish EPA. Sweden also has an environmental court where disputes can be solved which has been described earlier in the report.

The existing economic instruments in Lithuania are all based on taxes, excise or fees. The energy tax level is slightly under the EU minimum level while the tax level for specific emissions are low. Since energy taxes would not be increased to the EU minimum during this decade, complementary measures to reduce emissions would be emission specific e.g. NO_X tax or charge, SO_2 tax or charge such as discussed above with the exception that the levels should be based on accurate methods of measurement.

Contents

APPENDIXES

Preface

Different economic instruments have been important and often used tools for governments to improve and control the environmental performance in a country. Many different instruments exist and the application of them is often complex. The present study has been initiated to study and improve the economic instruments for environmental control in Lithuania. In the project the existing economic instruments in Lithuania and Sweden have been studied as well as an overview of economic instruments in other European countries. Economic analyses have been made of the different systems and improved systems for Lithuania have been proposed.

The project has been a co-operation between Sweden and Lithuania financed by The Swedish Environmental Protection Agency (Naturvårdsverket). The project has been performed by a team consisting of representatives from both Sweden and Lithuania. The project team has consisted of the following participants:

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List of Abbreviations

Abbreviations	
BOD	Biological Oxygen Demand
CEE	Central and Eastern European (CEE) countries
CO_2	Carbon dioxide
DH	District Heating
EC	European Commission
EPA	Environmental Protection Agency
EU	European Union
kr	Swedish kronor, same as SEK
kWh	Kilowatt hour, unit for energy, equal to 3.6 MJ
LSE	Lag (1994:1776) om skatt på energi (The Swedish Law of tax on energy)
LTL	Lithuanian Litas
MJ	Energy unit megajoule
NO_X	Nitrogen oxides (NO and NO_2)
PAH	Polycyclic Aromatic Hydrocarbons
RSV	Riksskatteverket, Swedish National Tax Board
SCR	Selective Catalytic Reduction (NO_X)
SEK	Swedish kronor
SNCR	Selective Non Catalytic Reduction (NO_X)
SO_2	Sulphur dioxide
SOU	Statens Offentliga Utredningar, Government White Papers
UNECE	United Nations Economic Commission for Europe
öre	Swedish öre, 1 SEK = 100 öre

1 Introduction

The global environment has been damaged increasingly during the last decades depending on production, consumption and transportation in all countries where the implied negative effects were/are non-negligible. Being aware of this fact the European community initiated since the seventies many action programs and adopted several pieces of legislation to limit the environmental externalities including human health and the ecosystem by way of minimum standards for waste management, water and air pollution. In order to achieve these minimum standards, several economic instruments have been developed.

The use of economic instruments has been increasing rapidly in the European community in particular and the Western countries in general where an important reason for the increased use of economic instruments is related to the positive experiences gained. Generally, Countries have developed action plans for long-term programmes to implement their strategies. Some countries have specified objectives for air pollution abatement policies on the basis of the effects of those pollutants, while others based their air pollution abatement policy on BAT (best available technology). Some parties set emission reduction targets based on Protocol obligations or domestic policy, whilst others set goals and requirements for achieving national air quality standards. A mix of instruments is used in most cases though the different types of measures should be complementary.

When it comes to the countries of Central and Eastern Europe (CEE) e.g. Lithuania, the priority problems typically identified include: centres of severe industrial pollution; pollution intensive and inefficient heat generation and distribution systems; increasing pollution from road transport; poor surface and groundwater quality; underdeveloped municipal environmental infrastructure; and the inefficient use of natural resources.[10] Nevertheless, economic transition has helped these countries to achieve certain degree of pollution reduction.

Such is the case in many European countries, the derived pollution of the energy sector in Lithuania including air pollution is regulated with the aid of administrative and economic measures. The administrative measures include mandatory requirements and standards while economic instruments are basically taxes and charges. However, although most economic instruments were introduced with an incentive effect for pollution reduction in mind, a review of these taxes or charges reveals that their levels are to low to warrant efficient reductions in pollution in the energy sector.

The objective of this report is to support the Ministry of Environment of Lithuania in developing and implementing efficient economic instruments in the energy sector. Chapter two is a summary of the EU requirements related especially to emissions from the energy sector. In chapter three the economic instruments for the energy sector in Lithuania are described and a discussion of both positive and negative sides of the economic instruments is made. Chapter four is a review of economic instruments in Sweden. Chapter five is a review of economic instruments in different countries. The energy sector in Lithuania is analysed in chapter six using different models and a panel data related to district heating and the industry sector. When it comes to transport sector that is considered to generate more pollution, it is assessed rather descriptively depending on data scarcity. Further different economic instruments to reduce emissions from the all energy sectors are suggested. Chapter six ends with some concluding remarks and finally chapter seven includes strategies for evaluation and follow-up of implemented environmental economic instruments.

[10] OECD

2 Overview of Specific EU Requirements in the Energy Sector

2.1 Introduction

The European environment has been damaged increasingly during the last decades depending on production, consumption and transportation in all member states where the implied negative effects were/are non negligible. Being aware of this fact, 6 successive action programs started in 1972 and the community adopted more than 200 pieces of legislation predominantly related to limiting externalities to the environment by way of minimum standards for waste management, water and air pollution.

Since introduction of legislation per se would not mitigate the increasing externalities, including determined actions was a prerequisite both at the European and international level to decrease pollution. For the sake of consistency, the actions have got the status of policy by the treaty on European Union (Maastricht 1992). Furthermore, *the Treaty of the Amsterdam* (1997) enshrines the principle of sustainable development as one of the European Community's aims and makes a high degree of environmental protection one of its absolute priorities.

In 2002, the *sixth action programme for the environment* has been adopted. It sets out the priorities for the European Community up to 2010. Four areas are highlighted: climate change, nature and biodiversity, environment and health and the management of natural resources and waste. Measures to achieve these priorities take the form of improving the application of environmental legislation, working together with the market and citizens and ensuring that other Community policies take greater account of environmental considerations.

Despite the different efforts, there is no substantial improvement in the environment yet, in spite of a decrease in the emissions to air and water of a number of pollutants, such as sulphur dioxide (a 50 % reduction since 1980), lead (a 60 % reduction since 1980), phosphorous in many water catchment areas (a 30 to 60 % reduction since 1980s) and to a lesser extent nitrogen oxides and volatile organic compounds (a 14 % reduction since 1990).

According to the Treaty establishing the European Union, one of the objectives of Community policy on the environment is to promote measures at international level to deal with regional or world-wide environmental problems. Accordingly, under the Treaty, the Community may co-operate with third countries and with the competent international organisations. The Community has, for instance, been a Party to international conventions on environmental conservation since the 1970s. At present it is a Party to more than 30 conventions and agreements on the environment and takes an active part in the negotiations leading to the adoption of these instruments, within the framework of its competence. Some of these Conventions are global in scope, while others are regional. Among the global Conventions is the Vienna Convention for the Protection of the Ozone Layer, its Montreal Protocol on Substances, which Deplete the Ozone Layer, the UN Conventions on Biological Diversity and on Climate Change and the Aarhus Convention on Access to Information and Justice. The Community has also signed the Kyoto Protocol, which provides for measures and commitments to reduce greenhouse emissions.

The Community also takes part, normally as an observer, in the activities and negotiations taking place within the context of international bodies or programmes and in particular under the auspices of the United Nations.

2.2 Conventions, Protocols, Directives and Programs

2.2.1 Convention on Long-range Transboundary Air Pollution

In response to the acute environmental problems, a High-level meeting within the Framework of the UNECE on the Protection of the Environment was held at ministerial level in November 1979 in Geneva. It resulted in the signature of the Convention on Long-range Transboundary Air Pollution by 34 Governments and the European Community. The Convention was the first international legally binding instrument to deal with problems of air pollution on a broad regional basis. Besides laying down the general principles of international co-operation for air pollution abatement, the Convention sets up an institutional framework bringing together research and policy.

Table 1 shows the effects covered by the convention's protocol where the history of the Convention can be traced back to the 1960s. Scientists demonstrated then the interrelationship between sulphur emissions in continental Europe and the acidification of Scandinavian lakes. The 1972 United Nations Conference on the Human Environment in Stockholm constituted the starting point for active international co-operation to combat acidification. Between 1972 and 1977 several studies confirmed the hypothesis that air pollutants could travel several thousands of kilometres before deposition and damage occurred.

Table 1 Effects of pollutants covered by the Convention's Protocols

Pollutant	Health effects	Ecological effects
SO_2	-Respiratory diseases -Respiratory symptoms in asthmatics -Asthma attacks	-Acid rain (e.g., damage to fish populations and forest soils)
NO_x	-Lung irritation (e.g., inflammation, respiratory cell damage, premature ageing) -Increased susceptibility to respiratory infection -Respiratory diseases -Asthma attacks	-Acid rain (e.g., damage to fish populations and forest soils) -Eutrophication (e.g., disruption of ecosystem functions, acidification of surface and ground waters) -Regional haze
VOCs	-Lung irritation (e.g., inflammation, respiratory cell damage, premature ageing) -Increased susceptibility to respiratory infection -Asthma attacks	-Decreased commercial forest productivity -Damage to ecosystem functions -Regional haze
Ammonia	-Eye and upper respiratory tract irritation -Burning and scarring of tissues -High blood pressure -Lethal at higher concentration (can cause blindness, lung damage, heart attack, death)	-Eutrophication (e.g., disruption of natural ecosystems) -Reduction in egg hatching success in fish, reduction in growth rate and morphological development (esp. gills, liver and kidney) -Toxic to fish and aquatic organism at high concentrations.

The Convention on Long-range Transboundary Air Pollution entered into force in 1983. It has been extended by *eight specific protocols*. These are:

- The 1999 *Protocol to Abate Acidification, Eutrophication and Ground-level Ozone;* 31 Signatories and 5 ratifications. (Not yet in force).
- The 1998 *Protocol on Persistent Organic Pollutants (POPs);* 36 Signatories and 16 ratifications. (Will enter into force on 23 October 2003).
- The 1998 *Protocol on Heavy Metals*; 36 Signatories and 14 ratifications. (Not yet in force).
- The 1994 *Protocol on Further Reduction of Sulphur Emissions*; 25 Parties. (Entered into force 5 August 1998).
- The 1991 *Protocol concerning the Control of Emissions of Volatile Organic Compounds or their Transboundary Fluxes*; 21 Parties. (Entered into force 29 September 1997).
- The 1988 *Protocol concerning the Control of Nitrogen Oxides or their Transboundary Fluxes*; 28 Parties. (Entered into force 14 February 1991).
- The 1985 *Protocol on the Reduction of Sulphur Emissions or their Transboundary Fluxes by at least 30 per cent*; 22 Parties. (Entered into force 2 September 1987).
- The 1984 *Protocol on Long-term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP);* 40 Parties. (Entered into force 28 January 1988).

2.2.2 The Gothenburg Protocol

The Executive Body adopted the Protocol to Abate Acidification, Eutrophication and Ground-level Ozone in Gothenburg (Sweden) on 30 November 1999. The Protocol sets emission ceilings for 2010 for four pollutants: sulphur, NO_X, VOCs and ammonia (for more details on emission ceilings see bellow). These ceilings were negotiated on the basis of scientific assessments of pollution effects and abatement options. Parties whose emissions have a more severe environmental or health impact and whose emissions are relatively cheap to reduce will have to make the biggest cuts. Once the Protocol is fully implemented, Europe's sulphur emissions should be cut by at least 63 %, its NO_X emissions by 41 %, its VOC emissions by 40 % and its ammonia emissions by 17 % compared to 1990.

The Protocol also sets tight limit values for specific emission sources (e.g. combustion plant, electricity production, dry cleaning, cars and lorries) and requires best available techniques (BAT) to be used to keep emissions down. VOC emissions from such products as paints or aerosols will also have to be cut. Finally, farmers will have to take specific measures to control ammonia emissions. Guidance documents adopted together with the Protocol provide a wide range of abatement techniques and economic instruments for the reduction of emissions in the relevant sectors, including transport.

2.2.3 Directives

For more details on the directives see section about air pollution and appendix 1.

2.2.3.1 Ceilings

Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 set national emission ceilings for certain atmospheric pollutants as shown in table 2. This Directive is part of the follow-up to the Commission's communication on a strategy to combat acidification, which sought to establish, for the first time, national emission ceilings for four pollutants - sulphur

dioxide (SO_2), nitrogen oxide (NO_X), volatile organic compounds (VOC) and ammonia (NH_3) - causing acidification, eutrophication and tropospheric ozone formation (also referred to as "bad ozone", present at low altitudes, as contrasted with stratospheric ozone), regardless of the sources of pollution.

Table 2 National ceilings for SO_2, NO_X, VOC and NH_3 to be attained by 2010 (in kilotonnes)*

Country	SO_2	NO_X	VOC	NH_3
Austria	39	103	159	66
Belgium	99	176	139	74
Denmark	55	127	85	69
Finland	110	170	130	31
France	375	810	1050	780
Germany	520	1051	995	550
Greece	523	344	261	73
Ireland	42	65	55	116
Italy	475	990	1159	419
Luxembourg	4	11	9	7
Netherlands	50	260	185	128
Portugal	160	250	180	90
Spain	746	847	662	353
Sweden	67	148	241	57
UK	585	1167	1200	297
EC 15	3850	6519	6510	3110
Lithuania	145	110**	92	84

Source: Official Journal of the European Communities. *) for emission levels in 1990 and percentage emission reduction for 2010 see http://europa.eu.int/eur-lex/en/com/pdf/2002/en_502PC0044.pdf. **) Refers to NO_2.

The purpose of the emission ceilings is broadly to meet the following interim environmental objectives:

- the areas with critical loads of acid depositions will be reduced by at least 50 % compared with 1990;
- ground-level ozone loads above the critical level for human health will be reduced by two-thirds compared with the 1990 situation. An absolute limit is also set. The guide value set by the World Health Organisation may not be exceeded on more than 20 days a year; and ground-level ozone loads above the critical level for crops and semi-natural vegetation will be reduced by one-third compared with 1990.

Moreover, Member States must prepare and annually update national emission inventories and emission projections for SO_2, NO_X, VOC and NH_3. These inventories and projections must be reported to the Commission and the European Environment Agency each year by 31 December at the latest.

The Commission must report (in 2004, 2008 and 2012) to the European Parliament and the Council on progress on the implementation of the ceilings and towards attaining the interim environmental objectives and the long-term objectives set by the Directive. These reports must contain an economic assessment of the implementation of the national emission ceilings, including

cost-effectiveness, costs and benefits, impact on competitiveness and socio-economic impact in each Member State.

The Member States and the Commission will co-operate with third countries and relevant international organisations with a view to exchanging information and proceeding with research aiming at reducing emissions of SO_2, NO_X, VOC and NH_3.

The Commission will report to the Council and the European Parliament on the extent to which emissions from international maritime traffic and aircraft contribute to acidification, eutrophication and the formation of ground-level ozone within the Community. It will also specify the actions, which could be taken to reduce emissions from these sectors.

2.2.3.2 Programmes

Generally, Countries have developed action plans for long-term programmes to implement their strategies. Some countries have specified objectives for air pollution abatement policies on the basis of the effects of those pollutants, while others base their air pollution abatement policy on BAT (or BAT not entailing excessive cost). Some Parties including Lithuania set emission reduction targets based on Protocol obligations or domestic policy, whilst others set goals and requirements for achieving national air quality standards. A mix of instruments is used in most cases though the different types of measures should be complementary.

2.2.3.2.1 The CAFE programme

The CAFE programme launched in 2001 is the first of the thematic strategies in the sixth environmental action programme. The programme's objectives to establish a long term, integrated strategy to tackle air pollution and to protect against its effects on human health and the environment are:

- to develop, collect and validate scientific information on the effects of air pollution (including validation of emission inventories, air quality assessment, projections, cost-effectiveness studies and integrated assessment modelling);
- to support the implementation and review the effectiveness of existing legislation and to develop new proposals as and when necessary;
- to ensure that the requisite measures are taken at the relevant level, and to develop structural links with the relevant policy areas;
- to determine an integrated strategy to include appropriate objectives and cost-effective measures. The objectives of the first programme phase are: particulate matter, tropospheric ozone, acidification, eutrophication and damage to cultural heritage;
- to disseminate to the general public the information arising from the programme.

Furthermore, a scientific input will be vital for implementing CAFE. Accordingly, links with the European Union's framework programmes of research and technological development will be one of the programme's priorities. Finally, a close co-operation will be set up with the United Nations Economic Commission for Europe Convention on Long-range Transboundary Air Pollution and with the World Health Organisation.

2.3 Air pollution

In order to achieve a significant reduction in air pollution, which is the main cause of global warming, national and international measures must be combined to reduce emissions of the gases responsible. To this end the United Nations Framework Convention on Climate Change (1992) and the Kyoto Protocol (1997) were adopted. The Parties have undertaken to reduce their emissions of greenhouse gases by at least 5 % of their 1990 levels during the period 2008-2012. In order to make progress towards this target it has set itself under the Kyoto Protocol, the Community has approved a programme on climate change and a communication on its implementation. The programme identifies energy, transport, industry and research in particular as areas for priority measures. In January 2005 the European Union Greenhouse Gas Emission Trading Scheme (EU ETS) commenced operation as the largest multi-country, multi-sector Greenhouse Gas emission trading scheme world-wide. The scheme is based on Directive 2003/87/EC, which entered into force on 25 October 2003.

2.3.1 Emissions from the transport sector

The emissions from the transport sector have a particular importance because of their rapid rate of growth: goods transport by road in Europe have increased by 54 % since 1980, passenger transport by road by 46 % in the past ten years in the EU and passenger transport by air has increased by 67 % in the past ten years.

The main emissions caused by motor traffic are nitrogen oxides (NO_X), hydrocarbons (HC) and carbon monoxide (CO), accounting for 58 %, 50 % and 75 % respectively of all such emissions. Whilst emission levels in the economically more developed countries within the Union have increasingly stabilised, they are continuing to rise in the less developed countries. Community directives establishing stricter standards for the emission of pollutants by motor vehicles have had positive results, but the progress achieved to date is threatened by the rising number of vehicles on the road and vehicle use. In the past years, the fuel consumption in the Community increased by 1.5 % a year.

Several directives have been adopted at Community level in order to limit pollution due to transport, setting maximum emission limits for vehicles and other sources of pollution and introducing tax measures in the transport sector aimed at encouraging the consumer to act in a more environmentally friendly manner.

a. The "Auto-oil" programme
In co-operation with the oil and motor vehicle industries the Commission has devised a common "Auto-oil" programme to reduce exhaust gas emissions. The programme comprises two new directives (98/69 and 98/70 amending Directives 70/156 and 70/220) dealing with the quality of petrol and diesel fuel and measures to tackle air pollution from motor-vehicle emissions.

- The new directive 98/70 reduces pollution emanating from car emissions by introducing new environmental specifications applicable to petrol and diesel fuels and it bans leaded petrol from the market from the year 2000. It also provides for progressive improvements in the environmental quality of unleaded petrol and diesel fuel.
- The directive 98/69 lays down differing limit values for emissions, by petrol and diesel cars, which shall apply from 2000 and 2005, according to the type of vehicle. Tax incentives granted by Member States to encourage advance compliance with new limit

values are permitted and after 28 September 1999, the new European test cycle provided by this directive shall apply.

- The Directive 98/77 inserts new technical requirements into Directive 70/220 such as the EC approval of replacement catalytic converters as separate technical units, the EC approval of vehicles, which may operate on liquefied petroleum gas or natural gas, and the measurement of rolling resistance.

b. Light commercial vehicles
On 26 June 1991 the Council adopted the consolidated emissions Directive 91/441. This directive particularly concerns passenger vehicles with a maximum capacity of six passengers and a maximum weight of 2500 kg and regulates both tailpipe emissions (including a durability test) and evaporative emissions. It was amended by Directive 94/12.

c. Heavy goods vehicles
On 1 October 1991 the Council adopted Directive 91/542, reducing in two stages the limit values for gaseous emissions and particulate pollutants from diesel-engine and other heavy goods vehicles of over 3.5 tonnes.

d. Light commercial vehicles of up to 3 500 kg and heavy vehicles for more than six occupants
These vehicles, with engine categories M and N, M1 and N1, are the subject of Directive 93/59. It categorises vehicles according to differences in power and design: Class I, with a reference weight of up to 1 250 kg; Class II, with a reference weight from 1 250 kg to 1 700 kg; and Class III, with a reference weight of more than 1 700 kg.

e. Mobile machinery and equipment with internal combustion engines
European Parliament and Council Directive 97/68 deals with gas emissions and polluting particles from mobile machines of this kind, such as bulldozers, excavators, rollers and harvesters. The directive introduces limit values for particulates, hydrocarbons, carbon monoxide and oxides of nitrogen from diesel motors of between 18 and 550 kW.

f. Motorcycles and mopeds
The Commission is currently drawing up limit values for exhaust emissions from these vehicles based on the UN Economic Commission for Europe regulations.

g. Lead in petrol
Since the compulsory introduction of unleaded petrol in October 1989, leaded petrol has been subject to restrictive measures and virtually disappeared from 1 January 2000 (Directive 98/70).

h. Sulphur in liquid fuels
Directive 93/12 lays down two stages for reducing the sulphur content: since 1 October 1994 the maximum limit value for all liquid fuels including diesel has been 0.2 %, and for diesel it has dropped to 0.05 % from 1 October 1996. The new directive 98/70 further reduces sulphur dioxide emissions resulting from the combustion of heavy fuel oils and gas oils.

i. Volatile organic compounds (VOCs)
In late 1994 the Council and Parliament adopted a directive controlling VOC emissions from the storage and distribution of petrol, Stage 1 (Directive 94/63/EC) [6]. The directive is significant, because

- annual VOC emissions from petrol and solvents in the Community amount to some 10 million tonnes;
- experts say they are very harmful to humans and the environment.

In March 1999, a new directive (99/13) on the "limitation of emissions of volatile organic compounds due to the use of organic solvents in certain industrial activities and installations" was approved. It provides for a two-third reduction in the VOCs, which are released into the atmosphere through the use of solvents in industry and together with nitrogen oxide and sunlight, cause the notorious summer smog.

2.3.1.1 Emissions from immobile sources (the greenhouse effect)

In order to curb CO_2 emissions, which are largely responsible for the gradual warming of the earth's atmosphere from the greenhouse effect, the European Union has pledged to limit them.

At the UN Conference on Climate Change in Kyoto in December 1997 the EU Member States agreed to reduce their greenhouse gas emissions (mainly carbon dioxide, CO_2; also methane CH and chlorofluorocarbons, CFCs) by 8 % between 2008 and 2012. The Kyoto Protocol allows for the use of various flexible instruments: international emissions trading, joint implementation and clean development mechanism.

The EC post-Kyoto strategy is based on environmental effectiveness, cost-effectiveness (economic and political), political acceptability and adaptability to new and unforeseen developments.

2.3.1.2 Emissions from power generation (sulphur dioxide)

To reduce sulphur dioxide (SO_2) emissions the Community has adopted a number of measures, the most important of which is the directive on large combustion plants, 88/609, as last amended by Directive 94/66. Taking 1980 as the reference year it aims to reduce annual emissions of SO_2 by 73 % by the year 2000. The EC directive on limit values for SO_2 emissions requires a reduction of 57 % from 14.4 in 1980 to 6.2 million tonnes by the year 2005. Furthermore, Directive 2001/80/EC applies to combustion plants (technical apparatus in which fuels are oxidised in order to use the heat thus generated) with a rated thermal input equal to or greater than 50 MW, irrespective of the type of fuel used. The aim of the Directive is gradually to reduce the annual emissions of sulphur dioxide and oxides of nitrogen from existing plants and to lay down emission limit values for sulphur dioxide, nitrogen oxides and dust in the case of new plants.

2.4 Environmental Instruments

The range of environmental instruments available has expanded as environmental policy has developed. Not only has the Community adopted framework legislation providing for a high level of environmental protection while guaranteeing the operation of the internal market, but it has introduced a financial instrument (the LIFE programme) and technical instruments: Eco-labelling, the Community system of environmental management and auditing, system for assessment of the effects of public and private projects on the environment, and the criteria applicable to environmental inspections in the Member States.

The European Environmental Agency has come to play an increasingly important role in recent years. It was set up to gather and disseminate comparable environmental data. Its role is purely advisory but its work has become more and more crucial for the adoption of new measures and for assessing the impact of decisions already adopted.

At present, emphasis is being placed on diversifying environmental instruments and, in particular, on introducing environmental taxes (the "polluter pays" principle), environmental accounting and voluntary agreements. No progress can be made unless environmental legislation is actually implemented, and effective implementation involves introducing incentives for economic operators (businesses and consumers).

2.4.1 Environmental taxes and charges

The Commission Communication (of 26 March 1997) on environmental taxes and charges has the objective to promote the use of fiscal instruments and to increase the efficacy of environmental policy as well as to ensure that environmental taxes and charges are used in accordance with Community legislation.

In addition to framework measures harmonised at Community level, the implementation of an environmental policy also requires the provision of a number of economic, technical/non-technical and/or fiscal instruments. This can be a way of implementing the "polluter pays" principle by inducing consumers and producers to adopt more environmentally compatible behaviour.

The Commission defines taxes and charges as covering all compulsory unrequited payments, whether the revenue accrues directly to the Government budget or is destined for particular purposes (e.g. earmarking). Further, the word "levy" is used to cover taxes and charges. There are two categories of environmental levies:

- those charged on pollutant emissions (taxes on water pollution and on noise emissions in the field of aviation);
- those charged on products (taxes on pesticides, excise on gasoline…).

Member States have considerable room for manoeuvre in fiscal matters. The revenue may be used to finance environmental protection activities, but also to decrease other taxes, which are perceived as distorting the economy (such as labour taxes). However, it is important to fix the level of environmental taxes and charges at an appropriate level to ensure that they have a real effect on the market.

However, Member States must take into account the following provisions when adopting environmental instruments of a fiscal nature:

- customs duties levied on intra-Community trade, or charges having equivalent effect (Articles 9 to 12);
- quantitative restrictions on imports and exports of goods between the Member States, or measures having equivalent effect (Articles 30 to 36);
- provisions on transport policy, that are less favourable in their effect on carriers of other Member States (Article 76);
- State aid creating distortions of competition affecting intra-Community trade (Articles 92 to 93);

- internal taxation discriminating against products of other Member States or otherwise protecting national production (Article 95) if it results from the application of objective and non-discriminatory criteria, and if the system is transparent;
- legislation concerning excise duties and other forms of indirect taxation based on Article 99;
- Article 130r stating the objectives of Community environmental policy: Member States must establish the need for a levy to solve environmental problems.

Furthermore, Member States must ensure that environmental taxes and charges are compatible with their Community obligations (competition, Single Market and fiscal policy) and with their obligations towards third countries (WTO rules)

The Commission control mechanisms can be triggered in various ways:

- notification of State aids;
- notification of areas covered by Directive 83/189/EEC (laying down a procedure for the provision of information in the field of technical standards and regulations) and secondary Community legislation;
- notification of national measures transposing the Directives;
- complaints by firms or Member States;
- the Commission's own-initiative investigations.

2.4.2 Taxation of energy products

In 1997, the Commission put forward a proposal for a Community framework for the taxation of all competing sources of energy, including minimum tax levels (see IP/97/211). This was debated in the EU's Council of Ministers and was extensively changed before being adopted as directive.

The aim of this initiative is to:

- improve the functioning of the Internal Market,
- ensure greater respect for the environment, and
- combat unemployment by allowing Member States to compensate increased revenues from energy taxation with lower taxation of labour.

On 27 October 2003, the European Union's Council of Ministers adopted Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity.[11]

The Directive widens the scope of the EU's minimum rate system for energy products, previously limited to mineral oils, to all energy products including coal, natural gas and electricity.

The objective of this Directive is to:

- reduce distortions of competition that currently exist between Member States as a result of divergent rates of tax on energy products;
- reduce distortions of competition between mineral oils and the other energy products that have not been subject to Community tax legislation up to now;

[11] COUNCIL DIRECTIVE 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity. Annexes with taxation levels and exemptions can be found in appendix 2.

- increase incentives to use energy more efficiently (to reduce dependency on imported energy and to cut carbon dioxide emissions); and
- allow Member States to offer companies tax incentives in return for specific undertakings to reduce emissions.[12]

3 Present Economic Instruments for the Energy Sector in Lithuania

3.1 Strategic framework

There are a number of strategic documents related to the use of economic instruments in energy sector. In this report the most relevant strategies will be mentioned, in particular:

- Lithuanian Sustainable Development Strategy
- The National Long Term Development Strategy
- Environmental Economic Instruments Development Strategy until 2015
- The National Energy Strategy
- National Programme on Increasing of Efficiency of Energy Use
- Strategic action plan of the Ministry of Environment 2003-2005

National Sustainable Development Strategy was adopted by the Governmental Resolution No. 3–817N on 20 August 2003 m. The strategy sets short (until 2005) term and long term (until 2010) goals and measures. The main focus of sustainability will be paid to the increase of environmental efficiency (for example energy and natural resources use per GDP, emissions per GDP, relative energy cost unit). The strategy set the goal to cut energy and natural resources inputs to produce 1 GDP unit and to achieve EU average level according this indicator.

The National Long Term Development Strategy (2002) sets, among others, the following tasks for economic instruments in the environment field:

- To develop application of the pollution charge through the extension of a list of chargeable products (end-of-life vehicles, etc.);
- To develop the taxation system of pollution from mobile sources, through introduction of the tax to all owners (including private) of the vehicles;
- To develop the pollution charges system through introduction or amendment of charges on pollution from energy sector (SO_2, CO_2, NO_X, VOC);
- To develop taxation of natural resources through setting tax rates that encourage sustainable use of natural resources and investments to research and investigation of oil and gas resources;
- To analyse and apply emission trading system.

Environmental Economic Instruments Development Strategy until 2015 prepared in 2001 (as a part of the Long Term Lithuanian Economic Development Strategy, adopted by the Governmental Resolution No. 853 on 12 June 2002) analyses SWOT of environmental economic instruments, declare vision and goals and set measures and actions to achieve those goals. The first goal states that the taxation system should be reorganised. It shall be done through strengthening

[12] http://europa.eu.int/comm/taxation_customs/taxation/energy/energy_en.htm

not only revenue raising aim of a tax, but also through reinforcement of pollution prevention incentives as well as through development of energy taxation. The strategy states among others that the taxation systems shall be amended by means of the following measures:

- Evaluation of the conformity of tax tariffs and a level of environmental incentives
- Development of mobile sources control measures while expanding scope of application
- Development of energy taxation through introduction or amendment of the existing taxes for emissions in energy sector

In addition the strategy sets the goal to analyse the application of emission trading system in Lithuania and to rationalise the use of natural resources.

The National Energy Strategy was approved by Resolution No IX-1130 of 10 October 2002 of the Seimas of the Republic of Lithuania. The main environmental directions for the energy sector in the nearest future include the following:

- wider application of economic measures promoting pollution reduction and implementation of environmentally friendly technologies;
- further development and improvement of the environmental taxation system by introducing pollution trading systems, green certificates systems and other measures;
- priority environmental investment in the energy sector should be made in the atmosphere sector first of all in order to fulfil the EU requirements and other international obligations in the field of atmospheric pollution, taking into consideration the consequences of the Ignalina NPP decommissioning.

National Programme on Increasing of Efficiency of Energy Use was approved by the government in 2001. The programme for 2001 – 2005 years states that funds have to be allocated constantly for implementation of programme on energy saving measures and these funds have to be used for energy saving, use of domestic, renewable energy resources. Also it is foreseen that houses have to be renewed and modernised, as well as energy system of such houses (first of all schools and houses that is paid of from state and municipal budgets) should be renovated.

Strategic Action Plan of the Ministry of Environment 2003-2005 (approved by Governmental Resolution No. 143; 31 January 2003) foresees Ministry of Environment to implement these measures (which are also stipulated in Governmental Programme and National Acquis Implementation Programme) related to the use of economic instruments in energy sector:

- to prepare amendments of the Law on Pollution Charge aiming at more efficient application of charges in energy sector (2003 II quarter);
- to prepare programme of nitrogen oxides, sulphur and carbon dioxide as well as other greenhouse gases emission reduction from energy sector (2003 IV quarter);
- implement requirements of directive 2001/81/EC On National Emission Ceilings for Certain Atmospheric Pollutants (SO_2, NO_X, VOC, NH_3) by elaboration of National Emission Reduction Programme (year 2003)[13].

[13] Developed in 2005 by the project "Preparation of national emission reduction and ambient air quality assessment programmes", EuropeAid/114743/D/SV/LT.

3.2 Legal framework

The Law on Environmental Protection (1992, No. 5-75, with last amendments made by X-147, on 2005-03-24) constitutes the framework for the application of environmental economic instruments in Lithuania. It prescribes economic mechanisms of environmental protection as follows (Article 28):

- taxes for use of natural resources;
- pollution charges;
- credit regulation;
- state subsidies;
- price policy;
- economic sanctions and damage compensation; and
- other ecological taxes and instruments.

Article 29 of the Law supports incentives for low waste technologies and manufacturing of ecological products by using tax reduction, soft loans and state subsidies.

According to the **Law on Tax Administration** (28 June 1995 No.I-974, last amendment by X-234, 2005-06-07) taxes can only be imposed by tax laws passed by Parliament of the Republic of Lithuania (Seimas). The Government of the Republic of Lithuania and, if an authorisation is given, the Ministry of Finance shall implement the tax laws passed by the Seimas. No other state institution may be assigned implementation of tax laws, except the Ministry of Finance, unless it is provided for in the appropriate tax law. The Government shall establish appropriate methods and regulations, ensuring tax administration, or shall task the Ministry of Finance. No subordinate legislation regarding questions of tax procedure establishment may be adopted without the consent of the Minister of Finance. Together with State Tax Inspectorate, Ministry of Environment is authorised to administrate taxes according to the Tax on State Natural Resources, Pollution Charge and Tax on Oil and Gas Resources Laws.

There are 2 main tax laws that regulate application of economic instruments:

- The Law on Pollution Charge (22 January 2002 No. IX-720)
- The Law on State Natural Resources Tax (21 March 1991 No. I-1163)

The Law on Pollution Charge (No. I X-720 720, last amendment by *X-152, 2005-03-31*) aims at encouraging the polluters to reduce environmental pollutions, comply with emission norms, as well as to accumulate funds from the charge for the implementation of measures of environmental protection. Among others emitted pollutants and certain products (packaging, tyres, batteries etc.) are charged according to the law. Separately, atmosphere pollution charges are imposed on mobile pollution sources. Emission charges have been developed since early 90-ies while product charges were introduced in year 2003 only[14]. The Law sets charge rates for the release of pollutants to air, to water and sets a product charge as well as defines general provisions for charge payment order. Detail charge administration procedure is stipulated in the order of Minister of Environment and

[14] Law on Pollution Charge impose charges for release of pollutants into environment and for release of certain products, which creates problematic waste streams after the end of their usage. For the sake of clarity, in this report pollution charges will be differentiated into emission charges and product charges. Product charges will be described in Annex 3 "Transport related taxation".

Minister of Finance (No 663/409a On Pollution Charge Calculation and Payment Order, 2002 December 21).

The Law on Natural Resources Tax states taxpayers, tax base, tariffs and order of payment. All natural and legal persons shall pay taxes at the established rate according to the amount and quality of the acquired natural resources or resources that could be potentially extracted. Under this Law two government resolutions set the tax rates and tax detailed administration procedure (Governmental resolution No. 1320 On the Tax of State Natural Resources, 10 October 1995; No. 493 On the Tax on Peat, as State Natural Resource, 6 April 1995).

Other environmentally related taxes on energy (fuels, extraction of raw oil and gas) and transport (vehicles, motor fuels) are set by the following tax laws:

- Law on Taxes on Oil and Natural Gas Resources (22 April 2003 No. IX – 15271527, last amendment by IX-1564, May 20, 2003);
- Law on Excise Duty (30 October 2001 d. No. IX-569, last amendment by X-248, 2005-06-16);
- Law on the Financing of Road Maintenance and Development Programme (12 October 2000 No. VIII-2032) (see Annex I Vehicle taxation).

3.3 Taxes and charges

In this chapter the following energy related taxes/charges will be described:

- emission charges;
- taxes on the use of natural resources;
- taxes on oil and gas;
- taxes on fuels (import and excise duties);
- other taxes (VAT)

User charges on heat and electric power consumption are not covered in this chapter as final consumption of these energy products in Lithuania is not subject to any additional taxation (except VAT) which would foster final energy users to implement energy saving measures i.e. payments are calculated purely based on cost incurred by energy provider and amount (or proxy) of energy used.

3.3.1 Emission charges

Any polluting activity (from stationery sources) in Lithuania is regulated administratively via permitting system. No pollutants can be released into environment without a priori approval of environmental authorities. Emission charges cover atmosphere, water and soil pollution.

The most relevant to the energy sector are emission charges for atmosphere and water pollution from stationery sources (heat and electricity production plants). Emission charges for atmosphere pollution from mobile sources (road, rail, air and water transport modes) pertain both to energy and transport sectors as tax is levied on fuel basis while taxpayers are users of various transport modes.

3.3.1.1 Emission charges from stationary pollution sources

Taxpayers of emission charges are mainly stationery pollution sources (industrial plants, energy production plants) which shall have permits for natural resource use (or Integrated Pollution Prevention and Control (IPPC) permits) with indicated norms of pollution emission. Energy enterprises are obliged to possess environmental permit if the total installed capacity of energy producing plant exceeds 1 MW (0.5 MW if solid fuel is used). Charge on pollution from stationary sources is paid according to the amount of pollutants actually emitted during a reporting period (quarter or half-year). Distinctively from many EU countries, charge is levied on each emission unit; i.e. emissions within allowable levels/concentrations are also taxable.

Separate charge rates are set mainly for "conventional" pollutants (SO_2, NO_X, BOD_7, solid particles, P, N) while the rest are aggregated into certain groups according to the degree of hazard posed by them. In total, there are 281 atmospheric and 42 water pollutants or their compounds distinguished in these groups. List of taxable pollutants is presented in Appendix 3.2. Basic charge rate is applied for emissions within allowable limits and/or concentrations. If a polluter breach the limit set, an additional charge is levied, i.e. basic charge rate is increased by a certain factor (1.5 – 300) depending on the hazardousness of the pollutant. Fines are imposed for unlawful (without permit) discharges, distortion of emission data or for concealed (undeclared) emissions. Emission limit values for fuel combustion are presented in Appendix 3.3.

Law on Pollution Charge provides that charge rates have to be set in advance for 5-year period and 2 years before they come into force. Currently charge rates are set in advance up to year 2009. From year 2000 charge rates for "conventional" pollutants were on gradual increase. New edit of the Law on Pollution Charges adopted in year 2002 determined further remarkable increase of charge rates for these pollutants for the period 2003-2004. Recently adopted amendment of the Law on Pollution Charges (IX-1547, 29 April 2003) has set uniform basic charge rates for the whole period of 2005-2009 fixing charge levels to the level of year 2004. Charge rates for the period 2000-2005 and year 2009 are shown in table 3 below.

Table 3 Charge rates: atmosphere pollution from stationery sources.

Pollutants	Charge rates (Litas/tonne)						
	2000	2001	2002	2003	2004	2005	2009
SO_2	206	225	268	288	311	311	311
NO_x	386	386	405	479	587	587	587
Solid particles	184	184	184	184	184	184	184
Vanadium pentoxide	11485	11485	11485	11485	11485	11485	11485
Groups of pollutants							
I	1210	1210	1210	1210	1210	1210	1210
II	570	570	570	570	570	570	570
III	74	74	74	74	74	74	74
IV	13	13	13	13	13	13	13

Table 4 Charge rates: water, soil pollution from stationery sources.

Pollutants	Charge rates (Litas/tonne)						
	2000	2001	2002	2003	2004	2005	2009
BOD_7	485	573	649	714	765	765	765
Total N	435	435	435	550	600	600	600
Total P	1480	1480	1480	2000	3000	3000	3000
Suspended particles	86	210	248	281	309	309	309
Groups of pollutants							
I	8700460	8700460	8700460	8700460	8700460	8700460	8700460
II	792710	792710	792710	792710	792710	792710	792710
III	129250	129250	129250	129250	129250	129250	129250
IV	29290	29290	29290	29290	29290	29290	29290
V	2871	2871	2871	2871	2871	2871	2871

Concerning water pollution, energy production plants are virtually exempted from charges as water is primarily used for cooling purposes. Discharged amount of pollutants, which had already existed in the water upon the intake from environment, shall be exempted from the charges on pollution from stationary pollution sources.

There is a general case when stationary energy production sources can be exempted from the emission charges. If they implement the measures reducing the emission of pollutants from stationary pollution sources not less than 10 per cent calculating from the established highest permissible pollution norm shall be exempted from the charge on the pollutants the amount of which is reduced by 10 per cent. Exemption shall be valid not more than 3 years from the beginning of the implementation of a measure. If a measure related to the reduction of pollution emission from stationary pollution sources is not implemented in due time or planned effect is not produced, pollution charge shall be paid for the whole period.

3.3.1.2 Charges on emissions from mobile pollution sources

Charges are levied on pollution from mobile pollution sources (MPS) – any other motor-driven vehicle consuming fuels (cars, buses, lorries, trains, vessels, aircrafts). Differently from stationery sources, charges are levied on inputs (fuels) rather than on actual emissions. Basic charge rates are set per tone of consumed fuels. Further rates are differentiated depending on fuel type, technical characteristics/standards of MPS (filters, exhaust neutralisation systems etc.). Air transport vehicles are also charged and charge base is one landing and take-off cycle. Charge payers are only those legal persons who are using MPS to carry out their commercial activities.

The new edition of the Law on Pollution Charges adopted in year 2002 foresaw a gradual increase of charge rates for the period 2003-2004. Recently adopted amendment of the Law on Pollution Charges (IX-1547, 29 April 2003) has set uniform basic charge rates for the whole period of 2005-2009 and returned charge levels to year 2003 level or even lowered charge rates. Basic rates according to the fuel used for years 2003-2009 are presented in a table below.

Table 5 Charge rates: Mobile Pollution Sources.

	Type of fuel or cycle	Charge rates (Litas/tonne or cycle)			
		2003	2004	2005	2009
1. Motor vehicles with internal combustion engines	petrol	21	24	21	21
	diesel	22	26	22	22
	liquefied petroleum gas	20	23	20	20
	liquefied natural gas	16	19	16	16
2. Vessels	petrol	32	39	32	32
	diesel	34	41	34	34
	fuel oil the sulphur bearing of which ≤0.5 %	8	10	8	8
	fuel oil the sulphur bearing of which is from 0.5 % to 1.5 %	14	16	14	14
	fuel oil the sulphur bearing of which is from 1.5 % to 2.5 %	20	22	20	20
3. Rail transport	diesel	32	39	26	26
4. Aircrafts	On take-off and landing cycle	5	6	5	5

If the pollution from the mobile sources was concealed, then the increased tariff is applied what is calculated using the set of coefficients depending on the type of fuel. The following is exempted from the charge on pollution from mobile pollution sources:

- natural and legal persons who pollute from vehicles in which the systems of neutralisation of exhaust gas are installed and function;
- natural and legal persons who pollute from vehicles which are used in agricultural activities, if their income from such activities amount to more than 50 per cent of all received income;
- natural persons who posses a patent and use their own vehicles in their activities;
- natural and legal persons who pollute from vehicles which use biofuel meeting the established standards and upon presentation of the documents confirming the consumption of biofuel.

3.3.2 Natural resource tax

The objective of this tax is to increase the responsibility of users of natural resources for the effective and economical utilisation of the national resources at their disposal, and to compensate public expenses spent on the investigation of natural resources and on the measures implemented for the preservation of the amount and quality thereof. As it is levied on extracted amount of natural resource rather than on amount actually used, it motivates taxpayers for careful and economical management of each unit of extracted material during all production cycle and prevention of losses (for example, leakage reduction in water distribution system). Higher tax tariffs on certain natural resources (for example, gravel, peat) can inflict substitution effect of these resources by recyclable or shifting to other materials.

For energy sector, taxation of water resources and peat is most relevant. A major amount (93 %) of the water consumed and consequently discharged in Lithuania is surface water used for cooling in energy and electricity production plants (3.29 km^3 out of 3.53 km^3. water used in 2000). Main amount of water is used for cooling Ignalina Nuclear Power Station.

Different tax rates on surface water resources are applied for various power plants and industry as well as agriculture. Tax rates on surface water for energy enterprises are much lower than for other users or water types (groundwater) (see table 6).

Table 6 Taxes on water resources in Lithuania.

Water consumed for cooling in energy sector:	Price Litas per m^3
Cooling of condense heat power plants	0.0005
Hydropower:	
Kruonis Hydro power plant	0.00002
Kaunas Hydro power plant	0.00002
Cooling of Ignalina Nuclear Power Plant	0.001
Surface water for agriculture and manufacturing	0.005
Groundwater for household use:	0.03
Groundwater for manufacturing processes	0.07

Combustion of peat plays a minor and diminishing role in energy balance, making up about 0.1 % of energy final consumption in Lithuania. Tax on extraction of peat for domestic usage or processing is equal to 1 Litas/tonne, while for exports of non-processed peat – 5 Litas/tonne.

The exemptions are applied for land users for business purposes other that sale that uses raw materials for construction and water, if the resources are in their property. Fines for concealed amount of natural resources equal to tenfold unpaid tax sum (plus exaction of unpaid tax).

3.3.3 Oil and gas extraction taxation

Oil and gas extraction taxation is prescribed by natural resources tax and by oil and gas resource tax.

Natural resources tax is applied for extraction of oil and gas. Basic tax rate is calculated as a percentage from extracted oil/gas sales price. Additionally, compensatory tax rate (9 %) is applied if geological investigation works were financed from state budget.

The Law on Oil and Gas Resource Tax was modified in 2003 aiming at more favourable economic conditions for private sector investments into geological investigations. Modified legislation provides more flexible taxation scheme, which differentiated tax rates (ranging from 2-20 % of sales price) depending on the location of the oil and gas deposits (tertiary/marine), extraction capacity and operation start time (see appendix 3.13).

In order to foster investigation works, tax allowance mechanism was set. The mechanism implies that oil and gas extraction companies, that operate deposits opened after year 2003 (or before 2003 provided that deposits are exploited by 75 %), can get tax allowances up to 50 % of the payable tax sum to compensate their investments into investigation works.

Last changes in legislation, according to which tax rates were reduced, are directed to increasing the private incentives of geological investigations though it is foreseen that amendments will lead in substantial tax revenue reduction.

3.3.4 Taxation of energy products

Out of energy products mainly liquid and gaseous fuels are subject to excise and import duties as well as VAT. Around 80 % of all fuels marketed in Lithuania are produced in domestic oil refinery "Mažeikių nafta", the rest is imported. It should be noted that up to year 2002 electricity production was also subject to excise duty – 1 % from sales price.

3.3.4.1 Excise duty on fuels

Excise duty is levied on certain fuel products if they are used for heating purposes or as motor fuel (or additives of motor) fuels. Thus excise duty could be considered as an important instrument to promote energy savings and the use of more environmental friendly fuel. No excise duty is levied on natural gas, the use of which is promoted in such a way.

The fuel excise duties in Lithuania are constantly growing and for certain fuels has reached the minimum EU levels (see table 59). Harmonisation with newly adopted EU Directive 2003/96/EC[15] will increase duty rates of all fuels and will also embrace the range of taxable objects to other energy products (coal, coke, natural gas, electricity; see Chapter 6.5). Tax rates for 2001 - 2004 are presented in the table below:

Table 7 Fuel excise duty rates (2001-2004*).

Fuel type	2001	2002	2003	2004
Motor petrol, its substitutes and extenders Litas/tonne (Euro/tonne)	1210 (351)	1250 (362)	1250 (362)	1318 (382)
Petroleum Gas and Gaseous Hydrocarbons Intended for Use as Motor Fuel, Their Substitutes and Extenders Litas/tonne, (Euro/tonne)	329 (95)	387 (112)	387 (112)	432 (125)
Kerosene, its Substitutes and Extenders Litas/tonne, (Euro/tonne)	560 (162)	720 (209)	720 (209)	1002 (290)
Gas Oils, their Substitutes and Extenders Litas/tonne, (Euro/tonne)				
for heating	560 (162)	80 (23)	80 (23)	86 (25)
other (incl. diesel)		720 (209)	860 (249)	1002 (290)
Heavy Fuel Oils, Their Substitutes and Extenders Litas/tonne, (Euro/tonne)				
For heating	20 (5.8)	80 (23)	80 (23)	86 (25)
Other		45 (13)	45 (13)	52 (15)

There are several of exemptions of excise duty. Excise duty on gas oils and/or their substitutes, intended for use as fuel (motor fuel) in agriculture and/or inland fisheries, is refunded (exempted from January 2004). The amount of the refund (exemption) is to be calculated in accordance with the amount of gas oils (diesel fuel) and/or their substitutes but not exceeding:

1. 120 litres per calendar year for one hectare of farming land declared in accordance with the procedure determined by the Government or an institution authorised by it,

2. 275 litres per calendar year for one tonne of fish caught in ponds or other inland waters and sold.

Excise duty on fuels obtained from biological raw materials produced in accordance with the requirements of the Law on Biofuel and the implementing legislation shall be levied at the rate reduced in proportion to the share (percent) of biological raw materials per 1 tonne of the product.

3.3.4.2 Import duties

Integrated Tariff of the Republic of Lithuania (approved by Governmental resolution 258 of March 24' 1997, updated in September 2003) sets three different custom regimes- preferential,

[15] Council Directive 2003/96/EC of October 27, 2003 restructuring the Community framework for the taxation of energy products and electricity

conventional, and autonomous. Preferential custom regime is applied for imports from EU and almost all CEE countries. Energy products imported from these countries are not subject to import duties (rate of custom duty is 0 %). Conventional custom regime is applied for countries which are members of WTO (World Trade Organisation), autonomous – for the rest. Import duties for energy products under conventional and autonomous custom regimes are presented in a table below:

Fuels	Rate %
Motor petrol, its substitutes and extenders	15
Petroleum Gas and Gaseous Hydrocarbons Intended for Use as Motor Fuel, Their Substitutes and Extenders	0
Kerosene, its Substitutes and Extenders	0
Gas Oils, their Substitutes and Extenders	
except Diesel fuel	15
except Stove fuel	15
Heavy Fuel Oils, Their Substitutes and Extenders Litas/tonne	0

3.3.4.3 Value added tax

A Value Added Tax (VAT) is set by the Law on Value Added Tax (/IX-751/2002 03 05). It imposes the value added tax and the obligations of taxable persons, VAT payers and other persons incidental to the payment of the tax. 3 VAT rates are applied in Lithuania: 18 % (standard), 9 % (reduced) and 0 % (zero).

As it was mentioned in introduction, virtually all energy products are taxed at standard tax rate though several applications of reduced or zero-rate VAT has positive implications for energy savings and use of biofuels. Reduced 9 % rate of VAT is applied to supplies of services relating to construction, renovation, insulation, which are financed from state and municipal budget resources as well as with soft credits granted by the state and resources of state special (including environmental) funds. A zero tax rate is applied for biofuels produced according to requirements of the Law on Biofuels.

It has to be mentioned that since the introduction of the Law on VAT reduced tax rate (9 %) has been applied for residential house heating. Zero-rate of VAT is charged on the supplies of goods and services among others fuelling of ships and aircrafts.

3.4 Revenue from environmental taxes/charges

Revenues generated by environmentally related taxes in EU member states constitute 4-9 % of state budget tax revenue (OECD, database of environmentally related taxes, 2000). Major revenue in EU are gained from fuel and motor vehicle taxation, while main share of revenue from environmentally related taxes/charges in Lithuania is collected from emission charges. Though such a comparison should be considered with reservations as excise duties on fuels generate considerable revenue in Lithuania – difference occur because linkage between fuel taxation and environmental protection targets is quite weak and excise duties on fuels, generally, are not considered as being environmentally-oriented. Motor vehicle taxation in Lithuania also creates considerable flow of revenues though taxes do not cover private passenger cars (annual circulation/recurrent taxes,

registration taxes) and main share of revenues is generated from taxes which are not environmentally oriented (see Appendix 3.1 for details).

Tables below shows total revenue from environmental levies and excise duties considered only in this report.

Table 8 Revenue from environmental taxation in Lithuania in 2000-2002 (million Litas and million Euro).

	2000		2001		2002	
	Litas	**Euro**	**Litas**	**Euro**	**Litas**	**Euro**
Pollution charges (air, water pollution)	21.9	6.3	35.4	10.3	40.2	11.6
Natural resource taxes (mineral resources, water extraction, hunting and fisheries)	14.5	4.2	15.3	4.4	20.8	6.0
Tax on oil and gas extraction	43.7	12.7	82.5	23.9	88.6	25.7

Source: Ministry of Environment, 2003

Table 9 Revenue from fuel excise duties in 2003 (million Litas and million Euro).

Fuels	**2003**	
	Litas	**Euro**
Motor petrol, its substitutes and extenders	442	141
Petroleum Gas and Gaseous Hydrocarbons Intended for Use as Motor Fuel, Their Substitutes and Extenders	62.7	18.2
Kerosene, its Substitutes and Extenders	1.5	0.44
Gas Oils, their Substitutes and Extenders	487	141
For heating:	*0.6*	*0.17*
For other purposes (incl. diesel)	*486*	*141*
Heavy Fuel Oils, Their Substitutes and Extenders LT/t	*11.7*	*3.4*
Total:	**1005**	**291**

Source: State Tax Inspectorate, 2004

As in most of other Central and Eastern European countries, larger proportion of revenue from environmental taxation is earmarked to environmental purposes in Lithuania. Revenue generated is divided among various environmental funds (national, municipal, environmental investment) and disbursed, via Environmental Support Programmes, in a form of grants, soft loans, interest subsidies etc. The Law on Environmental Protection in Lithuania (Article 30. Public Financing of Environmental Protection Measures) states that environmental protection measures shall be financed by natural resource users, the State and local authorities. The National Budget funds allocated for environmental protection shall be used in accordance with the directions and programmes defined by the Government. State Environmental Support Programme is mainly financed from non-compliance fees and fines, Municipal – from emission charges.

Allocation of revenues from environmental levies in Lithuania (2003) is shown in the figure below.

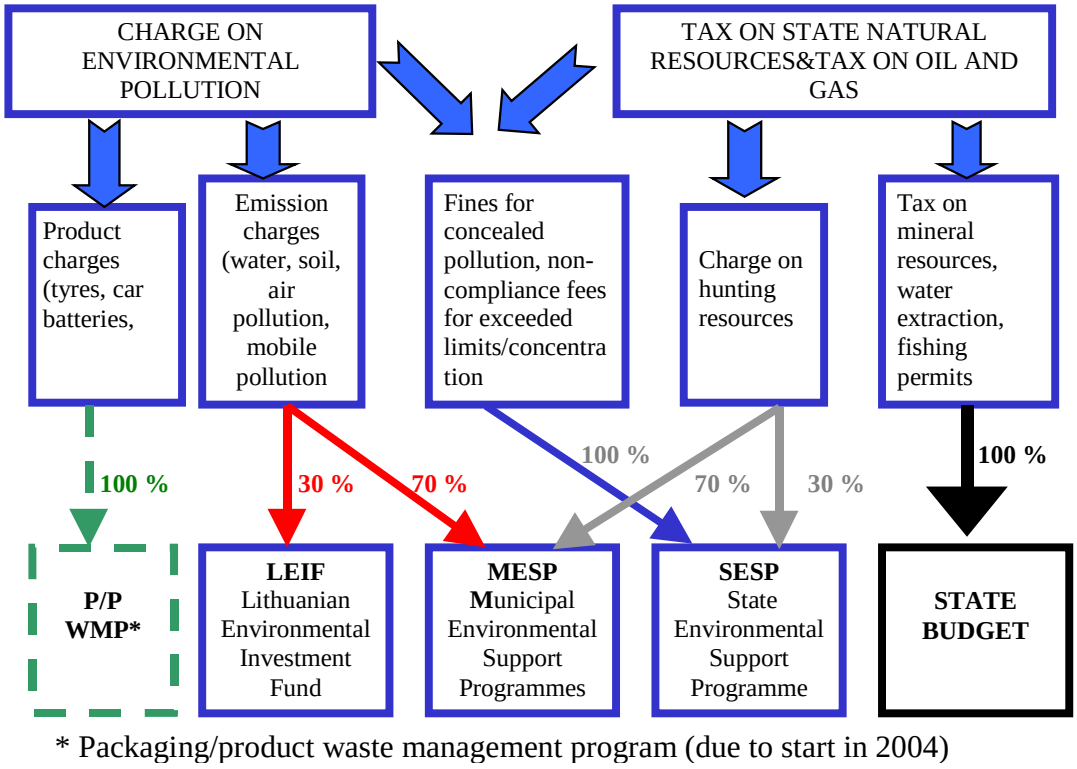

Figure 1 Allocation of revenue from environmental taxes/charges.

Revenue from fuel excise duties (except LPG) is distributed between state budget (62 % in 2002-2003, 60 % from 2004) and Road Maintenance and Development Programme (38 % in 2002-2003, 40 % from 2004). 100 % of revenue from excise duty for the sold liquefied petroleum gas intended for use as motor fuel is transferred to Road Maintenance and Development Programme.

3.5 Environmentally related subsidies in energy sector

In this chapter subsidy schemes directed for the following purposes will be reviewed:
- energy saving measures (house renovation, insulation; other);
- conversion to cleaner fuels;
- promotion of energy production from renewable.

It is possible to distinguish three major national and foreign sources of environmental subsidies/grant financing:

- state and municipal budgets
- environmental funds/programmes
- international support (pre-accession funds, bilateral aid, IFI's)

State budget, pre-accession funds (ISPA, PHARE), bilateral grants have been major source of financing for large environmental investment projects in Lithuania, though environmental measures in energy sector were financed mainly from state and municipal budgets and bilateral assistance

(Denmark, Sweden). IFIs (NEFCO, World Bank etc.) provide soft loans. Several technical assistance projects were financed by PHARE programme. ISPA programme (2000-2006) embraced only waste and water sectors so far. This chapter will review main national subsidy schemes directed to improvement of environmental performance in Lithuanian energy sector.

3.5.1 Subsidy schemes administered by Central Project Management Agency (CPMA)

CPMA established by the Ministry of Finance of Republic of Lithuania, which seeks to ensure efficient management of sovereign loans, financial assistance funds and other funds provided by the European Union, international financial institutions and other international and local donors. Currently CPMA administers several programmes, which provide subsidies for energy saving measures mainly in housing sector:

- Energy Efficiency/ Housing Project;
- Public Sector Energy Efficiency;
- Municipal Infrastructure Development Programme 2000.

Energy Efficiency/ Housing Project (EEHP; started in 1996) supports private and public initiatives to improve energy efficiency in residential and public buildings. Within the project framework municipalities, homeowners' associations and individual homeowners are able to obtain soft loans to finance investments in technically and economically attractive packages of energy efficiency measures.

EEHP is financed from state budget (30 % subsidy component), soft loans provided by the World Bank and incomes from repayment of loans provided. Dutch and Danish governments provided financing of several technical assistance projects. Projects are financed on the following terms:

- fixed interest rate (on average 2 - 3 percentage points lower than commercial loans)
- 10 % down-payment
- maturity up to 10 years
- no mortgage requirement
- 30 % State subsidy and VAT exemptions.

On average, share of supported investments amounted to 40 % of total value of projects implemented. Total subsidy costs and estimates of VAT exemptions for years 1999 - 2002 are summarised in table below:

Table 10 Total annual state grants and estimated value of VAT exemptions.

Year	Grant Amount (million Litas)	Exemption Value (million Litas)
1999	1.32	0.74
2000	3.94	2.22
2001	2.91	1.64
2002	4.0	2.25
2003 (estimate)	3.0	n.a.

Source: Housing Advisory Agency

As of September 1, 2003:

- 664 investment projects prepared
- 12 municipalities signed loan agreements and implemented energy efficiency measures in 53 public schools and kindergartens;
- Almost 1100 homeowners associations were involved in the project, 531 loan agreements were signed with associations and individual homeowners and around 52 million Litas were invested in renovation of residential buildings.

Public Sector Energy Efficiency Programme (PSEE, started in year 2003). The programme objectives should be achieved through provision of loans for technically and economically attractive packages of energy efficiency measures and support for the State institutions in the energy efficiency rehabilitation of public buildings. Nordic Investment Bank provided 34.5 million Litas, which will be used, for provision of soft loans (2003-2004). Repayment of loans (maturity 15-20 years, grace period up to 5 years) will be financed from state budget.

As for October 2003:
- contracts for renovation of 5 office buildings of State institutions, 14 universities and 25 hospitals were signed;
- renovation works in state office buildings, 11 universities and 23 hospital were commenced.

Municipal Infrastructure Development Programme 2000 (MIDP 2000). The purpose of this programme is to support municipalities to prepare and implement municipal investment projects, as well as strengthen municipal planning and financial management. The programme includes municipal investment projects related to:

- Environmental protection;
- District heating;
- Energy efficiency improvements;
- Water supply and wastewater treatment; etc

Investments are financed from soft loans provided by various IFIs (World Bank, NIB, EIB) and grants provided by municipal budgets. Altogether till mid 2003 MIDP has committed out 163 million Litas for municipal infrastructure investments. During 2001-2003 more than 88 million Litas were allocated for energy saving measures. Main funds were allocated to School renovation programme (2001 – 2003). Under this programme energy efficiency measures were implemented in 121 schools from all 60 municipalities. Total value of investments 104 million Litas: soft loans (maturity 15 years, 3 years grace period) - 80 million Litas, municipal grants – 24 million Litas.

3.5.2 Lithuanian Environmental Investment Fund (LEIF)

Lithuanian Environmental Investment Fund is one of the main sources that supports environmental investment projects in the form of grants and soft loans[16] in 3 priority areas: waste management, water protection, atmosphere protection.

The fund may subsidy projects on reduction of the pollution caused by energy system and projects on energy effectiveness up to 30 % of the Fund's loan (not more than 0.4 million Litas in three

[16] before year 2003 LEIF only provided soft loans and interest subsidies.

years) while subsidy up to 25 % of the loan may be allocated for the projects on use of renewable fuel and sources of alternative energy. Projects, implementing the "Best Available Practices" and reducing the negative impact of economic activities on environment, may be subsidised up to 15 % of the loan. Loans may be provided for other companies' or municipalities' investment projects that reduce the negative impact of economic activities on environment.

Fund's soft loans may constitute up to 100 % of the overall project value (up to 2 million Litas per project). Until June 2003 LEIF has provided support for over 16.6 million Litas in form of the soft loans and has paid approximately 1.78 million Litas of interest subsidies.

Up to know there were 22 atmosphere protection projects financed by the LEIF which mainly were related to pollution reduction from energy plants (conversion to cleaner fuels (natural gas, wood), renovation of boiler houses, installation of air-treatment filters) or energy saving measures (renovation of heating distribution networks, street illumination). More data on the Fund's provided soft loans and subsidies is presented in table 11.

Table 11 LEIF (Atmosphere protection) main facts.

Establishment date	officially established 1996, actually started in 2001)
Priority areas	- water protection; - waste management - atmosphere protection
Type of assistance/ /instruments	Soft loans and subsidies
Main financing sources	- State budget (30 % of pollution charge revenue) - PHARE
Budget (expenditures)	Interest subsidies in atmosphere sector: 2001 – 0.103 million Litas, 2002 – 0.414 million Litas Amount of soft loans disbursed in atmosphere sector: 2001 – 2.622 million Litas 2002 – 2,035 million Litas
Number of projects supported	In atmosphere sector: 2001 – 2; 2002 – 10

3.5.3 State regulated prices for electricity produced from renewable or waste energy resources

From year 2002 production of electricity from renewables (hydro, solar, wind, biomass) as well as utilisation of waste energy from any technological process is stimulated via administratively set purchasing prices mechanism. Operators of electricity distribution and transmission networks are obliged to secure transmission of such energy in a first order and are obliged to pay price fixed by the Government. Eligible are only installations which total installed capacity does not exceed 20 MW. Set price level in 2002- 2003 is shown in a table below:

Table 12 State regulated prices on electricity produced from renewables and waste energy.

Type of energy	Price ctLT/kWh
Hydro Power Plants	20
Wind Power Plants	22
Power Plants, using biofuel	20
Waste energy (AB "Lifosa")	7.8

National control commission for prices and energy

Costs of electricity produced from renewables or waste energy are reckoned in electricity tariffs and are covered by all electricity users. Small hydropower plants supplied largest amount of energy (57 MWh in 2002). In year 2002 there were around 50 small hydro power plants, 4 biogas cogeneration units and 1 biomass (wood waste) unit selling electricity to power grids.

3.5.4 State and Municipal Environmental Support Programmes

Grants provided by State Environmental Support Programme (former State Nature Protection Fund) and Municipal Environmental Support Programmes (former Municipal Nature Protection Funds), are allocated for small investment projects, technical assistance and so called "soft" measures where investment component is rather small. Supported areas range from atmosphere and water protection, remediation of past pollution to public awareness raising and ecological education. Beneficiaries of such subsidies are municipal enterprises, non-governmental organisations and even private businesses.

Pollution charges are the primary sources of revenue for Municipal Environmental Support Programmes. Non-compliance fees, fines, environmental damage compensations make the main source of revenue for the State Environmental Support Programme. Annual budgets (expenditures) of State Environmental Support Programme comprised 2.59 and 4.39 million Litas in 2001-2002 respectively. Revenue of Municipal Environmental Support Programmes from pollution charges accounted for 25 and 28 million Litas in year 2001 and 2002 respectively. *Around* 30 % of revenue are used for design, construction or modernisation of environmental infrastructure, 20 % - for environmental damage compensation measures, 20 % - for Municipal Health Programmes, 15 % - removal of pollution sources.

3.6 Administration and Implementation of the Lithuanian Economic Instruments

3.6.1 Introduction

As in many other EU countries, in Lithuania atmosphere pollution from stationery pollution sources is regulated with the aid of administrative and economic measures. Administrative measures include mandatory requirements and standards (inventory of pollution sources, ambient air impact assessment, emission limit values and annual norms (cumulative annual emissions), fuel quality standards, enforcement and monitoring etc.), economic – taxation (pollution charges and fuel excise duties, fines for violations). Important role, of course, plays fluctuations of fuel prices. Both types of measures have their impacts on atmosphere pollution abatement and it is highly difficult (if possible at all) to single out net impact of individual measure. This chapter will concentrate on pollution charges applicable to energy sector enterprises (*stationery pollution sources of energy sectors; atmosphere pollution, main pollutants SO_2, NO_X, solid particles, CO*) and will review whole chain of charge administration – calculation, payment and collection, liabilities and distribution of revenue.

3.6.2 Background information

Category A – pollutants emitted during production of heat and electric power;
Category B – pollutants emitted from fuel combustion in industrial processes;
Category C – pollutants emitted during chemical reactions;

Table 13 SO_2, NO_X, solid particles, CO emission statistics of 2000-2003.

		2000	2001	2002	2003	2000	2001	2002	2003
Pollutant	**Categories**	**Emission tonnes**				**Number of controlled pollution sources**			
SO_2	A	18010	21218	18299	10938	448	383	341	304
	B	11735	7228	6791	6174	203	201	210	198
	C	1248	6966	4651	3954	96	83	87	85
	Total:	**30993**	**35412**	**29741**	**21067**				
NO_X	A	6170	5314	5435	5861	800	770	783	780
	B	4423	3200	3380	5103	266	277	289	282
	C	508	1864	2195	586	255	280	287	277
	Total:	**11101**	**10378**	**11010**	**11551**				
Solid particles	A	1103	1197	1004	863	621	565	542	509
	B	502	722	315	522	203	218	232	221
	C	2961	2905	2896	2800	846	854	649	782
	Total:	**4566**	**4824**	**4215**	**4186**				
CO	A	10212	9822	10862	11598	803	770	780	777
	B	3931	4540	4608	5444	270	281	290	283
	C	7069	5664	5558	4474	269	285	295	284
	Total:	**21212**	**20026**	**21028**	**21516**				
Vanadium pentoxide	A			72.2	37.1			123	108
	B			24.6	21.7			26	15
	Total:			**96.8**	**58.8**				

Statistics over NO_X, solid particle and CO emissions for 2000-2003 shows overall stability of pollutants emissions from heat and power energy production (Category A) as well as stability of emission levels from all stationery pollution sources. Decrease of SO_2 and V_2O_5 in year 2003 could be explained by increased use of natural gas for heat and power generation. Previous emission trends are shown in table 14.

Table 14 Energy sector emission 1991-2000 (thousand tonnes).

	SO_2		**NO_X**		**CO**	
	Energy sector	**Total**	**Energy sector**	**Total**	**Energy sector**	**Total**
1991	103.3	174.2	20.9	38.9	9.7	101.5
1992	51.1	95.1	9.4	19.6	6.9	60.9
1993	44.7	77.6	6.2	13.2	5.6	40.7
1994	47.3	77.5	7.1	14.5	6.5	39.0
1995	33.3	64.7	5.2	13.3	5.3	26.7
1996	44.6	62.9	7.0	13.9	7.1	26.2
1997	41.1	60.9	6.5	14.7	6.6	24.5
1998	55.6	74.5	7.0	14.7	6.2	25.9
1999	37.6	55.3	6.5	13.4	5.5	23.8
2000	14.1	30.9	4.9	11.1	4.9	21.2

Expenditures (current expenditures, investments) of energy sector enterprises into air pollution abatement measures as well as related subsidies in year 2000 - 2002 (million Litas) are presented in a table below:

	Investments		Current expenditures	Total expenditures	Subsidies
Energy sector enterprises	End-of-pipe installations	Integrated technologies			
2000	11.11	1.84	0.11	13.06	n.a.
2001	3.19	2.4	35.8	41.4	n.a.
2002	1.36	3.73	37.1	42.2	0.22

3.6.3 Administration of pollution charges (energy sector)

Main elements of pollution charge:

- *Charge payers*: entities which are obliged to possess environmental permits for their activities;
- *Charge base*: amount of pollutants emitted (calculated or measured);
- *Charge rate*: basic charge is set for each individual pollutant (Litas per tonne) which is corrected by certain coefficients for emissions exceeding annual emission norms and/or exceeding emission limit value;
- *Charge period*: quarter/biennium;
- *Responsible institutions*:
  - Ministry of Environment (REPDs – regional environmental protection departments) – verification of charge calculations, control and enforcement;
  - State Tax Inspectorate – control of payments.

Calculation of charge payment is based on actual emission recording data and also depends on emission limit values and/or annual emission norms, calculation formulas, indexes, coefficients.

3.6.3.1 Emission recording

Emission recording order (regulation of the Minister of Environment # 408 of December 20‘ 1997; # 334 of July 4’ 334) set emission recording requirements for SPS operators who are obliged to possess environmental permit and pay pollution charges. Emission recording has to be performed by the means of instrumental measurements and/or calculations.

Instrumental measurements are performed according to provisions of “State laboratory control instruction of stationery pollution sources (approved by the regulation of the Minister of Environment # 97 of October 19‘ 1992 with amendments). The instruction sets a list of (temporally) recommended methods for instrumental measurements for various pollutants (see Table 15 for the list of methods for SO_2, NO_X, CO and solid particles) and measurements of emission flow parameters (volume, speed). Calculations of emissions are performed according to provisions of methods, which are recommended by the Ministry of Environment and approved by the order of the Minister of Environment # 395 of December 13’ 1999. Calculation methods (as well as majority of instrumental measurement methods) were elaborated by Soviet Union institutes in years 1986 – 1990 and have not been updated since then.

Operators obliged have to report annually by filling out “Annual ambient air protection statement” where the following information is provided:

- emission and treatment of pollutants (amount of pollutants emitted into ambient air with and without treatment, amount of pollutants treated (collected/neutralised);
- characteristics of pollution sources (parameters of stack, emission flow (speed, volume, temperature), emission values (max and average (g/s), annual amount of pollutants);
- operational indicators of pollution treatment installations (type of installation, pollutants treated, actual amount of pollutants before and after treatment (g/s), treatment efficiency);
- implementation of atmosphere pollution abatement measures (abatement measure, costs, implementation timetable, funds allocated, pollutants concerned, pollution abatement (planned and actual));

List of atmospheric pollutants subject to recording is set in the Annex of the Order.

Table 15 Recommended methodologies for instrumental measurements.

Pollutant	Measurement method	References
NO_X, SO_2,	Photocolormetric	a) "The compendium of methods for determination of concentration of pollutants in industrial emissions"; Leningrad.: Hidrometeoizdat. 1987 (Rus."Сборник методик по определению концентраций загрязняющих веществ в промышленных выбросах в атмосферу".- Л.: Гидрометеоиздат. 1987); b) Lithuanian normative document LAND 27-98/M-07
NO_X	Photometric (without vacuuming sampling receptacle)	Method prepared according to research report of Leading State Observatory (reg. # 81040621), Leningrad.: 1983 (Rus. Отчет ГГО по НИР No 81040621)
	Chemolumine-scentic	"Measurement instruction with chemoluminescentic analysor NO/NOX, Model 252; PPM Systems (Sweden) and Joint Research Centre (Lithuania); 1997 b) LAND 51:2003 "Determination of nitrogen okside concentration – Chemoluminescentic method (LST ISO 7996:1985); approved by the Order of the Minister of Environment
	Electrochemical	"Measurement instruction with fume analysor TESTO; PPM Systems (Sweden) and Joint Research Centre (Lithuania); 1997
SO_2	Titrimetric	a) "The compendium of methods for determination of concentration of pollutants in industrial emissions"; Leningrad.: Hidrometeoizdat. 1987 (Rus."Сборник методик по определению концентраций загрязняющих веществ в промышленных выбросах в атмосферу".- Л.: Гидрометеоиздат. 1987) b) LAND 30-98/M-10
	UV fluorescent	"Measurement instruction using UV analyser Model 152; PPM Systems (Sweden) and Joint Research Centre (Lithuania); 1997
	Electrochemical	"Measurement instruction with fume analyser TESTO; PPM Systems (Sweden) and Joint Research Centre (Lithuania); 1997
Solid particles	Weight	a) "The compendium of methods for determination of concentration of pollutants in industrial emissions"; Leningrad.: Hidrometeoizdat. 1987 (Rus."Сборник методик по определению концентраций загрязняющих веществ в промышленных выбросах в атмосферу".- Л.: Гидрометеоиздат. 1987) b) LAND 28-98/M-08 c) "Measurement order using EMES 3866 device"; PPM Systems (Sweden) and Joint Research Centre (Lithuania); 1997
CO	Infrared absorption	"Measurement order using infrared absorption analyser IPA PRO"; PPM Systems (Sweden) and Joint Research Centre (Lithuania); 1997
	Electrochemical	"Measurement instruction with fume analyser TESTO; PPM Systems (Sweden) and Joint Research Centre (Lithuania); 1997

3.6.3.2 Determination of emission limit values and annual pollution norms

Generally, all operators of pollution sources, which are obliged to possess environmental permits, have to perform inventories of all pollution sources according to methodology prescribed by the Ministry of Environment (Order # 126 of September 24, 1991). Determination of aforementioned norms differs depending upon the category/scale of pollution source.

1. Operators of pollution sources, which emit more than 50 tonnes of pollutants into ambient air per annum are obliged to perform "Ambient air pollution impact assessment" (subsequently Assessment) according to provisions set by the Ministry of Environment (Order # 64 of January 25, 2001). Regional environmental protection departments have right to oblige other operators to prepare the aforementioned assessment if the pollution caused by them is considered as being significant. Assessments are prepared by operators of pollution sources themselves or by outside organisations (laboratories) accredited by the Ministry of Environment. Assessment includes evaluation of pollution inventory data from all pollution sources (organised and unorganised), location schemes of pollution sources and vicinities, data on sanitary protection zones, 5 years perspective plan of economic activities causing atmospheric pollution as well as planned atmospheric pollution abatement measures, information pollution prevention measures, ambient air background pollution data. Based on these data allowable pollution levels are determined for each pollution source. Allowable pollution levels consist of two types of normative sets:

a) *Emission limit values (ELV)*. Depending on background pollution concentrations[17] which are regulated by hygienic norms (HN 35:1998) two types of allowable pollution values can be set:

- the *maximum allowable pollution* (mAP; if allowable concentrations in the ambient air are not exceeded);
- the *temporarily allowable pollution* (tAP; if allowable concentrations in the ambient are exceeded. In such a case operator of the pollution source has to submit plan of pollution abatement measures implementable within a certain period and which would guarantee attainment of allowable concentration of pollutant in the ambient air).

b) *Annual pollution norms* – (the total annual amount of allowable emission of certain pollutants from certain pollution sources. It is determined having in mind annual operation time and production factors).

For this type of pollution sources emission levels are mainly determined by instrumental measurements. Evaluation of Assessment and approval decision is made by regional environmental protection department. Assessment results can be valid up to 5 years period at the longest. If there are major changes, which can cause shifts in emissions of pollutants operators are obliged to report to environmental authorities and, if needed, have to renew Assessment (as well as allowable pollution levels).

2. Other operators (which annual emissions of pollutants do not exceed 50 tonnes) have to prepare inventories of pollution sources and pollutants. Based on these data, emission limit values (mAPs) are then determined according to national legislation as well as annual pollution norms. In case where emission limit values have to be reduced, taAPs for a limited period may be granted.

[17] Concentrations of air pollutants in the ambient air, which according to existing scientific knowledge do not course, negative impacts on human health.

After the inventory of all pollution sources and/or approval of Ambient Air Pollution Impact Assessment, determined allowable pollution levels (ELVs and annual pollution norms) are fixed in environmental permit issued/renewed.

Besides all this, starting from year 2004, pollution sources of energy sector, which rated thermal input is larger than 50 MW are subject to emission limit values recommended by BAT information documents. In this light, emission limit values set for fuel combustion plants in national regulations (Order of the Minister of Environment No. 486 of September 28 '2001) are considered as minimum requirements.

3.6.3.3 Charge calculation

Order of Minister of Environment and Minister of Finance (# 663/409a of December 24, 2002) sets the methodology on the calculation of the payments for pollution charges. The calculation of charge payments is rather complicated. Charge rates (as well as coefficients) are stipulated in the Annexes of the Law on Pollution charges. Calculation of total charge sum (C_T) for each pollutant consists of:

$$\mathbf{C_T = C_N + C_X}$$

where:

C_N - charge for pollution complying with allowable pollution levels (both ELV and annual pollution norms) defined in environmental permits;

C_X - charge for pollution exceeding allowable pollution levels defined in environmental permits.

Amount of pollutants, which were released into atmosphere without violation both of annual pollution norms and ELVs is charged by "regular" charge rate. In other cases, emissions are charged by "increased" charge rate ("regular" rate multiplied by certain coefficient).

In the simplest case – if pollution level doesn't exceed neither annual pollution norms nor ELVs set (that is $C_X = 0$), calculation formula is:

$$\mathbf{C_N = F_i * T_i * I, \quad (C_T = C_N)}$$

where,
F_i – amount of pollutant (in tonnes) i released without violations (annual pollution norms and ELVs);
T_i - tax rate levied on pollutant (Litas/tonne; "regular" charge rate)
I – indexation coefficient (charge rates are indexed quarterly (biannually) using consumer price index published by the Department of Statistics (basic period – 1999 December)).

Quite complicated conditional formulas (4 additional possible cases) are applied to determined C_N and C_X which result in separation of charge payment for pollution emission within and over allowable annual pollution norms and/or ELVs. If violations take place, increased charge rates are used, that imply that the "regular" charge rate is multiplied by a certain coefficient. Please, see table 16 for "regular" charge rates and coefficients applied in cases of violation.

Table 16 Pollution charges "regular" rate and coefficients (2003 - 2009).

Pollutants	Charge rates (Litas/tonne)				Coefficient
	2003	2004	2005	2009	
SO_2	288	311	311	311	1.5
NO_x	479	587	587	587	1.5
Solid particles[18]	184	184	184	184	1.5
Vanadium pentoxide	11485	11485	11485	11485	300
Groups of pollutants					
I	1210	1210	1210	1210	300
II	570	570	570	570	50
III	74	74	74	74	30
IV	13	13	13	13	1.5

Moreover, total charge sum payable for certain pollutant is multiplied by coefficient 1.2 if emission limit value is set as tAP in charge payer's environmental permit. As noted before, charge payments are also indexed quarterly using consumer price index (CPI).

3.6.3.4 Charge declaration, payment and sanctions

The pollution charge is declared and paid mainly quarterly (biannually - if the amount of charge payment for the last year period was lower than 10 000 Litas). The charge declarations should be filled out and submitted to the respective Regional Environmental Protection Departments (consequently REPD) and regional offices of State Tax Inspectorate and charge paid to State Tax Inspectorate account in 30 days after completion of the accounting period.

"Increased charge rate" is applied if the fact that pollution was concealed is proven (virtually should be regarded as "fine" but the sanctions are the same as for violation of ELVs or the annual pollution norm. See "earmarking" issue below). First institution for resolution of tax disputes is the State Environmental Protection Inspectorate of Lithuania (SEPIL). If not settled down dispute may be further appealed to court. Administrative penalties are set for failure to submit (or submit on time) charge declarations.

3.6.3.5 Inspection and enforcement system

Main charge administration functions are attributed to REPDs. State Tax Inspectorate only performs payment exaction control according to data submitted in declarations.

There are 212 state environmental inspectors in the Lithuanian Environmental inspection system (2002) employed in 8 REPD's and 20 at the State Environmental Inspectorate. Each REPD has its structural units in almost each districts of Lithuania - town or district Environmental Protection Agencies (60 in total). 3-5 inspectors are employed in each Environmental protection agency, which are responsible for the environmental protection control and enforcement.

[18] Except solid particles resulting from solid, liquid and gaseous fuel combustion and asbestos-containing particles i.e. solid particles emitted from energy sources (pollutant type A) is attributed to II group of pollutants and charged accordingly.

According to national legislation (Order of the Minister of Environment No. 486 of September 28 '2001), requirements for continuous emission monitoring (SO_2, NO_X and solid particles as well as oxygen concentrations) are only applicable for new combustion plants (plants for which construction permit was issued after 1998 July 1), which rated thermal input exceed 300 MW. Currently there are only 2 combustion plants where such systems are installed.

However, there are no technical solutions implemented to transfer monitoring data ("on-line" regime) to the REPDs yet.

The state environmental inspectors are directly responsible for the site inspections of the enterprises. From year 2004 those are made periodically and are based on the IMPEL minimum inspection criteria according to prepared annual inspection plans. Large energy enterprises (exceeding 50-100 MW) are usually inspected at least 2 times a year, smaller units – at least once a year. Beside emission measurement environmental inspectors also check correctness of pollution charge calculations.

3.6.3.6 Charge exemptions

If operators of stationery pollution sources implement measures to reduce emissions of pollutants from stationary pollution sources, not less than 10 percent calculating from the established highest permissible pollution norm, need not to pay a charge for the reduced amount of pollutants. Exemption shall be valid not more than 3 years from the beginning of the implementation of a measure. If a measure related to the reduction of pollution emission from stationary pollution sources is not implemented in due time or planned effect is not produced, pollution charge shall be paid for the whole period. However, in practice this exemption opportunity has not been used so far[19]. Till year 2003 charge release opportunity (granted for 10 % pollution abatement) was utilised only once by industrial enterprise. The companies argue that the exemption is applied only for the time period of the implementation of the pollution reduction measure and the exemption application procedure is too complicated or administrative costs are too extensive in comparison with charge exemption benefits.

3.6.4 Revenue from pollution charges

Total revenue from pollution charges are presented in table 17 below:

Table 17 Revenue from environmental taxation in Lithuania in 2000-2004 (million Litas).

Year	2000	2001	2002	2003	2004**
Total: (stationery&mobile sources)	21.9	35.4	40.2	37.9	
Out of which: Stationery sources – revenue from atmosphere pollution	n.d.	n.d.	15.7*	14.5*	14.8 **
Mobile sources	n.d.	7-8*	7-8*	n.d.	n.d

* - estimate; Source: Ministry of Environment

** - prognosis;

Revenue from atmosphere pollution charges in year 2000-2003, constituted approximately 25-30 % of all revenue of pollution charges. Revenue of 5 atmosphere pollutants (SO_2, NO_X, solid particles,

[19] According to the Ministry of Environment. However, this issue is delegated to Regional Environmental Protection Departments and no full report on the applications is present.

CO and V_2O_5, classified into A, B, C categories) made up around 96 % from revenue collected for atmosphere pollution (see table 18). 50-55 % of revenue from taxation of atmosphere pollution was collected from energy sector enterprises.

Table 18 Revenue of atmosphere pollution taxation (estimates) 2002-2004 in million Litas.

Year:	2002	2003	2004*
Stationery sources – revenue from atmosphere pollution taxation	**15.7**	**14.5**	**14.9**
SO_2	**8.0**	**6.1**	**5.5**
A	4.9	3.1	2.8
B	1.8	1.9	1.1
C	1.2	1.1	1.5
NO_X	**4.5**	**5.5**	**6.4**
A	2.2	2.8	3.2
B	1.4	2.4	1.9
C	0.9	0.3	1.3
Solid particles	**1.3**	**1.3**	**1.3**
A	0.57	0.49	0.57
B	0.18	0.3	0.17
C	0.53	0.51	0.51
CO	**0.27**	**0.28**	**0.27**
A	0.14	0.15	0.14
B	0.06	0.07	0.06
C	0.07	0.06	0.07
V_2O_5	**1.11**	**0.67**	**0.92**
A	0.83	0.43	0.69
B	0.28	0.24	0.23
Revenue from 5 major pollutants million LTL (% from all revenue atmosphere pollution taxation)	**15.1 (96%)**	**13.85 (95%)**	**14.3 (96%)**
Category A; million LTL (% from all revenue of atmosphere pollution taxation)	8.6 (55 %)	7.0 (50 %)	7.4 (50 %)
Category B; million LTL (% from all revenue of atmosphere pollution taxation)	3.7 (24 %)	4.9 (35 %)	3.46 (23 %)
Category C; million LTL (% from all revenue of atmosphere pollution taxation)	2.7 (17 %)	1.95 (15 %)	3.38 (22 %)
Other pollutants (million LTL)	**0.6**	**0.65**	**0.6**

* - prognoze;

Revenues for year 2002-2003 are estimated according to state statistical report data (Form No. 2 – Atmosphere), where 180 atmospheric pollutants are accounted. In total, there are 284 atmospheric pollutants in the list of taxable pollutants. Prognosis of year 2004 is compiled based on Ministry of Environment emission forecast. In total, emissions of 163 pollutants are accounted, out of which 94 pollutants generate revenue less than 100 Litas/per annum, 29 – from 100 to 1000 Litas/per annum, 30 – from 1000 to 10000 Litas/per annum.

3.6.5 Distribution of revenue

The Law on Pollution charges determines how revenue of pollution charges is distributed.

30 % of charge revenue is directed to Lithuanian Environmental Investment Fund (LEIF; see chapter 3.4), the rest 70 % - is distributed among Municipal Environmental Support Programmes. All revenue from "fines" (concealed pollution) and "increased charge rate" (violation of ELVs and/or annual pollution norms) enters the account of State Environmental Support Programme.

Following year 2002 amendments of legislation related to national (state and municipal) budget formation, formally revenue from all charges (in our case, revenue applying "increased charge rate" and "fine") firstly enters state/municipal budget but then it is assigned to specific lines in state/municipal budget (environmental funds/programmes) i.e. revenue is earmarked within a budget. Extent of earmarking actually remains the same as before, i.e. revenue generated from environmental charges can not be used for other purposes than environmental protection. This means that the programming principle for environmental funds is not fully implemented yet neither at state nor at municipal level.

3.6.5.1 State Environmental Support Programme: use of revenue

Law on Environmental Support Programme (2000 October 12 # VIII-2025) determines revenue sources of the Programme and the use of revenue. Main sources of the programme are environmental damage compensations, fines exacted for administrative and criminal violations and *economic sanctions* i.e. payments from pollution taxation by "increased charge rate" and "fines" for concealed pollution.

Annual budgets (expenditures) of State Environmental Support Programme comprised 2.59 and 4.39 million Litas in year 2001-2002 respectively. Out of this inflows from economic sanctions constituted 0.55 and 0.64 million Litas respectively (or 1.3-1.8 % from total revenue from pollution charges; see table 18).

Not less than 30 % of funds shall be used for environmental damage compensation measures and design and/or maintenance of small environmental infrastructure entities. The rest can be used for various purposes, out of which the most important are:

- funding of preparation of environmental protection programmes/planning as well as draft legislation documents;
- financing of environmental R&D, monitoring and EIA works;
- purchase of technical means used by (public) environmental protection institutions;
- financing of ecological education;
- financing of freelance environmental inspectors (no more than 5 % of revenue).

Funds, which are not disbursed during fiscal year are transferred to the next accounting period.

3.6.5.2 Municipal Environmental Support Programme: use of revenue

The sources and revenue use is determined by the Law on Municipal Environmental Support Special Programme (entered into force from 2004-01-01).

Total revenue of Municipal Environmental Protection Funds from pollution charges accounted for 25 and 28 million LTL in year 2001 and 2002 respectively. Within municipal environmental support programme funds are once again earmarked ("double earmarking"). Around 30 % of revenue are used for design, construction or modernisation of environmental infrastructure, 20 % - for environmental damage compensation measures, 20 % - for Municipal Health Programmes, 15 % - removal of pollution sources.

Revenue of pollution charges enters certain municipal programme (municipal budget) depending on the location of pollution source. If a pollution source (e.g. water treatment plant) is located in a territory of one municipality but actual pollution occurs in the territory of another municipality revenues are distributed 50/50 for both municipalities unless they agree on another proportion. Such a principle of revenue distribution inflicts large fluctuations in total budgets of municipal programmes in certain districts, as well as fluctuations in relative ratio (budget per capita of a certain municipality). The large towns (Vilnius, Kaunas, Klaipeda) and industrialised (Mazeikiai, Mazeikiai oil refinery mainly) municipalities annual budgets account up to 4-6 millions LTL per year while the small and rural municipalities receive around 50 – 300 thousand LTL).

In table 19 revenue from some selected small and large funds is presented together with calculations of revenue per capita for the region.

Table 19 Revenue from some selected small and large funds with calculations of revenue per capita for the region.

	Revenue 2002 (million LTL)	**Number of inhabitants (thousand)**	**LTL per capita**
"Large" funds			
Vilnius	6.198	553	11.20
Kaunas	3.392	374	9.08
Klaipeda	1.726	192	9
Mazeikiai district	4.751	67	70.81
"Small" funds			
Anyksciai district	0.082	34	2.41
Taurage district	0.288	53	5.43
Pakruojo	0.057	29	1.97
Birzai district	0.131	35	3.74

3.7 References

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4. Economic Instruments in Denmark, 2002
5. Environmental Requirements to the Energy Sector Final Report March 2002 Danish Energy Agency;
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8. An Inter - Ministerial Order on the Methodology of Calculation of the Damage to the Environment in Case of Violation of Environmental Legislation No. 471 of 9 September 2002);
9. The Law on Excise Duty (30 October 2001 No IX-569);
10. The Law on the Financing of Road Maintenance and Development Programme, 12 October 2000 No. VIII-2032;
11. The Law on Pollution Charge (No. IX-720 as amended 22 January 2002);
12. The Law on Oil and Gas Tax No. IX – 1564, 4 July 2003;
13. The National Energy Strategy, approved by Resolution No IX-1130 of 10 October 2002 of the Seimas of the Republic of Lithuania
14. The National Long Term Development Strategy (Valstybės ilgalaikės raidos strategija, Vilnius, 2002);
15. The National Sustainable Development Strategy was adopted by the Governmental Resolution No. 3–817N on 20 August 2003;
16. Use of Economic Instruments in Environmental Policy in the Baltic States, BEF, AAPC, 2003.

4 Present Economic Instruments for the Energy Sector in Sweden

4.1 Historical background

Of today's energy taxes the tax on gasoline is the oldest. It was introduced in 1929. The next step was that a special tax on electrical energy was introduced in 1951 in order to decrease the government's budget deficit. In 1957 a general energy tax was introduced. At its introduction, the tax liability comprised electrical energy, coal, fuel oil, motor fuel oil, gasoline and motor alcohol.

Up to the end of the 1970's nothing much happened other than that the taxes on gasoline and diesel oil were adjusted to cover the government's road costs. An important decision, however, was that fuel and electrical energy were exempt from value added tax (VAT) when that was introduced. Gradually, as the percentage of the value added tax (VAT) was increased, the use of household energy was more and more favoured in comparison with other consumer goods.

In the beginning of the 1980's a decisive step was taken concerning taxes on energy. At that time taxes on energy were raised without exception as a way of decreasing the government's budget deficit, which had skyrocketed in 1979. The next big increase was made in connection with the big tax reform in 1991. Among other things that happened was that energy was now subject to value added tax (VAT). Energy taxes on fuel were divided into two parts, one that was called general energy tax and one that was called carbon dioxide tax.

A reform of energy taxation was carried out in 1993. The reform meant that the tax on electrical energy that was used in the manufacturing process in industrial businesses and in green house cultivation was abolished. Furthermore, the part of the energy tax, which was called general energy tax, was taken away from the manufacturing process in industrial businesses and from the heating of greenhouses. In addition the carbon dioxide tax within these sectors was reduced to 1/4 of the carbon dioxide part of the tax. Therefore, the energy taxes for the manufacturing industry and for the greenhouse industry became lower than for other businesses.

However, in 1995 the energy taxation on industry was raised by doubling the carbon dioxide tax from 1/4 to 1/2 of the nominal tax rate. The percentage has changed several more times since then. In 2002 industry pays 30 percent of the nominal carbon dioxide tax.

4.2 The Swedish Energy and Environmental Policy

4.2.1 The Swedish energy policy

In the previous chapter, covering the historical background of the energy policy in Sweden, we have seen that the energy policy has varied significantly over time and that international and technical aspects have played a vital roll. Special occurrences such as the energy crises in the beginning of 1970th and 1980th, the development of the nuclear energy programme and the

environmental issues have had a large influence on the energy policy. In this chapter we will focus on the more recent energy policy.

In the guidelines for the energy *policy in 1991* [8] it was concluded that both the long and short term goals for the energy policy were to ensure a reliable supply of electric power and other type of energy based on the market conditions. Concerning the taxation of fossil fuels the idea of a tax on emissions rather than on the produced energy was supported. It was also concluded that this could increase the production cost for electric power and thereby have a negative effect on the electric demanding industry. As a consequence it was suggested that actions against carbon dioxide emissions should be handled in co-operation with other European countries. Meanwhile also other instruments than the carbon dioxide tax should be used to promote the expansion of alternative fuels (bio fuels) and combined heat and power production. As a consequence a tax reduction for combined heat and power production were introduce in combination with an investment subsidy for biofuel based combined heat and power plants.

In *1997 a new energy policy program [9]* was released. This program was mainly based on the energy program from 1991 and the energy goals were unchanged. The energy goals should promote an efficient energy used and a cost efficient energy production. The energy policy should also promote energy use and energy production with low impact on health, environment and climate. The overall aim was to facilitate the introduction of an ecological sustainable society. This will result in a good economic and social development in Sweden. The energy policy will however also promote the development of a competitive Swedish industry and broadened the co-operation between the countries in the Baltic Sea region.

The production of electric power is an important factor for Sweden and for the competitiveness of the Swedish industry. The energy supply in Sweden will be secured by an efficient use and production with a focus on safety, health and environment. The nuclear power will be replaced with a more efficient electric power use and conversion to renewable fuels. The use of fossil fuels should be reduced. Natural gas is the most favourable fossil fuels and the existing distribution network should be used more extensively. The national protected rivers will remain protected from hydro power plant expansion.

An electric power development programme was introduced to implement the electric power goals and to prepare for the shutdown of the Barsebäck nuclear reactor. The programme includes actions to reduce electric power use for heating, actions to increase the efficiency of the electric power systems and to increase the production of electric power and heat from renewable energy sources. The programme lasts from 1998 until 2002. The budget for the programme was as follows:

Activity	Amount (million SEK)
Reduction of electric power use in private houses and other buildings	1650
Increased efficiency of energy use	450
Increased electric power production from renewable energy sources	1000
Total	3100

The nuclear power station Barsebäck has now been closed down completely. Reactor 1 was closed down already 30 November 1999 and reactor 2 was closed down 31 May 2005.

Also a long term energy programme has been initiated. The aim of that programme is to promote research and development of new energy techniques and initiate demonstration of new techniques.

Year 2002 a new government bill for energy was released [10]. This government bill was mainly based on the former bill from 1997 but some new ideas were introduced.

1. Actions for an efficient energy use.
2. Proposed actions for strengthening of combined heat and power production in the energy system.
3. Proposed actions for the nuclear phase-out and energy production conversion towards a sustainable energy system.
4. Introduction of a quota-based electric power certificate system to promote environmental friendly and renewable electric power production.

1. Actions for an efficient energy use.

The government action will be focused on the spontaneous improvements of energy use that occur in the society and at the improvements that can be achieved by different economic instruments. The actions should be market based. The purpose of the actions should be to promote use of existing efficient energy technologies and to promote development and implementation of new technologies. This will be achieved by spreading of information and knowledge at community, regional and state level and by stimulation of environmental product development. The actions will contribute to the achievement of the environmental quality objectives set up by the government.

2. Proposed actions for strengthening of combined heat and power production in the energy system.

A change in the energy taxation for heat and power production in district heating systems is proposed which will place combined heat and power production in district heating systems on an equality with back pressure production in the industry. It is claimed that such a change in the taxation will improve the competitiveness of the combined heat and power production, increase the power production in existing plants and increase the investments in new plants. A probation by the EG commission is needed concerning the directives covering state aids and other subsidies.

3. Proposed actions for the nuclear phase-out and energy production conversion towards a sustainable energy system.

The German government and the German power industry have in June 2000 come to an agreement about the nuclear phase-out. In this agreement, a total electric power production volume is settled for the remaining lifetime of the existing nuclear reactors. The agreement also includes commitments concerning replacement power production. The Swedish government is of the opinion that it would be worth to investigate if a similar agreement could be applicable also in Sweden. The Swedish government intends therefore to invite the industry for further negotiation and a government negotiator has been chosen.

4. Introduction of a quota-based electric power certificate system to promote environmental friendly and renewable electric power production [11, 12].

The Swedish government has set up a goal for the electric power production and that goal consists of an increase of the electric power production from renewable energy sources with 10 TWh from year 2002 to year 2010. This goal can eventually be increased to 15 TWh to year 2012. The goal will be achieved by the introduction of a quota-based electric power certificate system.

The certificate system is based on the principle that the electric power producers that produce power from renewable sources are assigned electric power certificate from the government. Each produced MWh will result in one certificate. The following electricity production plants are to be entitled to certificates provided they comply with the requirement that electricity is to be produced

from renewable energy sources and that they meet the environmental criteria set, including fuel requirements, where electricity is produced with the aid of:

1. wind power,
2. solar energy,
3. geothermal energy,
4. certain types of biofuel,
5. wave energy,
6. hydroelectric power at existing plants which, at the time of the Electricity Certificate law coming into effect, have a capacity not exceeding 1 500 kilowatt,
7. hydroelectric power at plants which have not been in operation after 1 July 2001 but which were commissioned after the coming into effect of the Electricity Certificate law,
8. increased installed capacity at existing hydroelectric power plants to the extent that capacity is increased by measures undertaken after 1 July 2002, and
9. hydroelectric power produced at plants, which started operation for the first time after 1 July 2002.

The electric power produced is sold on the market in a regular way and gives the producer an income from the sold power. In addition, the producer can also sell the certificate on the market and thereby receive and additional income. To generate a market for the certificate it will be compulsory for electric power consumers and distributors to bay a certain amount of certificate based on their power consumption, the so called ”quota obligation”. The compulsory quantity of certificate in relation to the electric power consumption will be decided in the Swedish parliament. An increased demand of certificate will leads to an increased prise on certificate on the market and will thus promote an expansion of electric power from renewable sources.

If the obligation to bay certificate will not be fulfilled a sanction fee has to be paid to the government. Thus, a fine has to be introduced, to serve as a penalty for non-fulfilment of the quota undertaking. At the same time, the fine acts as a price ceiling for the certificate and thus provides a kind of consumer protection. The penalty for non-compliance with the quota undertaking is to consist of a charge per missing certificate (fine) amounting for each quota period (calendar year) to 150 % of the volume-weighted average of the certificate price during the twelve-month period preceding the last day of submission for compliance with the quota undertaking.

Furthermore, a decreasing price guarantee (floor) is to be introduced during the initial five years. During the introduction phase, the price guarantee constitutes a state guarantee for producers of electricity from renewable sources of energy to obtain a minimum price for their certificates. We do not, however, see any need for a floor in the long-term. The price guarantee is to be reduced in steps during the five-year period according to the following table:

Table 20 Guarantee level, SEK per certificate

Year	Guarantee (floor) SEK per certificate
2003	60
2004	50
2005	40
2006	30
2007	20
2008–	0

Simulations that have been made indicate that a reduction in the emissions of carbon dioxide both in Sweden and in the Nordic countries will result from the introduction of a quota-based certificate system in Sweden. The reduction in Sweden is primarily due to the replacement of fuel in the Swedish combined heating and power production in the district heating systems. At the Nordic level, investments in Sweden in electricity production from renewable energy sources will supersede investments in fossil power in the rest of the Nordic area.

Analyses indicate that the proposal for a certificate system interacts with price setting for electricity in a way that does not disturb the functioning of the Nordic electricity market. On the contrary, it can be noted that there will be dynamic interaction between both these market systems, which has the prerequisites to create efficiency and price transparency. The direct consequences for public finances of the proposed certificate system are:

- Income from fines.
- VAT income from the certificate price.
- Expenditure for the price guarantee, the ”floor” between 2003 and 2007.
- Expenditure for support for existing wind power stations between 2003 and 2007.
- Expenditure for support for network costs for small-scale electricity production between 2003 and 2010.
- Expenditure for establishment and operation of the system.

Although interest in, and development of, a certificate trade system has not advanced to the same stage in Norway and Finland as in Sweden and Denmark, it has been considered as possible that these countries as well can soon be included in a common Nordic certificate trading system. Developments in Belgium, the United Kingdom and the Netherlands may also provide opportunities for harmonisation. The systems now under development there have a lot of elements in common with the systems being developed by Sweden and Denmark. The investigator considers the initial opportunity, besides discussions with Finland and Norway, to be a bilateral agreement with Denmark. Harmonisation might require an adjustment of the Swedish regulations. A number of international initiatives have also been identified that are taking place in certificate trade. Of particular interest is the development of the international trade within RECS (Renewable Energy Certificate System). At the national level a special body is responsible for issue, registration and cancellation of certificates and for supervision of the certificate system. In Sweden, Affärsverket Svenska Kraftnät acts as the Issuing Body.

4.2.2 Environmental quality objectives

The Swedish Parliament has established 15 environmental quality objectives, to guide Sweden towards a sustainable society. The objectives have been prepared by the Committee on Environmental Objectives which is a committee incorporating representatives of all the political parties in the Swedish Parliament. The costs associated with environmental problems are considerable. They stem not only from production losses and the destruction of materials but also from impaired health and the loss of both cultural heritage and biological diversity. The costs in Sweden have been estimated by the committee to well over SEK 20 000 million a year. The 15 environmental objectives will function as benchmarks for all environmentally related development in Sweden, regardless of where it is implemented and by whom. The challenge facing us is to hand over to the next generation a dynamic but sustainable society in which the major environmental problems have been solved. The overriding aim is to solve all the major environmental problems within one generation.

The work on Sweden's environmental quality objectives is based on five fundamental principles:

- promoting human health,
- safeguarding biological diversity,
- protecting cultural heritage,
- preserving the long-term productive capacity of the ecosystem and
- ensuring that natural resources are properly managed.

Based on the principles above 15 environmental quality objectives have been developed for Sweden.

1. Clean air
2. High-quality groundwater
3. Sustainable lakes and watercourses
4. Flourishing wetlands
5. A balanced marine environment, sustainable coastal areas and archipelagos
6. No eutrophication
7. Natural acidification only
8. Sustainable forests
9. A varied agricultural landscape
10. A magnificent mountain landscape
11. A good built environment
12. A non-toxic environment
13. A safe radiation environment
14. A protective ozone layer
15. Limited influence on climate

In the committee work it is assumed that the objectives; 1. Clean air, 7. Natural acidification only, 11. A good built environment and 15. Limited influence on climate have a strong relation to the energy taxation system and that the tax play an important roll in achieving the objectives. The environmental requirements to achieve the objectives are described below.

Clean air

The air must be clean enough so as not to damage human health, flora, fauna and cultural values. The outcome within a generation for this environmental quality objective should include the following:

Concentrations of air pollutants do not exceed low-risk concentrations for cancer or target values for protection against diseases or effects on plants, animals, materials and cultural objects. The target values are set with reference to persons who suffer from hypersensitivity and asthma.

Interim targets for Clean Air decided by the Swedish Parliament:

1. A level of 5 μg/m³ for sulphur dioxide as an annual average will have been achieved in all municipalities by 2005.
2. A level of 20 μg/m³ as an annual average and 100 μg/m³ as an hourly average for nitrogen dioxide will have been achieved in most places by 2010.
3. Ground level ozone concentrations will not exceed 120 μg/m³ as an 8-hour average in 2010.
4. By 2010 emissions of volatile organic compounds (VOCs) in Sweden, excluding methane, will have been reduced to 241000 tonnes.

Effects of the decisions:
Air pollution will be substantially reduced when the interim targets are achieved. The risk of future cancers due to air pollution will be reduced by at least 50 %. There will also be a noticeable improvement for persons who suffer from asthma. Reduction of ground-level ozone concentrations will lead to an increase in agricultural production and reduce loss of growth in forests.

Natural acidification only
The acidifying effects of acid deposition and land use must not exceed limits that can be tolerated by land and water. In addition, deposition of acidifying substances must not accelerate the corrosion of technical materials or cultural artefacts and buildings. The outcome within a generation for this environmental quality objective should include the following:

The deposition of acidifying substances does not exceed the critical loads for land and water areas. Measures to prevent anthropogenic soil acidification preserve natural production capacity, archaeological objects and biological diversity. Forestry is adapted to the sensitivity of each site to acidification, thus preventing the acidification of land and water areas due to land use.

Interim targets for Natural Acidification, only decided by the Parliament:

1. By 2010 not more than 5 % of all lakes and 15 % of the total length of running water in the country will be affected by anthropogenic acidification.
2. By 2010 the trend towards increased acidification of forest land will have been reversed in areas that have been acidified by human activities, and a recovery will be under way.
3. By 2010 atmospheric emissions in Sweden of sulphur dioxide will have been reduced to 60000 tonnes.
4. By 2010 atmospheric emissions in Sweden of nitrogen oxides will have been reduced to 148000 tonnes.

Effects of the decisions:
It will take a long time for acidified areas to recover, but the load will be substantially reduced. Implementation of the international conventions will reduce the number of areas in Sweden where the critical load is currently exceeded from over 6 million hectares to just over 1.5 million hectares. In addition, the proportion of the land area that is affected by the critical load for eutrophication will be reduced from 14 % in 1990 to about 4 % in 2010. Health problems will diminish, as will the damage caused to cultural monuments and objects.

A good built environment
Cities, urban areas and other built-up areas must represent a good, healthy living environment and contribute to a good regional and global environment. Natural and cultural heritage values must be preserved and developed. Buildings must be located and designed in an environmentally appropriate fashion and in such a way as to promote the sustainable management of land, water and other resources. The outcome within a generation for this environmental quality objective should include the following:

- The built environment provides aesthetic experiences and wellbeing and offers a wide range of housing, workplaces, services and culture that give everybody the opportunity to live a full and stimulating life, while reducing everyday transport needs.
- The cultural, historical and architectural heritage in the form of buildings and built environments, including places and landscapes with special assets, are protected and enhanced.
- A sustainable urban structure is developed both in connection with the location of new buildings, structures and industries and with the use, management and conversion of existing buildings.
- The living and leisure environment, and wherever possible the work environment, meets society's requirements in terms of design, freedom from noise and access to sunlight, clean water and clean air.
- Areas of unspoiled nature and green spaces close to built-up areas, which are easily accessible, are protected in order to meet the need of play, recreation, local farming and a healthy local climate.
- Biological diversity is preserved and enhanced.
- Transports and transport facilities are located and designed in such a way as to limit interference with the urban or natural environment and so as not to pose health or security risks or be otherwise detrimental to the environment.
- Environmentally sound, good-quality public transport systems are available, and there are plenty of facilities for safe pedestrian and cycle traffic.
- People are not exposed to harmful air pollutants, noise nuisances, harmful radon levels or other unacceptable risks to health or safety.
- Land and water areas are free of toxic and dangerous substances and other pollutants.
- The use of energy, water and other natural resources is efficient, resource saving and environmentally sound; the preferred energy sources are renewable.
- Natural gas is only used where it is not possible to use substitutes in specific applications.
- Deposits of gravel that are valuable for the drinking water supply and the natural and cultural landscape are preserved.
- The quantity and dangerousness of waste are decreasing.
- Waste and residues are separated by categories and recycled on a co-operative basis by urban areas and the surrounding rural areas.

Interim targets for A Good Built Environment decided by the Parliament:

<u>Planning documentation</u>

1. By 2010 spatial and community planning will be based on programmes and strategies for:

- achieving a varied supply of housing, workplaces, services and culture in order to reduce car use and improve the scope for environmentally sound and resource-efficient transports;
- preserving and enhancing cultural, historical and aesthetic assets;
- preserving and enhancing green and water areas in urban and suburban areas and ensuring that the percentage of hardened surfaces does not increase;
- promoting more efficient energy use, the use of renewable energy resources and the development of production plants for district heating, solar energy, biofuels and windpower.

Built environments of particular cultural and historic value

2. By 2010 built environments of particular cultural and historic value will be identified and a programme adopted for protection of these values. In addition, long-term protection will be provided for at least 25% of valuable built environments.

Noise

3. By 2010 the number of people who are exposed to traffic noise in excess of the target values approved by Parliament for noise in dwellings will have been reduced by 5 % compared with 1998.

Gravel extraction

4. By 2010 the extraction of gravel in the country will not exceed 12 million tonnes per year and the proportion of reused materials will represent at least 15% of the ballast used.

Waste

5. The quantity of landfill waste, excluding mining waste, will be reduced by at least 50 % by 2005 compared with 1994, at the same time as the total quantity of waste generated does not increase.

6. All landfill sites will conform to uniform standards by 2008 and will meet stringent environmental requirements in accordance with Council Directive on the landfill of waste.

Energy use etc. in buildings

7. The environmental impact made by energy use in residential and commercial buildings will decrease and be lower in 2010 than in 1995. This will be achieved, inter alia, by improving the efficiency of and eventually reducing energy use.

Effects of the decisions:
More efficient energy use reduces the impact on the environment, for example in the form of reduced carbon dioxide emissions. Lower noise levels will raise the quality of life.

Limited influence on climate
Levels of greenhouse gases in the atmosphere must, in accordance with the UN Framework Convention on Climate Change, be stabilised at a level at which human impact will not have a harmful effect on climate systems. This objective is to be attained in such a way and at such a rate as to protect biological diversity, assure food production and not jeopardise other sustainable development goals. Together with other countries, Sweden is responsible for achieving this global objective.

The outcome within a generation for this environmental quality objective should include the following:

- The measures focus on stabilising greenhouse gas concentrations in the atmosphere at a level lower than 550 ppm (parts per million) and ensuring that there is no increase in the concentrations of other greenhouse gases in the atmosphere. The action taken by all countries is crucial to achievement of the objective.

Interim target for Reduced Climate Impact proposed by the Swedish Government:

The average Swedish emissions of greenhouse gases during the period 2008 - 2012 shall be at least 4 % lower than the emissions in 1990. The emissions are to be accounted for as carbon dioxide equivalents and include carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, perfluorocarbons (PFCs) and HFCs.

4.2.3 The Swedish environmental legislation

4.2.3.1 The Environmental Protection Law (1969:387)

The Swedish legislation for regulation of emissions and other ecologically harmful activities from stationary sources are build on a traditional form of control with permits, terms of conditions and inspections. The Environmental Protection Law (1969:387, Miljöskyddslagen) was designed in the end of 1960th and was a very comprehensive environmental law at that time. The introduction of the Environmental Protection Law results in significant improvements of the Swedish environment especially concerning water emissions from households and industry and air emissions from large industrial plants. The basic idea with the Environmental Protection Law was that a certain amount of environmental effects could be acceptable if the activity had an appropriate geographic location, if the environmental effects could be acceptable and that appropriate actions were taken to protect the environment. Permits were released by a special authority "Koncessionsnämnden för miljöskydd" (Concession board for environmental protection). A decision could be appealed to the government.

4.2.3.2 The Environmental Code (SFS 1998:808)

In 1999 the new Environmental Code was introduced. In this way a number of environmental laws were aggregated into one code. The objectives and area of application of the Environmental Code is described in the code as follows:

The purpose of this Code is to promote sustainable development, which will assure a healthy and sound environment for present and future generations. Such development will be based on recognition of the fact that nature is worthy of protection and that our right to modify and exploit nature carries with it a responsibility for wise management of natural resources. The Environmental Code shall be applied in such a way as to ensure that:

1. human health and the environment are protected against damage and detriment, whether caused by pollutants or other impacts;
2. valuable natural and cultural environments are protected and preserved;
3. biological diversity is preserved;
4. the use of land, water and the physical environment in general is such as to secure a long term good management in ecological, social, cultural and economic terms; and
5. reuse and recycling, as well as other management of materials, raw materials and energy are encouraged with a view to establishing and maintaining natural cycles.

The procedures are similar to the old Environmental Protection Law but the Concession board is replaced by five environmental courts. The district courts so designated by the Government shall be regional environmental courts. The Superior Environmental Court shall be the Svea Court of Appeal. The final court of appeal shall be the Supreme Court.

An environmental court shall consist of a president, who shall be a legally qualified district court judge, an environmental adviser and two expert members. The court may also comprise an additional qualified judge and an additional environmental adviser. Environmental advisers shall have technical or scientific training and experience of environmental issues. One of the expert members shall have experience of matters falling within the area of responsibility of the Swedish Environmental Protection Agency. The president shall decide, with reference to the nature of the case, whether the other expert member shall have experience of industry or of local government.

To give the new environmental code a certain amount of flexibility the code and laws were written as framework laws. The specific regulations are short and general. Instead, emission requirements and other regulations for specific industries are set up by a probation authority based on technical and economical possibilities and on what can be considered as environmental motivated. The procedure is integrated and all important environmental aspects are considered such as emission to air, water and soil, noise etc. All aspects are handled in one concession and one permit. This gives a comprehensive view of the case and many aspects of the case can be considered.

4.2.4 Green tax reforms in Sweden

The term "green tax reform" has been used since the beginning of the 1980th and is not very well defined. However, usually we mean an increase of tax on natural resources, emissions and other environmentally harmful activities. The income from the increased environmental taxes is used to lower other taxes, usually taxes on labour work. A green tax reform can be seen as a tool to improve the environmental performance of the tax system but it can also be seen in a wider perspective in the development of a environmentally concerning tax system. From a Swedish government perspective a green tax reform is meant to be tax income neutral. The purpose is to increase element of environment in the tax system. The first step towards a green tax reform was taken in the tax reform in 1990/1991.

In the government bill in year 2000 a green tax reform for the period 2001-2010 was introduced. The available amount for the reform was estimated to 30 billion SEK. It was postulated that the reform was essential to reach the environmental objectives that were set up for Sweden. The first step in the tax reform was taken in 2000 and the strategy was outlined. The strategy was well in line with the proposed structure of the Swedish tax reform committee (SOU 1997:11). In the first year

in 2001 the reform amount to 3.3 billion SEK. The following year the amount was set to 2 billion SEK and in 2003 the proposed amount was set to 3 billion after political negotiations.

An increased interest for green tax reforms and the return of Miljöpartiet, the green party, to the Parliament in 1994 opened up for a new official tax reform committee. The committee presented their work in a Government White Paper in 1997, Skatter, miljö och sysselsättning, Tax, Environment and Employment (SOU 1997:11). The conclusions of the committee were supported by all the political parties except Moderaterna.

The tasks for the committee were twofold. The first task was an analysis of the consequences on the national economy of the existing energy and environmental taxation system. The analyses should comprise not only the direct environmental results but also the consequences on the Swedish trade and industry (competitiveness, employment, state economy etc.). The second task was, on the basis of the first analysis, to analyse and propose improved and new environmental taxation. The conclusion from the committee was that it is possible to take additional steps towards a green taxation system but it has to be performed carefully. A model for the development work was also suggested. This model has later been proposed by the Government as a possible development platform.

The green tax reform committee model

The committee model is based on the present energy and environmental taxation system. It is suggested that the tax should be as general as possible to achieve the best control result. It is proposed that all fossil and biomass based fuels should be taxed with the sum of the following components:

- Energy tax proportional to the energy content in the fuel.
- Carbon dioxide tax proportional to the net emission of carbon dioxide.
- Sulphur tax proportional to the sulphur content in the fuel.
- Traffic and environmental tax which amount can be varied between different fuels to adjust for special traffic related situations.

The proposed taxes by the committee are shown in table 21. The system can easily be updated with other harmful environmental parameters if necessary. In the proposed tax system the energy tax can be seen as a more general tax while the carbon dioxide tax, the sulphur tax and the traffic tax have a more direct environmental purpose. The model indicates that all energy products are equally taxed irrespectively of their consumption sector or energy form (electric power or heat). Motor fuels are however more heavily taxed then fuels for heating. A tax system with equal energy tax can however have undesired effects on for example the industry tax level. It will also have a redistributive effect between taxes for e.g. industry and household. To mitigate those effects the committee has introduced principles for differentiated tax levels.

Table 21 Proposed taxes by the committee [6].

	Energy tax per kWh	Carbon dioxide tax per kg carbon	Sulphur tax per kg sulphur	Traffic and environmental tax	Total tax
Energy products	E	K	S	T	E+K+S+T

A basic principle in the differentiated tax levels was that the tax would be taken out early in the production chain to establish a good control effect. Different principles can be used for different emittants. For global emittants like e.g. CO_2 the tax should be equal in all countries. This is usually not the case; thus the tax level must be adjusted based on international aspects. The industry

competitiveness on an international market plays here an important roll. For emissions with a local effect the situation is different. Even if the economic instruments lead to a decreased production and increased import the effect of the instrument can be justified if the environmental benefit have a higher value than the decreased production.

According to the committee work the tax should be taken out at the consumption stage. A common argument against energy tax in the production chain is that it can result in non-optimal resource use. Another argument against general tax on energy in the production industry is that it will reduce the tax room for environmental taxes. In a case where the carbon dioxide tax is so high that a reduced tax must be used can the energy tax be set to zero. In a case where there are room for increased taxes the direct environmental related taxes should be increased in the first place. In the case with electric power production and heat production the consumption is taxed and the resources used for the production of the heat and electric power is not taxed. Table 22 illustrates the basic principles of the fuel tax in the proposed tax system. The tax model proposed for electric power and heat is shown in table 23.

Table 22 Proposed fuel taxes by the committee [6].

	Reformed energy taxes				
Fuels for heating	**K tax**	**E tax**	**T tax**	**S tax**	**Total tax**
Fuel oil	K	E	0	S	K+E+S
Coal	K	E	0	S	K+E+S
LPG	K	E	0	S	K+E+S
Natural gas	K	E	0	S	K+E+S
Uranium	K(=0)	E	0	S	K+E+S
Peat	K	E	0	S	K+E+S
Biofuels	K(=0)	E	0	S	K+E+S
Fuels for industry, electric power production and district heating					
Fuel oil	k	0	0	S	k+S
Coal	k	0	0	S	k+S
LPG	k	0	0	S	k+S
Natural gas	k	0	0	S	k+S
Uranium	k (=0)	0	0	S	k+S
Peat	k	0	0	S	k+S
Biofuels	k (=0)	0	0	S	k+S
Fuels for operation of motor driven vehicles, all users					
Gasoline	K	E	T	S (=0)	K+E+T+S
Diesel	K	E	T	S (=0)	K+E+T+S
LPG	K	E	T	S (=0)	K+E+T+S
Biofuels	K (=0)	E	T	S (=0)	K+E+T+S
Natural gas	K	E	T	S (=0)	K+E+T+S

K = general carbon dioxide tax
k = reduced carbon dioxide tax
K (=0) = general carbon dioxide tax set to zero
k (0=) = reduced carbon dioxide tax set to zero
E = energy tax
S = sulphur tax
S (=0) = sulphur tax set to zero
T = environmental and traffic related tax
0 = no tax

Table 23 Proposed taxes on electric power and heat by the committee [6].

Energy type	Energy tax, öre per kWh
Electric power:	
Industry, electric power and heat production	0
Consumers in sparsely-populated areas	E1
Consumers in other areas	E2
Heat:	
Industry, electric power and heat production	0
Other consumers	V1

E1 = reduced energy tax on electric power
E2 = full energy tax on electric power
V2 = full energy tax on heat
0 = no tax

The proposed model has also been evaluated by the Government office [7]. The difficulties with the energy taxation of today are divided in four groups:

- General target conflicts.
- Twisting effects in the heat and power production and in the district heating production.
- The international competitiveness of the industries and other competing activities.
- The use of untaxed energy for not intended purposes.

Many of those problems are dealt with in a Government White Paper [1]. In the government evaluation the need for tax reductions in the energy intensive and internationally competing industry is stressed. Also very low levels of taxes can have dramatic effects on the industry if the taxes can't be absorbed in an increased price level of the product. The energy taxation in most of the EU countries is lower than the level in Sweden. In competing countries outside Europe energy taxation is almost non-existing. The acceptable tax level is thus controlled, to a certain extent, of the international tax levels. In a situation, like in Sweden, where a higher energy taxation level than in competing countries is used there are two way to go to mitigate the negative effects. One can have tax exemption rules with tax refunds or one can have reduced tax levels. A third alternative is of course a combination of those two alternatives.

4.2.5 Emission trading of greenhouse gases

Sweden have signed the Kyoto protocol and has thereby made a commitment to reduce the increase of greenhouse gases to 104 percent of the emission level 1990 to the years 2008 to 2012. Sweden has also the intention to participate in the global emission trading connected to the Kyoto protocol. Sweden will also participate in the EU/CO_2 emission trading program that will start 2005 and the preparatory work for the trading is going on. The implementation and distribution of permits have been recently covered in a special investigation, Emission trading for a better climate [14].

4.3 The Energy and Carbon dioxide tax

4.3.1 Extent of the law and present tax levels

Tax on energy and carbon dioxide shall be paid according to fuels specified in a specification table. The last change of the table was by the law (2002:1142). In the table the different fuels to be taxed are specified and the tax rates for energy and carbon dioxide tax are shown. The table valid from 1 January 2003 is shown is table 24. In addition to the specification table, tax shall be paid also for other fuels for e.g. vehicle or heating use, fuel additive etc. according to chapter 2 § 3-4 (1994:1776).

The tax refers to a fuel volume at a fuel temperature of 15 °C. If the temperature of the fuel is different from 15 °C the volume can be recalculated to 15 °C. For natural gas and methane the tax levels shall be calculated based on the volume at 0 °C and 101.325 kilopascal. Law (1999:1323).

CN numbers are used to classify the different fuels. The CN (Combined Nomenclature) is a method for designating goods and merchandise which was established to meet, at one and the same time, the requirements both of the Common Customs Tariffs and of the external trade statistics of the Community. The CN is also used in intra-Community trade statistics. The basic regulation is Council Regulation (EEC) No 2658/87 on the tariff and statistical nomenclature and on the Common Customs Tariff. The CN is comprised of the Harmonised System (HS) nomenclature with further Community subdivisions. The Harmonised system is run by the World Customs Organisation (WCO).

Table 24 Energy and carbon dioxide tax rates in Sweden for different fuels from 1 January 2003. CN-numbers as defined 1 October 1994.

CN number		Fuel type	Energy tax rate	Carbon dioxide tax rate	Sum
1	2710 00 26,	**Gasoline that meet the following requirement:**			
	2710 00 27, 2710 00 29 or 2710 00 32	a) environmental class 1	2 kr 94 öre per litre	1 kr 77 öre per litre	4 kr 71 öre per litre
		alkylate gasoline	1 kr 41 öre per litre	1 kr 77 öre per litre	3 kr 18 öre per litre
		b) environmental class 2	2 kr 97 öre per litre	1 kr 77 öre per litre	4 kr 74 öre per litre
2	2710 00 26	**Other gasoline**			
	2710 00 34 or 2710 00 36		3 kr 63 öre per litre	1 kr 77 öre per litre	5 kr 40 öre per litre
3	2710 00 51	**Fuel oil, diesel oil, kerosene, etc. that:**			
	2710 00 55 2710 00 69	a) is marked with mark colour or gives less than 85 volume percent distillate at 350°C	720 kr per m^3	2 174 kr per m^3	2 894 kr per m^3
	or 2710 00 74 2710 00 78	b) is not marked with mark colour or gives at least 85 volume percent distillate at 350°C and classified in environmental class 1	1004 kr per m^3	2174 kr per m^3	3178 kr per m^3
		environmental class 2	1243 kr per m^3	2174 kr per m^3	3417 kr per m^3
		environmental class 3 or not belonging to any environmental class	1556 kr per m^3	2174 kr per m^3	3730 kr per m^3
4	from	**LPG that are used for:**			
	2711 12 11 2711 19 00	a) operation of motor driven vehicle, ship or aircraft	0 kr per 1000 kg	1322 kr per 1000 kg	1322 kr per 1000 kg
		b) other purpose than a)	141 kr per 1000 kg	2286 kr per 1000 kg	2427 kr per 1000 kg
5	from	**Methane that are used for:**			
	2711 29 00	a) operation of motor driven vehicle, ship or aircraft	0 kr per 1000 m^3	1087 kr per 1000 m^3	1087 kr per 1000 m^3
		b) other purpose than a)	233 kr per 1000 m^3	1628 kr per 1000 m^3	1861 kr per 1000 m^3
6	2711 11 00	**Natural gas that are used for:**			
	2711 21 00	a) operation of motor driven vehicle, ship or aircraft	0 kr per 1000 m^3	1087 kr per 1000 m^3	1087 kr per 1000 m^3
		b) other purpose than a)	233 kr per 1000 m^3	1628 kr per 1000 m^3	1861 kr per 1000 m^3
7	2701, 2702	**Coal fuels**			
	or 2704		307 kr per 1000 kg	1892 kr per 1000 kg	2199 kr per 1000 kg
8	2713 11 00 -	**Petroleum coke**			
	2713 12 00		307 kr per 1000 kg	1892 kr per 1000 kg	2199 kr per 1000 kg
9	3803 00 10	**Crude tall oil**			
			2894 kr per 1000 m^3		2894 kr per 1000 m^3

4.3.2 Use of environmental classes for oil products

To be able to promote production of more environmentally developed fuels the different fuels have been classified in different environmental classes. In this way can for example different tax level be used for different environmental classes of fuels. The basic use of the environmental classes is specified in Law (1994:1776, chapter 2 §5-7) and the fuel specifications for the different environmental classes are written in a supplement to the law of exhaust gas cleaning and motor fuels for motor vehicles (2001:1080). The specification tables are presented in appendix 1. Two different environmental classes are used for gasoline, table 54, and three classes are used for diesel fuels, table 55. In addition there is also a specification for alkylate gasoline, table 54. For mixtures of petroleum oils the environmental class will be determined by the composition of the final mixture.

4.3.3 Use of mark colour for petroleum fuels

To distinguish between taxed and untaxed fuels a mark colour can be used. Coloured fuels are not taxed. Marking of fuels is only allowed at sites approved by the Swedish customs or the Swedish tax authority. For marking of fuels the dye solvent yellow N-ethyl-N-[2(1-isobutoxietoxi)ethyl](-4-fenylazo)aniline will be used. The concentration will be at least 6 mg/litre fuel.

4.3.4 Exemptions to tax liability

Since the law of tax on energy (1994:1776) came into force 1 January 1995 a number of changes have been made in the law. The law has thus became less and less well arranged especially concerning the exceptions to tax liability.

The general position of the Swedish energy taxation is that fossil fuels, which are used for, engine operation or heating shall be taxed. Biomass based fuels shall not be taxed. Crude tall oil is however taxed due to industrial political reasons. Fossil fuels that are used for other purposes than engine operation or heating, i.e. mostly as raw material, are not taxed.

Several exemptions to tax liability exist in LSE. LSE postulates in chapter 2 §11 that energy and carbon dioxide tax will not be paid for:

1. methane produced in biological processes.
2. wood fuels that is sold or used for motor operation at simultaneous production of heat and electric power in a heat and power plant. (not raw tall oil)
3. fuels that is distributed in a separate package of maximum one litre.
4. fuels that are lost in connection to its production, storage and transportation.

Furthermore, several exemptions are specified in LSE chapter 6a §1-5. Some of the exemptions are specified directly in LSE some are specified in a supplementary law (2002:1142) that can be updated on a more regular basis. A short description of the main exemptions from taxation is given below.

1. *Use for other purposes than engine operation or heating or in processes where the fuel mainly is used for other purposes than engine operation or heating.*

The exemption is valid for all types of fuels. If the conditions are fulfilled it will result in a complete exemption from energy tax, carbon dioxide tax and sulphur tax. According to this regulation, fuels that are used as raw materials, as reducing agents at the chemical process industry or in reduction

processes for example in blast furnaces are exempt from taxation. Raw material should refer to fuels that are directly used in a product without chemical modifications. Sometimes, a part of the fuel in a reduction process can contribute to heating. In the preparatory work to the legislation the legislator indicated that exemption from taxation also could be present if the main use of the fuel in the process is other than for engine operation or heating. The legislator indicated a level of 70-75 percent. If this condition is meet the entire fuel use can be exempt from taxation.

Exemption from taxation for mineral oil used for other purposes than engine operation or heating is derived from the mineral oil directive [4]. An equivalent principle for coal and natural gas is commonly used in other EU member countries that have taxation on coal and natural gas and will also be included in the new energy tax directive.

2. *Use in trains or other railbound traffic.*

If the conditions are fulfilled it will result in a complete exemption from energy tax, carbon dioxide tax and sulphur tax. Apart from gasoline and marked oil the exemption is valid for all types of fuels.

Legal authorisation for the regulation in the EU legislation can be found in article 8.2. c in the mineral oil directive.

3. *Use in ship when the ship is not used for private purposes.*

If the conditions are fulfilled it will result in a complete exemption from energy tax, carbon dioxide tax and sulphur tax. Apart from gasoline and marked oil the exemption is valid for all types of fuels. Ship refers to a vessel with minimum length of 12 meter and a minimum beam of 4 meters. All other vessels are referred to as boats.

Legal authorisation for the regulation in the EU legislation can be found in article 8.1. in the mineral oil directive.

4. *Use in boats with permission according to 2 chapter 9 § LSE or permission according to law of fishery (1993:787) when the boat is not used for private purposes*

If the conditions are fulfilled it will result in a complete exemption from energy tax, carbon dioxide tax and sulphur tax. Apart from gasoline and marked oil the exemption is valid for all types of fuels. The rule of exemption in 2 chapter 9 § LSE was originally introduced for the case when authorities operates both ships and boats and handle both marked and unmarked fuel oils. Boats with ship licences for fishing boats according to law of fishery (1993:787) are handled as 3.

5. *a) Use in aircraft when the aircraft is not used for private purposes.*

If the conditions are fulfilled it will result in a complete exemption from energy tax, carbon dioxide tax and sulphur tax. Other gasoline than aircraft gasoline is not exempted from tax.

Legal authorisation for the regulation in the EU legislation can be found in article 8.1. in the mineral oil directive.

5. *b) Use in aircraft when the aircraft is used for private purposes or for use in aircraft engines in test bench or similar arrangements.*

The regulation is based on the Swedish exemptions of article 8.4. in the mineral oil directive where Sweden has been given the permission to exclude also non-professional aircraft operation from taxation. The purpose of the exemption was to avoid technical application problems with the separation of private and professional fuel use at the airports.

Concerning exemption from taxation in engine testing application the legal authorisation for the regulation in the EU legislation can be found in article 8.2. in the mineral oil directive.

Exemption from taxation is only valid for aircraft gasoline and aircraft kerosene.

6. *Use in production of mineral oil products, coal fuels, petroleum coke and other products, which have become subject of taxation.*

If the conditions are fulfilled it will result in a complete exemption from energy tax, carbon dioxide tax and sulphur tax. According to this regulation the tax exemption is valid for fuels which are used in the production of mineral oil products and other taxed products which can not be classified as mineral oils.

The regulation is based on article 4.3. in the mineral oil directive.

7. *Use in production of taxable electric power with limitations according to 3 §.*

The regulation imply that fuels which are used in the production of taxable electric power are exempted from energy and carbon dioxide tax. Instead the produced electric power is taxed according to chapter 11 LSE. In this way double taxation can be avoided. If heat is also produced in a combined heat and power plant the exemption is only valid for half of the energy tax for the fuel used in the production of useful heat. This means that full carbon dioxide tax and 50 percent of the normal tax for heat production will be charged (chapter 6a 3 § LSE)[20].

8. *Use in metallurgical processes, if not already exempt from taxation by preceding paragraphs.*

If the conditions are fulfilled it will result in a complete exemption from energy tax and carbon dioxide tax. The metallurgical process is considered to include the process steps from sintering to ingots or casting materials. The regulation was originally introduced 1984. It was kept in LSE while awaiting for a common coal taxation directive in EU. Exemption from tax can however already be present by application of chapter 6 a 1 § LSE[21].

9. *Use for other purposes than operation of motor driven vehicles in production processes in industrial activities, if not already exempt from taxation by preceding paragraphs.*

The regulation comprise all fuels except gasoline and marked fuel oil according to 2 chapter 1 § first paragraph 3a LSE. The regulation is not directly applicable to raw tall oil[22]. The regulation gives exemption from energy tax with 100 percent and from carbon dioxide tax with 75 percent. By this regulation a general exemption from energy and carbon dioxide tax for the industry is achieved. The achieved tax rate is usually called the industrial tax rate. However, this regulation also requires a definition of "industrial activity" and "production process". A brief description of the definition used in Sweden can be found in appendix 2.

10. *Use for other purposes than operation of motor driven vehicles in greenhouse heating in professional greenhouse production, in forestry production or in aquaculture production, if not already exempt from taxation by preceding paragraphs.*

[20] Separate regulations exist for tall oil due to the fact that tall oil is only taxed for energy tax and not for carbon dioxide tax.

[21] Application of the rule concerning "use for other purposes than engine operation or heating" in combination with the "main use of the fuel" regulation.

[22] By a reference in chapter 6 a 2§ LSE also raw tall oil can be exempt from tax in the same way as other fuels. Because raw tall oil only is taxed with energy tax (which corresponds to other fuels total energy and carbon dioxide tax) a direct application of regulation 9. should result in a overall larger tax reduction for tall oil than for other fuels. This is avoided by separate regulation in chapter 6 a § 2 LSE.

In this regulation professional greenhouse production, forestry production and aquaculture production is handled equally with the manufacturing industry. The regulation gives exemption from energy tax with 100 percent and from carbon dioxide tax with 75 percent. The regulation comprise all fuels except gasoline and marked fuel oil according to 2 chapter 1 § first paragraph 3a LSE. The regulation is not directly applicable to raw tall oil[22]. The production activities can be given an exemption from energy and carbon dioxide tax.

11. *Use for other purposes than operation of motor driven vehicles in professional agriculture production, if not already exempt from taxation by preceding paragraphs.*

In this regulation professional agriculture production is handled equally with the manufacturing industry. The regulation gives exemption from energy tax with 100 percent and from carbon dioxide tax with 75 percent. The regulation comprise all fuels except gasoline and marked fuel oil according to 2 chapter 1 § first paragraph 3a LSE. The regulation is not directly applicable to raw tall oil[22]. However, the tax relief is given by tax refunds.

12. *Use in black liquor boilers, liquor boilers, metallurgical processes or processes for production of other mineral substances than metals, if not already exempt from taxation by preceding paragraphs.*

By this regulation a deduction for the sulphur tax can be made on fuels that are used in processes for production of, for example bricks, cement, lime (CaO) and mineral wool. The regulation also allow deduction for the sulphur tax for fuels used in black liquor boilers (sulphate pulp production) and liquor boilers (sulphite pulp production).

13. *Use in the production process at mining industry for operation of other motor driven vehicles than cars, trucks and busses.*

The regulation gives exemption from energy tax with 100 percent and from carbon dioxide tax with 75 percent for fuels defined in 2 chapter 1 § first paragraph 3b LSE (high taxed fuel oil, diesel oil and kerosene) and that are used in the production process in the mining industry for operation of other motor driven vehicles than cars, trucks and busses.

Special regulations for energy intensive activities

0.8 percent rule

The regulation imply that the part of the tax that exceed 0.8 percent of a companies total sales value is reduced to 24 percent of the carbon dioxide tax level. For raw tall oil the reduction is based on the energy tax due to the fact that no carbon dioxide tax is paid for tall oil.

The regulation can be found in chapter 9 § 9 LSE and can be implemented by companies that consume fuels in a production process in industrial activities, at greenhouse heating in professional greenhouse production and in professional agriculture, forestry and aquaculture production. These activities are specified in chapter 6 a 1 § 9-11 LSE. The regulation comprises all taxed fuels except fuels used for operation of motor driven vehicles.

The tax reduction in this regulation must not imply that the tax will go below the minimum tax levels in EU.

Sweden have by decision 12 march 2001 been given an exception according to article 8.4 in the mineral oil directive to implement the 0.8 percent rule. The exception expires 31 December 2006.

1.2 percent rule

In this regulation a ceiling is fixed for the tax where the tax is limited to 1.2 percent of the sales value. Exceeding tax is set to zero. The regulation is not included in LSE but included in a separate

provisional regulation with an expire date set to 31 December 2003. The regulation concern reduction of carbon dioxide tax for other fuels than mineral oils i.e. coal and natural gas and can only be applicable for companies producing products made of other mineral materials than metals i.e. cement, lime, stone and glass industries. The regulation was introduced to mitigate the transition for those companies to higher tax levels. Further tax relieves can be necessary if not all fossil fuels are taxed in other countries (government bill 2002/03:1 p. 186).

Other exemptions in the Law of Tax on Energy (LSE)
In addition to the regulations above there are also other minor regulations in chapter 9 §1 and §3 LSE. Here exemptions from tax for fuels acquire by diplomats are regulated as well as gasoline for other than private use which are consumed in ships or boats and marked oil which for such purpose is consumed in boats without ship licences for fishing boats according to law of fishery (1993:787).

4.4 Tax on Electric power

The tax on electric power is regulated by the law of tax on energy (1994:1776) chapter 11.

§1: Electric power that is used in Sweden is liable to tax except for the exemptions in §2.

§2: Electric power is not liable to tax if it is:

1. produced in Sweden in a wind power station by a producer that is not a professional producer of electric power.
2. in other cases produced in Sweden by a producer that have an installed generator power of less than 100 kW and that is not a professional producer of electric power.
3. delivered in less than 50 kW without payment or compensation by a producer or supplier to a consumer that has no community of interests with the producer or supplier.
4. produced and consumed on a ship or other means of transport.
5. consumed in the production or distribution of electric power.
6. produced in a backup power plant.

§3: The actual tax is regulated in this paragraph and is shown in table 25.

Table 25 Tax on electric power in Sweden from 1 January 2003.

	Type of use	Tax rate
1.	Electric power for industrial use in the manufacturing process or in commercial greenhouse production.	0 öre per kWh
2.	Other use of electric power than under 1. and that are used in specific geographic areas of Sweden specified in separate table [1)]	16.8 öre per kWh
3.	Electric power used for electric power supply, gas supply, heat supply or water supply in other communities than in the separate table [1)].	20.2 öre per kWh
4.	Other use of electric power.	22.7 öre per kWh
	Electric power that is used during 1 November to 31 March in electric boilers that are a part of an electric power boiler installation which exceed an installed power of 2 MW have the following tax: a) 19.2 öre per kWh in communities defined in the separate table[1)], for other use than in industrial use in the manufacturing process or in commercial greenhouse production, b) 22.7 öre per kWh for electric power used for electric power supply, gas supply, heat supply or water supply in other communities than in the separate table[1)].	

1) All communities in Norrbottens county, Västerbottens county, Jämtlands county. The following specified communities: Västernorrlands county: Sollefteå, Ånge, Örnsköldsvik, Gävleborgs county: Ljusdal, Värmlands county: Torsby, Dalarnas county: Malung, Mora, Orsa, Älvdalen.

§5: Tax liability belongs to them whom in Sweden

1. professionally produce taxable electric power,
2. professionally deliver by him produced taxable electric power or deliver by other produced taxable electric power, and
3. them, for other purposes than refereed to in §9, sell or consume electric power, which has been acquired without taxation by assurance according to §11.

They who import taxable electric power to Sweden or they who acquire taxable electric power in Sweden without payment or other compensation shall be considered as the producer of the electric power.

§8: Energy tax on electric power shall be paid based on measurements of the energy contents in the electric power. Other determination methods than measurements can be applicable.

4.5 Tax on Sulphur

Tax on sulphur was introduced in Sweden 1 January 1991. The tax is settled in the law of tax on energy (1994:1776). The purpose of the tax was to reduce the sulphur emission from combustion of peat, coal, petroleum coke and other solid or gas fuels.

The sulphur tax cover the same fuels as the energy and carbon dioxide tax (chapter 2, § 1, 3 and 4, see chapter 4.3) but peat is also included in the sulphur tax.

For peat fuel, coal fuel, petroleum coke, other solid fuels and gas fuels the tax rate is 30 SEK per kg sulphur in the fuel. For liquid fuels the tax is set to 27 SEK per m^3 fuel for each 1/10 weight percent sulphur in the fuel. In the calculation of the tax the sulphur content shall be rounded off to the nearest higher 1/10 weight percent. If the sulphur content is higher than 0.05 percent but less than 0.2 percent the sulphur content shall be rounded off to 0.2 weight percent. No sulphur tax is charge on liquid fuels or gas fuels if the sulphur content is 0.05 weight percent or less. For liquid fuels the sulphur content values refers to a fuel temperature of 15 °C. If the temperature of the fuel is different from 15 °C the volume can be recalculated to 15 °C.

If a taxable have reduced the emission of sulphur by cleaning equipment or by retainment of sulphur in the product or in ashes the tax can be reduced with 30 SEK per kg reduced sulphur.

4.6 CO_2 emission trading

In the present system in Sweden the economic instrument used to reduce the emission of CO_2 is the CO_2 tax described in chapter 4.3. However, Sweden has as many other countries signed the Kyoto protocol and has the intention to participate in the emission trading of greenhouse gases that will start in 2008. Sweden will also participate in the emission trading of CO_2 that will take place in EU during 2005 and 2008. The question of how the emission certificate will be distributed for the EU trading system is now under investigation.

For the future there is a question of how the greenhouse gases will be handled. Should the CO_2 taxes be replaced with CO_2 emission trading or should both the systems be used? How should the emission certificate be allocated? Auction or grandfathering? Which consequences can the different systems have for example on the emissions and on the tax income to the state? Those questions are

under investigation in a special committee in Sweden and the outcome of this is uncertain for the moment.

4.7 The Swedish charge on nitrogen oxides[23]

Nitrogen oxides (NO_X) is an abbreviation for the two compounds NO and NO_2. NO is the main NO_X component in exhaust gases but is readily oxidised to NO_2 in the atmosphere. The emission of NO_X contribute to acidification, eutrophication and to formation of photochemical ozone and other oxidants (ground-level ozone). In 1985, the Swedish Parliament decided that airborne emissions of nitrogen oxides should be reduced by 30 % by 1995, compared to 1980 levels. Further reductions will be required in accordance with the UNECE-CLRTAP Protocol 1 to abate acidification, eutrophication and ground-level ozone ("Gothenburg Protocol") and with the EU-directive on national emission ceilings, on which member states reached political agreement on 22 June 2000 ("NEC Directive").

A charge on emission of nitrogen oxides (NO_X) from energy generation at combustion plants was introduced in Sweden on 1 January 1992 (Government bill 1989/90:141). The Government bill was based on the Government white paper on environmental charges, "miljöavgiftsutredningen" (SOU 1989:21 and SOU 1989:83). The intention was to achieve a more rapid reduction of emissions of nitrogen oxides than was otherwise considered possible, by relying on the administrative guidelines in place at that time, and also to provide an incentive for cost-effective emission reductions.

The NO_X charge applies to NO_X emissions from electricity and heat-producing boilers, stationary combustion engines and gas turbines with a useful energy production of at least 25 gigawatt hours (GWh) per year. It is based on actual recorded emissions. Initially the charge was confined to about 124 combustion plants (182 boilers) producing at least 50 GWh of useful energy per boiler. Because of its effectiveness in emission reduction and simultaneously falling monitoring costs, the charge system was later extended to include all boilers producing at least 40 GWh and in 1997 the limit was lowered to 25 GWh of useful energy per year. Today about 250 plants (375 boilers) are subject to the law emitting about 14000 tonnes of NO_X a year, which represents approximately 5 % of the total NO_X emissions in Sweden.

The charge is 40 SEK per kilogram NO_X calculated as NO_2. The NO_X charge is based on actual recorded emissions. The decision to set the unit charge at 40 SEK/kg NO_X was based on engineering data on expected effectiveness and costs of abatement investments at electricity power stations and district heating plants. The abatement cost was found to be between 3 and 84 SEK/kg reduced NO_X. A charge of 40 SEK/kg was therefore considered reasonable. The charge has remained constant in nominal terms since the introduction.

The total charge amount is returned to the participating plants with the exception of only 0.6 %, which is kept for administration costs. The refund to each plant is proportional to their production of useful energy. One of the reason for a refund system is to avoid distorting the pattern of competition between those plants which are subject to the NO_X charge and those that are not (and possibly avoid creating incentives to replace existing equipment with inefficient smaller boilers that are not subject to the charge).

[23] Material from the Swedish EPA, [15].

The refund varies from year to year but in recent years it has been approximately 10.80 SEK per megawatt hour (MWh) useful energy. This charge system encourages the targeted plants to reduce their emissions of nitrogen oxides per unit of energy to the lowest possible level. Plants with high emissions relative to their energy output are net payers to the system, whilst sources with low emissions relative to energy output are net receivers.

The charge is primarily applied to measured emissions but also to presumptive emission levels of 250 mg/MJ for boilers and 600 mg/MJ for gas turbines. Plant operators may choose to pay the charge on the basis of presumptive emissions levels instead of installing measuring equipment, although in most cases the presumptive emissions levels are substantially higher than actual emissions, so measurement is generally preferred. The presumptive levels are also applied when the measuring equipment has been out of order, or does not comply with the specifications required by the Swedish Environmental Protection Agency. To allow time for maintenance and calibration of the measuring equipment, operators may estimate emissions for a maximum of 5 percent of the monthly operating time, on the basis of emissions under similar operating conditions.

A short summary of the development of the NO_X charge system from its start in 1992 until 2002 is given in table 26. Since 1992 the number of plants and production units have steadily increased but the total NO_X emission from the plants have remained relatively constant in spite of an increase of the energy production of 63 %. The specific NO_X emission from the plant has been reduced from 0.409 kg/MWh_{useful} to 0.244 kg/MWh_{useful}, a reduction of 40 %.

Table 26 Summary of NO_X charge data for the years 1992 – 2002.

Year	Number of plants	Number of production units	NO_X emission (tonne)	Useful energy (GWh)	NO_X emission (kg/ MWh_{useful})	NO_X emission (mg/ $MJ_{supplied}$)*	Revenue (SEK/ MWh_{useful})	Environmental charge (million SEK)
1992	124	181	15305	37465	0.409	99	16.17	612
1993	131	189	13333	41158	0.324	78	12.58	533
1994	131	202	13025	45193	0.288	70	11.35	521
1995	136	210	12517	46627	0.268	65	10.69	501
1996	177	274	16083	57150	0.281	68	11.26	643
1997	250	371	15107	54911	0.275	66	10.77	604
1998	252	374	14617	56367	0.259	63	10.14	585
1999	248	375	14050	54921	0.256	62	10.09	562
2000	241	363	12765	51399	0.248	60	9.64	511
2001	252	393	14160	58142	0.244	59	9.55	555
2002	256	393	14730	61014	0.241	58	9.51	589

*) Calculated based on an assumed total energy efficiency of 87 %.

There are also side effects connected with NO_X reduction activities. There is a risk of other emissions increasing when measures are taken to reduce NO_X emissions. Modification of combustion techniques with lower temperature and/or oxygen rate in the combustion chamber, so-called "trimming", implies a less complete combustion with reduced efficiency and often increased emissions of carbon monoxide (CO) and other non-combusted compounds. CO is a poisonous gas. The concentrations that reach humans from stationary combustion sources are generally too low to create any serious health problems. The concern for CO emissions from stationary sources is rather aimed at CO emissions as an indicator of less complete combustion and increased emissions of more harmful pollutants like volatile organic compounds (VOC) and polycyclic aromatic hydrocarbons (PAH).

Flue gas treatment using urea and certain combustion conditions may result in increased emissions of nitrous oxide (N_2O). Effects on N_2O emissions from NO_X abatement arise mainly when non-catalytic flue gas treatment (SNCR) with urea is used to reduce NO_X in the flue gases. An increase in N_2O emissions is undesirable since it is a very stable greenhouse gas. N_2O and the decay products, such as NO, are also involved in the atmospheric chemistry of stratospheric ozone. Hence, emissions of N_2O contribute to the depletion of the ozone layer.

When using non-catalytic (SNCR) or catalytic (SCR) flue gas treatment, ammonia or urea is used to reduce emissions of NO_X. Not all the ammonia reacts chemically; some will be released with the flue gases, collected in condensate or be fixed in fly ash. Ammonia emissions contribute to acidification and eutrophication of land and waters.

In 1995 an estimate was made of the emission increases which may have resulted from the measures taken to limit NO_X emissions at the plants in the NO_X charge system. The increased emissions of carbon monoxide and ammonia represented 0.5 percent or less of total emissions and the increase of nitrous oxide represented approximately 5 percent of total Swedish emissions. The emission increases, which have been found to result from measures to reduce NO_X emissions, can largely be avoided. Most of them are due to the pronounced influence of the NO_X charge in combination with the lack of instruments governing other emissions. Only carbon monoxide emissions from waste incineration plants are subject to general rules. So far there are relatively few plants with clearly specified permit conditions concerning emissions of ammonia, nitrous oxide and carbon monoxide.

4.8 Other economic instruments related to energy and environment[24]

4.8.1 Taxes on motor vehicles

In addition to taxes on fuel, there are also taxes on cars and other motor vehicles. The vehicle tax was introduced in 1922 to pay for road maintenance. A special sales tax was added in the 1950s to slow the rapid expansion of motoring. It was abolished on passenger cars in 1996 and on lorries in 1998. On 1 January 2001, the last part of the sales tax was abolished, that is the sales tax on buses and motorcycles. The scrapping fee was introduced in 1975 to finance a premium paid to car owners who turn in their run-down cars to authorised car breakers instead of leaving wrecks along the roadside. The total revenue from vehicle tax was in year 2001 7017 million SEK and from scrapping fees 226 million SEK.

4.8.2 Pesticide tax

The pesticide tax shall be paid in connection with the sale or use of pesticides within the country. The term ”pesticide” is used to denote agents intended to provide protection against damage to property, sanitary inconvenience or other similar inconvenience caused by plants, animals, bacteria or virus. Wood preservatives, which in other contexts are deemed to be pesticides, are exempt from pesticide tax.

[24] Information materials from the National Tax Board (Riksskatteverket), Swedish Board of Housing, Building and Planning (Boverket) and Scandinavian Airline System (SAS).

Persons liable to pay tax are those who commercially manufacture pesticides in the country and persons who import pesticides into Sweden for commercial resale or for their own commercial use within the country.

The tax amounts to 20 SEK (1 January 2003) for each whole kilogram of active constituent in the pesticide. By active constituents in the pesticide is meant agents with the pesticidal effect.

4.8.3 Fertiliser tax

Fertiliser tax is payable on fertilisers. The term fertiliser includes ammonia assigned to CN code 2814, potassium nitrate and calcium nitrate assigned to CN code 2834 as well as products assigned to CN codes 3102, 3103, and 3105. The definitions of products are based on the EU's common harmonised system known as the Combined Nomenclature. The Customs Tariff number is abbreviated to a CN code.

The following persons are liable to pay fertiliser tax – persons approved as authorised-stock keepers, – persons who commercially manufacture fertilisers within the country without being approved as authorised-stock keepers, – persons who import fertilisers for commercial resell or for their own commercial use within the country without being approved as authorised stock keepers.

The tax is 1.80 SEK (1 January 2003) for each whole kilogram of nitrogen, when the proportion of nitrogen in the agent is at least 2 percent, and 30 SEK (1 January 2003) for each complete gram of cadmium in the fertiliser, to the extent that the cadmium content exceeds 5 grams per tonne of phosphorus.

4.8.4 Nuclear power tax

Nuclear power tax shall be paid on the thermal effect of a nuclear power reactor. Thermal effect refers to the nuclear power reactor´s capacity to produce heat. Whoever possesses a licence to own and operate nuclear power reactors (the reactor owner) is subjected to the tax. The tax rate for each calendar month is 5514 SEK per megawatt (MW) (1 January 2003) of the highest permitted thermal effect of the nuclear power reactor.

4.8.5 Natural Gravel Tax

Tax will be charged on quarried natural gravel, if the removal of the gravel takes place for purposes other than the domestic needs of the land owner and

- is carried out on the basis of a permit granted in accordance with Chapter 11 of the Environmental Code or the Water Rights Act, or
- requires a permit in accordance with Chapter 11 of the Environmental Code.

Persons liable to pay tax are persons who exploit a natural gravel pit. The government can stipulate a responsibility for those who have a permit for the removal of gravel to keep the county council informed about whom exploits a gravel pit. If such regulations have been issued, the permit holder and the exploiter are jointly and severally liable to pay tax until such information has been provided.

Tax is charged at a rate of 10 SEK per tonne (1 January 2003, weighed amount is used for calculation of the tax).

4.8.6 Waste tax

Landfills
Waste tax shall be paid for waste brought into a landfill where hazardous waste or other waste exceeding 50 tonnes per year, are deposited or stored for a longer time than three years.

Other facilities
Waste tax shall also be paid for waste that arises within a facility where the main activity is another than waste management, if hazardous waste or other waste exceeding 50 tonnes per year, are deposited or stored for a longer time than three years at the facility.

Anyone operating (business) activities at a facility is liable to pay waste tax.

The waste tax is 370 SEK per tonne of waste (1 January 2003). Tax exemption is permitted for certain types of waste where there is, for the moment, no environmentally acceptable alternatives to landfills and where the possibilities to reduce the quantity of waste through process changes, selection of raw material etc. are limited.

4.8.7 Building Regulations

Not only taxes but also different regulations play an essential role for environmental improvements and reduction of energy consumption. An important regulation for reduction of energy consumption is the building regulation. The building regulation is administrated by Swedish Board of Housing, Building and Planning (Boverket). The building regulations can be found in BFS 2002:19. A main regulation document is used for the building regulations, Building Regulations BBR - Mandatory provisions and general recommendations. Chapter 9 of this document specifies the energy requirements for the building sector, Energy Economy and Heat Retention. The documentation gives detailed requirements of the energy system including:

Limitation of heat losses
The building envelope
Thermal insulation
Maximum permissible average thermal transmittance
Calculation of average thermal transmittance
Practical value of thermal transmittance for a structural or non-structural element
Airtightness
Ventilation
Thermal insulation and airtightness
Control systems
Production and distribution of heat
The efficiency of boilers
Heating of water
Temperature level of water as heating medium
Protection against heat loss
Control systems
Efficient use of heat
Efficient use of electricity

Buildings shall be designed so that the energy requirement is limited by low heat losses, efficient use of heat and efficient use of electricity. The requirements in Limitation of heat losses and Efficient

use of heat, do not apply to buildings – which are used only for short periods or – where there is no heating requirement during a major part of the heating season. The requirements need not be complied with by buildings where it is shown by special investigation that heat increments from processes cover a major proportion of the heating requirement.

4.8.8 Aircraft fees

Environmental fees for aircrafts are mainly used to cover environmental costs related to the air traffic. The main concern so far has been the noise around the airports. Much of the revenue from the fees is also used for noise measurements, noise protection and to buy real estates around the airports. Development works have been initiated in several countries in order to develop emission based environmental fees. Such systems are already in operation in Sweden and in Switzerland as landing fees. The Swedish system is only based on nitrogen oxide emissions while the Swiss system is based both on nitrogen oxide and hydrocarbon emissions. A common model for EU is also under development in the European Civil Aviation Conference, ECAC. In some countries e.g. Denmark and Norway environmental passenger fees are used.

4.9 Administration and Implementation of the Swedish Economic Instruments

4.9.1 An overview

In principle, the administration of the Swedish economic instruments for environmental and energy control can be divided in to parts; one that is administrated by the National Tax Board (Riksskatteverket) and one that is administrated by the Swedish Environmental Protection Agency. In addition, some special fees can also be administrated by e.g. the Swedish National Road Administration and the Swedish Civil Aviation Administration.

The main reason for the division of the administration is the type of control and inspection information that is needed for the different types of emittents. Amount of fuel used, amount of electric power produced etc. are all easily available figures that can easily be incorporated in the ordinary tax system. The same situation exists for the emission of CO_2 and SO_2. There is a direct correlation between the amount of carbon in the fuel and the CO_2 emission. In principle[25], all carbon will be converted to CO_2. The same situation exists for sulphur in the fuel where, in principle[26], all sulphur will be converted to SO_2. However, if SO_2 cleaning equipment is used or retainment of sulphur in e.g. ash or limestone can be excepted, measurements can be necessary.

This means that fuel data in most cases can be used to calculate the emissions. Those data can easily be implemented in an ordinary tax system and those taxes are also administrated by the National Tax Board (Riksskatteverket).

For the NO_X charge system the situation is somewhat more complicated. First of all the NO_X emission can not be calculated based on fuel data. The actual emission has to be measured in e.g.

[25] Some carbon atoms form e.g. hydrocarbon and CO but those effects can be neglected in a CO_2 tax application.
[26] Some sulphur atoms form e.g. SO_3 and H_2S but those effects can be neglected in a sulphur/SO_2 tax application.

exhaust gases. The installation of a NO_X measurement system including measurement of both NO and NO_2 cost somewhat between 10000 – 30000 Euro. In addition there are also costs for operation, maintenance and independent calibrations. This limits the use of economic instruments for NO_X to larger plants and industries. The NO_X charge system is also more complicated than a tax and include not only measurement data but also refund systems, inspections etc. This means that it does not fit in so well in a normal tax administration system. In Sweden, the NO_X charge system is therefore administrated by the Swedish EPA.

The following table shows a general overview of the Swedish administration system.

Tax or charge	**Administrated by (taxation authority)**
Tax on electric power	National Tax Board (Riksskatteverket), Special Tax Office (Särskilda skattekontoret) in Ludvika. Administrated in the ordinary tax account system.
Energy tax	—″—
CO_2 tax	—″—
Sulphur tax	—″—
NO_X charge system	Swedish Environmental Protection Agency

4.9.2 Administration and implementation of Environmental taxes in Sweden[27]

The Swedish Tax Administration comprises a central authority, the National Tax Board, and ten regional Tax Authorities. The National Tax Board and the Tax Authorities administer the entire Swedish tax system with the exception of customs matters. The National Tax Board (Riksskatteverket) is responsible for and deals with the activities of the Tax Administration and the Enforcement Agency in Sweden. The National Tax Board reports to the government through the Ministry of Finance, although as an authority it is independent of the government. Consequently, the National Tax Board and the Tax Administration, in line with other administrative authorities, are only subject to laws, ordinances, general instructions and allocation of funds. Individual tax matters are handled by the Tax Administration without the involvement of the government. The head of the National Tax Board is the Director General, who is also the chairman of the Board's governing council.

There are ten regional Tax Authorities. Under the guidance of the National Tax Board, these Authorities are responsible for taxation in the regions. Most of the Tax Authority's work is conducted through the local tax offices located throughout the regions. The Tax Authorities also have units that specialise in dealing with large companies and the provision of legal and administrative support. Each Tax Authority has a tax fraud investigation unit. The main duty of the unit is to conduct preliminary enquiries in tax cases on behalf of the public prosecutor. The Tax Authority management comprises a Regional Tax Director and a governing council.

Indirect taxes are divided into general and special taxes on consumption. VAT is a general tax on consumption and is levied on more or less all products and a large number of services. The special taxes on consumption are, on the other hand, levied on specifically selected products and services. Therefore, they are known as excise duties.

[27] Information materials from the National Tax Board (Riksskatteverket).

As far as payments to the state are concerned, it is common to distinguish between taxes and fees. A fee usually relates to the provision of a particular service or function by the state in consideration for the sum of money paid. The fees paid to obtain a driving licence or a passport are typical cases. Payment of a tax does not entail any such direct service in return on the part of the state. The revenue from taxation is used – via the state budget – to finance all government activities, including defence and the education system.

In the case of excise duties, the government does not provide any specific services in return for paying these taxes. The revenue from excise duties is stated via the state budget. Today, excise duties account for a large proportion of state revenue, amounting to some SEK 82 billion per year.

Most of the excise duties were introduced for other purposes than merely to provide income for the state. They can, in fact – in contrast to other taxes – also be used as instruments to influence consumption patterns in a desirable direction for society. The introduction of an excise duty is, as a rule, based on both public finance requirements and other political considerations.

The taxes on alcohol, tobacco and energy are typical examples of excise duties that serve as instruments of influence. They are also some of our oldest excise duties.

The National Tax Board is responsible for the excise duties. Excise duties are administered by the Special Tax Office in Ludvika[28], which is part of the National Tax Board. The Special Tax Office has some 100 employees. By comparison with direct taxes, excise duties are administered by a very small number of tax officers. The annual cost to the government of administering excise duties (personnel, premises, computers and so on) amounts to some SEK 35.9 million, or 0.04 per cent of the excise duty revenue.

In connection with imports from non-EU countries, excise duties should in some cases be paid to the customs authorities.

Excise duties and value added tax are the two forms of tax that have been the most influenced by Sweden´s accession to the European Union (EU).

At the end of calendar year 1992, customs inspection at borders were abolished within the EU in the case of commercial traffic and travellers. In order to make this possible, efforts have been made to harmonise tax procedures, tax bases and – to some extent – the rate of tax in the case of indirect taxes. Certain minimum tax rates have been indicated. The procedural rules stipulate that goods subject to tax may be circulated without restriction between member countries before reaching the end consumer, and that tax shall be charged in the country where the goods are consumed. Decisions have been made to harmonise the procedures for excise duties on alcoholic beverages, tobacco and mineral oils.

Member countries may charge tax on products other than those covered by the harmonisation. However, such national excise duties must not make border controls necessary, nor should they prevent free trade between individual countries.

The common procedural rules for tobacco products, alcohol and alcoholic beverages as well as for mineral oil products mean that liability to pay tax on the products arises when they are produced within the EU or imported into the EU. The goods may circulate freely within the community

[28] Special Tax Office ”Särskilda skattekontoret” in Ludvika Tel. no. +46 240 870 00.
S-771 83 Ludvika, Sweden, e-mailaddress: ssk@rsv.rsv.se.

without fiscal consequences. The tax is only charged when the goods are released for consumption; until then the goods are handled under a procedure known as suspension. Suspension means that the payment of tax is postponed until the goods become available for consumption, which normally occurs when they are supplied to the retail stage. In many cases guarantees must be provided to cover payments of the tax. While being transported between EU countries the goods shall be accounted for by an accompanying document.

The energy, resource and environmentally related taxes that exists today are:

Tax	Revenue (MSEK)	Number of tax payers
Taxes on energy incl. electric power, carbon dioxide and sulphur	56502	1290
Pesticide tax	43	43
Fertiliser tax	305	76
Nuclear power tax	1796	4
Natural Gravel Tax	114	769
Waste tax	907	276
Taxes on motor vehicles	7017	

As of January 1, 2003, the Tax Collection Act (1997:483) regulates taxation procedures for excise duties in those circumstances when the tax is not in exceptional cases to be paid to the customs authority.

Within the EU there are joint regulations concerning the harmonised excise duties on tobacco, alcohol and alcoholic beverages and mineral oil products. The regulations include both material rules as well as procedural rules. The Swedish laws and ordinances within the harmonised area are subject to special rules due to harmonisation.

Any person liable to pay an excise duty shall declare his tax liability on a standard tax return form established by the National Tax Board. The tax return shall be signed by the taxpayer or a proxy and it is completed under oath. All excise duties – except tax on prizes from savings, etc. and with certain exceptions for harmonised excise duties – shall be reported in the return for specific periods – reporting periods. As a rule, the reporting period is one calendar month. However, for some excise duties the reporting period is longer. If specifically agreed with the tax authority, taxpayers may also be allowed to submit returns for excise duties on annual basis. Such an agreement is conditional on the assumption that the tax liability will not normally exceed a net amount of SEK 20 000 annually.

Persons obliged to submit a return for an excise duty are also obliged to register with the tax authority. The tax return is declared on a special form, which is available from the taxation authority. Upon registration the tax payer will receive an income tax return form, in which certain information is pre-printed, well in advance of the date when the returns shall be submitted. A registered taxpayer must also submit a tax return for those periods when he has no tax to report, known as a zero return.

The statute for each excise duty stipulates the time when the tax becomes payable. As a general rule, the time an excise duty become due for payment is the date when the taxable product is delivered. A tax liability also arises when the taxpayer makes a withdrawal from his business (for example, for private consumption) and when the taxpayer is removed from the register maintained by the tax authority. The time when the reporting obligation comes into effect is important for

deciding when the taxpayer should report the tax. The return for each accounting period must include the taxes, which have become due during the period in question.

The reporting obligation is generally conditional on a liability to pay tax having arisen. The factor determining the date when the reporting obligation comes into effect is whether or not the taxpayer is required to maintain accounting records.

For those required to maintain accounting records – in fact, most of those liable to pay excise duties – the reporting obligation arises when a commercial event upon which the tax liability is based has been, or should have been entered in the books in accordance with generally accepted accounting standards. The reporting of excise duties will consequently be based on the same accounting standards in most cases. This means that the reporting obligation may arise in a later accounting period than the tax liability.

For those who are not required to maintain accounting records, the obligation to submit a tax return always coincides with the tax liability.

Taxpayers who shall report VAT in an income-tax return form and those who shall not report VAT at all shall make sure that the tax return for excise duties reach the tax authority by no later than the 12th day of the month following the end of the accounting period. Taxpayers who have accounting records for VAT exceeding SEK 40 millions for a payment period shall make sure that the tax return for excise duties reach the tax authority by no later than the 26th day of the month following the end of the accounting period. Taxpayers who have accounting records for VAT below SEK 40 millions for a payment period shall make sure that the tax return for excise duties reaches the tax authority by no later than the 12th day of the second month following the end of the accounting period.

The tax shall be paid to the tax authority by no later than the final day of submitting the tax return. As a general rule from the 1st January 2003 excise duties shall be paid in the same way as VAT, employer´s social insurance contributions etc.

When a tax return is filed with the tax authority on time, a tax decision is deemed to have been made in accordance with the return, and the tax authority is not required to notify the taxpayer of any specific decision. Even if the tax return is submitted too late, the tax is in some cases agreed to be the amount stated in the return. The tax authority may, however, reconsider an assessment decision at the request of the taxpayer, or if there are other grounds.

The tax authority may also assess the tax on reasonable grounds, known as a discretionary tax assessment. This possibility is used when the tax return has not been submitted or when it is so inadequate that it cannot be used to arrive at a correct tax assessment.

If the taxpayer wishes to request reconsideration of the tax assessment or to appeal against it, he or she shall write to the tax authority. The tax authority shall then reconsider an assessment decision. If a decision that has been appealed against is not changed to the satisfaction of the taxpayer, the documents pertaining to the case shall be submitted to the county administrative court for its decision.

For the actual payment of the tax or excise, a tax account at the National Tax Board is used. Only one tax return form is used for each tax type and natural or legal person. Energy tax, carbon dioxide tax and sulphur tax are specified on a special form and send to the National Tax Board. The payment of the tax is performed in the same way as other taxes such as VAT by deposition in

the tax account. Each natural or legal person have a tax account at the National Tax Board. Any tax refund is also deposited at the same tax account. The tax account can be balanced once a year or once a month.

4.9.3 Administration and implementation of the Swedish NO_X charge system[29]

The Swedish Environmental Protection Agency (Swedish EPA) is the taxation authority for the NO_X charge. A special department at the Swedish EPA handles the entire system. The administration cost was 3972000 SEK for the year 2002. The total amount of NO_X charge was at the same time period 589 million SEK. The NO_X charge system was introduced 1 January 1992 and is controlled by the law (1990:613) concerning environmental charges on emission of nitrogen oxides in energy production. This law covers information about the charge amount and liability to the charge. To this law an ordinance (1991:339) concerning environmental charges on emission of nitrogen oxides in energy production is connected. This ordinance covers mainly the liability and authorisation for Swedish EPA. Also the law (1984:151) of special taxation and price control charges (LPP) is applicable.

Charge payers must register with the Swedish EPA by submitting returns for each liable boiler no later than 25 January each year. The return presents the amount of NO_X emitted and the energy produced. The Swedish EPA examines these returns and a net payment/refund is calculated for each company. Polluters that end up with a net payment are invoiced on 1 September and companies that are to receive money are refunded before 1 December. The equipment for continuous monitoring of NO_X that is permanently installed on a boiler must be checked by an independently accredited inspector at least once a year to ensure that the system used meets the quality requirements stipulated by the Swedish EPA. The installed monitoring equipment is checked against an independent monitoring system. When sending in their returns, companies must also enclose the inspection report. The Swedish Board for Technical Accreditation (SWEDAC), a government agency, accredits the inspectors. At the beginning of 1992, there were only a few accredited inspectors. Today, however, 21 laboratories are accredited. In addition to scrutinising returns and administering incoming and outgoing payments, the Swedish EPA audits plants subject to the charge independently of the inspections made by the accredited companies. The aim is that every plant should be audited at least once every fifth year. The following elements are examined in the audit:

[29] Material from the Swedish EPA, [15]

- Measuring equipment capability
- Calibration procedures
- The daily report system
- Maintenance procedures
- Calculations and measurements of useful energy
- The measurements carried out by the examiner (accredited laboratory)
- Examination of the return (if appropriate)

By the end of 1999, almost 80 percent of the plants had been audited. The administrative work carried out by the Swedish EPA in 1999 represented 5 man-years at a cost of SEK 3.3 million (approximately Euro 413 000). That corresponds to approximately 0.6 per cent of the total charge amount.

The Swedish EPA has published requirements for the performance properties of automatic monitoring systems for determination of the NO_X emissions. The measured NO_X concentrations combined with the accurate volume flow in the stack make up the basic data for the calculation of the NO_X emission. For 90 percent of the boilers, the volume flow is calculated from fuel data (elementary composition, specific heat), fuel consumption and oxygen or carbon dioxide concentration in the stack. In only 10 percent of the boilers is the volume flow determined by direct measurements.

Automatic measurements of the NO_X concentration can be performed in principally two different ways: extractive methods and in situ methods. In an extractive method, the gas sample is sucked from the stack and transported to external measuring equipment through a sampling line. In situ measurements are performed inside the stack. 90 percent of the boilers use extractive methods and of these, 99 percent of the analyses are based on photometric determination.

Every hour, the mass flow of NO_X (kg/h) is calculated as NO_2 by multiplying the measured NO_X concentration and the volume flow. The mass flow values should be stored either in a computer, in the form of paper printouts or in some other suitable way. The average hourly values are then added together to give the total annual emission, which is to be reported to the Swedish EPA.

The automatic NO_X measuring systems used have proven highly reliable – more than 95 percent of the plant owners reported that none or only minor problems had occurred. The annual cost for operation, maintenance, data collection and data handling of the automatic NO_X measuring systems is about SEK 100 000 (approx. Euro 12 000) for the average plant, but there is considerable variation between plants. If the automatic measuring system can be used to measure more than one boiler at the same time, the cost per boiler will of course be lower.

The present investment cost for equipment for monitoring NO_X emissions is SEK 250 000 – 300 000 (Euro 30 000 – 36 000). More expensive instruments that can simultaneously measure several parameters are being used more and more frequently. At some old plants, the cost of installing the monitoring equipment can be very high due to rebuilding. For calculation of the revenue it is also necessary to monitor the amount of useful energy produced. Monitoring equipment for this normally already exists for other purposes. A calculation example for NO_X calculations is given below:

Calculation examples
Below there are two examples of plants that are covered by the NO_X charge system. At first, the base credit amount for a specific year (1999) is calculated. The base credit amount is equal to the total amount of money collected (minus costs) divided by the total number of megawatt hours (MWh) of useful energy produced.

All financial amounts in SEK
Calculation of the base credit amount for 1999
Total income from charges 1999:
SEK 561 991 080
Amount brought forward from 1998:
SEK 10 557 430
Swedish EPA administration costs:
SEK 3 255 000
Amount excluded from distribution[30]:
SEK 15 000 000
→ Amount to distribute: 561 991 080 + 10 557 430 - 3 255 000 - 15 000 000 **=**
SEK 555 293 510
Useful energy produced at all plants in 1999: **54 921 000 MWh**
→ Base credit amount: **SEK 554 293 510 / 54 921 000 = 10.09 SEK/MWh**

Plant A
Plant A has relatively high specific NO_X emissions and has to pay the net sum of SEK 205 715 for 1999.
Measured NO_X emissions: **14 601 kg**
→ NO_X charge: 40 SEK/kg × 14 601 kg **= SEK 584 040**
Useful energy produced: **37 495 MWh**
→ Energy credit balance for plant A:
37 495 × 10.09 SEK/MWh = SEK 378 325
→ Net payment = Environmental charge - Energy credit balance
= 584 040 – 378 325 = SEK 205 715

Plant B
Plant B has low specific emissions and is a "financial winner" in the system and receives a net income of SEK 1 110 000 for 1999.
Measured NO_X emissions: **110 577 kg**
→ NO_X charge: 40 SEK/kg × 110 577 **= SEK 4 423 080**
Useful energy produced: **548 374 MWh**
→ Energy credit balance for plant B:
548 374 MWh × 10.09 SEK/MWh = SEK 5 533 094
→ Net payment = Environmental charge - Energy credit balance
= 4 423.080 - 5 533 094 = SEK -1 110 014.

As this result is negative the plant will receive this amount.

[30] Amount that is reserved each year to be used for any necessary adjustments to the environmental charge which may occur when returns are under scrutiny. What's left of this amount is brought forward to next year.

4.10 Revenue from the Swedish environmental taxes and charges

In contrast to Lithuania no allocation of the tax revenue to special funds exist. The revenue from the taxes goes directly into the state budget. Only for some special fees a direct allocation is used. The revenue in current prices from the Swedish taxes for the years 1993 to 2001 is shown in table 27. The most of the increase in the tax levels during the period is due to inflation. The total tax level in relation to GNP is almost constant over the period, around 3 %. The most of the tax revenue comes from different energy taxes (86.4 % in 2001). Only 2.2 % come from taxes on certain substances. Note that the NO_X charge system is not included in the table. Only the sulphur tax shows a decreasing trend.

Table 27 Environmental taxes in Sweden, 1993-2001, Current prices, SEK million. Source: Statistics Sweden.

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Energy tax	**39 029**	**42 418**	**43 551**	**50 060**	**49 811**	**52 634**	**52 552**	**51 958**	**54 261**
Energy tax (total)	26 234	28 542	29 675	32 916	35 026	37 201	37 367	38 332	36 507
of which: fuel tax	*20 524*	*22 781*	*23 509*	*25 505*	*26 217*	*26 829*	*26 664*	*27 032*	*23 944*
electricity tax	*5 710*	*5 761*	*6 166*	*7 411*	*8 809*	*10 372*	*10 703*	*11 300*	*12 563*
Other product taxes on electricity	2 243	2 375	2 436	4 093	2 276	2 422	2 490	1 464	730
of which: hyrdroelectic power tax	*1 029*	*800*	*933*	*1 520*	*0*	*0*	*0*	*0*	*0*
nuclear power tax	*100*	*139*	*133*	*1 115*	*1 472*	*1 549*	*1 545*	*827*	*0*
fees/tax for reduction and storage	*1 114*	*1 436*	*1 370*	*1 458*	*804*	*873*	*945*	*637*	*730*
Carbon dioxide tax	10 552	11 501	11 440	13 051	12 509	13 011	12 695	12 162	17 024
Tax on certain substances	**578**	**565**	**674**	**757**	**568**	**543**	**502**	**1 589**	**1 411**
Sulphur tax	184	191	157	217	144	148	120	89	84
Tax on domestic air transport	196	188	186	117	-	-	-	-	-
Tax on insecticides	13	22	32	35	52	55	40	58	59
Tax on commercial fertilisers	185	164	299	388	372	340	342	357	369
Tax on waste	-	-	-	-	-	-	-	1 085	899
Tax on transportation	**8 119**	**5 852**	**5 798**	**6 721**	**6 451**	**6 336**	**6 657**	**7 026**	**6 995**
Vehicle tax	4 095	4 064	4 049	5 471	6 242	6 103	6 396	6 832	7 017
Sales tax on motor vehicles	1 287	1 778	1 749	1 250	209	233	261	194	-22
Kilometre tax	2 737	10	-	-	-	-	-	-	-
Tax on natural resources	-	-	-	**70**	**131**	**142**	**140**	**125**	**123**
Natural gravel tax	-	-	-	70	131	142	140	125	123
Total	**47 726**	**48 835**	**50 023**	**57 608**	**56 961**	**59 655**	**59 851**	**60 698**	**62 790**
Percent of GNP in Sweden	3.1 %	3.0 %	2.8 %	3.2 %	3.0 %	3.0 %	2.9 %	2.8 %	2.8 %

4.11 Evaluation and experiences of the Swedish systems

The Swedish energy taxation system has carefully been presented in chapter 4.3 and 4.4. The system has so far been based on a differentiated taxation system. Different tax rates are used for different sectors in the society. The industry is also divided in different industrial sectors. The present used sectors are:

Industry sector
- Agriculture (including greenhouse production), forestry and aquaculture. (SNI 01-05)
- Mining and mineral industry (SNI 10-14)
- Manufacturing industry (SNI 15-37)

Energy transformation sector
- Electric power, gas and heat producers. Water supply industry. (SNI 40-41)

Other sectors
- Construction industry (SNI 45)
- Public industry(SNI 70, 80 and 85)
- Transport sector(SNI 60-64)
- Other services(SNI 50-55, 65-90)

An active tax policy has been used where the tax rate has continuously been adjusted. As can been seen from the presentation of the tax system, the tax system has become more and more complex.

Awareness concerning the complications of the energy taxation system (energy and CO_2 tax) exists in Sweden and the government has initiated an evaluation of the system. This evaluation committee presented their results in a Government white paper in April 2003 [1].

One of the first questions to consider is how uniform the tax legislation is. The answer to this is simple, the legislation is not uniform. The energy taxation is different for different sectors in the society and in the industry. In the industry the energy tax is also different depending on if the energy is used directly in the manufacturing processes or for other purposes. In a modern industry it can be very difficult to distinguish between the manufacturing process and other activities. The definition is unclear and has resulted in many legal proceedings. Different tax rates also exist for heat produced by different types of producers. This can also have negative consequences.

The largest problem with the present energy taxation model is probably the division of the industry in the different sectors. The Swedish membership in EU has changed the conditions for taxation. Normally, it is not allowed, according to the EG directives concerning state aids and other subsidies, to have a differentiated taxation in the industry. Those directives have to be considered when new legal taxation systems are designed. A crucial step towards this development is the judgement in the EG court concerning the Adria-Wien case. In this judgement it was concluded that it can be considered as state aids and subsidy to select certain industrial sectors and give them different tax rates. The Swedish tax system can thus be considered as state aid and subsidy but the EG commission have given Sweden a time limited approval for the Swedish energy taxation model.

Another consequence of the differentiated system is that some industrial activities that include energy consuming activities are left outside the system. An example of this is the laundry industry.

The main conclusion is that the Swedish system in its present form can not be considered as satisfactory in a long term perspective. The fact that much of the system can be considered as state aid and subsidy make the system dependent on continuos and unreliable approvals by the EG commission. The approvals are time limited and time consuming to prepare. The approval system also imposes an uncertainty concerning the regulations in the energy consuming industry. The Swedish system has also been changed many times and this has a negative effect on the investments in the energy sector.

The conclusion is that a new energy taxation model (energy and CO_2) has to be developed for Sweden, which also consider the new EU energy taxation directive.

The sulphur tax is more neutral concerning competitiveness in the industry and thus less problematic as long as it does not interfere with the regulation concerning barriers to trade.

The NO_X charge system is, in a brief way, evaluated yearly by the Swedish EPA which also administrate the system. Some of the results are presented on SEPA's webb page. Summary data from the NO_X charge system is shown in table 28 for year 2001 and 2002. The data include information of number of plants and production units, the total NO_X emission from the units in the system, economic figures and the specific NO_X emission expressed as kg per MWh produced useful energy or mg per MJ used fuel.

Table 28 Summary data for the NO_X charge system covering year 2001 and 2002 [1].

	2001		2002	
Number of plants	252	units	256	units
Number of production units	393	units	393	units
Reported NO_X emission	14 160	tonne	14 730	tonne
Total NO_X charge	566 390 200	SEK	589 188 560	SEK
Excess reserve from last year	7 602 064	SEK	9 891 174	SEK
SEPA administration cost	-3 836 000	SEK	-3 972 000	SEK
Kept reserve this year	-15 000 000	SEK	-15 000 000	SEK
Amount to distribute	555 151 264	SEK	580 107 734	SEK
Useful energy	58 141 917	MWh	61 013 932	MWh
Repayment	9.55	SEK/MWh	9.51	SEK/MWh
Emission per net delivered energy	0.244	kg/MWh	0.241	kg/MWh
Emission per supplied energy [2]	59	mg NO_X/MJ	58	mg NO_X/MJ

1) Data from Swedish EPA.

2) A general boiler efficiency of 87 % has been assumed.

Data are derived for each year and till now data from the start in 1992 to 2002 are available. Those data have been evaluated and some of the results are presented below. From the start, the number of units included in the system have steadily increased, figure 2. A rapid increase occurred from 1995 to 1997 due to a decrease of the participation limit from 50 GWh to 25 GWh yearly production. In spite of the increased number of plants in the system, the total NO_X emission from the plants has slightly decreased. The specific emissions (expressed as kg NO_X/MWh produced useful energy) from the plants have shown a relatively large decrease (41 %) over the period, figure 3. However, most of the decreases occurred the first four years of the period from 1992 to 1995. This shows that the most cost efficient actions to reduce the NO_X emission are taken relatively soon. As expected, the figure also shows that the reduction subside with time. However, a system in operation will help to maintain the low emission level.

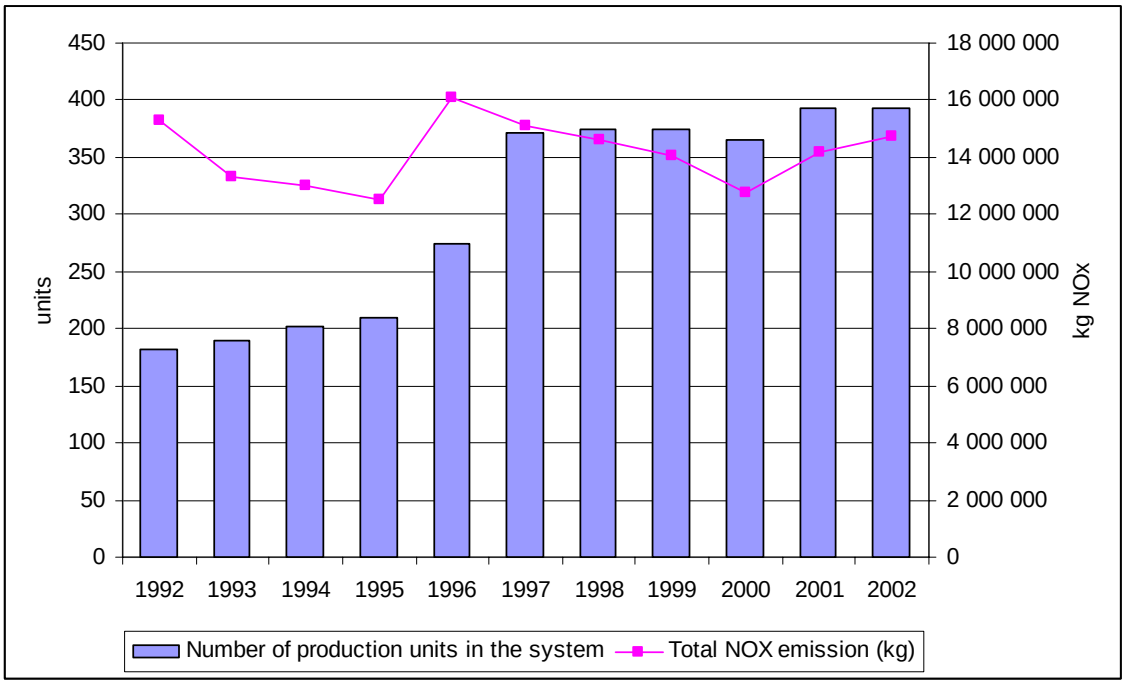

Figure 2 Number of production units included in the NO_X charge system and the total NO_X emissions from the units over the time period 1992 to 2002.

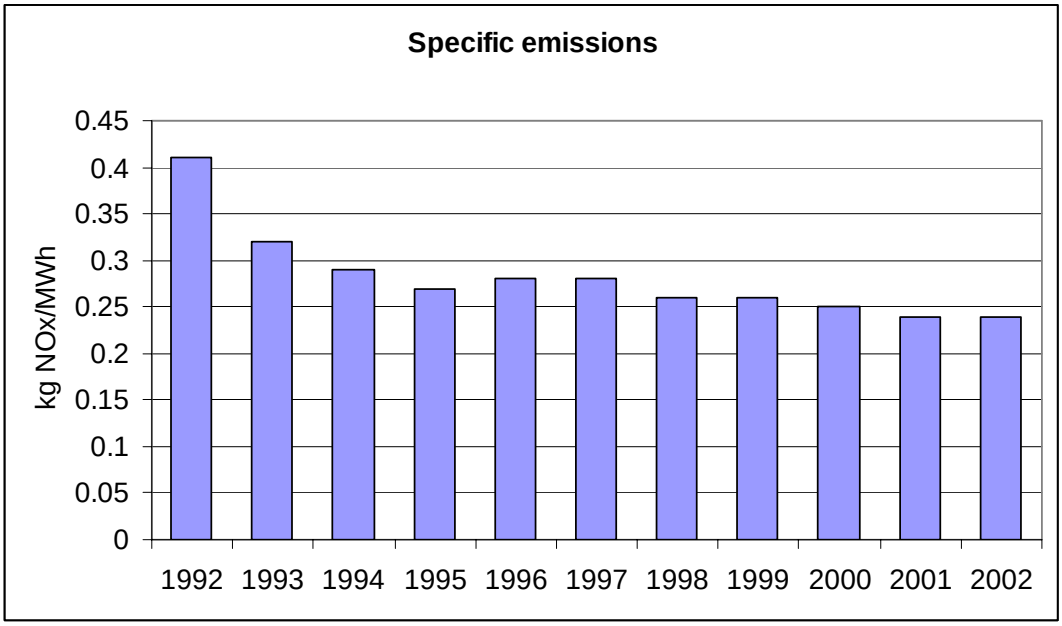

Figure 3 The figure shows the development of the specific NO_X emission expressed as kg NO_X per MWh produced useful energy.

If the system is divided in different industrial sectors we can see that the power and heat production sector is dominating in terms of the number of production units, figure 4. The pulp and paper sector and the incineration sector are also relatively large. All sectors show an increasing number of units in the system. All sectors also show a decreasing specific emission level (kg NO_X/MWh produced useful energy), figure 5. Note that the first two years of participation is very important and it is during this time period that much of the action to reduce the NO_X emission is taken e.g. NO_X instruments are installed and the boiler is NO_X optimised.

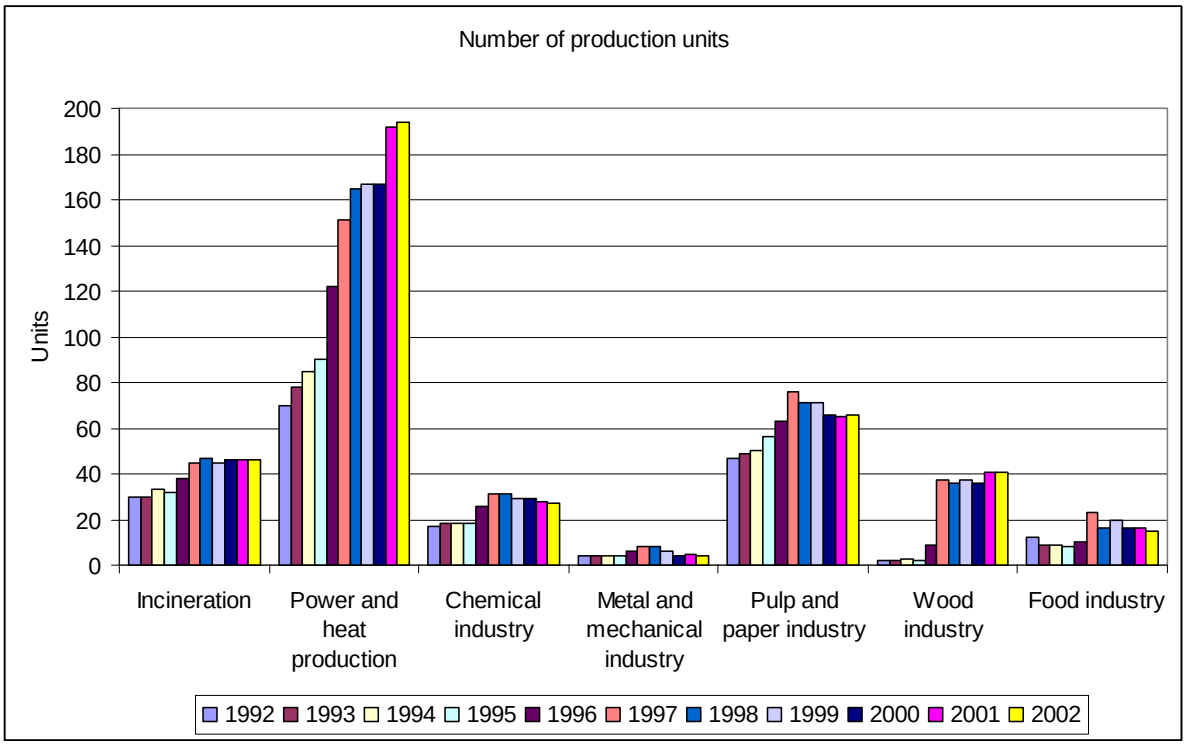

Figure 4 Number of production units in different industrial sectors included in the NO_X charge system over the time period 1992 to 2002.

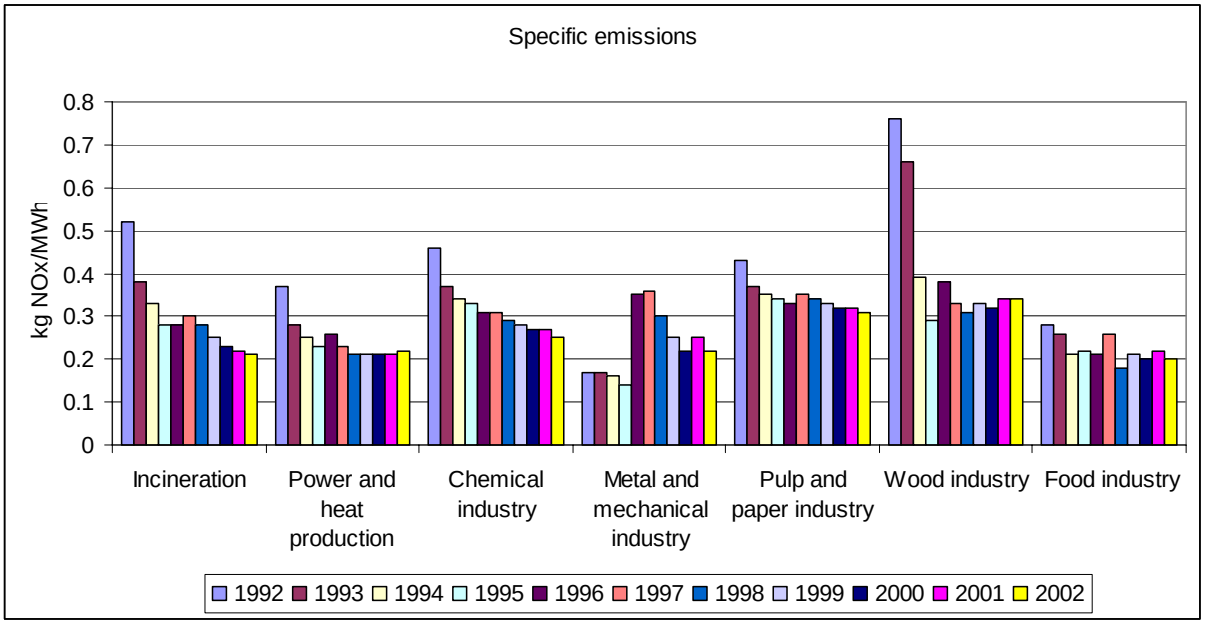

Figure 5 The figure shows the development of the specific NO_X emission expressed as kg NO_X per MWh produced useful energy for different industrial sectors.

A PhD thesis has also been written by Lena Höglund from Gothenburg University covering some aspects of the NO_X charge system, [16]. Three essays have been published and abstracts from those essays can be found below.

Essay I: Output-based Refunding of Emission Charges: Static and Dynamic Properties.
"Refunding emission charges in relation to firm output may appear to be an attractive way to attain an environmental objective without placing a heavy financial burden on the polluters. The findings of this paper show that with many small and competitive polluters targeted by a refunded charge, emissions are reduced to approximately the same marginal abatement cost as under an equivalent Pigouvian tax. However, resource allocation is distorted because of a limited output effect. Marginal spending on research and development of abatement technology is likely to be lower for targeted firms and about the same for outside suppliers under a refunded charge compared with an equivalent Pigouvian tax."

Essay II: Abatement costs in Response to the Swedish Charge on Emissions of Nitrogen Oxides: In Search for Empirical Evidence of Low-hanging Fruit.
"This is an analysis of the costs for abatement investments implemented in response to the Swedish charge on nitrogen oxide emissions. Detailed plant-level data is used to analyse costs for reducing emissions of nitrogen oxides from 114 large combustion plants, which were subject to the Swedish charge on nitrogen oxide emissions in 1992-95. Marginal abatement cost functions are estimated for three industrial sectors using a double-hurdle model specification. The results are discussed in relation to the so-called 'win-win' and 'low-hanging fruit' hypotheses. Little evidence is found in support of the 'win-win' hypothesis. However, extensive emission reductions at a zero or very low abatement cost support the hypothesis that 'low-hanging fruit' is abundant in abatement activities."

Essay III: Regulation Cost Analysis: The Swedish Charge on Emissions of Nitrogen Oxides.
"Although many studies have acknowledge the sometimes high transaction costs associated with environmental regulation, few attempt to derive their magnitudes in a systematic way. Based on

detailed annual cost data for 114 Swedish combustion plants in 1990-96, this study calculates a number of costs associated with the Swedish charge on nitrogen oxide emissions. Costs for abatement, monitoring and control, plant and regulator administration, and charge refunding are calculated, as well as estimates of the environmental costs for increases in other pollutants, which follow from abatement of nitrogen oxides. The sum of the average costs of regulation per unit of nitrogen oxides reduced is found to be close to the level of the unit charge."

As a summary one can conclude that the Swedish NO_X charge system has result in a significant reduction of the NO_X emissions without any capital flow outside the participant group. However, capital has been reallocated between the participating industries. The reallocation between the different industrial sectors is shown in figure 6. The figure shows the net payment (charge payment - refund) in different industry sectors for the years 1992-2002. It is clear that there are winners and losers and this is mainly because different types of plants are mixed in the same charge system e.g. different fuel use. A low cost for administration exists (0.6 %) of the total charge and costs also exists for administration in the industries, for measurements of e.g. NO_X and for independent inspection measurements. The charge is primarily applied to measured emissions but also to presumptive emission levels of 250 mg/MJ for boilers and 600 mg/MJ for gas turbines. Plant operators may choose to pay the charge on the basis of presumptive emissions levels instead of installing measuring equipment, although in most cases the presumptive emissions levels are substantially higher than actual emissions, so measurement is generally preferred. Because of the measurement requirements the NO_X charge system is only applicable for relatively large plants, in Sweden plant producing more than 25 GWh per year. In addition to this, costs also exist for NO_X reduction actions.

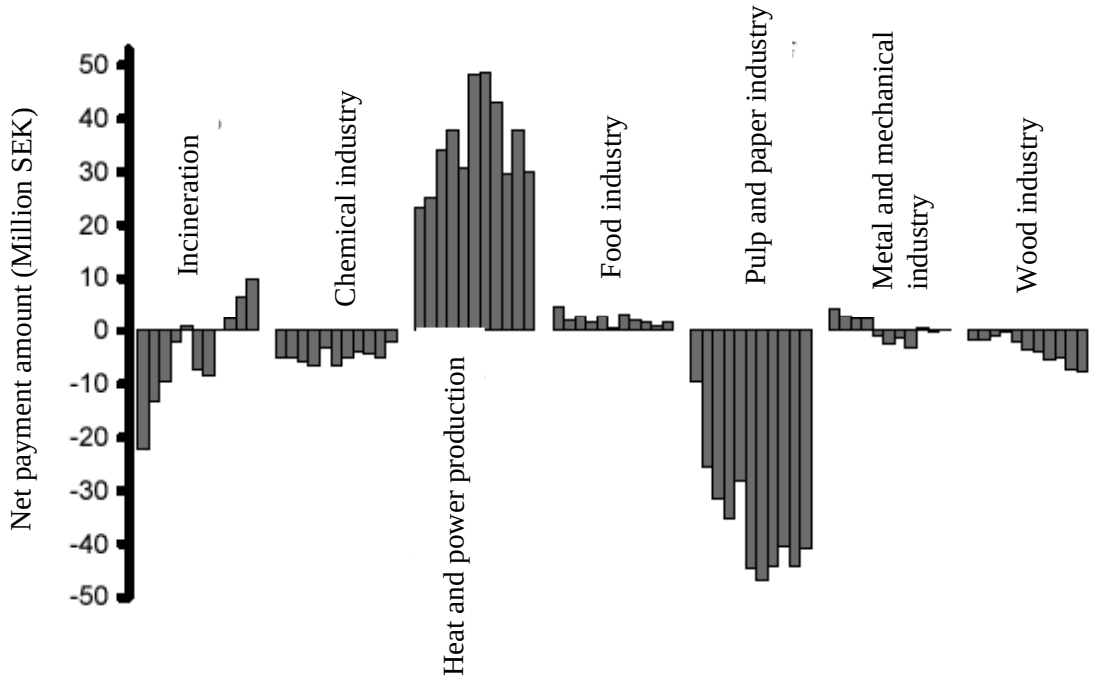

Figure 6 Net payment (charge payment - refund) in different industry sectors for the years 1992-2002.

4.12 References

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5 Survey of energy taxation in different countries

5.1 Introduction

A brief survey covering mainly the energy and environmental taxation systems in Europe have been performed in the project. A comparison has been made of the system in different countries. In this chapter a short presentation of the taxation system in different countries can be found. The study covers the Nordic countries, some selected western European countries of great interest (The Netherlands, Great Britain and Germany) and several countries in central and eastern Europe. A focus is set on the energy taxation of the industrial sector and on eventual exemptions from tax liability.

5.2 Energy taxation in the Nordic countries

Of the main Nordic countries (Island excluded in the text) are all members of EU except Norway. Norway is however a member of EFTA. Generally, there are taxes on all fossil fuels and electric power in the Nordic countries. There is normally no tax on biomass fuels. The main structure of the taxation system is relatively equal. The energy tax consists generally of a base tax (energy tax), a carbon dioxide tax and some additional taxes such as the sulphur tax. Generally, there are also special exemptions to taxation for the industry. Those special regulations are different for the different countries. Many of those special exemptions to taxation have the purpose to mitigate the negative effect of a generally very high energy tax level compared to other countries. The different exemptions also reflect a different industry structure in the countries. In table 29 below a short summary of the energy taxes in Denmark, Finland and Norway is given.

Table 29 Summary table of energy taxation in three Nordic countries.

Country	VAT level	Tax on fuels	Tax on electric power
Denmark	The general VAT level is 25 % and the tax covers all consumer goods including energy. VAT is calculated on the energy price including energy taxes.	Tax on mineral oils, natural gas and coal fuels. Crude tall oil is not taxed. The taxes are energy tax, carbon dioxide tax and sulphur tax. The energy tax is differentiated based on the energy content in the different fuels. The carbon dioxide tax is based on the net emission of carbon dioxide. The sulphur tax is either based on the sulphur content in the fuel or the net emission during combustion. Tax relief rules exists for energy intensive industries usually as process energy. Industries can also receive grants if they participate in a energy saving programme based on a contract with the government.	Energy tax on electric power is a consumption tax and is applied to all electric power consumed in Denmark. Exemptions are: - Electric power produced in small plant less than 150 kW - Power in transportation vehicles (trains, ships etc.) - Renewable power that is consumed by the producer. - Power from reserve generators. - Power from solar cells with less than 6 kW per household for non-commercial use. The tax is levied based on, if the used is for a permanent residence or other use. In addition to the energy tax a carbon dioxide tax is also used for electric power.
Finland	The standard VAT level is 22 %. Different VAT tax levels exists but the standard level is applied to energy.	The energy taxation is basically regulated by two laws: “The law of excise on liquid fuels” (No. 1472/1994) and “The law of excise on electric power and certain fuels” (No. 1260/1996). The first law regulates taxes of mineral oils and the second law regulates taxes on electric power, coal fuels, peat, natural gas and crude tall oil. All the taxes are divided in a base excise and a supplementary excise. A small fee for contingency energy supply plan also exists. The same tax level is used for all user categories for mineral oils, coal and natural gas. Peat is only taxed in heat production and if the yearly production exceeds 25000 MWh. Crude tall oil is only taxed if it is used for heat production in industrial activities. Fuel that is used as a material or auxiliary material in the production is exempt from tax. Thus, fuels that are used in cement or lime production are exempt from tax as well as fuels used for electric power production.	Finland has two different tax rates for electric power levied based on user category. A lower tax rate, 0.433 eurocent per kWh is used for electric power that is used in the industry and delivered so it can be measured separately. A higher rate, 0.703 eurocent per kWh, is used for other users e.g. households. A large part of the tax can be refunded if the electric power is produced by renewable resources (windpower, hydropower, wood and other biomass fuels, gases from metallurgical processes). The refund is between 0.25 and 0.69 eurocent per kWh. Tax relief rules exists for energy intensive industries.
Norway	The general VAT level is 24 % and the tax is applied to all energy products. An exemption exist for electric power delivered to households in the north part of Norway (Finnmarken and Nord-Troms Communities) where no VAT is applied.	A green tax reform was introduced in 1999 where the tax on labour work was reduced and the tax on environmentally harmful activities were increased. A carbon dioxide tax is applied to mineral oils, gasoline, coal, coke and natural gas. The CO_2 tax on natural gas is however only applied for use in the offshore industry. Reduced tax rates are also used in the pulp and paper industry and in the fish meal industry for their mineral oil use (a 50 % reduction). Coal and coke use as reduction agents in industrial processes are exempt from tax. Use of coal and coke in cement and leca fabrication is also exempt from tax. However, a general exemption from CO_2 tax for coal and coke has been proposed. In year 2000 a special heat tax for mineral oils was introduced. The tax rate is 389 NOK (53 Euro) per 1000 litre. The pulp and paper industry is exempt from this tax.	A general consumption tax of 0.093 NOK per kWh (1.27 eurocent/kWh) is applied. Certain communities in Finnmark and Nord-Troms are exempt from this tax. The exemption is valid for both households and industry. Electric power used directly in the production process has also a general exemption from tax in Norway. Production in greenhouses is also totally exempt from tax.

5.3 Energy taxation in Europe

Tax on energy and environmental taxes exist in most of the European countries. However, Sweden and the other Nordic countries have introduced such taxes on an early stage and the tax system has been relatively comprehensive. The tax system for energy and the environment is complex in all countries and it is here only possible to cover some countries in an overview perspective. In this chapter three different western European countries (The Netherlands, Great Britain and Germany) of particular interest have been chosen as an introduction and in the next chapter a brief comparison is made between different European countries with a special angle towards central and eastern Europe. The brief presentation of the tax system in the Netherlands, Great Britain and Germany is found in table 30.

Table 30 Summary table of energy taxation in some selected European countries.

Country	VAT level	Tax on fuels	Tax on electric power
The Netherlands	VAT level 19 %	The energy taxation system is based on three components: - a special tax used on harmonised fuels. - a general fuel tax that is used on the harmonised fuels and coal and natural gas. - -and a regulating energy tax.	The tax is based on the consumption. For large consumers the tax is zero on the marginal. The rates are shown in table 31. In addition every consumer receive a discount of 142 Euro per every 12 month period.
Great Britain	VAT is 17.5 % and is applied to all energy. However, for households the tax rate is 5 %.	Special taxes exists on mineral oils based on Hydrocarbon Oil Duties Act from 1979. The rate are approximately in the site of the EU regulation, see table 32. GB have also rights to exclude LPG, natural gas and methane from taxation for use in motor vehicles. The Climate Change levy is regulated by the Finance Act 2000, section 30 and schedules 6 and 7. This tax was introduced 1 April 2001. The aim of the tax is to cover fuel uses other than household use, see table 32. Tax relief rules exists for energy intensive industries.	The tax on electric power is covered by the Climate Change levy introduced 1 April 2001, see table 32.
Germany	VAT is 16 % and is applied to all energy.	1 of April 1999 an ecological tax reform was introduced. This tax reform resulted in an increased tax on mineral oil. The reform was introduced by a four step increase of the taxes. Energy taxes are used on mineral oil and natural gas. Coal and nuclear fuels are not taxed in Germany. The German industry can however chose to pay a eco-tax on coal and thereby receive a tax reduction on labour cost.	A consumption tax was introduced 1 April 1999. The tax rate is 1.79 eurocent per kWh.

Table 31 Tax rates on electric power in the Netherlands 1 January 2003.

	Tax rate per kWh (Euro)
0-10000	0.0639
10001-50000	0.0207
50001-10 MWh	0.0063
> 10 MWh	0

Table 32 Tax rates on fuels and electric power in Great Britain 2002.

Type of energy	Tax according to Hydrocarbon Oil Duties Act (Euro)	Tax according to Climate Change levy (Euro)
Diesel oil (per litre)		
base quality	0.8393	-
ultra low sulphur grade	0.7421	-
Light fuel oil (per 1000 litre)	50.70	-
Heavy fuel oil (per 1000 litre)	44.38	-
Coal fuels (per 1000 kg)	-	18.95
Natural gas (per MWh)	-	2.4295
LPG (per 1000 kg)	-	15.5491
Electric power (per kWh)	-	0.0070

5.4 Comparison of countries with regard to economic instruments

The use of economic instruments has been increasing rapidly in Western countries since the late 1980s, and it is expected that they will play a larger role in future environmental policies. This trend of applying more economic instruments is strongly supported both by the OECD and the European Commission.

An important reason for the increased use of economic instruments in all Western countries is related to the positive experiences gained with economic instruments that have been in place for some time already. Both environmental effectiveness and economic efficiency of some instruments has been proven in empirical evaluation studies such as in the case of the Swedish sulphur tax, the Norwegian CO_2 tax, the Danish waste charge and the Dutch wastewater charges. The key for achieving positive results was careful and proper design of the instruments, formulation of clear objectives and gradual implementation.

When it comes to the countries of Central and Eastern Europe (CEE) and the "relatively" Newly Independent States (NIS) of the former Soviet Union they continue to face substantial environmental challenges. Priority problems typically identified include: centres of severe industrial pollution; pollution intensive and inefficient heat generation and distribution systems; increasing pollution from road transport; poor surface and groundwater quality; underdeveloped municipal environmental infrastructure; and the inefficient use of natural resources.[31]

Nevertheless, economic transition has helped these countries to achieve certain degree of pollution reduction, which accompanied the massive reduction in industrial output in the early years of transition. Such pollution reduction may be temporary unless regained growth is separated from a corresponding growth in pollution.

Effective environmental policies, together with improved implementation and enforcement practices, are also needed and are gradually being introduced in the CEE and NIS regions. Although most charges were introduced with an incentive effect for pollution reduction in mind, a review of these pollution and product charge systems suggests that the primary function has been to raise revenues for supporting environmental investments. With the exception of Albania, Croatia, Romania and Slovenia, the revenue from environmental charges is earmarked for environmental funds in CEE countries.

[31] OECD

For instance, charges are favoured due to their revenue raising potential in Poland, Czech republic and the Baltic States. These countries have implemented economic instruments primarily following the permission permit/ charge/ non-compliance fee model. Such systems generally have a two tiered charge rate structure: a base rate applies to emissions bellow the permitted level and a penalty factor is added for emissions above that level. Hungary has relied more on product charges on environmentally damaging products, and has recently started to consider introducing elements of an emission charge system.

To varying degrees each of these countries earmark the revenues from economic instruments for environmental funds. Bulgaria (and Romania) have experienced major problems in developing economic instruments as part of coherent environmental strategies. Nevertheless, important groundwork, related to more integrated economic instruments, has been completed in these countries and several proposals for new economic instruments have been prepared (see appendix 6).

Experience in Poland, for instance, shows that environmental charges (even if set at high rates) have contributed to accelerated economic restructuring, which has also lead to improved economic performance.

However, a closer look at CEE and NIS countries' application of economic instruments reveals several dubious specific sub-optimal features (for details about the instruments and their levels see appendix 6).[32]

Some basic information concerning "Air emission charges and taxes" and "Transport taxes" have been collected in the project and the base data can be found in appendix 5. Some general comments can however be made for the different countries.

- *Bulgaria:* Until recently, Bulgaria has relied primarily on traditional non-compliance fines to prevent pollution above standard levels. The pollution fine system, introduced in 1978, has encountered several difficulties even though it was reformulated in 1993. Collection efficiency wavered at around 50 percent of the fines levied through 1995. Since 1995, however, collection efficiency has been considerably improved (up to 80 percent in some cases) by allowing tax authorities to collect fines, which remain outstanding. In 1997, the fine rates were increased several times and linked with the national minimum salary.

- *Czech Republic:* In the early 1990s, the Czech Republic successfully introduced a comprehensive system of economic instruments for environmental policy. The current system of environmental charges includes: air emission charges, CFC product charges, water extraction and pollution charges, sewage charges, charges for waste disposal, land conversion charges, and an airport noise tax. Revenues from charges have largely been earmarked into the State Environmental Fund, which provides grants and soft loans for environmental investments on a co-financing basis.

- *Estonia:* this country has exhibited initial success implementing a permit-pollution charge-fine system for reducing pollution from larger industrial point sources. Economic instruments including water extraction fees, mineral resource extraction charges, and environmentally relevant excise taxes have also been included in the policy mix. One stated principle guiding the use of economic instruments for environmental policy in Estonia has been to encourage the rational use of natural resources. In regional comparison, many charge rates are rather low which is reflected in a somewhat lower revenue raising potential of the Estonian pollution charges.

[32] OECD

It has also been politically viable to gradually increase pollution charge rates which have led to increased revenues in recent years, a large portion of these administered by the State Environmental Fund. Payment collection efficiency has been reported as positive. This may have been partially influenced by existing strict enforcement sanctions (daily interest rate of 0.2 percent applied to late charge payment).

Compared to other CEEs, a rather high degree of evaluation of economic instruments has also been carried out in Estonia. Weaknesses have been identified in the permit system and in the levels of charge rates. It is assumed that permitted emission levels have initially been established too high and charges set too low to realise full pollution abatement potential.

- *Hungary:* The Hungarian model for using economic instruments has focused on product charges rather than a system of emission charges. Environmental charges levied on products such as fuel, packaging, tires, refrigerators, etc. have played a central role in generating funds earmarked for state support to environmental investment. In 1997, product charges accounted for 78 percent of the Central Environmental Protection Fund. A successful innovation to the charge system, in 1997, has been the role of tax inspectorates in charge of collection process.

An extensive environmentally relevant incentive system also exists through non-earmarked fuel taxes, excise taxes, VAT, and road charges. Additional tax differentiation in the transport sector is applied to vehicles based on age and other environmental considerations. The combination of earmarked product charges and non-earmarked taxes have resulted in the highest gasoline prices in the CEE. Non-compliance fines have been used to enforce standards regarding air emissions from fixed sources and water effluents, but these, being too low, have not been very effective as revenue raisers or incentives for abatement.

- *Latvia:* The use of economic instruments in Latvian environmental policy is based on the Law on Natural Resources Tax (1995) which established a mixed policy approach with an accent on economic instruments to both efficiently achieve established goals and raise revenues for environmental spending. Referred to domestically as taxes, the resulting system contains a permit/charge/non-compliance fee system in the air, water, waste, and natural resource extraction sectors.

- *Poland:* The recent growth in environmental expenditures in Poland, the regions largest economy, has relied heavily on the rapid increase of revenue from pollution fees and non-compliance fines, which have been earmarked for environmental investment via local, regional, and national environmental funds. Emission charges on sulphur dioxide alone generated USD 127 million in 1996, while actual emissions continue to decrease indicating an environmental incentive effect.

On the other hand, economic subsidies in the industry, transport, energy and agriculture sectors including support such as tax allowances and exemptions, non-payments or delayed payments, debt forgiveness, direct support (grants, preferential loans, loan guarantees) and tariff barriers and exemptions is a common characteristic in these countries. Moreover, low pollution charge rates (below the marginal abatement costs of the actions that the instruments are intended to trigger) are the rule rather than the exception in the region. For most of the emission charges currently in force, the relative differences in rates of different pollutants usually are primarily correlated with differences in pollutants toxicity or potential to cause environmental damages. Another criterion often applied in defining charge rates is targets for raising revenues.

In *OECD countries*, the current trend in the use of economic instruments is to integrate environmental externalities into the overall fiscal system by: (i) replacing revenues from

distortionary taxes (mostly taxes on labour) with environmental tax revenues; (ii) eliminating environmentally harmful tax exemptions and subsidies. Such an approach is also promoted by the European Commission and is being discussed (and partially implemented) in several member states. Considering the extensive set of environmental charges already in force and the ongoing process of reforming fiscal policies, the possibility of eco-tax reform may be present in CEE and NIS countries. There are few environmental charges in the region, which raise enough revenue to be seriously considered for a revenue switch (or, if sizeable revenues are raised with high charge rates, the charge base might not provide the needed stability). Current earmarking is also incompatible with the eco-tax shift and current state environmental financing systems (with environmental funds playing key roles) would have to be completely redefined.

6 Principles and Proposals for Economic Instruments in Lithuania

6.1 Introduction

As discussed in the previous chapters the control of energy and environmental behaviour in a country is a very complex and difficult issue. Many different control instruments exist from advanced market-based economic instruments to pure regulations. Legislation in the energy area have been in place at least from the beginning of the last century and legislation and regulation in the environmental field have a slightly shorter history but have in spite of that been in place since the 1960th. Several types of economic instruments exist such as taxes, excises, charges, fees and market-based economic instruments. Market-based instruments refer here to instruments such as emission trading according to the Kyoto protocol or to the Swedish NO_X charge system. The first instrument to be used was different types of taxes. The experiences from different tax and charge systems are therefore relatively solid.

6.2 Efficiency and optimisation of taxation systems

The efficiency criterion helps in demonstrating why markets fail to produce an efficient level of pollution control and in tracing out the effects of this less than optimal degree of control on the markets for related commodities[33]. It can also be used to define efficient (optimal) policy responses. Efficiency is achieved when the marginal cost of control (MC) is equal the marginal damage (MD) caused by the pollution for each emitter. If the limit were chosen precisely at the level of pollution where marginal control cost equals marginal damage (Q* in figure 7, left figure) efficiency would have been achieved. An alternative approach would be to internalise (see figure 7, right figure) the marginal damage (P0 to P1) caused by each unit of emissions by means of a tax (Pigouvian tax) or charge on each unit of emissions. Assuming linearity and proportionality between the quantity produced and the emitted quantities, the tax would imply a reduction of the quantity produced from Q0 to Q1 and thereby the emissions.

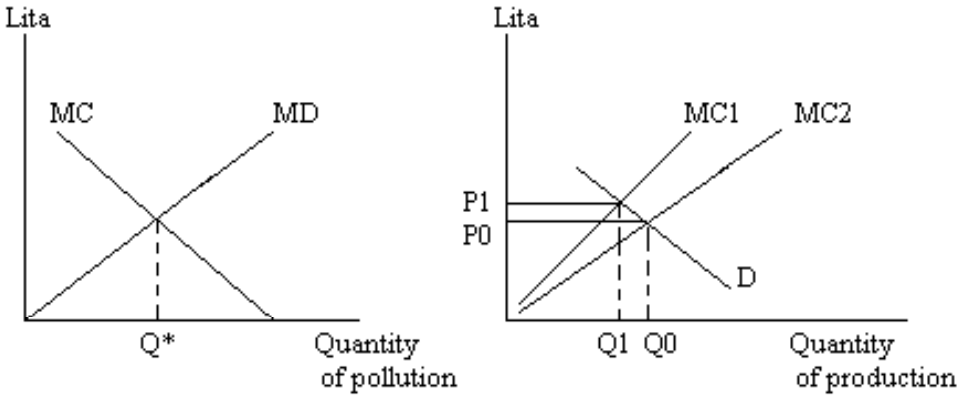


Figure 7 Left: Allocation of pollutant. Right: Internalisation of damage.

[33] Tietenberg, T. (1992) Environmental and natural resource economics. HarperCollinsPublishers.

However, while the efficient levels of these instruments can be defined in principle, they are very difficult to implement in practice depending on the lack or scarcity of information related to MC and MD. Hence, the authorities often select specific legal levels of pollution based on some other criterion e.g., EU directives. Once the objective is stated in terms of meeting the predetermined pollution level at minimum cost, it is possible to derive the conditions that any cost-effective allocation of the responsibility must satisfy. These conditions can then be used as a basis for choosing among various kinds of instruments as shown in table 33. Yet, emission charges are sometimes applied instead of taxes. The charges are designed to reduce the quantity or improve the quality of pollution by making polluter pay at least parts of the costs of the harms they do to the environment. However, given the information problems associated with emission charges the next best alternative for the regulator is product charges. These take the form of fees or taxes levied on outputs or inputs that are potentially hazardous to the environment.

Table 33 Various aspects on the choice of instruments[34].

	Regulation	**Tax**	**Tradable emission permits**
Dynamic efficiency with rapid technical change	None (or perverse) incentive	Yes	Yes (it depends)
Cost efficiency	No	Yes, specially with many agents with distinct technology	Yes If market not too thin
Goal fulfilment	(No) maybe at firm level not aggregate level	Inflation may be a problem	Yes Partly with irreversible damage
Administration costs	Best Control needed anyway but CaC* often simplest	Depends	Hard to administer with many/ few agents
Barrier to entry	Worst Required for new plants protect new ones	Neutral	Can be used by established firms
Polluter pays principle		Yes	Yes (it depends)
Opinion		"buy right to pollute"	(same as tax) or even more so
Public choice	Rent seeking (corruption)	Risk of waste	Neutral

*) CaC = Command and control.

The major advantage of economic instruments is that they incorporate environmental concerns directly into the market price mechanism of the economy. Therefore, these instruments have all the efficiency properties of the competitive market pricing. They generate actions both among producers and consumers that allow the achievement of given environmental objectives at the lowest costs. Therefore, the economic instruments if designed and implemented properly they would lead to sustainable growth. This is confirmed by experiences from OECD countries where the economic instruments helped for instance to[35]:

[34] Adapted from Hanley N., Shogren J.F. and White B. (1997) Environmental Economics, London, Macmillan.
[35] Source: OECD

- provide flexibility to polluters in choosing the most cost-efficient and environmentally effective measures, thereby reducing compliance costs;
- change the relative prices of environmentally sensitive goods, leading to an allocation of resources towards more environmentally sustainable production and consumption;
- create incentives for environmental investments which generate profits and environmental benefits at the same time;
- promote technological innovation needed for more environmentally sustainable production and consumption; and raise revenues which governments can use for catalysing environmental investments of national priority, or for decreasing income taxes, profit taxes or social security contributions.

The academic development of market-based economic instruments started at the same time as the first environmental legislation was introduced. One of the first implementations of an advanced market-based economic instrument were the introduction of the SO_2 - reduction credit banking and trading program in the US Clean Air Act from the beginning of the 1990th. This system was developed by the US Environmental Protection Agency (US EPA) and gave the industry the opportunity to bank or sell emission reduction credits in the context of air regulation. The history of advanced market-based economic instruments is thus relatively short and the experiences from utilisation are equally short.

The main reason for implementing advanced market-based economic instruments is to achieve an overall higher economic efficiency for the reduction activities. A reduction of a pollutant should preferably take place in the plant where it is most economic efficient i.e. where the cost per reduced amount of pollutant is lowest. The US SO_2 –reduction credit banking and trading program gave the producers the possibility to control their pollution more cheaply by accumulate credits for reduction actions which they can sell to other producers who otherwise have to spend more to reduce their pollution. This US SO_2 allowance system has been successful and the SO_2 emission has been reduced significantly. However, the Swedish emission of SO_2 has also shown a significant reduction in spite of the fact that the reduction pressure is caused by a sulphur tax. The reason for the successful reduction of the SO_2 emission can thus not entirely be found in the economic instrument. The answer is more likely to be found in the technical reduction methods and possibilities. Another question is however if the Swedish reduction has taken place with the same economic efficiency as in USA.

The introduction of the SO_2 allowance system was a highly controversial system [17] from the beginning. It was thus necessary to meet requirements from many different stakeholders. The system was designed as a rule of law with punishment of non-compliance in an enforcement system and the possibility of private litigants to enforce against cheating. The allowance system was made transparent and online. The system was designed based on a government management. The emission was monitored and every emission credit was assigned and numbered to ensure that the number of allowances meet the actual emission reduction.

Much attention has been paid on those advanced economic instruments but in spite of this they play a minor roll in the environmental legislation in the western European countries and in United States. The fact is that many different types of economic instruments are used in usually a complex structure. Advanced market-based economic instruments are usually used as a complement to an ordinary environmental tax system.

A market-based economic instrument is a sophisticated tool which implementation requires e.g. a firm legal structure, institutions to administrate the system, inspection and enforcement possibilities, possibilities to measure the actual pollutant so real reductions can be traded and an understanding and acceptance among the participating actors. A failure in the system or failures or falsifications among the participants can easily undermine a trading system. To ensure a successful implementation it is of importance to carefully consider the underlying requirements. Emission credits also need a market place for trading. Emission credits are highly advanced commodities (property rights) actually more advanced than regular foreign exchange trading. An indication of the possibilities of a successful implementation can be to analyse how well developed the exchange trading system is today. Advanced market-based economic instruments can also suffer from high administration costs even though it is market-based. The old joke saying, "nothing need so many regulations as a free market" have certainly some meaning here.

If the requirements for advanced market-based economic instruments are lacking, ordinary tax methods can very well be used as in most of the western European countries. The phrase "command and control" which is very often used has a tendency to give an undeserved negative reputation to the conventional economic instruments.

Since the Soviet time, before 1990, the energy consumption in Lithuania has shown a dramatic decrease, more than 40 %. The energy consumption is still today at the same low level. There are several reasons for the dramatic drop in the energy consumption. One reason is of course the financial problem related to the liberation from the Soviet Union. Many industrial production units were shut down in the beginning of 1990th. However, another important factor was probably the introduction of market economy in Lithuania. During the Soviet time energy was handled almost as a free commodity without a market price. In the former Soviet Union the price for energy and investment capital was low and the cost for labour can be characterised as high. This situation results in an in efficient overuse of energy. When a market price was introduced for energy it became absolutely necessary to reduce the energy consumption. However, the energy consumption per capita is low in Lithuania compared to other western European countries or United States.

The price situation in the former Soviet Union promoted the development of heavy industry. After the liberation from the Soviet Union the relative price structure was change. Lithuania was now exposed to world market prices for energy and investment capital. At the same time the low productivity result in low labour cost (salaries). The relative price between energy and labour cost is very different if one compare the eastern and western European countries. If one compare the cost for 1 MWh/cost for 1 labour hour one will find that this ratio is close to 1 in Sweden but 10-20 in Lithuania. The green tax reforms that are discussed in Sweden where the taxes on energy are increased and the taxes on labour cost are decreased are thus already well in action in Lithuania. The change in relative price between energy and labour cost is also an important factor for the industrial structural changes that have taken place the last decade in many eastern European countries. The competitive factor is today instead an well-educated and low cost labour force. A growing service sector and light industry where labour cost is important have also been detected. The energy/labour cost ratio will however change in Lithuania with increased income levels.

The previously described background is an important factor to bear in mind when new economic instruments are developed for Lithuania. As a rule of thumb one use to say that one need at least an equal number of economic instruments as the number of parameters one want to control. In the following chapters the old system will be analysed, new economic instruments will be proposed and the consequences for Lithuania will be analysed.

6.3 Analysis of the current environmental economic instruments in Lithuania – positive and negative sides

An analysis of positive and negative aspects of the current environmental economic instruments in operation in Lithuania today has been performed. This chapter gives a presentation of the results from this analysis. While assessing the efficiency of the current set of the economical tools the social, political, administrative and economic particularities of the Lithuanian economy in transition should be taken into account.

6.3.1 Positive sides of the current system

The positive features of the current system could be as follows:

1. *Raises the governmental revenue that may be used for implementing national environmental programmes and compensating damage done to the environment.*
   - The income from nature resources tax is directed to the state budget. In 2001 almost 14.84 million Litas was generated in the state budget from this tax while in 2002 it comes to 20.36 million Litas.
   - Pollution charges generated were 40.2 million Litas in 2002 and 37.9 million Litas 2003 in total, out of which 70 % were directed to Municipal Environmental Support Programmes and 30 % - to Lithuanian Environmental Investment Fund. Energy related (atmosphere pollution charges) generates about 15 million Litas per annum;
   - Revenue from the compensation of damage done to the environment, fines for violation of emission limits enter the State Environmental Support Program and ensure annual financing of 3-4 million Litas.
2. *Creates an awareness of the environmental issues and stress the importance of reduction of specific pollutants.*
3. *Induces a small economic incentive for pollution reduction.* There are no sufficient evidences that current pollution charges significantly contribute to (atmosphere) pollution reduction. Experience from previous years shows that pollution reduction was mainly determined by other incentives such as fuel savings, administrative regulation etc. However, it cannot be stated either that polluters do not take into account taxation aspect (savings of charge payable) when planning investment/change of technology.
4. *Energy saving effects due to Excise duty on fuels.* Even if the direct taxes on pollutants are low the overall energy tax is sufficient to create a certain pressure for energy reduction actions.

6.3.2 Negative sides of the current system

The use of a specific set of economic instruments in the energy sector not only improves the state of the environment, but can also have weaknesses and negative aspects. The main drawbacks of the current set up of economic instruments are presented below[36].

[36] Drawbacks no. 1, 2 and 3 are listed first, as they are most specific for Lithuania and could be applied as the arguments to amend the existing system.

1. *No clear financial incentives for economic actors to invest in the energy efficiency measures and environmental sound technology.* First of all, incentives for investments depend a lot on the rate of environmental charge. Too low tariff will not create such incentives for implementation of environmental measures as well as too high tariff may subdue economical growth of economy. Up to now not a single energy enterprise (neither industrial combustion plants) in Lithuania has installed SO_2 and NO_X emission treatment equipment. Till year 2003 charge release opportunity (granted for 10 % pollution abatement) was utilised only once by industrial enterprise. In separate cases, emission reductions were achieved through installation of modern burners what, in its turn, was mainly determined by fuel saving incentives, in other cases - enterprises (which have multi-firing units allowing simultaneous combustion of HFO and natural gas) increased the share of gaseous fuel due to enforced stricter emission limit values and favourable fuel price level. Generally, the inference could be drawn that administrative regulation (setting of emission limit values, fuel quality requirements) has created the main incentives for atmosphere pollution reduction so far and pollution charges can only be regarded as a complementary means.
2. *Violates polluter pays principle* as the pollution charge on mobile sources is levied on mobile sources owned by the legal persons only. The private cars are not levied while the largest share of atmosphere pollution from mobile sources is coursed by private vehicle fleet. The total number of vehicles registered over the last decade increased 1.85 times. In the beginning of year 2004, 1580 thousand vehicles were registered in total out of which passengers cars (category M1) made up 1260 thousand, heavy duty vehicles (categories N1, N2, N3) – 156 thousand, busses (categories M2, M3) – 17 thousand. Real quantity of vehicles in exploitation is estimated to be lower for about 10-15 percent. According to state enterprise "Regitra" (performing function of vehicle registration board) less than 8 % percent of passenger cars and less than 60 % of heavy duty vehicles and busses are registered (owned) by legal persons. The potential list of taxpayers may encompass the 10-20 thousand firms, while actual number of taxpayers is many times lower (around 1000). Besides violating "polluter pays" principle current taxation system creates significant administrative burden for environmental institutions as well as taxpayers.
3. *Creates administrative costs of environmental charges.* Administrative costs are important designing practically environmental tax policies. Environmental taxes and charges are a complex issue: it requires the calculation, declaration and control of the calculation. Thus, it makes certain administration costs, which could be minimised if the current system is amended.
4. *Implies not reliable measurements of certain pollutants and NO_X in particular* because of methodological and technical disadvantages. This situation is more a consequence of the applied measurement regulations than of the actual tax system.
5. *Earmarking:* It is doubtful that current earmarking of charge revenue (70 %) to municipal Environmental Support Programmes depending on the location of pollution source (charge payer) ensure effective use of charge revenue as well as efficient distribution of resources. The main argument used for the earmarking is that the funds for measures to improve environment are secured. Current charge revenue distribution mechanism is also often backed up by the argument that „ municipalities should be compensated for pollution coursed by pollution sources located in their territory". At least in atmosphere pollution case, it doesn't hold true as majority of pollutants are transboundant in regional as well as international dimensions and allowed emission levels can not exceed air quality standards fixed in hygienic norms in the territory outside the sanitary zone of pollution source. Questionable aspect of current distribution mechanism is the efficiency of revenue use. In relative terms, the municipal income from charge revenue are very different: from 2 to 70 LTL/per capita and from 0.05 to 6.5 million LTL per budget. It creates problems of such a nature that municipalities with low level

of income can not finance any major investment projects, municipalities with high level confront with the problems how to use all funds purposefully (according to stipulated percentages of expenditure distribution). Up to now there were only some cases when municipal Environmental Support Programmes contributed to major environmental investments to a significant extent. The main financing was provided from grants of pre-accession funds, state budget and general municipal budget (loans, loans guarantees).

Another problem (at least up to recently) was that certain amount of funds were used for purposes which environmental effect is questionable (subsidies for unprofitable and/or obsolete municipal environmental infrastructure (water-treatment plants, local landfills), maintenance of cleanness, aesthetic landscaping etc.). It also creates additional administrative burden for environmental authorities, as they have to verify annually whether funds of Environmental Support Programmes were used purposefully. In some cases several negative side-effects has been observed from the part of municipal authorities. One of them is that, when evaluating municipal environmental infrastructure investment project which would reduce pollutions (and consequently will result in loss of charge revenue for municipality), municipal authorities tend to consider loss of charge revenue due to improved environmental performance of pollution source after investment as a "extra" costs of the investment project.

6. *Partial internalisation of externalities.* Without government intervention, firms may have no reason to take external costs into account. It is difficult to estimate how much of social cost are internalised by means of economic instruments, however, externalities are not internalised fully into the costs of pollution. For instance, according to acid rain organisation the damage caused in general by one ton of NO_X in rural European areas is estimated to 4200 Euro.
7. *Increases costs of goods and services production.* This influences the prices of goods and services as well as will affect inflation rate, competitiveness of firms in domestic and external market, level of living, etc.

6.4 Economic models with analyses for Lithuania

6.4.1 Energy and economic modelling

In order to study efficiency of economic instruments in the energy sector, the environmental impacts of the energy sector should be described first of all. Many models can be used for this purpose. These models range from optimisation (e.g. MERGE), impact assessment strategies (e.g. RAINS) to pure economic models as partial and general equilibrium (CGE) approaches.

Concerning the optimisation models, they do not adopt a detailed economic representation but include a detailed energy sub-model. For the impact assessment strategy models, they aim to reduce emissions levels to meet prescribed emissions target at least cost. These models do not include explicitly a representation of the economy to explore economic measures such as taxation as a policy instrument to reduce emissions. For the CGE models, they allow for a desegregated economic representation considering markets by industry category and allowing GDP to be partly determined by inter-industry interactions.

In order to run these models long series of detailed and specific data are required. Further, there is in our knowledge no CGE model that analyses the transport sector in a consistent manner. The use

of CGE models as an all-purpose model has also been criticised due to the complexity of the model and the risk for covariations.

The aim of the project is to support the Ministry of Environment of Lithuania in developing and implementing efficient economic instruments in the energy sector. Therefore, we choose to analyse the sensitivity of the instruments being implemented in the country and to develop and apply efficient ones in the energy sector. To make the analysis, a partial equilibrium model related to households heat demands, transport fuel demand and industry energy demand was conducted. The purpose of using partial equilibrium approach is to measure the impact of the economic activity and real energy prices on energy demand by estimating income and price elasticities. The simplicity of estimation and the rather straightforward interpretation of the results are strong advantages that cannot be overlooked (Rapanos et al in press: Energy Policy 2004)[37].

The use of partial equilibrium models is a common method for evaluation of economic instruments. This procedure has been used in many studies such as in the case of household energy demand and carbon taxes in Sweden (Brännlund, 2004)[38]. This procedure has also been used to study environmental taxes in the cases of Greece (Rapanos et al)[37], Japan (Toshihiko (2003) Germany, Italy, Spain and the UK (Symons et al (1997)[39].

However, depending on data availability in the case of Lithuania where the series are very short, we made use of panel data in order to increase the number of observations. This procedure was possible in the cases of household heat demand and industry energy demand. In the case of the industry sector and since official data is not available, the data was collected by way of a questionnaire that has been sent to different representative firms. In the case of transport sector the series was too short and it is the reason way the study of this sector was mainly descriptive.

6.4.2 District heating

In Lithuania, the total energy system cost as a percentage of GDP is in the range of 12-17 percent per year, and heating represents an important share of it. The largest proportion of the cost is the cost of fuels and all of it, with the exception of a small fraction of domestic oil production and renewables, is imported. The foreign cost share amounts to 80-90 percent of the total system cost.

Several important problems are associated with heating of housing in Lithuania[40]. Residential heating is heavily dependent on fossil fuel, combustion of which contributes to air pollution and atmospheric build-up of carbon dioxide. The problem is amplified since most households in apartments are billed on the basis of their floor area, not on real heat consumption. Moreover, the problem is heightened by the inefficient manner in which energy is used to heat most residential buildings. This inefficiency concerns losses in transmission and distribution of district heat, high losses through the building envelopes, as well as lack of proper metering and control of district heat. At the same time, subsidies from the State budget to maintain the residential heat price at below cost level, which declined, in recent years are often still substantial.

[37] Rapanos, V. (2005) Energy demand and environmental taxes: the case of Greece. Energy Policy V33, I 14.
[38] Brännlund, B. Ghalwash, T., Nordström, J. (2004) Increased Energy Efficiency and the Rebound Effect: Effects on consumption and emissions. Umeå University.
[39] Symoms, L., Speck, S., Proops, J., 1997. The distributional effects of european pollution and energy taxes. Paper Presented at the Conference The International Energy Experience: Markets, Regulations and Environment, December 8-9, 1997, Warwick.
[40] Kazakevicius, E., Schipper, L., Meyers, S. (1998) The residential space heating problem in Lithuania, Energy Policy, Volume 26, Issue 11.

6.4.2.1 Characteristic of the sample

The characteristics of the sample are shown in table 34. The data is a panel one for the years 1998-2002 including 32 enterprises supplying heat in all regions of Lithuania. The heat demand has been almost constant during the period with a minimum of 5.8 GWh from Vilnius district heating and a maximum of 1972.8 GWh from Vilniaus Energija.

The stock of dwellings connected to centralised heating network includes homeowners association. This stock in square meters has also been quite constant during the studied period. Depending on the enterprise supplying the heat, the mean stock of dwellings connected to centralised heating networks is 1539.9 thousand m^2 with a minimum of 41.3 and 10044 thousand m^2 from Vilniaus district DH and Vilniaus energija, respectively.

Table 34 Characteristics of the sample.

Variable	Mean	Minimum	Maximum
Heat demand (GWh)	270.8	5.8	1972.8
Stock of dwellings connected to centralised heating networks (thousand m^2)	1535.9	41.3	10044
Heat price (Litas/MWh)	123.4	94.9	159.3
Household income per month (Litas)	419.5	409.5	428

The prices and incomes are in nominal values (and depending on the low inflation rate during the period studied the difference between the nominal values and the reel ones is less significant). Heat prices also remained rather constant during the years 1998-2002 with a mean of 123.4 Litas. However, prices vary between supplying firms where the lowest and the highest prices are charged by Klaipėdos energija and Lazdijų DH, respectively. When it comes to household incomes, they did not vary significantly during the studied period. In 2002 the average price for heat was 0.13 Litas/kWh.

6.4.2.2 The model

The fundamental advantages of a panel data set over a cross section is that it allows greater flexibility in modelling differences in behaviour across individuals. The basic framework for this discussion is a regression model of the form: [41]

$$Y_{it} = \alpha_i + \beta' x_{it} + \varepsilon_{it}$$

There are *K* regressors in x_{it}, not including the constant term. The individual effects is α_i, which is taken to be constant over time *t* and specific to the individual cross-sectional unit *i*. As it stands, this is a classical regression model. If the α_is are taken to be the same across all units, ordinary least squares provides consistent and efficient estimates of α and β.

There are two basic frameworks used to generalise this model. The fixed effects approach takes α_i to be a group specific constant term in the regression model. The random effects approach specifies that α_i is a group specific disturbance, similar to ε_{it} except that for each group, there is but a single draw that enters the regression identically in each period.

[41] Greene., H. W. (1997), Econometric analysis, Third edition. Prentice-Hall, London.

6.4.2.3 Estimation results

In order to comment the parameter estimates as constant elasticities, all covariates are in logarithmic form. Further, a lagged variable y_{t-1} is included to account for time adaptation. The Price elasticities are negative but not very significant implying that (all other things being equal) an increase in prices would not reduce demand of heat significantly. As concerns income and the lagged variable' elasticities, they are statistically non-significant. As concerns the dummies i.e., demand behaviour towards each enterprise compared to Vilniaus energija 1 (dummy 1), they are shown in the appendix. When it comes to comparing the fixed effects and the random effect models, the first one is to be preferred based on a Hausmans test.

Table 35 Heat demand by households.

	Parameter estimates (t-ratios)	
	Fixed effects	**Random effects**
Intercept	1.42 (1.34)	-1.48 (-0.29)
Heat price	-0.51 (-1.71)	-0.45 (-1.2)
Household income	1.03 (1.37)	0.83 (0.23)
Lagged	-0.02 (-0.66)	
Dummies	*	
Adj.R2	0.99	

*) the parameter estimates of the dummies are shown in the appendix.

These results may be commented in the following way:

Since prices are both subsidised and they do not depend on the existence of individual heat metering, we would suspect they do not reflect the true prices the consumer is paying. Therefore, it is not easy to unambiguously derive parameter estimates in order to suggest changes. But on the other hand, and based on the estimations the prices are conceived to be less significant suggesting that increasing them (by certain percentage) would not reduce demand. Hence, we would suggest the following alternatives (or a combination of them);

- An increase of the price of heat from the average 0.13 Litas/kWh to 0.249 Litas/kWh.[42] Doing so, the new price would be adapted to incomes in Sweden (approximated here by GDP/capita). On the other hand, depending on the fact that both the supply side and the demand side of district heating is not efficient (i.e., high loss of heat while supplied and high loss of heat in poorly insulated apartments) an increase in the price of heat would incite for efficiency.[43]
- As is the case in some countries a block tariff would be the solution where households with lower income (or square meters) would pay lower price for the heating than households with higher income (and larger number of inhabited square meters).

In both cases, however, the suggestions would be inefficient (and unfair) if metering heat demand is at the residential building level and not at the private apartment level such as is the actual case in

[42] 0.249 =[(GDP/capita (Lithuania)) / (GDP/capita (Sweden))] x 0.8, where 0.8 is the average market heat price (kWh) in Sweden in 2004 and GDP/ capita is at purchasing power parity and the source is The world Development Indicators (The World Bank 2000).
[43] In 2002, the loss of heat in Vilniaus Energija was reported to be about 15 %.

Lithuania. Therefore, and in the sake of efficiency and fairness, meters would be installed for each private apartment. This measure would incite apartment holders to insulate, to save energy and to indirectly reduce air pollution.

However, we are aware of the fact that the implementation of switching to individual heating would be very difficult because all households in an apartment building would have to bear the considerable investment expense themselves.[44]

6.4.3 The transport sector

Transport volume in Lithuania increased strongly especially during the last decade. Du to the lack of enough time series data related to this sector and mostly for passenger cars and the fuel consumed by these vehicles, the analysis will be descriptive and based merely on the few years for which the data is available. As shown in table 36 passenger cars and the number of cars per 1000 inhabitants has increased by more than 50 percent during the period 1995-2001. Simultaneously, and as in the case in many CEE and NIS countries, fundamental changes took place in the transportation modal split: road transport increased while rail and public transport declined or remained more or less stable.[45] As shown, the number of buses and lorries has decreased since 1995 to 89 and 88 percent, respectively.

Table 36 Road transport in Lithuania (1995-2001).

	1995	1996	1997	1998	1999	2000	2001	2001/ 1995
Passenger transport								
Passenger cars [1]	718469	785088	882101	980910	1089334	1172394	1133477	1.57
of which personal	685552	745742	835462	920373	1021795	1097797	1055164	1.54
Personal Passenger cars per 1000 inhabitants	190	208	235	260	291	315	304	1.6
Buses	17052	15482	14888	15156	15590	15069	15171	0.89
Trolley-buses	532	544	547	523	500	474	470	0.88
Motorcycles [1]	20033	19402	19128	19266	19515	19842	20244	1.01
Goods transport								
Lorries, incl. pick-ups and vans	101422	81291	84731	89866	86824	88346	89373	0.88
Road tractors	7469	7992	8939	9588	9752	10267	11016	1.47
Trailers	9136	7077	6840	6255	6365	6479	7127	0.78
Semi-trailers	9119	8730	9359	9252	9256	9875	11143	1.22
Special purpose road vehicles, incl. Special cars	15346	15269	15148	15063	12636	11798	10815	0.70

Source: Statistical yearbook of Lithuania 2002.

As concerns fuel consumption (in terajoules), diesel oil and gasoline has increased by 23 percent and 57 percent, respectively from year 2000 to 2001. Although the data is not specified for diesel oil consumption (not only vehicles), the increase in the consumption of this fuel is rather exceptional. The environmental impacts would be dramatic (especially when considering the emissions of PM10 and PM2.5) if this trend would sustain during the coming years.

[44] For a discussion of how to structure investments in district heating see World Bank report ESM 234 (2000)
[45] OECD

Depending on the consumption rate of these fuels, one would expect that their price level does not matter. In year 2002, the price of gasoline and diesel were 2.39 and 2.04 respectively. Hence, the price gap between the two fuels is not considerable and may not give incite to a shift from gasoline to diesel. However, fuel economy of diesel vehicles is advantageous and would incite for more use of diesel vehicles.

In order to mitigate the impact of gasoline and diesel consumption i.e., emissions of noxious gases on the Lithuanian environment the following measures are suggested:

- Increase the price of gasoline and diesel by at least 0.5 Litas and progressively to the average retail price in EU countries where the corresponding prices today for gasoline and diesel are around 3.5 and 2.85 Litas, respectively. Adequate pricing is a necessary condition for promoting energy efficiency. The percentage tax in the average retail price of gasoline and diesel (including excise tax and VAT) was about 75 % and 55-60 % respectively. Further, Denmark, Norway and Sweden set up a CO_2 or environmental tax of 1 %, 5 % and 9 %, respectively.[46]
- Establish an annual vehicle tax for passenger cars;
- Enforce catalytic converters on new cars;
- Establish an annual control of vehicles emission of all noxious gases.

Moreover, congestion, which is estimated to generate higher external effect[47] (health effect in urban areas), should be considered while suggesting policies in order to mitigate the external effects of road transport.

6.4.4 The industry sector

In general, total industry production has increased during the years, while electricity, gas and water supply has decreased since 1995 as shown in table 37.

Table 37 Indices of total industrial production (previous period = 100)

Type of economic activity	1995	1996	1997	1998	1999	2000
Total industry	105.3	105.0	103.3	108.2	88.8	105.3
Mining, quarrying and manufacturing	100.9	103.5	108.0	109.3	90.4	108.8
Electricity, gas and water supply	121.9	109.7	90.7	103.2	80.8	85.2

Source: Statistical Yearbook of Lithuania (2002)

6.4.4.1 Characteristic of the sample

In order to study the Lithuanian industry sector in detail a questionnaire was sent to the industry sector in November 2003 but only 32 firms replied[48]. Hence, the results of the survey are a panel data including 32 firms producing different products during the period 1997-2001. These firms represent very different economic sectors e.g., peat mining companies, light industry (food and drinks, textile), producers of refrigerators, TV, cables, glass, cement and iron-works. Therefore, the data is assumed to represent the Lithuanian industry sector.

[46] World Energy Council
[47] ExtenE 2004.
[48] For the name of the firms see appendix 7.

Table 38 Characteristics of the sample 1997-2001 (thousand Litas).

Variable	N	Mean	Minimum	Maximum
Total revenue	173	55837.19	25	438870
Electricity	150	2125.67	0.673	18890
Natural gas	63	2242.34	0.139	9601
Fuel	109	1276.67	0	32960
Heat	76	764.77	0.597	6063
Labour	174	9182.01	5	73595
Environmental tax	150	65.44	0.005	947
Other tax	163	3646.23	0.249	78991

N= number of observations

As shown in table 38 the mean total revenue has been 55.8 million Litas with a minimum of 0.025 million Litas and a maximum of 438.8 million Litas. The mean revenue has increased by factor 7.4 during the period being 5.3 million in 1997 and 39.4 in 2001. As concerns environmental taxes the mean value is 65 thousand Litas. The mean environmental tax has increased only by factor 4.4 during the period being 0.34 thousand in 1997 and 1.48 thousand in 2001. Hence, total revenues and environmental taxes have not increased proportionally.[49] However, other taxes have increased almost proportionally as total revenues.

6.4.4.2 Estimation results

The explanatory variable is supply of the firms and it may be used as a proxy for the emissions, since we believe production and emissions during the period studied should be proportional. This is done that way since we have no access to emission data for these representative firms and for different years.

Table 39 Supply of the industry sector.

	Parameter estimates (t-ratios)	
	Fixed effects[50]	Random effects
Intercept	5.61 (19.6)	5.45 (15.9)
Environmental taxes	0.14 (3.29)	0.17 (4.4)
Other taxes	0.15 (2.73)	0.16 (3.3)
Lagged	0.10 (3.22)	
Dummies	**	
Adj.R2	0.98	-

*) In order not to bias the estimates, many variables are omitted (multicolinearity).

**) the parameter estimates of the dummies are shown in the appendix.

[49] For instance, in the case of DH heating where official figures for the emissions of PM, CO, SO_2, CH, $V_2 0_5$ for the period 1998-2002 are given, it is not easy to unambiguously comment the trend of the emissions as a decreasing one, since for instance total emissions of PM, CO, SO_2, CH, $V_2 0_5$ in the case of Vilniaus energija, Panevėžio energija/Panevėžio DH, Klaipėdos energija have increased considerably.

[50] As concerns the dummies i.e., supply behaviour of each enterprise compared to Dainava (dummy 1), they are shown in the appendix.

The estimation results are not intuitive, i.e. taxes, both environmental and others, are positive and highly significant suggesting increases in supply if these taxes are increased. However, in the Lithuanian case and depending on the economic phase which this country experiences, the estimation results show a positive relation between supply and taxes both environmental and others (using different models). The results may be explained in the following way:

- Think of a production function curve with an almost S shape form. Production in Lithuania is located in the beginning of the curve with a positive marginal return. This is the result of both historical and structural reasons. Moreover, the taxes and especially the environmental ones, which are imposed on producers, are also perceived just as an "other tax" where distinction between them and other taxes is not made. Thus, we assume that the design of the tax and its magnitude (being low) is the reason way this instrument is not fulfilling what is required from it i.e., to reduce emissions and to reflect environmental policies priorities.

Therefore, and in order to reduce emissions the following is to suggest:

- Since it is suspected that the true value of emissions is not reported a better way to estimate the emissions should be (especially in the case of SO_2 and NO_X) based not on a specific formula as is the case today, but on other methods. However, since the mean firm is not very large when related to capital endowment, it would be not cost efficient to suggest emission metering for each firm and for each pollutant. A conservative way is to charge for different pollutants, and especially when no technical improvement has taken place would be introduce product charges instead. However, a common feature of almost all reported product charges is their apparent lack of impact on the behaviour of producers depending on the fact that product charges have been set at relatively low levels, so that it is more cost effective for producers and consumers to pay these charges than to seek alternative inputs or finished products, or to vary their practices with respect to emissions.
- Another alternative would be to put the tax (or charge) proportional to energy consumption. Since environmental taxes have shown to be non significant at the industry level, a good start would be to double the environmental tax or the taxes on the emissions of SO_2 and NO_X;
- Setting emission levels at the firms level would be both cost effective and environmentally efficient;
- A good start, however, when it comes to sulphur is to reduce its magnitude at the refinery level.

According to the protocol COM (2002) 44 final: The Lithuanian emission ceilings listed in the table below relate to the provision of article 3, paragraphs 1 and 10, of the present protocol.

	Emission levels		**Emission ceilings for 2010**	**Percentage emission reductions for 2010 (base year 1990)**
	1980	**1990**		
SO_2	311	222	145	35
NO_2		158	110	30

Furthermore, Directive 93/12 lays down two stages for reducing the sulphur content: since 1 October 1994 the maximum limit value for all liquid fuels including diesel has been 0.2 %, and for diesel it has dropped to 0.05 % from 1 October 1996. The new directive 98/70 further reduces sulphur dioxide emissions resulting from the combustion of heavy fuel oils and gas oils.

The current system of partially earmarked pollution charges and non-earmarked taxes on natural resources in Lithuania was developed in 1991. The state budget generally receives 30 percent of

charges on pollution and 100 percent of taxes on nature resources. The remaining revenue from pollution charges is administered by Municipal Nature Protection Programmes in the local area where charges are levied. The State Nature Protection Fund (currently State Environmental Support Programme) receives revenues from non-compliance fees only (USD 0.5-1.5 million in recent years). Total revenues from economic instruments (USD 30 million in 1997) represented 1.4 percent of state budgetary revenue in 1997. Further analysis of both the fiscal component of pollution charges and the effectiveness of local administration vis à vis national funds are discussed in chapter 3.

Problems implementing some charges and non-compliance fines in the area of air and water pollution have been attributed to methodological inadequacies and complexity of the original law. The 1991 law elaborated 151 distinct charge rates for pollutants in air and water and defined pollution permit limits that proved difficult to monitor and administer. The effect of the charge system on the behaviour of enterprises has been characterised as low. Reasons cited are: delay in indexing charge rates to inflation; methodological inaccuracies; lack of knowledge of abatement costs; and lack of political consensus regarding environmental goals. Although collection efficiency is weak for non-compliance fees, air emission and water effluent charges demonstrate collection efficiencies close to 100 percent, raise revenues, fulfil an environmental education role, and help implement the polluter pays principle.

However, money raised should be used to fund a transfer to a low-carbon economy. A substantial part of the money raised should be used in a decarbonisation fund, to bring about a rapid change to a more energy-efficient, renewables-based economy.

6.4.5 Conclusions

When analysing the economic instruments, i.e. prices in the case of DH and taxes (charges) in the case of transport and industry sectors, the general finding is that these instruments are not fulfilling their functions and they are not sending adequate signals to reduce emissions. They are "several" times lower than emissions fees and taxes designed to incentive purposes, such as in Sweden (SO_2, CO_2) and in Norway (CO_2). Indeed it seems that the rates of the Lithuanian pollution taxes (including charges and fees) are established on the basis of criteria unrelated to abatement costs. The rates for air emissions remain in the low range of marginal abatement costs, indicating that they provide some incentive to reduce emissions, but not enough to achieve efficient emission reduction.

- Regarding DH and since the prices are both subsidised and they do not depend on the existence of individual heat metering, we would suspect they do not reflect the true prices the consumer is paying. Hence, it is not easy to unambiguously derive parameter estimates in order to suggest changes. Yet, and based on the estimations the subsidised prices are conceived to be less significant suggesting that increasing them (by certain percentage) would not reduce demand. Therefore we suggest a minimum price adapted to GDP per capita and/or a block tariff where households with lower income (or square meters) would pay lower price for the heating than households with higher income (and larger number of inhabited square meters). Further, metering heat at the household level would increase efficiency and fairness.
- In general, total industry production has increased during the years. The estimation results are not intuitive in the sense that there exists a positive correlation between both environmental and other taxes suggesting that producers conceive these taxes to be marginal. It is also suspected that the true value of emissions is not reported. Therefore, a better way to estimate the emissions should be based (especially in the case of NO_X) on reliable formulas.

- In the transport sector the volume of vehicles as well as the fuels consumed has increased strongly especially during the last decade. However, due to scarcity of data no analytical assessment was made. But, depending on the consumption rate of transport fuels one would suspect that their prices do not matter. Therefore, increases of both the gasoline price and the diesel price are suggested to at least EU minimum level.

6.5 Proposed Strategies for Economic Instruments in Lithuania

6.5.1 Introduction

Until today, very little of advanced market-based economic instruments have been used for energy and environmental control in the western European countries. An example is the Swedish NO_X charge system, which can be characterised more as a charge-refund system where the charge is transferred back to the industry according to a specific rule. One of few examples of an economic instrument with emission trading possibilities actually in operation is the SO_2 allowance system in United States. The advantage with a system with tradable reduction credits is the possibility to improve the cost efficiency. Tradable credits gives the participants a possibility to reduce the emissions where it is most cost efficient i.e. not only in its own plant but also in another plant with another participant. However, a system can result in capital flows between the different participants, which can be interpreted as unfair. The specific design of the trading system is here very important. A trading system for CO_2 is now in operation in EU as a preparation for the trading system, which is planned according to the Kyoto protocol.

Thus, the most common economic instruments for energy and emission control in the western European countries are traditionally tax systems combined with different charges and fees. Those taxes are usually refereed to as Pigouvian taxes[51]. The strategy for the proposed reformation work has thus been to use solid and well developed economic instruments as a base combined with options for implementation of more advances instruments to improve cost efficiency. Basic ideas have also been to develop individual and independent instruments for each type of control (energy, SO_2, NO_X etc.). The instruments should be as precise as possible even if interactions between instruments always exist. A reduction in energy consumption has for example a reducing effect on the NO_X and SO_2 emissions. A prerequisite is also that the developed instruments are in line with the EU directives.

The introduction of solid economic instruments for energy and the environment in Lithuania will be an important tool in the rapid economic development the coming years. The energy consumption will show an increasing trend the coming years and it is important to be able to control the energy use and to promote an efficient energy use. Indications of the growing energy trend can be seen already today. Statistics Lithuania from 2002, table 40, brings together production (consumption) of different fuels for the years 2000-2001. The period is very short to draw any conclusion but on the other hand it corresponds to the period where the trend of reduced emissions has been broken. Nevertheless, except the fact that this period may be exceptional, the

[51] A tax on an external cost, such as pollution, designed to use market forces to achieve an efficient allocation of resources. Named after Arthur Cecil Pigou (1877-1959) who 1920 presented the theory of pigouvian taxes in "The Economics of Welfare" where he studied the market failure of externalities and the internalisation of external costs into the market. An external cost caused by pollution, e.g. can be internalised if polluters pay a tax equal to the value of the external cost.

increase in consumption is rather high especially in the case of fuel oil and diesel oil (although some share of this production may be exported). According to different studies on emission trends in Lithuania, emissions in general have been reduced based mainly on the transition to market economy and on the fact that in the industry sector is implementing cleaner production methods.

When it comes to the transport sector, the emission of its pollutants accounted for almost 3/4 in year 2000 of the total emission compared to 55 % in the beginning of the decade. Hence, the transport sector has become a problem sector when it comes to emissions of noxious gases.

Table 40 Fuel production in Lithuania.

	2000	2001	2001/2000
Fuel oil, TJ	39422	53574	1.36
Diesel Oil, TJ	56262	88234	1.56
Motor gasoline, TJ	68837	84279	1.22
Kerosene, TJ	18566	19886	1.07

Source: Statistics Lithuania (2002)

Accordingly, assuming linearity (where energy consumption is proportional to emissions) an adequate measure to reduce emissions in the industry sector would be to increase efficiency. Where compared to the European Union member states, the efficiency of energy consumption in Lithuania is still quite low and 1.5 times more energy is consumed in order to produce one unit of GDP. In the transport sector, however, energy efficiency would not be enough and other instruments (such as discussed above) including taxation of gasoline and diesel should be implied.

On the other hand, and as shown in table 41 below, the gap between fuel excises duty rates in Lithuania (although very low) and the EU minimum has been narrowed during the last years. The gap would have been eliminated during the first years of the Lithuanian EU membership if the country had not negotiate to be exempted for some years from the implementation of EU minimum taxation on energy while becoming member of EU, see appendix 8.

Table 41 Fuel excise duty rates in 2003 and 2004 in Lithuania and EU minimum.

	Lithuania		EU minimum[52]
Fuel type	**2003**	**2004**	**from 2004**
Motor petrol, its substitutes and extenders			
Unleaded, euro/tonne	362	382	478
Leaded, euro/tonne	-	-	560
Petroleum Gas and Gaseous Hydrocarbons Intended for Use as Motor Fuel, Their Substitutes and Extenders, euro/tonne	112	125	125
Kerosene, its Substitutes and Extenders, euro/tonne	209	290	377
Gas Oils, their Substitutes and Extenders, euro/tonne			
for heating	23	25	25
other (incl. Diesel)	249	290	359
Heavy Fuel Oils, Their Substitutes and Extenders, euro/tonne			
For heating	23	25	15
Other	13	15	--
Natural gas (euro/per gigajoule gross calorific value)	0	0	0.15/0.3
Coal and coke (euro/per gigajoule gross calorific value)	0	0	
Electricity (euro/per MWh)	0	0	0.5/1.0

[52] EU minimum levels of taxation were converted into measurement unit used for Lithuanian fuel excise duties with following density ratios: petrol – 750 kg/1000 litres; kerosene – 800 kg/1000 litres; gas oils – 840 kg/1000 litres;

6.5.2 General outline and possibilities for modifications

As a rule of thumb the base should be to aim for precise taxes, i.e. one tax for each substance or other aspect one want to reduce/control. Thus we should aim for separate taxes for energy, CO_2, SO_2, NO_X etc. The sum of all those taxes will be the final tax. This means e.g. that a good base for fuel taxes could be to have:

Energy tax based on energy content in the fuel.
CO_2 tax based on carbon content in the fuel.
SO_2 tax based on sulphur content in the fuel.

Sum → Total fuel tax

The sum of the taxes will constitute the total fuel tax. All taxes above can be calculated based on fuel content and can be added to the fuel price. The energy tax will control the energy consumption and energy efficiency, the CO_2 tax will promote use of less carbon rich fuel i.e. promote natural gas instead of coal, the SO_2 tax will promote the use of desulphurised oil and other low sulphur product. A question can be biofuels (wood). Usually there is no CO_2 tax for biofuels and the sulphur content is very low so there are almost no SO_2 tax. A question can be if one should have energy tax on biofuels. However, a very primary and important aspect is that the actual emissions are used in the economic instruments. If calculations are used these must be done in a correct way and if measurements are used these must also be performed correctly. It is also important to avoid misuse or cheating in the system.

Concerning CO_2 control we think that it is possible for Lithuania to keep the CO_2 tax even if the Kyoto agreement will be in place. A pressure is needed to guide the investments towards a low-CO_2 direction. The Kyoto protocol does not give this incitement to Lithuania so one needs to create such incitement.

Another question is to set a total tax level and an appropriate balance between energy, CO_2 and SO_2 tax. An EU directive together with transition rules regulates the minimum taxation level of energy tax.

With NO_X it is different compared to CO_2 and SO_2 because one need a measurement to have a correct value to use in an economic instrument. The purpose is such that one needs to create an instrument that creates a pressure to invest in low NO_X equipment (e.g. to chose a low NO_X burner instead of an ordinary burner when a company or other organisation invest in new equipments), to promote low NO_X fuels and to optimise there plants both for energy efficiency and NO_X. We think it is possible to develop a tool that is based on e.g. one yearly measurement by the inspectors. May be a tax or a NO_X charge system can be arranged. This is however only possible for larger plants. Small plants are difficult to control and cars need special regulations usually based on catalytic cleaning and yearly inspections of the cars. Today the NO_X charges are based on calculations or emission factors. NO_X can not be calculated in a correct way but one can of course use emission factors for example for oil boilers, natural gas boilers etc (e.g. mg NO_X /MJ used fuel). The problem is that if an owner of a boiler do an investment to reduce the NO_X emission he will still have the same tax. This creates no incitement to reduce the NO_X emission so therefore a change is needed. However, measurements require investments in measurement equipments and this is only reasonable for large plants. In the Swedish NO_X charge system the economy of the investment to install measurement equipment have to be weighted against the NO_X charge for all the participants in the system.

The other emittents (particles, PAH, the 300 list of other substances etc.) have the same problem as NO_X, one need to measure. Many of those are very specific for an industrial sector. One needs an active work with those substances. Many of those can also be harmful for human health (cancer risk etc). The tax system in Lithuania today gives actually no incitement to work actively with those questions. One just calculates the emission (which usually are not functioning formulas) and pay a very small sum of money in tax. We think it is better to have a system where the industry (at least the big ones) have separate permissions for there operations where many problems are considered like emission levels, control and measurement programs, obligation to reduce some emissions etc. The permission can be granted for several years and can then be renegotiated. It is here of course important with rules so all the industries feel that they are treated equally of the authority. In Sweden this work is performed by local community environmental departments or by Swedish EPA. Sweden also has an environmental court where disputes can be solved which has been described earlier in the report.

In the following chapters, principles for economic instruments for control of energy, CO_2, SO_2, NO_X, other emittents and electric power are described more in detail. The possibilities for an implementation in Lithuania are also discussed.

6.5.3 Economic instruments for energy management

The purpose of a control system for energy is at least twofold. First of all it is of great interest to control the overall consumption of energy to ensure a proper use of the commodity. Secondly it is also important to control the efficiency of the energy use. These two aspects are of course not independent of each other. A higher energy price will naturally initiate a more efficient use of the energy. However, concerning the use of economic instruments it is possible to distinguish between total energy use and the efficiency of the use. It is thus possible to design instruments that focus on the total energy use or on the efficiency of the energy use.

The control of energy in the western European countries is almost entirely focused on traditionally tax systems. A simple energy tax is by far the most common tool. An energy tax is an instrument, which is directed to the total use of energy. The purpose is however in many cases to ensure an efficient use rather than to restrict the total use.

To have some kind of control of the energy use is important to ensure that the energy aspects are considered in the design, construction, maintenance and operation of many kinds of activities in the society. However, there is also an ambition not to restrict the economic growth.

The obvious choice of economic instrument for energy is a simple energy tax on the fuel use. Such a tax is widely used in Western Europe and also used by the European Union. The tax should be based on the energy content of the fuels[53]. The tax can also be differentiated for different fuel qualities such as the Swedish environmental classes for fuels.

However, if the purpose is to promote an efficient use one can think of a tax on the energy loss instead of the energy use. Such a tax could be based on the difference between supplied and produced energy. A tax of that kind should specifically promote the work for a more efficient energy use in the society. There are however difficulties to determine the produced energy and to define the system boundaries for the determination. What is for example the produced energy in a car application. For limited use in e.g. heat and power production these problems should be

[53] The lower heating value of the fuel can for example be used.

possible to overcome. If the goal is to implement a more capital neutral system it is also possible to design a system like the Swedish NO_X charge system for energy. The participants in such a system will pay a charge for their energy use (fuel use) and at the end of the year the charge will be paid pack according to their energy production. Such an energy charge system will however suffer from the same kind of problem as the taxation of energy loss namely the determination of produced energy. Economic instruments for energy are very similar to economic instruments for CO_2. The developed instruments for CO_2 e.g. in the Kyoto protocol can to some extent also be applicable for energy. However, to experiment with tradable energy credits or tradable energy loss credits can be questioned. It can look tempting with the possibility to perform actions for a more efficient energy use at the plant where it is most cost efficient. The purpose of a cap and trade system is, however, to set a fix limit to the overall use and if the used commodity is energy, negative effects can be expected on the economic growth.

A conventional energy tax on fuels should thus be considered as the primary choice but what should then the optimal tax level be? The tax level should at least be so high that the effect of promoting energy efficient solutions is achieved but on the other hand it should not be so high that it has severe negative effects on the economic growth. The minimum energy tax levels in EU is shown in table 42 to table 44[54]. These required levels should at least be met unless no transition agreements or other exceptions concerning the energy directive are in force. Compared to the excise duties used on fuels today in Lithuania this will result in an increase of the energy tax levels. Compared to Sweden these tax levels are low if one consider that the Swedish tax is split up in energy tax and CO_2 tax, see table 24.

Table 42 EU minimum levels of taxation applicable to motor fuels.

	1 January 2004			1 January 2010		
	Euro	Litas	SEK	Euro	Litas	SEK
Leaded petrol (per 1 000 l)	421	1452.5	3776.4	421	1452.5	3776.4
Unleaded petrol (per 1 000 l)	359	1238.6	3220.2	359	1238.6	3220.2
Gas oil (per 1 000 l)	302	1041.9	2708.9	330	1138.5	2960.1
Kerosene (per 1 000 l)	302	1041.9	2708.9	330	1138.5	2960.1
LPG (per 1 000 kg)	125	431.3	1121.3	125	431.3	1121.3
Natural gas (per gigajoule gross calorific value)	2.6	9.0	23.3	2.6	9.0	23.3

Table 43 EU minimum levels of taxation applicable to motor fuels used for the purpose set out in Article 8(2)[55].

	Euro	Litas	SEK
Gas oil (per 1 000 l)	21	72.5	188.4
Kerosene (per 1 000 l)	21	72.5	188.4
LPG (per 1 000 kg)	41	141.5	367.8
Natural gas (per gigajoule gross calorific value)	0.3	1.0	2.7

[54] COUNCIL DIRECTIVE 2003/96/EC of 27 October 2003 restructuring the Community framework for the taxation of energy products and electricity

[55] This Article (8.2) shall apply to the following industrial and commercial purposes: (a) agricultural, horticultural or piscicultural works, and in forestry; (b) stationary motors; (c) plant and machinery used in construction, civil engineering and public works; (d) vehicles intended for use off the public roadway or which have not been granted authorisation for use mainly on the public roadway.

Table 44 Minimum levels of taxation applicable to heating fuels and electricity.

	Business use			Non-business use		
	Euro	**Litas**	**SEK**	**Euro**	**Litas**	**SEK**
Gas oil (per 1 000 l)	21	72.5	188.4	21	72.5	188.4
Heavy fuel oil (per 1 000 kg)	15	51.8	134.6	15	51.8	134.6
Kerosene (per 1 000 l)	0	0.0	0.0	0	0.0	0.0
LPG (per 1 000 kg)	0	0.0	0.0	0	0.0	0.0
Natural gas (per gigajoule gross calorific value)	0.15	0.5	1.3	0.3	1.0	2.7
Coal and coke (per gigajoule gross calorific value)	0.15	0.5	1.3	0.3	1.0	2.7
Electricity (per MWh)	0.5	1.7	4.5	1	3.5	9.0

6.5.4 Economic instruments for CO_2 management

The economic instruments for CO_2 have many similarities with instruments for energy control especially when we talk about fossil fuel use. Also here, in principle, three different concepts can be distinguished:

- A conventional CO_2 tax.
- A CO_2 charge system like the Swedish NO_X charge system.
- Advanced tradable economic instruments such as emission trading in the Kyoto protocol.

The emission of CO_2 from a fuel can easily be calculated based on an elementary analysis of the fuel (carbon content). In principle all the carbon in a fuel will be converted to CO_2. Thus, the CO_2 emission can more or less be treated as a constant for a certain type of fuel. No CO_2 measurements are thus necessary. However, usually the net emission of CO_2 from biomass based fuels are set to zero due to the fact that an equal amount of CO_2 is taken up by growing biomass.

A conventional CO_2 tax can thus be considered as a good base alternative. An introduction of a CO_2 trading system according to the Kyoto protocol give in this case no economic pressure on CO_2 reduction in Lithuania due to the fact that 1990 is selected as a base year and that Lithuania already fulfil the reduction requirements because of the circumstances with the liberation from the Soviet Union. It should thus be suggested to use a conventional CO_2 tax in combination with the Kyoto protocol system to maintain a pressure on CO_2 reduction.

If a more tax neutral system is considered necessary a system similar to the Swedish NO_X charge system can be applied also for CO_2. A charge will in this case be paid for a certain amount of CO_2 emitted and the charge will be refunded according to the amount of produced useful energy. The limitations are of course the same as for energy control.

6.5.5 Economic instruments for SO_2 management

Also for control of the SO_2 emissions, the same concept as for CO_2 can be used. The emission of SO_2 can be calculated directly from the sulphur content in the fuel. No measurements are therefore needed. The difference compared to CO_2 control is the possibilities to reduce the emission. In contrast to CO_2, the SO_2 emission can be reduced by e.g. installation of cleaning equipments or by desulphurisation of different fuels. Regulations of the sulphur content in different fuels can also be an efficient control instrument for the SO_2 emission. This regulation can also be included in different environmental classes for fuels. The concepts can thus be summarised as:

- A conventional SO_2 tax.
- A SO_2 charge system like the Swedish NO_X charge system.
- Advanced tradable economic instruments such as the SO_2 allowance program in the United States.
- Regulations for sulphur content in different fuels.

The strong reduction trend of the SO_2 emission that can be seen in many western European countries is to a large extent dependent on the possibilities and costs for SO_2 reduction. The SO_2 emission is relatively easy to reduce and a strong reduction can be seen independent of which economic instrument that has been used provided that an instrument that gives a sufficient economic pressure is used.

These facts indicate an application of very simple economic instruments. A first choice can be to apply a combination of a conventional SO_2 tax with sulphur content regulations for petroleum/natural gas fuels. In case conventional taxes are included into (and administered together with) fuel excise duties, tax refund provisions should be foreseen for those polluters who reduce SO_2 emissions by installing emission treatment equipment.

A SO_2 charge system can of course also be applied. A charge will in this case be paid for a certain amount of SO_2 emitted and the charge will be refunded according to the amount of produced useful energy. The limitations are of course the same as for energy control.

A SO_2 reduction credit trading system should here be considered only as a secondary choice. The advantage of such a cap and trade system is the possibility to control the overall emission and to improve cost efficiency. However, due to the complexity of the system and the reduction results by alternative systems it is advised to leave this concept to future applications.

6.5.6 Economic instruments for NO_X management

A fundamental difference between NO_X on one hand and CO_2 and SO_2 on the other hand is the possibility to calculate the emission. While the emission of CO_2 and SO_2 can be calculated directly from elementary analysis data for the fuels the NO_X emission has to be measured. In the application of different economic instruments it is important that the instrument is directed towards a real emission. If a calculated emission is used that does not reflect the actual emission an action to reduce an emission in a plant will not result in an economic benefit for the company and will thus not stimulate to further reduction actions. In principle, the same concept of instruments can be used as for CO_2 and SO_2:

- A conventional NO_X tax.
- A system like the Swedish NO_X charge system.
- Advanced tradable economic instruments for NO_X like the SO_2 allowance program in the United States.
- Regulations for NO_X emissions e.g. on cars and other vehicles.

However, the crucial factor is here the measurement of the NO_X emission. If an actual emission is not used an economic instrument can easily take the form of a fiscal tax instead of a dynamic environmental tool. All the above mentioned instruments should be based on NO_X measurements. A problem is however that NO_X measurements also involve a cost for the measurements. These costs include investments in NO_X measurement equipments and operation and administration

costs. These costs can be disproportionally high if the plant is small. There are thus needs for modified instrumentation with simplified measurement strategies and also for modified economic instruments. The primary purpose of an economic instrument for NO_X should be to stimulate to investments in low NO_X equipments, use of low NO_X fuels and to promote active NO_X optimisation of the plants. A secondary goal can also be to stimulate to use NO_X cleaning equipments such as SCR[56] or SNCR[57].

The primary choice is thus a complete online NO_X measurement system. If such a system will be implemented, measurement regulations also have to be implemented. Because of the cost, this type of systems can only be implemented in relatively large plants. Today a NO_X tax is used in Lithuania. The problem is however how the NO_X emission is determined. A calculation method is used today which can be questioned. If calculated values should be used these should be based on emission factors for different types of plants, equipments, fuels etc. Such a system will behave very much as a fiscal tax. However, some effect can be achieved by using different emission factors for e.g. different fuels. This could have a stimulating effect for the change to low NO_X fuels. Other possibilities can be to work with tax reduction for plants that install e.g. low NO_X burners. An alternative to emission factors can be to base the emission level from a plant on regular measurements e.g. one or two measurements per year by environmental inspectors. There are of course problems with this too. The NO_X emission varies significantly with different process conditions e.g. type of fuel, load of the combustion equipment and oxygen excess. It can therefore be difficult to receive a representative measurement value to base the tax or charge on. It can in this case be necessary to develop a mathematical model that can predict the NO_X emission as a function of already existing parameters e.g. fuel flow and oxygen excess. This function can than be used to estimate the NO_X emission. The function is only valid for a specific combustion equipment and if changes are made in the equipment e.g. installation of a low NO_X burner, a new function has to be developed based on actual measurements. This technique is usually called Predictive Emission Monitoring System (PEMS).

The possibility to determine the NO_X emission is thus a very important factor for the selection of economic instruments. For large combustion plants with measuring possibilities all the above mentioned economic instruments can be applied. For small combustion plants emission factors have to be used for the NO_X emission determination. In this case it is probably most favourable to use a simple NO_X tax in combination with regulations that promote installation of low NO_X equipments. The owner of the plants can usually do very little about the NO_X emission in their plants more than investing in good equipments, selecting the right fuel and eventually optimising the plants. An idea for a complete economic instrument for NO_X is to combine small and large plants in one system that consists of a voluntarily NO_X charge system for plants that invest in measuring equipments and a NO_X tax combined with regulations for other plants.

The same situation as for small combustion plants is more or less the case for cars, trucks and other vehicles. The car owners can do very little about the NO_X emission more than buy the right car and maintain the car in good shape. It is thus better to work with regulations of the NO_X emission for the cars, e.g. catalytic cleaning of the exhausted gases and yearly control of the car fleet concerning the function of the catalytic equipment.

[56] Selective Catalytic Reduction
[57] Selective Non Catalytic Reduction

6.5.7 Economic instruments for management of other emittents

In the Lithuanian environmental tax system there are taxes on many different emissions such as solid particles, vanadium pentoxide, BOD_7[58], total N, total P, suspended particles and a list of more than 200 other chemical substances. Some questions can however be raised concerning this system. Also in this case it is important that the environmental tax is directed towards an actual emission to be able to function as an instrument to promote further reduction of the emission. Otherwise, the tax will be more of a fiscal type. Almost all of the emittents on the list have to be measured and can not be calculated.

Furthermore, some of the emissions such as BOD can have different maximum tolerable emission levels depending on the geographic location of the plant and the toxicity of the different chemical compounds vary also significantly. The efficiency of a tax can therefore be difficult to predict. If the taxes are low this can result in major emissions of toxic compounds. For larger plants and industries, it should in this case be better to work with pure regulations of the different activities to maximise the emission of specific compounds from a certain production. For smaller plants, cars, trucks and other vehicles it is probably better to work with regulations of the equipments or vehicles instead of target the actual emissions, which can not be measured for all the equipments.

6.5.8 Economic instruments for electric power management

For all economic instruments it is important to define what you actually want to achieve with the instrument. Such targets can be e.g. to reduce the overall electric power consumption, to make the power production more efficient, produce more of a certain type of power such as wind power or biomass based power or to promote back pressure power production.

The electric power production situation in Lithuania is today unclear. The nuclear power station Ignalina will however be closed down and its production has to be replaced with other power production. In this situation an economic instrument for electric power production can play a roll as a market instrument to select new power production. However, very little experience exists in this field.

In the Nordic countries a market for electric power has opened (Nord Pool). The electric power can now be traded as a commodity and the power production is separated from the power distribution. In Sweden a quota-based electric power certificate system to promote environmental friendly and renewable electric power production has been introduced, see chapter 4.2.1. Also in California, United States the electric power generation was deregulated (not the transmission and distribution). Due to the design of the deregulated market (economic instrument) serious problems were introduced to the power generation system. This resulted in low investments of new power generation capacity, closing down of back-up power capacity, serious economic problems and bankruptcy for power producers. Thus, before major changes are made in the power generation sector and new economic instruments are introduced it is important to carefully analyse proposed system and its consequences.

The basic economic instrument used for electric power both in Sweden and in Lithuania is a tax on electric power consumption. The electric power certificate in Sweden plays only a minor roll today. For the moment it should be advised for Lithuania to continue with the tax system. The level can

[58] Biological oxygen demand.

always be discussed. The main purpose of the tax is today to control the total use of electric power and the way electric power is used in the society.

6.5.9 Economic instruments for transport sector

Suggestion would be to give up with current taxation of mobile pollution sources owned by legal entities and to introduce new economic instruments encompassing all vehicle users. It is very important for policy makers to decide upon time-bounded targets to be achieved in transport sector (emission reduction, renewal of car fleet, change of motor fuel balance, regulation of vehicle quantity, fiscal objectives (financing of road maintenance) etc.) what would allow to create new (or improve current) target-oriented policy measures – administrative as well as economic ones. Inevitable raise of motor fuel excise duties (due to implementation of directive 2003/96/EC) will give incentives for vehicle users to switch to more fuel efficient vehicles (more favourable conditions for small size and/or newer vehicles, also using of LPG as cleaner motor fuel if the taxation (or price) of this motor fuel will remain lower comparing to gasoline and diesel). Achievement of determined targets could be backed up by introduction of vehicle related taxation. Besides fuel taxes (excise duties) 2 main types of vehicle taxes (charges) are distinguished:

- Registration tax (RT) – tax payable at the time of acquisition, or first putting into service, of a vehicle;
- Annual circulation tax (ACT) – periodic tax payable in connection with the ownership of the vehicle.

Other taxes or chargers on vehicles includes registration fees, insurance taxes, import duties, road user charges, road tolls etc. Currently all 15 EU Member Countries operates different vehicle taxation system and vehicle related taxes generates substantial taxation revenues [59]. In Lithuania vehicle taxation currently embrace certain types of vehicles (heavy duty vehicles, busses, others but not passenger cars) and RTs and/or ACTs are applied and revenues are used for public road maintenance. (see Appendix A.3.1 on vehicle taxation in Lithuania). Recently, by releasing COM (2002) 431 final "On taxation of passenger cars in EU), EC has started debates on taxation of passenger cars within EU, focusing its attention into tax obstacles, distortions and inefficiencies resulted from different taxation systems. This document could be considered as the first to start harmonisation of passenger car taxation at EU level.

For the beginning we could recommend (after analysis of current situation and determination of environmental and other objectives to be achieved for transport sector) to start from:

- elaboration of economic instruments aiming at opting for more environmentally friendly vehicles. Possible economic instrument: annual vehicle circulation tax/charge (applicable to all types vehicles and forms of ownership) related as much as possible to emission performance (CO_2 etc.) of certain type of the vehicle. Parameters which could be taken into account in determining tax rates can be vehicle age, fuel, engine size etc.

- possible option is to combine environmental and road maintenance (fiscal) objectives into one economic instruments i.e. to single out road maintenance component which could be aggregated to certain types of vehicles depending on the extent of how much certain type of the vehicle is contributing to road deterioration;

[59] for example, ACTs and RTs only (excluding fuel taxes) generates around 4-4.5 % of all taxation revenues in Denmark and Ireland, 3 % in Netherlands, 1,5 % in Austria and UK (COM(2002) 431 final).

Administration of such taxes could be easily performed by the present network of Roadworthiness Test Stations. As abolishment of current taxation of mobile pollution sources would result in revenue losses of about 7 million LTL per annum of earmarked revenues. As an option it could be considered to single out "environmental component" in current excise duties applied for motor fuels (gasoline and diesel; LPG could be exempted as a cleaner fuel; please, recall that increase of motor fuel excise duties is inevitable because of directive 2003/96/EC requirements). According to preliminary estimations, revenue (7 million LTL) neutral changes can be made if current excise duties (year 2004 level) on gasoline and diesel would be increased approximately by 0.8 % and 0.3 % respectively (in case of equal distribution between gasoline and diesel based on year 2003 data).

Of course, designing new economic instruments of vehicle taxation would require careful analysis of social situation in Lithuania and attention to certain social groups. However, the following general trends could create favourable environment for introduction of new economic instruments:

- constantly increasing pressure of transport sector on environment (number of cars, emissions);
- increasing growth of GDP, real wages;
- governmental plans to reduce labour taxes (in this light, vehicle taxation could be regarded as a step to green budget reform); abolishment of charges for mobile pollution sources.

And finally, it is very important that closer co-operation between Ministry of Environment and Ministries of Finance and Transport would be established in planning these measures.

6.5.10 Final remarks and conclusions

The development of economic instruments for energy and environmental control in Lithuania is an essential step in the economic development of the society. Lithuania will undergo a rapid development phase in the coming years and it is important to guide the development in a direction towards a long-term sustainable society. Investments in industrial production or infrastructures are usually long-term investments, which can have an influence on the society for decades. Buildings that are developed today can have a lifetime of much more than 100 years so a long-term perspective is an essential aspect. The market economic mechanisms do not always include this long-term perspective so additional regulations or economic instruments can therefore be necessary.

In this study many different aspects of economic instruments have been highlighted and examples from Sweden and other countries have been studied. The existing economic instruments for energy and environmental control in Lithuanian have also been studied and positive and negative aspects have been analysed.

The existing economic instruments in Lithuania are all based on taxes, excise or fees. The energy tax level is slightly under the EU minimum level while the tax level for specific emissions are low. Since energy taxes would not be increased to the EU minimum during this decade, complementary measures to reduce emissions would be emission specific e.g. NO_X tax or charge, SO_2 tax or charge such as discussed above with the exception that the levels should be based on accurate methods of measurement.

As discussed in chapter 3, Lithuania is implementing pollution charges for mobile and stationary sources. The drawback of these charges is except that they are based on non-accurate measurement methods, their levels are too low to warrant any reduction incitement.

Hence, in order to:

- mitigate the environmental impacts of different emissions when whether the marginal control cost nor the marginal damage are known for Lithuania;
- avoid higher administration costs related to the measurement and monitoring of different pollutants;
- have uniform system for all polluters. Since depending for instance in the case of NO_X, both on the size of the firm and the cost the monitoring equipment; moral hazard and asymmetric information;

We propose that the total tax would be:

Total tax = energy tax + SO_2 tax + NO_X tax + CO_2 tax + other emission taxes

Where the inclusion of different environmental taxes is source specific. In the case of a firm producing goods for example, a product tax would include taxes on different emissions such as SO_2 and NO_X and CO_2 tax. In the case of gasoline, total tax could include e.g. energy tax and CO_2 tax. And in the case of diesel, total tax could e.g. include energy tax and PM tax. This taxation system is well in line with the existing taxation system in Lithuania and can thus easily be implemented in the existing system.

As discussed above there exist emission charges in Lithuania but their levels are too low to incite for reduction. Therefore, the emission taxes to be implemented should be based on accurate measurement of damage costs in order to insure optimality. These estimations and by way of a cost benefit analysis they would also allow the evaluation of whether these economic instruments were beneficial or not.

Lithuania can very well keep the CO_2 tax even if the Kyoto agreement will be in place. A pressure is needed to guide the investments in a CO_2-low (energy efficient) direction. The Kyoto protocol does not give this incitement to Lithuania so one needs to create such incitements.

The taxes of energy, CO_2 and SO_2 can be calculated based on fuel content and can be added to the fuel price. The energy tax will control the energy consumption and energy efficiency, the CO_2 tax will promote use of less carbon rich fuel i.e. promote natural gas instead of coal, the SO_2 tax will promote the use of desulphurized oil and other low sulphur product. A question can be biofuels (wood). Usually there is no CO_2 tax on wood fuels and the sulphur content is very low so there are almost no SO_2 tax. A question can be if one should have energy tax on biofuels.

With NO_X it is different because one need a measurement to have a correct value to use in an economic instrument. The purpose is such that we need to create an instrument that create a pressure to invest in low NO_X equipments (e.g. to chose a low NO_X burner instead of an ordinary burner when investing in new equipments), to promote low NO_X fuels and to optimise plants both for energy efficiency and NO_X. Such a system should be based on continuous NO_X measurements but it should also be possible to develop a tool that is based on e.g. one yearly measurement by the inspectors. Not only a NO_X tax can be applicable here but also a NO_X charge system. However, this is only possible for larger plants. Small plants are difficult to control and cars need special regulations. Today the NO_X charges are based on calculations. NO_X can not be calculated in a correct way but one can of course use emission factors for example for oil boilers, natural gas boilers etc (e.g. mg NO_X/MJ used fuel). The problem is that if an owner of a boiler do an investment to reduce the NO_X emission he will still have the same tax. This creates no incitement to reduce the NO_X emission so therefore a change is needed.

The other emittents (particles, PAH, the 300 list of other substances etc.) have the same problem as NO_X, one need to measure. Many of those are very specific for an industrial sector. One needs an active work with those substances. Many of those can also be harmful for human health (cancer risk etc). The present tax system in Lithuania gives actually no incitement to work actively with those questions. One just calculate the emissions (with formulas that can be questioned) and pay a very small sum of money in tax. In such case it should be better to have a system where the industry (at least the big ones) have separate permissions for there operations where many problems are considered like emission levels, control and measurement programs, obligation to reduce some emissions etc. The permission can be given for several years and can then be renegotiated. It is here of course important with rules so all the industries feel that they are treated equally by the authority. In Sweden this work is performed by local community environmental departments or by Swedish EPA. Sweden also has an environmental court where disputes can be solved which is described earlier in this report.

7 Evaluation and follow up of implemented environmental economic instruments

When economic instruments have been implemented, regular and systematic monitoring and evaluation of the environmental effectiveness and economic efficiency of the instruments are needed. Examples of such evaluation have already been presented in chapter 4.11 covering the Swedish NO_X charge system. In the Swedish environmental tax system one can generally distinguish between two types of evaluation:

- Continuous (usually yearly) evaluation of the instrument.
- Special evaluation work usually on research base.

The evaluation results shown in chapter 4.11 are examples of a yearly follow up of the NO_X charge instrument. The continuous follow up programs are usually performed by the organisation in charge of the system. The evaluations are performed as a part of the administration of the economic instrument. The results are usually based on statistic information and the reports do not comprise any deeper economic evaluation of the instrument. However, sometime an economic instrument needs to be evaluated in a more comprehensive way. The environmental and economic efficiencies have to be tested and the instruments have to be updated and further developed. This type of evaluation is usually performed in different research studies. This is an important part of an economic instrument. Sometimes, for example, the effect of an instrument can be very good the first years but after a certain time period the efficiency will decrease. This is, for example, the case with the Swedish NO_X charge system. An essential part is to detect such behaviour, propose changes to the instrument or to adjust charge levels.

An important prerequisite for a successful evaluation is the access to data from the economic instrument. In the case when the instrument includes a complete reporting system like the NO_X charge system (economic information as well as emission information) the evaluation can be performed relatively easy. In the case of a tax system the information can be more scanty. In this case additional statistic information can be collected from the different tax objects. The performance of the national environmental statistics can here play an important role. For Lithuania some general data sources can be detected:

- Statistics Lithuania (various statistics on energy/fuel production, consumption, transport, inhabitants, housing etc.)
- State tax inspectorate (environmental and fuel taxation revenue data, tax/charge rates, taxable objects)
- Ministry of Environment (statistics on controlled stationery pollution sources)

In the design of an environmental economic instrument it can be recommended to include information on how to evaluate the instrument already at the design stage. Collection of necessary statistical information can in this way be initiated in an early stage.

Appendixes

APPENDIX 1: Directives for ambient air quality

- Directive 80/779/EEC on air quality limit values and guide values for sulphur dioxide and suspended particulates, as last amended by Directive 89/427/EEC
- Directive 82/884/EECon a limit value for lead in the air
- Directive 85/203/EECon air quality standards for nitrogen dioxide, as last amended by Directive 85/580/EEC
- Directive 96/61/EECconcerning integrated pollution prevention and control
    - COM/2000/177: Proposal for a Council Decision on the conclusion on behalf of the European Community of the 1998 Protocol to the 1979 Convention on Long Range Transboundary Air Pollution on Heavy Metals.

STATIONARY SOURCE EMISSIONS

Large Combustion Plants

- Directive 2001/80/EEC on the limitation of emissions of certain pollutants into the air from Large Combustion Plants
- Directive 88/609/EEC on the limitation of emissions of certain pollutants into the air from Large Combustion Plants.
- Council Directive 94/66/EEC amending Directive 88/609/EEC on the limitation of emissions of certain pollutants into the air from large combustion plants.

Waste Incineration Plants

- Directive 89/369/EEC of 8 June 1989 on the prevention of air pollution from new municipal waste incineration plants.
- Directive 89/429/EEC of 21 June 1989 on the reduction of air pollution from existing municipal waste-incineration plants.
- Directive 94/67/EEC on incineration of hazardous waste, latest amendment proposal COM (97) 604..
- Directive 2000/76/EEC of the European Parliament and of the Council of 4th December 2000 on the incineration of waste.

VOCs

- Directive 94/63/EEC of the European Parliament and of the Council on the control of VOC emissions resulting from the storage of petrol and its distribution from terminals to service stations.
- Council Directive 1999/132/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations.

Sulphur content of liquid fuels

- Directive 1999/32/EEC on reduction of sulphur content of certain liquid fuels.

NATIONAL EMISSION CEILINGS

Establishment of national emission ceilings for acidification and eutrophication

- Directive 2001/81/EC on national emissions ceilings for certain atmospheric pollutants
- Directive 2002/3/EC relating to ozone in ambient air

TRANSPORT AND ENVIRONMENT

Road vehicles

Light Vehicles

- Directive 70/220/EEC on the approximation of the laws of the Member States relating to measures to be taken against air pollution by gases from positive-ignition engines of motor vehicles.

Amendments to Directive 70/220/EEC:

- Council Directive 74/290/EEC
- Commission Directive 77/102/EEC
- Commission Directive 78/665/EEC
- Council Directive 83/351/EEC
- Council Directive 88/76/EEC
- Council Directive 88/436/EEC
- Council Directive 89/458/EEC
- Council Directive 91/441/EEC
- Council Directive 93/59/EEC
- European Parliament and Council Diretive 94/12/EC
- Commission Directive 96/44/EEC
- European Parliament and Council Directive 96/69/EC
- European Parliament and Council Directive 98/69/EC
- Commission Directive 99/102/EC
- European Parliament and Council Directive 2001/1/EC
- European Parliament and Council Directive 2001/100/EC

Heavy Duty Vehicles

- Directive 88/77/EEC on the approximation of the laws of the Member States relating to the measures to be taken against the emission of gaseous pollutants from diesel engines for use in vehicles

Amendments to Directive 88/77/EEC:

- Council Directive 91/542/EEC (this provides the Euro 1 and Euro 2 emission standards)
- Commission Directive 961/1/EEC
- European Parliament and Council Directive 1999/96/EEC (this provides the Euro 3 (from October 2000), Euro 4 (from October 2005) and Euro 5 (from October 2008) emission standards)
- Commission Directive 2001/27/EEC

Motorcycles and mopeds

- Directive 97/24/EC on certain components and characteristics of two or three-wheel motor vehicles
- Amendments to Directive 97/24/EC (to be published soon)

Roadworthiness of vehicles:

- Directive 96/96/EC on the approximation of the laws of the Member States relating to roadworthiness tests for motor vehicles and their trailers
- Directive 2000/30/EC as regards speed limits and exhaust emissions of commercial vehicles

Non-road mobile machinery

- Directive 97/68/EC on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines
- Directive 2000/25/EC on action to be taken against the emission of gaseous and particulate pollutants by engines intended to power agricultural or forestry tractors and amending Council Directive 74/150/EEC

Automotive fuel quality

- Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC.
- Commission Directive 2000/71/EC of 7 November 2000 to adapt the measuring methods as laid down in Annexes I, II, III and IV of Directive 98/70/EC of the European Parliament and of the Council to technical progress as foreseen in Article 10 of that Directive.

Pollutant emissions from ships

- Marine Pollution Convention, MARPOL 73/78.

APPENDIX 2: On the taxation of energy products and electricity, COUNCIL DIRECTIVE 2003/96/EC, of 27 October 2003

In this appendix the annexes to the directive are presented. The annexes describe minimum levels of taxation and reduced rates of taxation and exemptions from such taxation for different countries.

ANNEX I

Table A. - Minimum levels of taxation applicable to motor fuels

	1 January 2004	1 January 2010
Leaded petrol (in euro per 1000 l) CN codes 2710 11 31, 27101151 and 27101159	421	421
Leaded petrol (in euro per 1000 l) CN codes 2710 11 31, 27101141, 27101145 and 27101149	359	359
Gas oil (in euro per 1000 l) CN codes 27101941, 27101949	302	330
Kerosene (in euro per 1000 l) CN codes 27101921 and 27101925	302	330
LPG (in euro per 1000 l) CN codes 27111211 to 27111900	125	125
Natural gas (in euro gigajoule gross calorific value) CN codes 27111100 and 27112100	2.6	2.6

Table B. - Minimum levels of taxation applicable to motor fuels used for the purpose set out in Article 8(2)

Gas oil (in euro per 1000 l) CN codes 27101941 to 27101949	21
Kerosene(in euro per 1000 l) CN codes 27101921 and 27101925	21
LPG (in euro per 1000 l) CN codes 27111211 to 27111900	41
Natural gas (in euro per gigajoule gross calorific value) CN codes 27111100 and 27112100	0.3

Table C. - Minimum levels of taxation applicable to heating fuels and electricity

	Business use	Non-business use
Gas oil (in euro per 1000 l) CN codes 27101941 to 27101949	21	21
Heavy fuel oil (in euro per 1000 l) CN codes 27101961 to 27101969	15	15
Kerosene (in euro per 1000 l) CN codes 27101921 and 27101925	0	0
LPG (in euro per 1000 l) CN codes 27111211 to 27111900	0	0
Natural gas (in euro per gigajoule gross calorific value) CN codes 27111100 and 27112100	0.15	0.3
Coal and coke (in euro per gigajoule gross calorific value) CN codes 2701, 2702 and 2704	0.15	0.3
Electricity (in euro per MWh) CN code 2716	0.5	1.0

ANNEX II

Reduced rates of taxation and exemptions from such taxation referred to in Article 18(1).

1. BELGIUM:
- for liquid petroleum gas (LPG), natural gas and methane;
- for local public passenger transport vehicles;
- for air navigation other than that covered by Article 14(1)(b) of this Directive;
- for navigation in private pleasure craft;
- for a reduction in the rate of excise duty on heavy fuel oil to encourage the use of more environmentally friendly fuels. Such reduction shall be specifically linked to sulphur content and in no case can the reduced rate fall below EUR 6,5 per tonne;
- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty;
- for a differentiated rate of excise duty on low-sulphur (50 ppm) and low-aromatic (35 %) unleaded petrol;
- for a differentiated rate of excise duty on low-sulphur (50 ppm) diesel.

2. DENMARK:
- for a differentiated rate of excise duty, from 1 February 2002 to 31 January 2008, to heavy fuel oil and heating oil used by energy-intensive firms to produce heating and hot water. The maximum amount of the authorised differentiation in the excise duty is EUR 0.0095 per kg on heavy fuel oil and EUR 0.008 per litre on heating oil. The reductions in excise duty must comply with the terms of this Directive, and in particular the minimum rates;
- for a reduction in the rate of duty on diesel to encourage the use of more environmentally friendly fuels, provided that such incentives are linked to established technical characteristics including specific gravity, sulphur content, distillation point, cetane number and index and provided that such rates are in accordance with the obligations laid down in this Directive;
- for the application of differentiated rates of excise duty between petrol distributed from petrol stations equipped with a return system for petrol fumes and petrol distributed from other petrol stations, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum rates of excise duty;
- for differentiated rates of excise duties on petrol, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum levels of taxation provided for in Article 7 thereof;
- for local public passenger transport vehicles;
- for differentiated rates of excise duties on gas oil, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum levels of taxation provided for in Article 7 thereof;
- for partial reimbursement to the commercial sector, provided that the taxes concerned are in conformity with Community law and provided that the amount of the tax paid and not reimbursed at all times respects the minimum rates of duty or monitoring charge on mineral oils as provided for in Community law;
- for air navigation other than that covered by Article 14(1)(b) of this Directive;
- for the application of a reduced rate of excise duty of a maximum of DKK 0,03 per litre on petrol distributed from petrol stations meeting more stringent standards of equipment and operation designed to reduce leakage of methyl tertiary butyl ether into ground water, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum rates of excise duty.

3. GERMANY:
- for a differentiated rate on excise duty on fuels with a maximum sulphur content of 10 ppm from 1 January 2003 until 31 December 2005;
- for the use of waste hydrocarbon gases as heating fuel;
- for a differentiated rate of excise duty on mineral oils used as fuel in local public passenger transport vehicles, subject to compliance with the obligations laid down in Directive 92/82/EEC;
- for samples of mineral oils intended for analysis, tests on production or for other scientific purposes;
- for a differentiated rate of excise duty on heating oils used by manufacturing industries, provided that the differentiated rates are in accordance with the obligations laid down in this Directive;
- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty.

4. GREECE:
- for use by national armed forces;
- to grant relief from the excise duties on mineral oils for fuels intended to be used to power the official vehicles of the Ministry of the Presidency and the national police force;
- for local public passenger transport vehicles;
- for differentiated rates of tax on unleaded petrol to reflect different environmental categories, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum levels of taxation provided for in Article 7 thereof;
- for LPG and methane used for industrial purposes.

5. SPAIN:
- for LPG used as fuel in local public transport vehicles;
- for LPG used as fuel in taxis;
- for differentiated rates of tax on unleaded petrol to reflect different environmental categories, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum levels of taxation provided for in Article 7 thereof;
- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty.

6. FRANCE:
- for differential rates of tax on diesel used in commercial vehicles, until 1 January 2005, which cannot be less than EUR 380 per 1000 l as from 1 March 2003;
- in the framework of certain policies aimed at assisting areas suffering from depopulation;
- for consumption on the island of Corsica, provided that the reduced rates at all times respect the minimum rates of duty on mineral oils as provided for under Community law;
- for a differentiated rate of excise duty on a new fuel composed of a water-and-antifreeze/diesel emulsion stabilised by surfactants, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum rates of excise duty;
- for a differentiated rate of excise duty for premium-grade unleaded petrol containing a potassium-based additive to improve resistance to valve burn-out (or any other additive of equivalent effect);
- for fuel used in taxis, within the limits of an annual quota;
- for exemption from excise duty on gases used as fuel for public transport subject to an annual quota;

- for an exemption from excise duties for gases used as engine fuels in gas-powered refuse collection vehicles;
- for a reduction in the rate of taxation on heavy fuel oil to encourage the use of more environmentally friendly fuels; this reduction shall be specifically linked to sulphur content and the rate of duty charged on heavy fuel oil must correspond to the minimum rate of taxation on heavy fuel oil as provided for in Community law;
- for an exemption for heavy fuel oil used as fuel for the production of alumina in the region of Gardanne;
- for air navigation other than that covered by Article 14(1)(b) of this Directive;
- for gasoline delivered from the harbours of Corsica to private pleasure craft;
- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty;
- for local public passenger transport vehicles until 31 December 2005;
- for the granting of permits for the application of a differentiated rate of excise duty to the fuel mixture "petrol/ethyl alcohol derivatives whose alcohol component is of agricultural origin" and for the application of a differentiated rate of excise duty to the fuel mixture "diesel/vegetable oil esters". To allow a reduction in excise duty on blends incorporating vegetable oil esters and ethyl alcohol derivatives which are used as fuel within the meaning of this Directive, the French authorities must issue the necessary permits to the biofuel production units concerned by 31 December 2003 at the latest. The authorisations will be valid for a maximum of six years from the date of issue. The reduction specified in the authorisation may be applied after 31 December 2003 until the expiry of the authorisation. The reductions in excise duties shall not exceed EUR 35,06/hl or EUR 396,64/t for vegetable oil esters and EUR 50,23/hl or EUR 297,35/t for ethyl alcohol derivatives used in the mixtures referred to. The reductions in excise duties shall be adjusted to take account of changes in the price of raw materials to avoid overcompensating for the extra costs involved in the manufacture of biofuels. This Decision shall apply with effect from 1 November 1997. It shall expire on 31 December 2003;
- for the granting of permits for the application of a differentiated rate of excise duty to the mixture "domestic heating fuel/vegetable oil esters". To allow a reduction in excise duty on mixtures incorporating vegetable oil esters and used as fuel within the meaning of this Directive, the French authorities must issue the necessary permits to the biofuel production units concerned by 31 December 2003 at the latest. The authorisations will be valid for a maximum of six years from the date of issue. The reduction specified in the authorisation may be applied after 31 December 2003 until the expiry of the authorisation, but may not be extended. The reductions in excise duties shall not exceed EUR 35,06/hl or EUR 396,64/t for the vegetable oil esters used in the mixtures referred to. The reductions in excise duty shall be adjusted to take account of changes in the price of raw materials to avoid overcompensating for the extra costs involved in the manufacture of biofuels. This Decision shall apply with effect from 1 November 1997. It shall expire on 31 December 2003.

7. IRELAND:
- for LPG, natural gas and methane used as motor fuel;
- in motor vehicles used by the disabled;
- for local public passenger transport vehicles;
- for differentiated rates of tax on unleaded petrol to reflect different environmental categories, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum levels of taxation provided for in Article 7 thereof;
- for a differentiated rate of excise on low-sulphur diesel;
- for the production of alumina in the Shannon region;

- for air navigation other than that covered by Article 14(1)(b) of this Directive;
- for navigation in private pleasure craft;
- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty.

8. ITALY:
- for differentiated rates of excise duty on mixtures used as motor fuels containing 5 % or 25 % of bio-diesel until 30 June 2004. The reduction in excise duty may not be greater than the amount of excise duty payable on the volume of biofuels present in the products eligible for the reduction. The reduction in excise duty shall be adjusted to take account of changes in the price of raw materials to avoid overcompensating for the extra costs involved in the manufacture of biofuels;
- for a reduction in the rate of excise duty used as fuel by road transport operators, until 1 January 2005, which cannot be less than EUR 370 per 1000 l as from 1 January 2004;
- for waste hydrocarbon gases used as fuel;
- for a reduced rate of excise duty to water/diesel emulsions and water/heavy fuel oil emulsions from 1 October 2000 until 31 December 2005 provided that the reduced rate is in accordance with the obligations laid down in this Directive, and in particular with the minimum rates of excise duty;
- for methane used as fuel in motor vehicles;
- for the national armed forces;
- for ambulances;
- for local public passenger transport vehicles;
- for fuel used in taxis;
- in certain particularly disadvantaged geographical areas, for reduced rates of excise duty on domestic fuel and LPG used for heating and distributed through the networks of such areas, provided that the rates are in accordance with the obligations laid down in this Directive, and in particular the minimum rates of excise duty;
- for consumption in the regions of Val d'Aosta and Gorizia;
- for a reduction in the rate of excise duty on petrol consumed on the territory of Friuli-Venezia Giulia, provided that the rates are in accordance with the obligations laid down in this Directive, and in particular the minimum rates of excise duty;
- for a reduction in the rate of excise duty on mineral oils consumed in the regions of Udine and Trieste, provided that the rates are in accordance with the obligations laid down in this Directive;
- for an exemption from excise duty on mineral oils used as fuel for alumina production in Sardinia;
- for a reduction in the rate of excise duty on fuel oil, for the production of steam, and for gas oil, used in ovens for drying and "activating" molecular sieves in Reggio Calabria, provided that the rates are in accordance with the obligations laid down in this Directive;
- for air navigation other than that covered by Article 14(1)(b) of this Directive;
- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty.

9. LUXEMBOURG:
- for LPG, natural gas and methane;
- for local public passenger transport vehicles;
- for a reduction in the rate of excise duty on heavy fuel oil to encourage the use of more environmentally friendly fuels. Such reduction shall be specifically linked to sulphur content and in no case can the reduced rate fall below EUR 6,5 per tonne;

- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty.

10. NETHERLANDS:
- for LPG, natural gas and methane;
- for samples of mineral oils intended for analysis, tests on production or for other scientific purposes;
- for use by the national armed forces;
- for the application of differentiated rates of excise duty on LPG used as fuel in public transport;
- for a differentiated rate of excise duty on LPG used as fuel for waste-collection, drain suction and by street-cleaning vehicles;
- for a differentiated rate of excise duty on low sulphur (50 ppm) diesel to 31 December 2004;
- for a differentiated rate of excise duty on low sulphur (50 ppm) petrol to 31 December 2004.

11. AUSTRIA:
- for natural gas and methane;
- for LPG used as fuel by local public transport vehicles;
- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty.

12. PORTUGAL:
- for differentiated rates of tax on unleaded petrol to reflect different environmental categories, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum levels of taxation provided for in Article 7 thereof;
- for exemption from excise duty on LPG, natural gas and methane used as fuel in local public passenger transport;
- for a reduction in the rate of excise duty on fuel oil consumed in the autonomous region of Madeira; this reduction may not be greater than the additional costs incurred in transporting the fuel oil to that region;
- for a reduction in the rate of excise duty on heavy fuel oil to encourage the use of more environmentally friendly fuels; this reduction shall be specifically linked to sulphur content and the rate of duty charged on heavy fuel oil must correspond to the minimum rate of duty on heavy fuel oil as provided for in Community law;
- for air navigation other than that covered by Article 14(1)(b) of this Directive;
- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty.

13. FINLAND:
- for natural gas used as fuel;
- for an exemption from excise duty for methane and LPG for all purposes;
- for reduced excise duty rates on diesel fuel and heating gas oil, provided that the rates are in accordance with the obligations laid down in this Directive, and in particular the minimum levels of taxation provided for in Articles 7 to 9;
- for reduced excise duty rates on reformulated unleaded and leaded petrol, provided that the rates are in accordance with the obligations laid down in this Directive, and in particular the minimum levels of taxation provided for in Article 7 thereof;
- for air navigation other than that covered by Article 14(1)(b) of this Directive;
- for navigation in private pleasure craft;

- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty.

14. SWEDEN:
- for reduced tax rates for diesel in accordance with environmental classifications;
- for differentiated rates of tax on unleaded petrol to reflect different environmental categories, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum rates of excise duty;
- for a differentiated rate of energy tax to alkylate-based petrol for two-stroke engines, until 30 June 2008, provided that the total excise duty applicable comply with the terms of this Directive;
- for an exemption from excise duty for biologically produced methane and other waste gases;
- for a reduced rate of excise duty on mineral oils used for industrial purposes, provided that the rates are in accordance with the obligations laid down in this Directive;
- for a reduced rate of excise duty on mineral oils used for industrial purposes by introducing both a rate which is lower than the standard rate and a reduced rate for energy-intensive enterprises, provided that the rates are in accordance with the obligations laid down in this Directive, and do not give rise to distortions of competition;
- for air navigation other than that covered by Article 14(1)(b) of the present Directive.

15. UNITED KINGDOM:
- for differentiated rates of excise duty for road fuel containing biodiesel and biodiesel used as pure road fuel, until 31 March 2007. Community minimum rates have to be respected and no overcompensation for the extra costs involved in the manufacture of biofuels can take place;
- for LPG, natural gas and methane used as motor fuel;
- for a reduction in the rate of excise duty on diesel to encourage the use of more environmentally friendly fuels;
- for differentiated rates of tax on unleaded petrol to reflect different environmental categories, provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum levels of taxation provided for in Article 7 thereof;
- for local public passenger transport vehicles;
- for a differentiated rate of excise duty on water/diesel emulsion provided that the differentiated rates are in accordance with the obligations laid down in this Directive, and in particular the minimum rates of excise duty;
- for air navigation other than that covered by Article 14(1)(b) of this Directive;
- for navigation in private pleasure craft;
- for waste oils which are reused as fuel, either directly after recovery or following a recycling process for waste oils, and where the reuse is subject to duty.

APPENDIX 3: Economic instruments for the energy sector in Lithuania

A 3.1 Vehicle taxation

The transport sector represents a growing environmental concern and it is recognised that motor vehicle tax could, in principle, induce a shift to less polluting vehicles (Nordic Council of Ministers, 1999). A number of opportunities remain for the application of economic instruments to influence a number of vehicles on the road and the age and environmental impact of a car fleet in Lithuania. The revenue raising potential of vehicle taxation is of great importance considering that more than 90 % of all revenues generated by environmental related taxes (in OECD countries) are being raised by motor fuel taxes and motor vehicle taxes (Braathen, 2000).

Currently no taxation on private passenger vehicles is levied in Lithuania (except import duties and turnover tax on luxurious vehicles). Existing taxation embrace only heavy-duty vehicles used for commercial purposes and revenue generated is earmarked for road maintenance purposes. Waste management related product charges are levied on several vehicle components parts (tyres, car batteries etc.) indirectly creating obligations for private passenger car users as well. Moreover, most probably additional levies (or deposit) for all newly registered vehicles will be introduced in order to finance management of end-of-life vehicle waste in the nearest future.

Vehicle import duties

According to Integrated Tariff majority of vehicles imported into Lithuania are not subject to import duties as preferential custom regime is applied (rate of custom duty is 0 %). Preferential custom regime is applied for imports from EU and almost all CEE countries. Conventional custom regime is applied for countries which are members of WTO (World trade organisation), autonomous – for the rest.

Import duties (conventional and autonomous) are is differentiated according to the age of a vehicle:
0 – 7 years – import duty free;
7 -10 years –5 %
10 and more years – 10 % (conventional) or 20 % (autonomous).

Annual vehicle charges

Charges are levied for commercial vehicles and are paid by legal entities only. There are 2 main annual vehicle charges levied:

- Charges Payable for Commercial Vehicles Registered in the Republic of Lithuania
- User Charge Payable by the Owners or Users of Vehicles Registered in the Republic of Lithuania;

Charges Payable for Commercial Vehicles Registered in the Republic of Lithuania

Charge is levied only on heavy-duty vehicles (type N3) and trailers (O4, exceeding 12 tonnes) according to their weight:

Heavy duty vehicles (by weight)	**Charge rate intervals (in LT)**	
	2003	**2004**
12 – 15 tonnes	300 – 520	300 – 880
15 – 23 tonnes	440 – 840	440 – 1980
23 – 29 tonnes	820 – 1320	820 - 2600
29 – 33 tonnes	1300 – 2150	1300 – 3870
33 - 40 tonnes	1850 – 3760	1850 – 5080
40 – 44 tonnes (N3O4)	2260 – 3760	2260 - 6690

User Charge Payable by the Owners or Users of Vehicles Registered in the Republic of Lithuania

Charge is levied on heavy-duty vehicles, buses and special purpose vehicles:

Chargeable vehicles			**Charge rate intervals (in LT)**	
Type	**Category**	**Weight**	**2003**	**2004**
Buses	M2	< 5 t	-	350 -700
	M3	> 5 t	-	400 - 1000
Heavy-duty	N1, O2	< 3.5 t	250–500	250–500
	N2, O3	3.5 – 12 t	300–600	300–600
	N3, O4	12 – 40 t	150–800	150–800
Special purpose	-	-	200 - 500	200 - 500

Besides aforementioned charges, the owners or users of vehicles registered in foreign states shall pay the user charge when the vehicle crosses the state border of the Republic of Lithuania. The range of an annual charge from 100 to 3000 LT depending on the characteristics of a vehicle (light duty, heavy duty, special vehicle). Additional charge on the use of roads is paid by the owners of vehicles that exceed standard dimensions. The rate of single payments varies from 5 to 14 Lt for 10 km and monthly payments varies from 875 to 2450 Lt depending on the dimensions of a vehicle.

The following vehicles are exempted from charges :

- vehicles belonging to the Ministry of the Interior and institutions under the Ministry, which have been attributed to combat, combat training, training, drilling and transport groups. The above vehicles shall be presented for state roadworthiness test accompanied by a document confirming that they have been attributed to one or another transport group;
- vehicles fitted to suit people with disabilities, which belong to municipal institutions and non-governmental organisations of people with disabilities.

All taxation revenues are transferred to Road Maintenance and Development Programme.

Vehicle turnover tax

Law on Turnover Tax (21 May 2002 Law No. IX-896) which came into force on 1 July 2002, impose taxation of imported motor vehicles which value exceeds 100 thou LT – 15 % of taxable amount, exceeding 100 thousand LT. Exceptions are applied for the special use vehicles. This excise duty is purely of fiscal nature. Revenue is transferred into state budget.

Product charges

Since 2003, waste related products charges are levied on various vehicle component parts in Lithuania. Main purpose of these product charges is to stimulate financially collection and recycling of some problematic waste streams as well as to encourage reducing consumption of those products by increasing their sales price.

Before 2003 in Lithuania collection and reprocessing of used tyres and batteries, mercury bulbs and other products' waste was not intensive. Used products were collected and recycled (exported for recycling) only if market price of recovered materials overrun related cost. As collection costs are quite high and market of recovered materials is subject to significant fluctuations, conditions to develop reprocessing were quite unfavourable. For example, recycling of tyres has not been performed at all. It is anticipated that introduction of charges will change situation. Nevertheless, after half of year taxation is enforced taxpayers' (mainly importers) response is quite moderate so far.

Taxable products, charge rates in Lithuania are presented in a table below.

Table 45 Charges on products harmful to the environment in Lithuania in 2003.

Type of goods or products	Charge- base	Charge rate
Mineral oils	kg	-
Electric power batteries and chemical batteries: Lead (depending on capacity) Used in transport vehicles Other	 unit kg value	 - 0.15 4 %
Mercury luminescent bulbs	unit value	 25 %
Tires	kg	0.09-0.1
Filters (oil, fuel, air)	unit	0.29
Hydraulic shock absorbers	unit	0.87

Charge relief is granted if defined waste recovery rate is achieved. For example, in order to avoid charge payment, importer of tires has to recover 80 % of used tires by weight from the amount placed on domestic market during taxable period.

The reduced rate of VAT of 5 % shall be applied to passenger transport by regular routes determined by the Ministry of Transport, passenger transport by passenger trains as well as transportation of passenger .

A 3.2 Taxable pollutants

Approved by the Government of the Republic of Lithuania
Regulation No. 53, January 18' 2000

Taxable pollutions and their groups

I. Pollutants emitted to surface water bodies, soil and deeper ground terrain

I group
Halogen hydrocarbons
Trichlorbenzene
Hexachlorbenzene
hexachlorbutadiene
Pentachlorphenol
Hexachlorcyclohexane

Other organic compounds:
Benzpyrene

II group
Metals and its compounds
Arsenic
Cadmium and its compounds
Mercury
Vanadium
Chromium VI

Organic compounds:
Formaldehyde
Phenol
Chloroform

III group
Halogen hydrocarbons
Tetrachlorethylene
Tetrachlorethane
Trichlorethylene
1,2dichlorethane
carbon tetrachloride

Metals and theirs Compounds
Lead
Antimony
Cobalt
Nickel
Copper

Organic Compounds
Naphtalyne

IV group
Metals and its compounds
Zinc
Manganese
Chromium III
Inorganic compounds
Cyanides
Rodanide

Organic compounds
Naphtha and its products
Xylene
Terpentyne
Vinylacetate
Acetone
Methanol
Styrene
Detergents

V group
Inorganic Halides And Anions
Fluorides
Sulphides
Metals and it compounds
Iron
Aluminium
Organic stuff
Furfural

II. Pollutants emitted to atmosphere

I group
Alfa-naphtylamine
1,1-dichlorethylene
1,1-dimethylhydrazine
1,2-dimethylhydrazine
1,1,1-trichlorethane
acrylamide
carbon tetrachloride
asbestos
barium carbonate
3,4-benzpyrene
benzyl chloride
benz(b+y+k)fluorethane
benzantracene
berilium and its compounds
biphenyl
vinyl chloride
m-chlorphenol
o-chlorphenol
p-chlorphenol
chromiumVI (as chromium trioxide)
m-dichlorbenzene
o-dichlorbenzene
p-dichlorbenzene
dichlorphenol
dichlordifluormethane (Freon-12)
difluorchlorbrommethane(halone1211)
diethylsuphate
dimethylsulphate
ethylenoxide
ethylamine
ethylenimine

p-acetaminophenol (phenacetine)
phenazopyridine
fluorotrichlormethane (Freon-11)
furfuryl alcohol
mercury and its compounds (as mercury)
hexachlorocyclohexane
hexamethylen-1 ,6-diisocyanate
hydrazines
cadmium and its compounds(as cadmium)
potassium bromate
cobalt
creosote
mercaptanes
methylchloride
N,N-di methylnitrosoamine
Nickel and its compounds (as nickel)
Nitrobiphenyl
Nitronaphtalyne
2-nitropropane
ozone
p-chlor-toluidine
PCB(polyhalogenbiphenyl)
PCDD(polyhalogen dibenzdioxane)
PCDF(polyhalogenbenzfunan)
Pentachlorethane
Pentachlor-phenol
Pentafluorochlorethane(Freon-115)
Propylen oxide
Selenium and its compounds (as selenium)
Lead organic and inorganic compounds (as lead)
Thallium and its compounds (as thallium)
Telliurium and its compounds (as telliurium)
Tetrafluordibromethane(halone2402)
Tetrafluordichlorethane(Freon-114)
Toluilendiisocyanate
Trichloethane
2,4,6-trichlorphenol
trifluorchlormethane (Freon-13)
trifluorbrommethane(halone1301)
1,2,2-trifluor-1,1,2-trichlorethane (freon-113)
vinylbromide

II group

1,1,1,2,2-pentafluor,-3-dichlorpropane(Freon-225ca)
1,1,2,2,3-pentafluor,-1-3-dichlorpropane(freon-225cb)
1-fluor,-1,1-dichlorethane(freon-141b)
1,1-difluor,-1 chlorethane(Freon -142b)
1,2,3-trimethylbenzene
1,2,4-trimethylbenzene
1,3,5-trimethylbenzene
methylisobutylketone
acrylonitrile
acrolein
carbon disulphide
aniline
arsenic and its compounds (as arsenic)
nitric acid
benzene
boron fluoride hydride acid
bromine
bromethyl
butylacrylate
chlorine
chlorocyan
trichlormethane (chloroform chladon 20)
chloroprene
cyanic hydric acid
diacetone
dichlorethane
diethanolamine (2,2'-dioxyethylamine 2,2-imidoethanol)
diphenylmethandiisocyanate
difluorochloromethane (Freon-22)
N,N'-dimethylacetamide
Dimethylamine
Dimethylformamide (DMFA)
Chlorine hydride
Epichlorhydrine
2-ethoxyethanol
ethoxypropylacetate
phenol
fluordichlormethane (Freon-21)
fluorchlormethane (Freon-31)
fluorine inorganic compounds
formaldehyde
phosphorus (V)oxide
phosgene
ftalic anhydrous
hexamethylendiamine
isopropylbenzen hydrycperoxide
2-mercaptobenztiazole
maleic anhydride
methylbromide
2-methoxyethanol
methoxypropyl acetate
monochloracetic acid
nitrobenzene
oxymethylfurfural
pentafluordichlorpropane (Freon-225)
pyridine
1,2-dihidroxybenzene
polydimethylsiloxan
polyethylenpropyl amine
polyisocyanate
polypropylene
polyvinylchloride
polyvinylformaldehyde

sulphuric acid
sulphur hydride
formic acid
styrene
tetrachlorethylene
tetrafluorochlorethane (Freon-124)
trifluorochlorethane (Freon-133)
Trifluordichlorethane
Tricresol
p-phenyldiamine

III group

Acetic aldehyde
Acetylene
Acetic acid
Acrylic acid
Tin and its compounds (as tin)
Aluminium chloride (as aluminium)
Aluminium oxide
Amyl alcohol
Benzaldehyde
Bismut oxide
Boron acid
Butanol (butyl alcohol)
Butylformiate
Butyl glycol
Phosphine
Butanal (ethyl acetic aldehyde)
Ceric oxide
Chlorbenzene
Cyclohexanone
Cyclohexanol
Zinc and its compounds (as zinc)
Dimethyl ether
Dioctylftalate
Emulsone
Ethanolamine
Ethylacrylate
Ethylbenzene
Ethylene
Ethylene oxide
Ethyl erher (diethyl ether)
Fluorine hydride
2-formylfuran
iron and its compounds (as iron)
isoamyl acetate
2-methylbutadiene-1,3 (isoprene)
isopropanol
calcium carbide
potassium oxide
caprolactam
xylene
magnesium chloride
magnesium oxide
manganese, manganese oxides
methanol
methybutylketone
methylcelosolvacetate
methyldiglycol
methylethyl ketone
methylmetacrylate
methylmethoxypropyl acetate
methylpentane molibdennum compounds
monoethanolamine
sodium sulphate
pynene
propylene
propanal (propionaldehyde)
silicone
antimony and its compounds (as antimony)
strontium carbonate
ethyl acetic acid (butyric acid)
tetramethylturamdi sulphite (TMTD)
toluene
thorium hydride
trichloroethylene
triethylamine
pentanic acid
bromine hydride
hydrogen peroxide
copper and its compounds (as copper)
vinylacetate
volfram oxide (volfram
anhydride,volframtrioxide)

IV group

p-amylacetate
1,3-butadiene
acetone
aluminium sulphate
aluminium
amophose
amonia
amonium acetate
amonium chloride
amonium nitrate (limestone)
carbon monoxide
benzylalcohol
butylacetate
cyclohexane
cyclopentane
methylen chloride
dimethylethylamine
dimethylsulfid
ethylenglycol
ethanol
ethylacetate
ethylacetone
ethylendiglycol
o-phosphoric acid

p-dioxybenzene
isobutane
isobutanol
isobutylacetate
2-methylpropene
isopentane
isopropylbenzene
calcium chloride
calcium carbonate
calcium oxide
potassium chloride
potassium hydroxide
colophony
carbamide
volatile organic compounds (VOC)
magnesium chlorate
methylacetate
methylacrylate
2-metoxy-2methylpropane
naphtalyne
sodium chloride
sodium hydroxide ,caustic soda
soda ash
sodium nitrate
sodium nitrite
oxalic acid
oleic acid
p-toluensulphonic acid
palmytinic acid
paraffin
lactic acid
propandiol-1,2 (propylenglycol)
solventnaphtha
sulphitic acid
terpentine
tetrahydrofuran (TGF)
titanium oxide

A 3.3 Emission limit values for fuel combustion

Emission limit values (ELV) for large combustion plants (rated thermal input > 50 MW) and other plants (0,12 – 50 MW) are set by the Order of the Minister of Environment No. 486 of September 28 '2002 which came into force from December 31' 2002. Order sets ELVs for major pollutants (SO_2, NO_X, solid particles, CO) emitted by fuel combustion plants depending on their rated thermal input, fuel used, status of the combustion plant ("new", "existing" [60]). Provisions concerning large combustion plants are harmonised with requirements of EU directive 2001/80/EC on the limitation of emissions of certain pollutants into air from large combustion plants.

Emission limit values enforced from 2004[61] are presented in tables below.

Combustion plants with rated thermal input less than 50 MW:

Type of fuel	Rated thermal input (MW)	ELV mg/Nm³		
		SO_2	NO_x	Solid particles
Gaseous	0.12 ≥ MW<1	-	350	-
Liquid	0.12 ≥ MW<1	1700	700	250
Solid	0.12 ≥ MW<1	2 000	650*	800

* - 750 mg/Nm³ ELV for biofuels;

Type of fuel	Rated thermal input (MW)	ELV mg/Nm³							
		SO_2		NO_x		CO		Solid particles	
		Existing plant	New plant	Existing plant	New plant	Existing plant	New plant	Existing plant	New plant
Gaseous	1 ≥ MW < 50	-	35	350	350	400	400	-	20
Liquid	1 ≥ MW< 20	1700	1700	650	450	500	500	250	200
	20 ≥ MW< 50			650	450	400	400	250	100
Solid	1 ≥ MW< 20	2 000	2 000	650*	650*	2 000 **	1 000**	700	400
	20 ≥ MW< 50	2 000	2 000	650*	650*	1 500	1 000	500	300

* - 750 mg/Nm³ ELV for biofuels

** - 4000 mg/Nm³ ELV for biofuels.

[60] "Existing" combustion plant – construction permit was issued before 1998 07 01; "new" combustion plant - construction permit was issued after 1998 07 01. From year 2008, ELVs set for "new" combustion plants will be applied for "existing" plants".

[61] According to the plans of the Ministry of Environment ELV for SO_2 (1700 mg/Nm³) for liquid fuel will be enforced only from May 1, 2004.

Large combustion plants (existing):

Type of fuel	Rated thermal input (MW)	ELV mg/Nm³			
		SO_2	NO_x	CO	Solid particles
		Existing plant	Existing plant	Existing plant	Existing plant
Gaseous	50-300	-	350	300	20
	>300-500		350	300	20
	>500		350	300	20
Liquid	50-300	1700	450	400	100
	>300-500		450	400	100
	>500		450	300	100
Solid	50-300	2 000	650	1 000	400
	>300-500	2 000	650	800	300
	>500	2 000	650	500	200

Large combustion plants (new):

Type of fuel	Rated thermal input (MW)	ELV mg/Nm³			
		SO_2	NO_x	CO	Solid particles
		New plants	New plants	New plants	New plants
Gaseous	50-100	5-800	350	300	5-50
	>100 – 500			300	
	>500			200	
Liquid	50-300	1700	450	400	50
	>300-500	1700-400		400	
	>500	400		300	
Solid	50-100	2000	650	700	100
	>100 – 500	2000-400		500	100
	>500	400		300	50

A 3.4 Transitional periods related to energy sector

The negotiations of Chapter 22. "Environment" lasted from 15 November 2000 until 27 June 2001. During this period the directives adopted by 2000 were discussed. The requirements of the Directives adopted later have been included into the acquis later. As the result of the negotiations, 4 transition periods were approved and only 2 of them are directly linked to the Energy sector. Those are the following:

1. Transitional period until the 31 December 2007 for the implementation of the requirements of the Directive 94/63/EC on the Control of Volatile Organic Compound Emissions Resulting from the Storage of Petrol and its Distribution

2. Transitional period until 31 December 2015 for the implementation of the requirements of the Directive 2001/80/EC on Large Combustion Plants to Vilnius, Kaunas and Mazeikiai power plants

The Directive 94/63/EC on the Control of Volatile Organic Compound Emissions Resulting from the Storage of Petrol and its Distribution limits the emission of volatile organic compounds (VOC) in entire petrol distribution chain: oil terminals, mobile tanks, railway tanks as well as petrol stations. As the directive requires meet certain technical standards, the transition period will be in

favour particularly for small petrol distribution enterprises, as they will have more time for allocation of investments to the transfer of technology.

The Directive 2001/80/EC on the Limitation of Emissions of Certain Pollutants into the Air from Large Combustion Plants limits the emissions from the plants that have installed capacity larger than 50 MW. The requirements imply more stringer limits of sulphur dioxide generated during the heavy fuel oil combustion process. Those requirements come into forces from 2008. Out of less than 50 installations the derogation is applied only for the 3 CHP: Vilnius, Kaunas and Mazeikiai power plants. Those companies have to meet the requirements set by the end of 2015.

It is worth to mention, that the EU requirements on sulphur content will be applied for petrol and diesel used in Lithuania from the year 2005. Starting from year 2004 heavy fuel oil with up to 2.5 % sulphur content will be allowed to be used in large combustion plants (e.g. boiler-house, electric power station) under condition that these plants keep up with SO_2 emission limits. If these plants are not able to comply with emission limits only heavy fuel oil with less than 1 % sulphur content will be allowed for use.
Moreover, by the year 2004, integrated permits should be issued for enterprises, that impose the requirements concerning pollution limits, waste management, energy saving (taking into consideration the best available technologies) for each enterprise or each equipment. The enterprises will have to implement the requirements not later than 30 October 2007. The requirements will be applied for new equipment from the year 2001.

Lithuania has applied for transitional periods for recently adopted Directive 2003/96/EC of October 27, 2003 restructuring the Community framework for the taxation of energy products and electricity. Harmonisation of requirements laid down in the Directive will necessitate the increase of current fuel excise duty rates (see Chapter 3.4.1.) and will broaden the range of taxable energy products. Lithuania has applied for transitional periods for taxation of energy products, which previously were not subject to excise duties (coal, lignite, coke, electricity). Lithuania has requested transitional periods on the following terms:

Energy product	**Tax rate and tax base**	**Transitional period till year**
Coal		
- for business purposes	13 LTL/tonne	2007
- other purposes	26 LTL/tonne	
Lignite, coke		
- for business purposes	16 LTL/tonne	2007
- other purposes	31 LTL/tonne	
Orimulsion	52 LTL/tonne	2016
Electricity		
- for business purposes	1.8 LTL/MW	2010
- other purposes	3.5 LTL/MW	

Currently (2003 November) it is not yet decided upon what (or whether) transitional periods will be negotiated. It is expected that decision concerning transitional periods will be made in the first quarter of year 2004.

A 3.5 Environmental Protection Priorities in Energy Sector

Extracts of the National Energy Strategy, approved by Resolution No IX-1130 of 10 October 2002 of the Seimas of the Republic of Lithuania:

43. In the energy sector Lithuania will comply with the international environmental conventions acceded to by Lithuania, with the National Environmental Strategy approved by Resolution of the Seimas of the Republic of Lithuania No I-1550 of 25 September 1996 (Official Gazette, 1996, No. 103-2347), the Strategy for Approximation in the Environment Sector and the National Strategy for the Implementation of the United Nations Framework Convention on Climate Change accepted by Resolution of the Government of the Republic of Lithuania No 1236 of 25 October 1996 (Official Gazette, 1996, No 105-2409) and the requirements of the EU environmental directives.

44. The main environmental directions for the energy sector in the nearest future are as follows:

1) in order to comply with environmental requirements, all combustion plants will have to reconsider by 2008 the structure of the fuel used and to prepare for fulfilling new requirements;
2) in order to ensure energy supply reliability, the largest Lithuanian power plants will have to install flue gas cleaning equipment;
3) priority in fuel consumption will be given to indigenous and renewable energy resources, having regard to the environmental and economic aspects of the use of these resources;
4) the Government shall prepare the required legal acts and measures ensuring stable long-term supply of indigenous and renewable resources to energy generating enterprises and other consumers;
5) improvement of radioactive waste management and reconstruction of radioactive waste storage facilities in conformity with international requirements;
6) ensuring pollutant emission monitoring in major thermal power plants and boiler houses;
7) implementation of oil products desulphurization technologies in the "Mažeikių nafta" Oil Refinery;
8) wider application of economic measures promoting pollution reduction and implementation of environmentally friendly technologies;
9) further development and improvement of the environmental taxation system by introducing pollution trading systems, green certificates systems and other measures;
10) priority environmental investment in the energy sector should be made in the atmosphere sector first of all in order to fulfil the EU requirements and other international obligations in the field of atmospheric pollution, taking into consideration the consequences of the Ignalina NPP decommissioning.

A 3.6 Energy Demand Forecast

Extracts of the National Energy Strategy, approved by Resolution No IX-1130 of 10 October 2002 of the Seimas of the Republic of Lithuania:

10. The new version (2000) of the Model for Analysis of Energy Demand (MAED) widely applied in Western countries in forecasting energy demand was used. This version offered better opportunities to analyse energy consumption in economic sectors depending on mutual relationship between the factors determining consumption and tendencies of their changes.

In drawing up the energy demand forecast, detailed information on the GDP growth, its structural changes, development of social indicators, technological indicators of energy consumption by economic sectors (industry, construction, agriculture, transport, household, trade and services sector), changes in energy consumption and other indicators was used.

11. Final energy demand has been predicted by estimating energy saving potential in particular economic sectors in accordance with the executive summary of the National Energy Efficiency Programme revised and updated in 2001. The total increase in energy efficiency has been predicted by taking into account a reduction in energy intensity, i.e. a decrease in the final energy consumed per GDP unit. Final energy means the share of primary natural resources (coal, natural gas, oil, etc.) and secondary energy resources (electricity, petroleum products, district heat, etc.), which is consumed for a particular type of industrial production, for a desired quantity of services provided by the services sector and a desired level of living conditions. Final energy is directly consumed by final consumers (industrial and agricultural enterprises, enterprises in the transport and services sector, individual consumers, etc.) in their equipment.

A thorough analysis shows that in all cases the final energy demand in 2020 would not exceed the demand in 1990. At the end of the forecasting period, the consumption of fuel and energy in the basic scenario would be 6.2 million tons of oil equivalent, or 71 % of the amount in 1990. In this case, the energy intensity index in 2020 would constitute only 49 %, as against 1990, while energy efficiency according to this indicator would be close to the current average level in the European Union.

12. The decrease in the electricity consumption in 1990-2000 was the least as compared to the consumption of other energy forms. However, at present Lithuania is lagging behind developed European countries in terms of the comparative indicator of electricity consumption in economic sectors per capita (1860 kWh per capita), i.e. the average indicator in the European Union in 1999 was 3.1 times higher. Thus, according to forecasts, the modernisation of the national economy could lead to the fast growth of electricity demand, and its share in the structure of final energy would increase according to all scenarios and in all economic sectors. During the period until 2010, electricity demand in economic sectors in the basic scenario could increase annually by 4.3 % on average. According to this scenario, electricity consumption in 2020 could exceed the 1990 level nearly 1.1 times.

District heat consumption decreased nearly three times in 1990-2000. In all cases, the district heat demand in 2020 will not reach the 1990 level. At the end of the forecasting period, the district heat consumption in sectors of the Lithuanian economy in the basic scenario would be 1.3 times higher than in 2000.

13. With the closure of the Ignalina NPP by the end of 2009, primary energy demand in the basic scenario would increase only by approximately 30 % during the period until 2020. However, total demand for fossil fuel would increase almost 1.9 times within 20 years, i.e. from 5 million tons of oil equivalent in 2000 to 9.4 million tons of oil equivalents in 2020. The increase in natural gas consumption would be particularly rapid – from 2.1 million tonnes of oil equivalent in 2000 to 5 million tons of oil equivalents in 2020. During the forecasting period the share of natural gas in the primary energy balance would increase from 28.5 % to 53 %. The forecasts predict that at the end of the period the share of indigenous (excluding indigenous crude oil) and renewable resources in the total primary energy balance would increase by up to 14 %, while the share of petroleum products would constitute about 32 %.

A 3.7 Implementation of Kyoto mechanisms

Current status
Lithuania has signed the United Nations Framework Convention on Climate Change in June 1992. The Seimas (the Parliament) of the Republic of Lithuania ratified the Convention on 23 February 1995 and it has entered into force for our state since 22 June 1995. Since then, Lithuania has started an inventory of greenhouse gases (GHG). The National Climate Change Implementation Strategy and Action Programme was prepared. First National Communication prepared in 1998 was followed by the Second National Communication in 2002. It is claimed that the delay in preparation of the second communication was due to the lack of resources.

The Kyoto Protocol was signed by the President of the Republic of Lithuania in October 1998. According to Annex B to the Kyoto Protocol, Lithuania has pledged itself to reduce GHG emissions by 8 percent below 1990 emission level by 2008-2012.

In Lithuania GHG emissions currently are significantly below Kyoto target. CO_2 level in 1990 was 42 Mtonnes, thus in year 2012 Lithuania could emit 39 Mtonnes of CO_2. In year 2000 the CO_2 emission was only 16 Mtonnes and was almost at the same level in the successive years. Such a drastic decline is due to the recession of economy and reduction of energy consumption. Generally, it is stated that during the last decade the rate of the emitted amount of CO_2 equivalent and GDP was decreasing not due to the decline of the economy, but because of increase of energy efficiency and implementation of new technologies (Lithuanian Energy Institute, 2002).

General economic and energy data are presented in Table 46 below. The table shows that energy efficiency is quite low and thus could be improved (for example energy efficiency in Estonia reaches 2.24).

Table 46 General economic and energy data.

	Main data	**Unit**	**Value for Lithuania**
1	GDP	Billion Lt	45.3
2	Population	103 inhabitants	3506
3	GDP/capita	103 Lt/cap	12.9
4	Primary energy supply	Mtoe	7.72
5	Final energy consumption, FEC	Mtoe	4.08
6	Gross electricity consumption, GEC	TWh	10.09
7	Final electricity consumption, FELC	TWh	6.20
8	Losses in the networks	TWh	1.28
9	Efficiency of power sector, GES/FELC		1.75
10	Primary energy/capita	toe/capita	2.2
11	Final energy/capita	toe/capita	1.16
12	FELC/capita	KWh/capita	1768
13	Primary energy per GDP unit,	kgoe/103 Lt	170
14	Final energy per GDP unit	kgoe/103 Lt	90
15	FELC per GDP unit	KWh/103 Lt	137
16	Energy efficiency TPES/FEC		1.89

As regards the energy production, about 80 % of the energy is produced by the Ignalina Power plant. However, the plant should be decommissioned in phases: First reactor in 2005 and the second reactor - by 2010. It is forecasted that after the closure of the Ignalina Nuclear Power Plant, total fuel demand will increase by 30 %. It implies that energy will be generated by co-generation plants (CHP) coursing a level of emissions of carbon dioxide CO_2 to reach the level of 1990. Then the Kyoto commitment will require Lithuania to undertake serious steps toward achieving the Kyoto targets.

The projections for the GHG are calculated in the Lithuanian Energy Institute. Three different scenarios were used to project energy consumption and the emissions from energy sector.

It is estimated that 90 % of CO_2 comes from the energy sector and about 30 % of CO_2 equivalents would be emitted from heat sector. The historical data and projections are presented in figure 8 below.

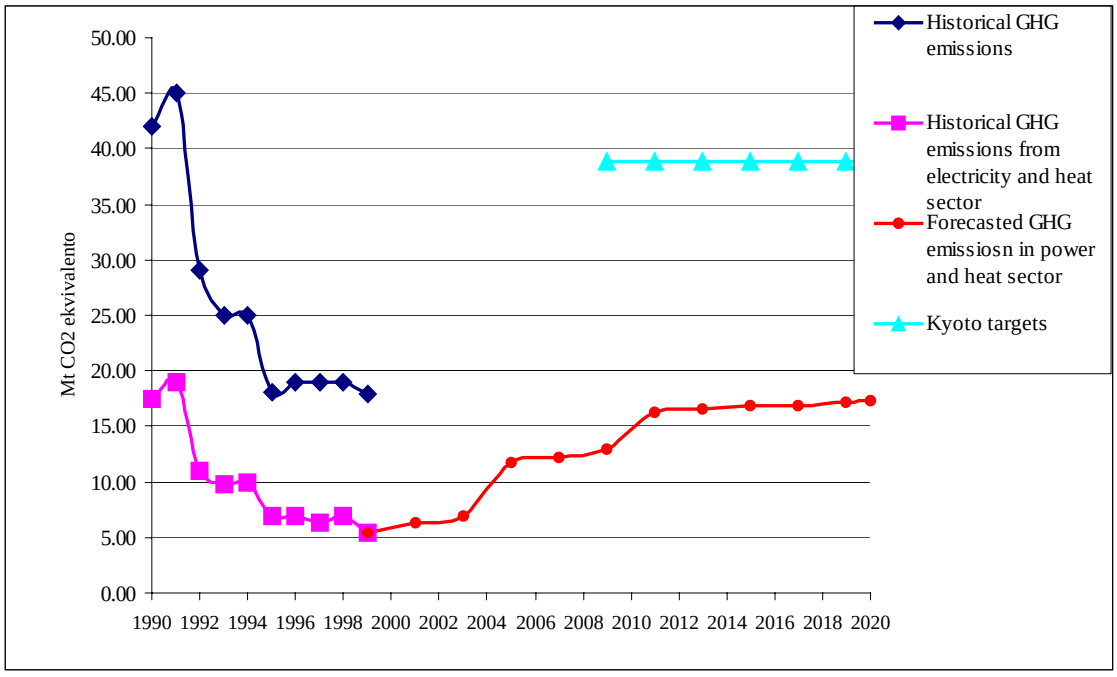


Figure 8 GHG historical data and projections in Lithuania (source: Lithuanian Energy Institute).

Activities Implemented Jointly in Lithuania

Activities Implemented Jointly in Lithuania started in 1993 in the framework of the Swedish Programme for an Environmentally Adapted Energy System (EAES) in the Baltic Region and Eastern Europe. The Programme is financed by the Swedish Government and carried out in co-operation with the Swedish National Energy Administration (STEM, formerly NUTEK), which is the assigned body by the Swedish Government for the implementation of Activities Implemented Jointly projects. The Swedish National Energy Administration is also responsible on reporting about AIJ to the UNFCCC Secretariat. The EAES Programme is formulated in line with the

UNFCCC provisions on AIJ and is a part of Sweden's climate strategy contributing to the AIJ pilot phase. It was one of the country's initiatives to support the upgrading of the energy system in the Baltic region and Eastern Europe. The programme involves projects on shifting from fossil fuels to bio-fuels for heat production (boiler conversion projects) and, to a lower extent, projects on energy efficiency improvement of district-heating systems and the residential sector (district-heating renovation and renovation of buildings projects). The activities are directed towards the heating systems: heat production, heat distribution and end-use of district heating in the residential sector. Majority of the projects aim to cut CO_2 emissions by converting heating plants to the use of bio-fuels and some of them introducing energy efficiency measures in the distribution systems of district-heating plants. The successful implementation of these AIJ projects initiated many other boiler conversion projects by local companies.

The Swedish National Energy Administration provides financial and technical, i.e. consultancy support for the implementation of the AIJ projects. As regards to financial assistance, all the plant owners in Lithuania received loans with 10 years repayment time on favourable conditions, i.e. with two years grace period and at the interest rate equal around 3.0 %, what is much lower than a normal lending rate in Lithuania. Normally the projects show good profitability with short pay-off periods, for example three-five years for boiler conversion projects.

Up to date Sweden is the only AIJ investor country in Lithuania. Other Nordic countries also discuss a plan to use the Baltic Sea Region as a 'testing ground' for the Kyoto mechanisms. One of the proposals is to establish an investment fund to support climate-oriented projects in the region. Potential investor countries for Lithuania might be northern countries, like Norway, Finland, Sweden and Denmark. In these countries the majority of electricity generation is based on renewable energy sources. Therefore, CO_2 reduction in the electricity supply sector in these countries would be quite expensive. Another reasons for the mentioned countries to be potential investors are the geographical location and the size of these countries. On 19 March 2001, the Memorandum of Understanding was signed in between of the Lithuania Ministry of Environment and the Finish Ministry of Environment. According to it, both countries agreed on co-operation implementing projects jointly with the aim to reduce GHG emissions.

It should be noted that the boilers which participated in the AIJ were using either heavy fuel oil or coal, therefore, the fuel and boiler performance level (i.e. low efficiency) were causing high emission level and, consequently, high environmental taxes. On the other hand, all the implemented AIJ projects have been financially profitable projects, therefore, other programmes or commercial banks could have financed them. The Lithuanian Government could help to create local programmes that would finance financially profitable projects, and save the AIJ/JI potential for financially not/less profitable projects that are hard to fund from other, especially domestic, programmes. Moreover, the increasing energy prices are expected to speed up the expected technology change. Higher energy prices create a strong initiative for energy efficiency improvement projects. Therefore, future AIJ/JI projects that are financially profitable should not be accepted as AIJ/JI projects, if they can be implemented by other programmes.

Related projects and activities at national scale

Lithuania participates in the Nordic – Baltic co-operation in energy sector BASREC programme, co-ordinated by the Nordic Council of Ministers. (BASREC – ad hoc group for Climate Change, 11 countries in the BSR, established in 1999). Among the other activities, the important part will be the adaptation of the emission trading simulation game, development of sector-baseline for energy

related Joint Implementation, testing ground for emission trading in the region (Testing Ground Agreement, signed by 7 countries in September 2003).

Implementation of the EU directive on large combustion plant and the EU directive on National Emission Ceilings has a close link with the implementation of the Kyoto protocol. The consequences those directives for Lithuania have been evaluated in 2002.

Currently a comparative analysis of policy of GHG takes place under the project named Challenges of Kyoto commitments for Baltic States' Energy Sectors. The project (2003 -2004) is led by Lithuanian Energy Institute, and funded by the Nordic Council of Ministers. The goal of the project is to evaluate the feasibility of three Baltic States to implement their commitments under the Kyoto protocol and foreseen and already implemented GHG mitigation policies and measures.

Moreover, there is an initiative to elaboration the Joint Implementation Strategy and a working group was set and seminar was organised for that purpose in summer 2003.

In addition, a project on the preparation of the GHG registry is on the way. It is planned to design a prototype for the registry, which then could be further developed.

A 3.8 Energy Prices

Extract from Environmental Requirements to the Energy Sector Final Report March 2002 Danish Energy Agency:

In this section, the average prices of different fuels during year 2000 in Lithuania have been estimated. The prices presented are so-called economic prices, which are prices exclusive of taxes, and which are applied when analysing the consequences of implementing the EU directives from the point of view of the Lithuanian Society. When analysing the consequences of implementing the EU directives from the point of view of the large combustion plants, financial fuel prices should be applied. The following taxes and costs of handling of fuels have been applied in setting fuel prices, table 47.

Table 47 Taxes and cost for handling/transportation of fuel to large consumers.

	Excise taxes	**VAT**	**Cost of inland handling/transportation**
HFO, 2.5 % S	45 LTL/tonne	18 % on sales price	60 LTL/tonne
HFO, 1 % S	45 LTL/tonne	18 % on sales price	60 LTL/tonne
Orimulsion	45 LTL/tonne	18 % on sales price	60 LTL/tonne
Light fuel oil	720 LTL/tonne	18 % on sales price	60 LTL/tonne
Natural gas	0	18 % on sales price	100 LTL/1000 m^3
Wood chips	0	18 % on sales price	15 LTL/m^3

Economic Energy Prices
The prices have been estimated as follows:
Basis has been average prices in year 2000. In year 2000, the average price of HFO (2-2.5 % S) supplied from "Mažeikių nafta" oil refinery to large combustion plants was 450 LTL/tonne delivered at plant site (taxes excluded). According to the refinery, desulphurisation at "Mažeikių

nafta" oil refinery would raise the prices of HFO by 120 LTL/tonne. In year 2000, the average price for HFO (sulphur < 3.5 %) based on FOB Rotterdam was 125 USD tonne. Cost of transportation from Rotterdam to Klaipeda is estimated at 10 USD per tonne and handling/inland transport from Klaipeda to end-user is estimated at 15 USD per tonne. Based on the above, it is expected that HFO (sulphur > 3 %) could have been supplied from Western Europe to large combustion plants at a price of 600 LTL/tonne delivered at plant site. At Rotterdam, the price of HFO (Sulphur < 1 %) is normally 25 USD/tonne higher than HFO (Sulphur < 3.5 %).

In year 2000, the average price of natural gas supplied to large consumers (> 5 million m^3 per year) was 410 LTL/1000 m^3. The price of wood chips is estimated based on information provided by Lithuanian Energy Institute and COWI-Baltic.

Summarising the above, the prices in table 48 below have been reached:

Table 48 Average prices in year 2000 of different fuels supplied to large consumer in Lithuania – the prices are based on delivery at plant site and exclusive of any taxes.

Product	**Supplier**	**Calorific value**	**Price**	**Energy price (LTL/MWh)**
HFO – 2.5 % S	"Mažeikių nafta"	11.0 kWh/kg	450 LTL/tonne	40.9
HFO – 1 % S (this product is not available)	"Mažeikių nafta"	11.0 kWh/kg	570 LTL/tonne	51.8
Natural gas	Lithuanian Gas Company	9.4 kWh/Nm^3	410 LTL /1000 m^3	43.6
Wood chip	Domestic suppliers			25
Heavy fuel oil <3.5 % S	Western Europe		600 LTL/tonne	54.5
Heavy fuel oil <1.0 % S	Western Europe	11,0 kWh/kg	700 LTL/tonne	63.6
Orimulsion	Venezuela	7.7 kWh/kg	240 LTL/tonne	31.0

A 3.9 Electricity tariffs in 2003 LTL cent/kWh

Tariff element	0.4 kV voltage level	6-35 kV voltage level		110 kV voltage level (without transmission and capacity reserve services)
		Depending on the meters place		
		At primary voltage	At 0.4 kV voltage	
FOR RESIDENTIAL CUSTOMERS, INCLUDING VAT				
One-part tariff:				
for residents	29.0	20.0	20.4	
for residents, using the electric stoves*	24.0			
for residents, using more than 12000 kWh per year**	22.0			
Time of use tariff:				
day-time	33.0	24.0	24.4	
day-time, using the electric stoves*	27.0			
day-time, using more than 12000 kWh per year**	26.0			
night-time and weekend	16.0	11.3	11.5	
night-time and weekend, using the electric stoves*	13.0			
night-time, using more than 12000 kWh per year**	12.0			
FOR ALL OTHER CUSTOMERS, EXCLUDING VAT				
One-part tariff	26.0	18.0		11.21
Time of use tariff:				
day-time	28.5	20.5		
night-time and weekend	16.1	11.2		
Differentiated tariff:				
minimum demand (23.00-7.00 h)	18.4	12.8		7.11
medium demand	23.8	16.0		9.11
maximum demand	37.5	25.6		14.61
during weekends and national holidays (7.00-23.00 h)	18.4	12.8		7.11
FOR THE ELECTRODE BOILER-HOUSES, EXCLUDING VAT				
One-part tariff		18.0	26.9	
Differentiated tariff:				
minimum demand (23.00-7.00 h)		8.3	12.1	
medium demand		16.4	23.8	
maximum demand		34.2	47.4	
during weekends and national holidays (7.00-23.00 h)		8.3	12.1	

*) Tariff is applied to the residential customers, who do not have the stationary gas kitchen-ranges at their flats or houses, and there are stationary electric stoves, which were provided in the projects of houses or assembled according to the permitted technical terms by energy supply utilities.

**) Tariff is applied, when a customer writes the request to the supplier. After the end of the year the payments are recalculated to the residents, whom these tariffs were applied and which consumed less electricity per year, by the tariff, which corresponds to the actual amount of the consumed electric energy.

Note:
1 EUR = 3.4528 Litas, The distribution network operators and customers, receiving electricity from the transmission grid pay for the transmission service at tariffs and prices effective from April 1, 2002.

A 3.10 The transmission service prices

The transmission service prices (VAT not included) by types of services provided to distribution network companies and customers who receive electricity from the transmission grid.

Non-differentiated price of TSO service:	
when property borderline is between 330-110 kV voltage equipment	2.0 LTC/kWh
when property borderline is between 35-6 kV voltage equipment	4.0 LTC/kWh
Non-differentiated price of capacity reserve service	1.39 LTC/kWh
Price of service to meet public interest	0.0 LTC/kWh
Preferential two-component transmission system service price:	
capacity component, when property borderline is between 330-110 kV voltage equipment	5.41 LTL/kW per month
capacity component, when property borderline is between 35-6 kV voltage equipment	10 LTL/kW per month
Energy component, when property borderline is between 330-110 kV voltage equipment	1.02 LTC/kWh
Energy component, when property borderline is between 35-6 kV voltage equipment	1.04 LTC/kWh
Differentiated capacity reserve service price - capacity component	7.42 LTL/kW per month

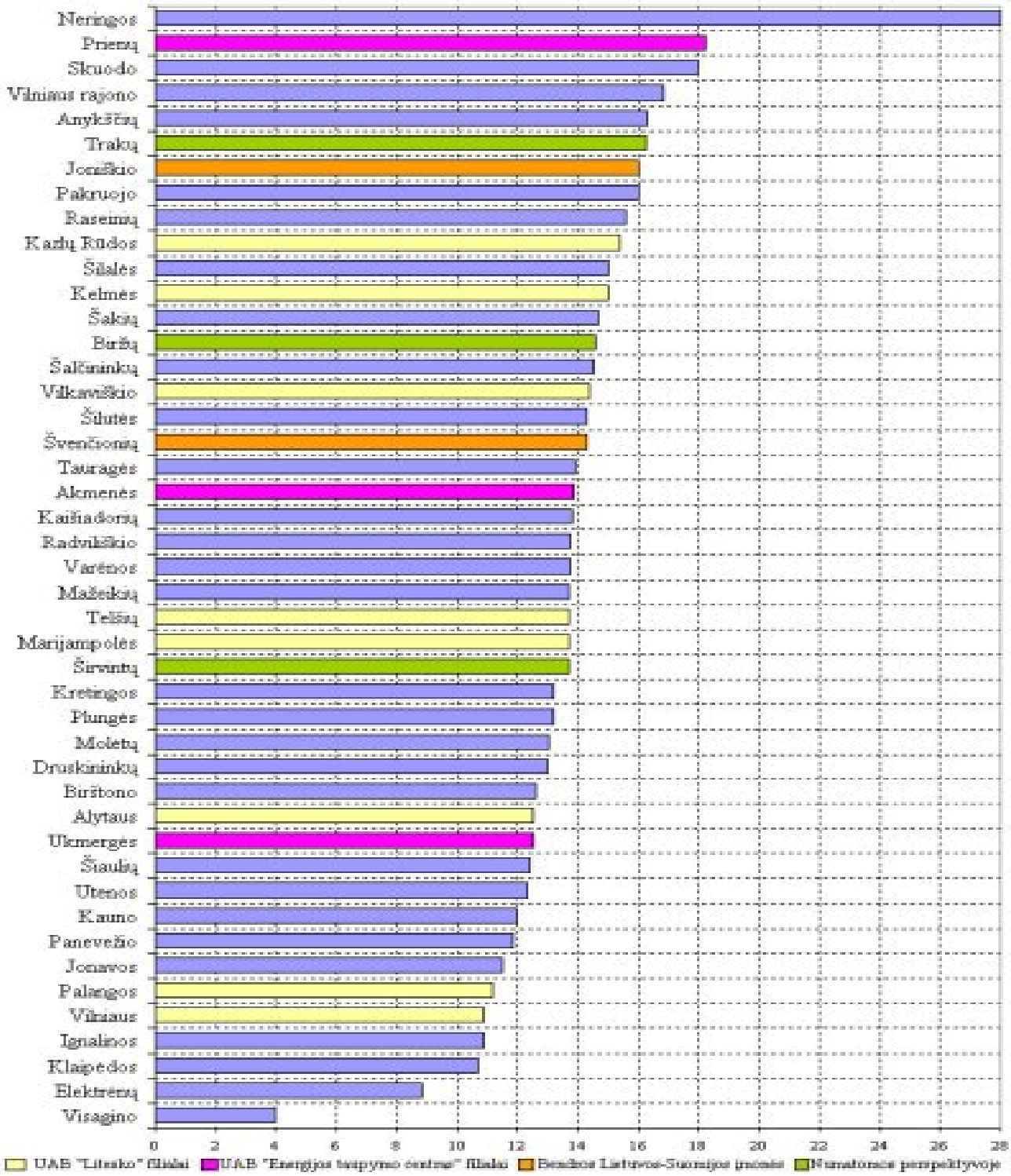
During the period of April 1, 2002 - September 1, 2002 the price of transmission service varies by types of services. However, these prices are not composed of capacity and energy components – customers pay TSO service price, general system transmission service price, capacity reserve service price and public interest service price for the active electricity supplied to customer, by LTC/kWh.

The transmission service price is composed of capacity and energy components since September 1, 2002.

A 3.11 Average electricity prices by consumer groups in 1993 – 2001 Euro cent/kWh without VAT.

CUSTOMERS GROUPS	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Industry	2.15	2.83	3.81	3.99	4.03	4.10	4.09	4.63	4.41
Agriculture	1.89	2.57	3.70	3.99	4.15	4.28	4.23	5.74	5.94
Residents	1.87	2.79	4.58	4.88	4.45	4.83	4.77	5.99	6.15
Other consumers	1.98	2.84	4.66	5.08	5.01	4.87	4.98	6.17	5.85
Average tariff	2.00	2.79	4.14	4.41	4.35	4.46	4.49	5.39	5.39

A 3.12 Prices of district heating in different Lithuanian municipalities (LTL cent/kWh) in 2001.



A 3.13 Base tax tariffs on oil extraction

Appendix 1 of the order Law on Oil and Gas Natural Resources No. IX-1564, 20 May 2003.

For Inland fields:

Annual output (thousand tonnes)	Basic tax rate (%)
Less than 10	2
10–25	4
25–50	6
50–75	8
75–100	10
100–125	12
125–150	14
more than 150	16

For offshore fields:

Annual output (thousand tonnes)	Basic tax rate (%)
Less than 100	2
100–200	4
200–300	6
300–400	8
400–500	10
500–600	12
600–700	14
More than 700	16

A 3.14 Main economic indicators

Extract from Environmental Requirements to the Energy Sector Final Report March 2002 Danish Energy Agency:

Economic growth in Lithuania in recent years, after the initial downturn following the disintegration of the Soviet Union, has been growing at an accelerating pace, achieving even 9 % during first quarter of 2003. The average annual growth rate was over 5 %.

In 2001 GDP grew by 6.5 %, and in 2002 by 6.7 %. The final consumption (what is more related to water consumption possibilities) grew at the lowest pace – 4.2 %. In the latter years, the growth of the final consumption is slower than that of GDP. Due to the appreciation of the exchange rate the average annual inflation declined from 5.1 % in 1998 to the average 0.8 % in the years of 1999 to 2002.

Unemployment levels have historically been low. However, in the last ten years there has been a notable increase. This has been partly caused by economic downturn and privatisation. The

maximum levels of unemployment were reached in 2001 and since then unemployment is decreasing.

GDP and average monthly salary indicators over the latter years are presented in table 49 below.

Table 49 Main economic indicators.

Parameter	1996	1997	1998	1999	2000	2001	2002
GDP growth, real, %	4.7	7.0	7.3	-1.8	4.0	6.5	6.7
GDP growth, nominal, %	27.2	22.2	13.1	-2.2	4.9	6.3	6.7
Unemployment rate, %	7.1	5.9	6.4	8.4	11.5	12.5	11.3
GDP per capita, current prices, Lt	8.510	10.347	11.611	11.529	12.157		
GDP per capita, constant prices, Lt	6.804	7.307	7.687	7.393	7.645		
Change in %, 1995=100%	4.9	7.4	5.2	-3.8	3.4		
Average monthly salary (brutto), Lt	618	778	930	987	971	982	1034

A very important role in the consumption of water plays the level of disposable household income and expenditure. The trend of previous years is given in the table below.

Table 50 Average disposable income and expenditure per capita per month in Litas.

	1996	1997	1998	1999	2000	2001	2002
Disposable income	326.7	368.9	422.5	428.0	415.4	409.9	422.0
Disposable income in cash	253.0	297.0	350.4	360.4	349.4	346.1	359.7
Disposable income in kind	73.7	71.9	72.1	67.6	66.0	63.7	62.3
Consumption expenditure	348.1	382.6	426.8	425.4	404.4	411.0	416.1
Consumption expenditure in cash	274.7	311.3	354.9	358.8	338.7	347.3	353.9
Consumption expenditure in kind	73.3	71.3	72.0	67.5	65.7	63.6	62.1

Source: Household income and expenditure, Statistics Lithuania, Vilnius, 2002, and website of the Ministry of Finance (for years 2001 and 2002).

Disposable income and expenditure were impacted by the general economy downturn in 1999, but starting from 2000 it increases again.

A 3.15 Macro-economic/sector policies and population growth – short term trends.

Population

There are no official population trends in Lithuania. The population has been decreasing and no major fluctuation pattern may be detected between districts. Most of investment projects under preparation in environmental sector in Lithuania accept the population growth rate at 0 % or assume some slight increase of inhabitants in towns by 0.2 % and decrease in rural areas by 0.3 %. Any mentioned trend cannot have considerable impact on water resource uses, therefore cannot be considered as a pressure for planned 20 years period.

Employment
The current demographic situation in the country enables to predict that in the period from 2003 to 2006 a number of the most economically active population will decrease, and this will result in the decline of the activity level and manpower. Impressively increased number of the employed in 2002 points to that enterprises have used off available manpower resources and to continuously increase the outputs will be possible by recruiting additional employees. The employment expansion will be initiated by the EU financial aid. Therefore, despite the decline in the activity rate, the employment will constantly increase and will further the growth of production.

Table 51 Historical unemployment rates and short-term forecast (%).

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
7.1	5.9	6.4	8.4	11.5	12.5	11.5	10.8	10.2	9.1	8.5

Income levels
The accession to the European Union will have a positive impulse to the consumption growth. The average monthly salary is forecasted to grow from LTL 1089 in 2003 to LTL 1333 in 2006.

Economic activities
The data published by the Department of Statistics suggest that Lithuania's real GDP will sustain the growth trends, disregarding the risks of global recession. External prerequisites and factual data updated by the Department of Statistics justify the forecast that Lithuania in the middle term may maintain a sustainable annual economic growth of 6 %. In 2003 GDP growth would account for 6.1 %, in 2004 – 6.2 %, in 2005 – 6.5 %, in 2006 – 6 %. During the forecast period the economic growth will be accelerated by changes associated with the envisaged Lithuania's integration to the EU. Boosting growth of investments, increase in the general government's consumption expenditure is predicted in 2004.

Export and import prices are projected to decline in 2003, and the average rate of consumer prices will remain almost stable.
GDP growth forecast is based on the assumption that the economic development in Europe will take a gradually accelerating pace. GDP growth will be sustained due to Lithuania's business facilities for competitiveness either in domestic or foreign markets. The EU accession will have a positive impulse to the economic development: in 2002–2003 the pre-accession aid was employed in Lithuania, in 2004–2006 the EU Structural Funds and other EU financial assistance will accelerate the GDP growth pace.

Sectors, providing goods and services for export, will remain the basis for the economic growth: the industry will keep growing, other business activities (especially software development), transport and storage, wholesale and retail trade will continue developing.

Industrial output
The industrial activities are diversified from a district to another. The average industrial output of districts belonging to separate river basins is shown in the following table.

According to the forecasts of the Ministry of Finance (MoF), the GDP should grow in the next years as shown in the following table:

Table 52 Forecasts of the GDP growth (%).

GDP	**2003**	**2004**	**2005**	**2006**
Real increase	6.1	6.2	6.5	6.0
Nominal increase	6.1	7.1	8.2	7.8

A main issue in the framework of water consumption and wastewater generation forecasting is represented by the expected changes in disposable household income. MoF short-term forecasts are given in the tables below. They are available only up to the year 2006. In average the growth rate planned comprises approximately 5 %. Based on those forecasts, we may assume that the similar pace will continue up to 2011. Starting from 2012, we assume growth of household disposable income by 3 %. In the following table the forecasted short-term growth of household disposable income per capita is presented.

Table 53 Disposable household income short-term forecasts.

Household income	**2002**	**2003**	**2004**	**2005**	**2006**
All households, million Lt per year	31385	33115	34743	36850	38852
Growth in %, 2002 = 100%	100	105.5	110.7	117.4	124.0

APPENDIX 4: Specifications of environmental classes for fuels in Sweden.

Table 54 Requirements of environmental classes for gasoline in Sweden.

Requirements	**Environmental class 1 motor gasoline**	**Environmental class 1 alkylate gasoline**	**Environmental class 2**
Research octane number, minimum	95	-	95
Motor octane number, minimum	85	-	85
Vapour pressure according to Reid, maximum, kilo Pascal	70/95	65	70/95
Vapour pressure according to Reid, minimum kilo Pascal	45/65	50	-
Distillation:			
- Evaporated at 70ºC, volume percent	-	15-42	-
- Evaporated at 100ºC, minimum volume percent	47/50	46	46
- Evaporated at 100ºC, maximum volume percent	-	72	-
- Evaporated at 150ºC, minimum volume percent	75	-	75
- Evaporated at 180ºC, minimum volume percent	-	95	-
Final boiling point, maximum ºC	205	200	-
Olefins, maximum volume percent	13.0	0.5	18.0
Aromates, maximum volume percent	42.0	0.5	42.0
Benzene, maximum volume percent	1.0	0.1	1.0
Cykloalkanes, maximum volume percent	-	0.5	-
n-Hexan, maximum volume percent	-	0.5	-
Oxygen, maximum mass percent	2.7	-	2.7
Oxygenates:			
- Methanol, maximum volume percent, stabilisation agents have to be added	3	-	3
- Ethanol, maximum volume percent, stabilisation agents can be necessary	5	-	5
- Isopropyl alcohol, maximum volume percent	10	-	10
- Tertiary butyl alcohol, maximum volume percent	7	-	7
- Isobutyl alcohol, maximum	10	-	10

volume percent			
- Ethers with5 or more carbon atoms per molecule, maximum volume percent	15	-	15
Other oxygenates, maximum volume percent	10	-	10
Sulphur, maximum milligram per kilogram	50	50	150
Lead, maximum gram per litre	0.005	0.002	0.005
Phosphorus	not measurable	-	-
Density at 15ºC, kilogram per cubic meter	-	680-720	-

Table 55 Requirements of environmental classes for diesel fuel in Sweden.

Requirements	**Environmental class 1**	**Environmental class 2**	**Environmental class 3**
Cetan index, minimum	50	47	-
Cetan number, minimum	51	51	51
Density at 15ºC, minimum kilogram per cubic meter	800	800	-
Density at 15ºC, maximum kilogram per cubic meter	820	820	845
Distillation:			
- Starting boiling point,			
minimum °C	180	180	-
- at 95 percent distillate, maximum °C	285	295	360
Aromatic hydrocarbons, maximum volume percent	5	20	-
Polycyclic aromatic hydrocarbons, maximum volume percent	not measurable	0,1	-
Polycyclic aromatic hydrocarbons, maximum mass percent	-	-	11
Sulphur, maximum milligram per kilogram	10	50	350

APPENDIX 5: Definition of "industrial activity" and "production process"

Industrial activity
The legislator has in this case expressed that the Swedish standard for branch of industry, SNI 92 can be used as a guideline. Item C (extraction of mineral, code 10-12) and D (production, code 15-37) are considered as industrial activities. It has been expressed in preparatory work to the legislation that the term industrial activity shall be interpreted generously and that the focus shall be to avoid unfair competition (SkU 1976/77:22 p. 13). Problem exists for example in the distinction between artistic and industrial activities (glass blowing, sculpturing) and printing and computer activities.

Production process
For exemption from tax the activity has to be a part of a production (manufacturing) process and not only be a part of an industrial activity. The Swedish National Tax Board (RSV) has published a guideline which cover the interpretation problem, "Allmänna råd om beskattning av bränslen enligt lagen (1994:1776) om skatt på energi (RSV 2002:18)", "General advises concerning the taxation of fuels according to the law (1994:1776) of tax on energy (RSV 2002:18)". According to RSV the interpretation of the extent of the production process (start and end point) shall be the standard classification of the main business activities in a company – manufacturing, sales, administration and research and development (R&D). One should not make a geographic distinction in the manufacturing, thus e.g. also heating of storage or offices in connection to the manufacturing can be included in the manufacturing process. Similar statements have been made by RSV concerning the use of electric power in the production process "RSV:s rekommendationer m.m. om energiskatt på elektrisk kraft (RSV Sp 1999:1)", "RSVs recommendations etc. on energy tax on electric power (RSV Sp 1999:1)".

APPENDIX 6: Additional information on economic instruments in different countries.

A 6.1 Air Emission Charges and Taxes

Table 56 Air Pollution Charges and Fines in Central and Eastern Europe.

Country	Type	Goal / function	Subject: who pays	Basis and # of pollutants chargeable	Factors determining charge rates	Level / rate, end 97' (USD/t)	Indexed for inflation?	Revenue leaders	Yearly revenue (million USD)	Yearly revenue / capita (USD)	Collection efficiency (%)	Revenue distribution	Effectiveness / comments
Bulgaria	NCF	Compl RR	Stationary industrial sources & energy prod.	16 air pollutants	Quan, ExceedS, Time, MinS, Tox, Regio	n.a. (accord. to a formula)	No but to national minimum salary	SO_2, NO_2, CO, dust, Cu, Pb, phenols	1994: 0.04 1995: 0.34 1996: 0.18 1997: n.a.	1994: 0.00 1995: 0.04 1996: 0.02 1997: n.a.	1994: 25.4 1995: 27.3 1996: 30.0 1997: n.a	70% NEF 30% SEF	80% waiver if environm. investments accepted by MoE are done. Enforcement problems esp. with state-owned industry. Inability to pay. Low fine rates.
Czech Republic	EC (a)	RR Incent	medium & large indust. sources & energy prod	ca. 90 air pollutants	Quan, Tox	SO_2: 29 Part.: 88 NO_x: 24 CO: 18	No	SO_2	1994: 46.6[1] 1995: 45.6[1] 1996: 48.0[1] 1997: n.a.[1]	1994: 4.5[1] 1995: 4.4[1] 1996: 4.7[1] 1997: n.a.[1]	n.a.	100% NEF (earmark. For air poll. Programs)	Introduction of higher charge rates planned. Plans to reduce # of chargeable pollutants. Plans to decentralise certain charges.
	EC (b)	Incent	small busin. heat. syst.	heating syst. performance	Fuel type, Tox		No					100% SB	
	NCF	Compl	like EC (a)	like EC (a)	Like EC (a)	1.5 x EC	No		n.a.	n.a.	n.a.	Like EC (a)	
Estonia	EC	Incent RR	Stationary industrial sources	6 standard pollutants + 134 other pollutants	Quan, Tox, ExceedS, Regio	SO_2: 2.3 NO_x: 5.3 CO: 0.3	No, but revised each year.	Dust, SO_2, NO_x	1994: 0.5[2] 1995: 0.6[2] 1996: 0.8[2] 1997: 0.8[2]	1994: 0.3 1995: 0.4 1996: 0.5 1997: 0.5	> 90%	100% NEF (earmark. For air poll. Programs)	Low efficiency due to weakness in emission permit system. Evaluation study on the effectiveness of this charge is underway. Revenue has risen in past years due to gradually increased charge rates.
	NCF	Compl				SO_2: 116 NO_x: 265 CO: 1.7							
Hungary[4]	NCF	Compl RR	Stationary and diffuse industrial and building sources	ca. 200 air pollutants (self reporting) or violation of law.	Quan, ExceedS, Time, Tox, Regio, Height	n.a. (complicated formula)	No	SO_2, NO_x, CO, Dust	1994: 6.4 1995: 3.6 1996: 5.7 1997: 3.2[3]	1994: 0.6 1995: 0.4 1996: 0.6 1997: 0.3[3]	n.a.	70% NEF 30% SB	Part of the fine can be waived if environm. investments accepted by MoE are done. For violating reporting duties the fines can be doubled. New air EC proposed.

Latvia	EC	Incent RR	All legal and natural persons discharging chargeable air pollution	4 classes with > 160 air pollutants (self report.)	Quan, Tox	Dust: 5 CO: 8 SO_2: 17 NO_x: 17	No	n.a.	n.a.	n.a.	n.a.	40% NEF 60% SEF	There is a charge waiver available to subsidise the financing of air pollution related investment projects, which are accepted by the MoE.
	NCF	Compl			3 x EC for emissions above the limit; 12 x EC for illegal or no reporting							100% NEF	
Lithuania	EC	Incent RR	Stationary and mobile industrial sources	more than 100 pollutants	Quan, Tox	SO_2: 52 NO_x: 97 CO: 2.3	Quarterly indexation.	n.a.	n.a.[6]	n.a.[6]	n.a.	30% NB 70% SEF	The incentive function of the current system is probably low. Proposed new legislation foresees: decrease of # of chargeable pollutants, revised rates, which better reflect environm. policy priorities, simplification especially of the NCF system.
	NCF	Compl, RR			Like EC[5], and: Regio, ExeedS	According to several formulas					50-60% (est.)[7]	100% NEF	
Poland	EC	Incent RR	All legal entities with commercial and non-commercial activities	62 air pollutants	Quan, Tox	SO_2: 949 NO_x: 949	Yes	SO_2?, NO_x?	1994: 142.0[8] 1995: 178.6[8] 1996: 175.9[8] 1997: n.a.	1994: 3.7[8] 1995: 4.6[8] 1996: 4.6[8] 1997: n.a.	1994: 97%[8] 1995: 97%[8] 1996: 90%[8] 1997: n.a.	36% NEF[10] 64% SEF[10]	A reduction of the pollutants covered by the charge system from the current 62 to around 10 has been suggested. Revenues from air charges are quite high and collection rates exceptionally positive.
	NCF	Compl				10 x EC							

Abbreviations:
Type: NCF = non-compliance fee; EC = emission charge; ET = eco-tax. Goal/function: Compl = Compliance; RR = revenue raising; Incent = incentive function.
Factors determining charge rates: Quan = quantity of emissions; ExceedS = exceedance of standard; Time = time period of emissions; MinS = minimal salary of the country; Tox = toxicity of pollutants; Regio = regional factors; Height = height of emission source from ground. Type = type of pollution source (power plant, industrial plant, mobile source).
Revenue distribution: NEF = national environmental fund; SEF = sub-national environmental fund; NB = national budget; SB = sub-national budget.

Notes: Air pollution non-compliance fees are also in force in Croatia and FR Yugoslavia. They are not described in detail here because they have no dynamic rates (i.e., they are penalty instruments with fixed rates).
Czech Republic: 1) Total revenue for both Czech air emission charges (i.e., large, medium and small scale sources). It should be noted that the charge rates have been gradually introduced: since 1997, the final rates are in place; in 1996, 80% of the final rates applied; in 1994-5, 60% of the final rates applied.
Estonia: 2) The data listed represent total revenue from both, emission charge and non-compliance fee.
Hungary: 3) 1997 revenue data for the Hungarian air NCF are estimates. 4) In Hungary, also a NCF on ozone depleting substances is in force. This NCF aims at controlling manufacturing or importing ODS substances in order to implement the Montreal Protocol and the Vienna Convention. Total revenue in 1996 and 1997 from this NCF was around 5'000 - 10'000 USD per annum.
Lithuania: 5) If an emission source has emissions of one pollutant above the standard, the NCF in Lithuania has to be paid for all pollutant emissions of a source not just for the one for which the standard is exceeded. Consequently, this system has the potential to create very high marginal penalty rates and therefore provides substantial incentive for a pollution source to comply with standards. 6) Revenue data are only available for all ECs and NCFs in force in Lithuania (i.e., EC and NCF on air poll., EC and NCF on water pollution, NCF on waste

disposal): total revenue from pollution charges was USD 4.9 million in 1994 and USD 17.8 million in 1997 (i.e., yearly revenue/capita was USD 1.3 in 1994 and USD 4.8 in 1997); total revenue from pollution fines was USD 0.3 million in 1994 and USD 1.3 million in 1997 (i.e., yearly revenue/capita was USD 0.1 in 1994 and USD 0.4 in 1997). 7) This percentage is an estimation for the collection efficiency of all pollution charges in force in Lithuania (air and water emission charges and all non-compliance fees).
Poland: 8) Data include revenues from the SO2 and NOx emission charges (not including revenue from other pollutants and NCFs - needs clarification) only. 9) The data represents the EC level in 1996. 10) 10% of revenue goes to local (gmina) funds and 54% to regional (voivod) funds, except for NOx charges where 100% of revenue goes to NEF.

A 6.2 Transport

Gasoline and Diesel Pricing

Table 57 Tax Differentiation between Leaded and Unleaded Gasoline in Central and Eastern Europe.

	Tax differentiation between leaded and unleaded gasoline						**Related road transport indicators**		
	1994			**end 1997**					
Country	**Basis for tax differentiation**	**End-use price difference (USD)**	**Price difference in % of leaded fuel end-user price**	**Basis for tax differentiation**	**End-use price difference (USD)**	**Price difference in % of leaded fuel end-user price**	**Market share of unleaded gasoline as of 1996[4] (%)**	**Cars / capita as of 1996[4] (#/1000 inhabit.)**	**Average car age as of 1996[4] (years)**
Bulgaria	Excise (10%)	? $	? %	Excise (10%)	0.03 $[2]	4.7%[2]	6%	241	15
Czech Republic	Excise	0.02 $	3.0%	Excise	0.01 $	2.1%	55%	326[5]	13.9[5]
Estonia	no tax diff.	n.a.	n.a.	no tax diff.	n.a.	n.a.	81%	239	n.a.
Hungary	Excise	0.02 $	3.1 %	Excise	0.03 $	4.0%	64%	246[5]	11.2[5]
Latvia	no tax diff.	0.00 $	0.0%	Excise	0.02 $	7.7<%	n.a.	188	>10
Lithuania	no tax diff.	n.a.	n.a.	no tax diff.	0.00 $	0.0%	98%	231[5]	12[5]
Poland	Excise	0.01 $	2.4%	Excise	0.02 $[2]	3.5%[2]	48%	244	10-11

Notes: "n.a." = data not available; "..." = not applicable.

1) The prices represent maximal retail prices set by the Government.

2) These data refer to average 1996 prices.

3) Since 1995, there is no leaded gasoline in the Slovak market anymore.

4) Source: Danish EPA/COWI (1998): Task Force on the Phase out of Lead in Gasoline - Final Country Assessment Report.

5) Data refer to 1995.

6) Data unsafe - needs clarification. Two sets of data have been provided for end 97 price differences with the following values: 0.01$ / 3.4% and 0.04$ / 9.7%. It is unclear which set is correct

Vehicle Related Taxes and Duties

Bulgaria

- Import of vehicles: An import tax on used cars in the amount of 10 % existed until 1996. Now, there is no tax/duty/differentiation with environmental relevance.
- Annual vehicle tax: is dependent on engine power and provides allowance for cars with catalyses.

Czech Republic

- A road tax is enacted and has to be paid based on engine capacity (cm^3) and/or vehicle weight. Exempt from the Road Tax are vehicles used in urban public transportation and vehicles used exclusively for combined transport (road-rail) if road component < 50km and electrically powered vehicles. The total revenue from the road tax was USD 134 million in 1997.

Estonia

- Motor vehicle excise duty: For political and social reasons; there is little environmental logic in this duty. For the part of excise based on age, new vehicles pays the same tax as 10-year old vehicles (the excise tax is ca. 70 USD). For used vehicles aged 1-12 years 7 USD must be paid per year, for vehicles aged over 12 years: 85 USD + 11 USD x number of years over 12. Estimated total revenue of the motor vehicle excise in 1997 was 9.3 million USD.
- There is also an annual motor vehicle tax and registration charges. The motor vehicle tax is part of municipal taxes and implemented only in two municipalities at present. There are no special allowances for environmental purposes.

Hungary

- VAT has to be paid on purchase of vehicles and on vehicle equipment (the standard VAT rate of 25 % applies). For some equipment with environmental relevance (catalytic converter, thermal re-burner, exhaust gas filter) the preferential tax rate of 12 % applies.
- Consumption tax has to be paid on the purchase of cars. The tax rate is preferential in the case of small cars, cars with low fuel consumption, electric cars and cars with catalytic converters. The incentive effect for buying cars with built in catalytic converter is evident, especially for cars in lower price categories.
- Import duty has to be paid when vehicles are imported. Import duty on trains is lower than on other vehicles. Concerning cars, the environmental relevance is evident: rate is preferential in case of new or cars less than four years old, small cars, and, cars with catalytic converters. There is also some environmental relevance in case of lorries: the rate is lower for waste collecting vehicles and other vehicles for special purposes, (e.g. road sweeping car). There is also differentiation between new and old used lorries.
- The annual vehicle tax has to be paid for domestic and foreign cars. For domestic cars, the tax base is the weight of the vehicle, and, in case of lorries, the weight plus 50 % of the load-carrying capacity. The tax currently varies from USD 2-4 for each 100 kg. Tax exempt are: budgetary organisations, the church, penal authorities, social organisations, foundations, local and regional public transport, motorbikes under 250 cm^3, cars transporting handicapped people, vehicles for commuting purposes, agricultural tractors, and vehicles under international agreement. A preferential tax rate applies for cars with built-in catalytic converters (50 % of the tax has to be paid) and cars subsequently equipped with catalytic converter (75 % has to be paid). In case of lorries, which meet UN-EC regulations on air pollution and noise emissions, favourable tax rates should be paid (50 % or 75 %). In case of combined freight transport, the tax is also favourable (50-80 %). For foreign cars, the tax base is the time of stay in Hungary in days. There is a tax holiday for the first 60 days. For

lorries the calculation base is the weight plus 50 % of the load carrying capacity and the kilometres done.

- There is also a registration fee in force as well as a fee for emission control (compulsory every 3 years and in case of motor change).
- Three vehicle related and environmentally motivated product charges are in force: the product charges on fuel, tires and batteries. These product charges are described in more detail in table A9.

Lithuania

- Import of vehicles: the VAT (18 %), a customs tax (5 % for cars 7-10 years old, and, 10 % for cars > 10 years old), and, an excise tax (15 % for cars < 5 years old and with a value of > 15000 USD) have to be paid. This tax system provides for incentives to import new and small cars: total taxes for importing a car > 10 years is 28 % while the import of a small car < 5 years old is taxed at 18 %.
- There is no annual vehicle tax for passenger cars and no tax for vehicle registration. However, an annual tax should be paid by owners of light duty vehicles, heavy-duty vehicles and special road vehicles. Exempt from the tax are vehicles that belong to the Defence Ministry. The tax rate varies from USD 25-750 per vehicle according to weight. Total revenue in 1997 from this tax was 6.0 million USD. The revenue is channelled to the Road Fund and used for modernisation and repair of existing roads and construction of new roads.
- A tax is levied on light and heavy-duty vehicles and for buses, which are registered abroad. The tax rate is USD 20-100 depending on vehicle type and weight. Exempt are vehicles, which are registered in countries that have international agreements with Lithuania, as well as vehicles of charity organisations. The 1997 revenues from this tax in 1997 were about 0.14 million USD and channelled to the Road Fund.
- Another tax is levied on vehicles whose dimensions, axle load and/or weight exceed the standards fixed in law.

Taxes on Air Travel

Czech Republic At the Prague airport Ruzyni, noise pollution charges are levied based on the mass of a plane landing. The yearly revenue is ca. 0.8-0.9 million USD and is used for monitoring. It is planned to increase the charges to create revenue for financing noise protection installations in villages surrounding the airport.

Lithuania There are no direct environmental charges/taxes on air travel in Lithuania, but the air emission charge and non-compliance fees apply also for airports. Basis for charging is emissions during the landing - take off cycle of airplanes.

APPENDIX 7: Industry sector – additional statistical information

Table 58 Firms included in the statistical evaluation of the industry sector.

Putokšnis	Žalvaris	Snaigė	Siūlas	Ortopedijos technika	Dvarčionių keramika
Atrama	Rokiškio sūris	Panevėžio stiklas	Dainava	Ukmergės versmė	Ekranas
Girių bizonas	Liregus	Lelija	Tytuvėnų durpės	Kuršėnų tyras	Linų audiniai
Sulinkiai	Astra	Klaipėdos laikraščio redakcija	Šilutės durpės	Vilniaus duona plius	Kauno Baltija
Drobė	Vernitas	Rokiškio autogamyklas	Apavikta	Vilniaus vingis	Akmenės cementas
Linas	Kauno ketaus liejykla				

APPENDIX 8: Influence of transition rules for EU energy directive

According to COM(2004) 42 the following is related to Lithuania:[62]

In the Lithuanian authorities letter dated 7 November 2003, Lithuania would face difficulties in implementing some new minimum rates of taxation for motor fuels and heating fuels, and in introducing taxation for products which were not previously subject to the Community harmonised structure.

As a consequence, Lithuania requests several transitional periods regarding for motor fuels, and electricity, natural gas, coal, coke and lignite, and orimulsion.

Motor fuels
Lithuania will apply the minimum rates applicable to motor fuels set by Directive 92/82/EEC at the date of the Accession. The increase of the tax rates up to the level prescribed in the energy tax Directive would have a significant direct impact on the growth of expenses of households and businesses.

Lithuania considers that the following transitional periods are needed:

- for unleaded petrol: until 1 January 2011;
- for gas oil and kerosene: until 1 January 2011 to reach the minimum rate of EUR 302 and until 1 January 2013 to reach the minimum rate of EUR 330.

[62] COM(2004) 42 (28.1.2004), amending Directive 2003/96/EC as regards the possibility for certain Member States to apply, in respect of energy products and electricity, temporary exemptions or reductions in the levels of taxation.

Lithuania is contemplating a gradual path to reach the minimum rates.

Assessment
The lengthiest transitional periods granted in the Directive regarding gas oil and unleaded petrol are respectively 1 January 2012 and 1 January 2010. Due to the exceptional circumstances prevailing in Lithuania, in particular the current low duty rates on motor fuels, the Commission acknowledges that one additional year would be necessary for Lithuania to reach the minimum levels set by the Directive. An intermediate step increase of the national tax rates should then be planned.

The Commission concludes that Lithuania should be authorised to apply a transitional period until 1 January 2011 to adjust its national level of taxation on gas oil and kerosene used as propellant to the new minimum level of EUR 302 per 1000 l and until 1 January 2013 to reach EUR 330. However, the effective tax rate applied to gas oil and kerosene cannot be less than EUR 274 per 1000 l as from 1 January 2008.

Lithuania should also be authorised to apply a transitional period until 1 January 2011 to adjust its national level of taxation on unleaded petrol used as propellant to the new minimum level of EUR 359 per 1000 l. However, the effective tax rate applied to unleaded petrol cannot be less than EUR 323 per 1000 l as from 1 January 2008.

The Commission notes that the minimum levels of taxation to be achieved as from 2008 according to this proposal are consistent with the tentative timetables of excise duty increases for motor fuels transmitted by the Lithuanian authorities in their letter of 7 November 2003.

Electricity, natural gas, coal, coke and lignite, and orimulsion.
The Directive introduces taxation of electricity, natural gas, coal, coke and lignite as well as of orimulsion. Lithuania seeks transitional periods on the introduction of the taxation of new energy products in order to avoid adverse economic and social implications of the increase of consumption of alternative energy products following the decommissioning of the Ignalina Nuclear Power Plant (between 2005-2009).

Lithuania considers that the following transitional periods are needed:
- for coal, coke and lignite: until 1 January 2007;
- for natural gas and electricity: until 1 January 2010;
- for orimulsion: until 1 January 2016.

Lithuania would like to be allowed to apply full tax exemption to the above-mentioned products until the end of the relevant transition periods, instead of taxing the products at lower rates and gradually increasing them. In response to an additional question raised by the Commission, the Lithuanian authorities point out that orimulsion is not used solely to produce electricity. In Lithuania, power stations producing electricity also produce, at the same time, heat energy, which is supplied to the heat consumers. The proportion of energy produced in thermo-power stations consists of 60-70 % of heat energy and 30-40 % of electricity.

Assessment
In the Protocol n° 4 to the treaty of accession to the European Union 2003 on the Ignalina nuclear power plant, Lithuania commits to the closure of Unit 1 of the Ignalina Nuclear Power Plant before 2005 and of Unit 2 of this plant by 31 December 2009 at the latest and to the subsequent decommissioning of these units. The "Ignalina Program" is established to support this action.

According to this programme, measures should be adopted to "contribute to the necessary restructuring, environmental upgrading and modernisation of the energy production, transmission and distribution sectors in Lithuania as well as to enhancing the security of energy supply and improving energy efficiency in Lithuania."

In this context, the Commission considers that, until 31 December 2009, tax reductions/-exemptions could be granted as complementary measures to help smooth the very important restructuring process of the energy production sector in Lithuania.

The Commission concludes that Lithuania should be authorised to exempt coal, coke and lignite from taxation until 1 January 2007 and natural gas and electricity until 1 January 2010. Orimulsion is a mixture of bitumen and water. It is classified under CN code 2714. It does not fall within the scope of Directive 92/81/EEC[63]. The Lithuanian authorities explain that 30-40 % of orimulsion consumption will be used to produce electricity. Member States have, in principle, to exempt from taxation energy products and electricity used to produce electricity (see Article 14(1)(a)). Furthermore, according to the Lithuanian authorities, orimulsion is used to produce heat in "combined heat and power" (CHP) plants. Pursuant to Article 15(1)(c) of the Directive, Member States may apply under fiscal control total or partial exemptions or reductions in the level of taxation to energy products and electricity used for combined heat and power generation. Therefore, the request of Lithuania to apply a full tax exemption to orimulsion used to produce either electricity or heat in CHP plants appears redundant in comparison with measures included in the energy tax Directive. Moreover, the Commission is of the view that no twelve-year transition period can be deemed proportionate in the context of the Directive. The possibility of a tax exemption could be granted to orimulsion used for purposes other than to produce electricity or heat until 1 January 2010, due to the special circumstances explained above. The Commission concludes that Lithuania should be authorised to exempt orimulsion used for purposes other than to produce electricity or heat until 1 January 2010.

Lithuania's situation regarding current excise duty levels, minimum taxation levels set by EU Directive 2003/96/EC and proposed transitional periods (COM (2004) 42 final) is summarised in table 59.

[63] Cf. discussions at the Excise Committee in October 1995 (CED 163/12) and January 1996 (CED 176/3).

Table 59 Fuel excise duty rates in 2004 in Lithuania, minimum EU taxation level of energy products according to Directive 2003/96/EC and transitional periods.

Fuel type	Lithuanian excise duties	Directive 2003/96/EC; minimum taxation levels		Transitional periods under COM(2004) 42 final			
	2004	From 2004 January	From 2010 January	2004	2008	2011	2013
Motor petrol, its substitutes and extenders, euros/1000 l	287	359	359	287	323	359	-
Petroleum Gas and Gaseous Hydrocarbons Intended for Use as Motor Fuel, Their Substitutes and Extenders, euros/t	125	125	125	-	-	-	-
Kerosene, its substitutes and extenders, euros/1000 l	232	302	330	245	274	302	330
Gas oils, their substitutes and extenders, euros /1000 l							
for heating	21	21	21	-	-	-	-
other (incl. diesel)	244	302	330	245	274	302	330
Heavy fuel oils, their Substitutes and extenders, euros/t							
For heating	25	15	15	-	-	-	-
Other	15			-	-	-	-

In order to be exempted from the EU minimum taxation the Lithuania arguments were the following:

Motor fuel
The increase of the tax rates up to the level prescribed in the energy tax Directive would have a significant direct impact on the growth of expenses of households and businesses;

Electricity, natural gas, coal, coke and lignite, and orimulsion
Lithuania seeks transitional periods on the introduction of the taxation of new energy products in order to avoid adverse economic and social implications of the increase of consumption of alternative energy products following the decommissioning of the Ignalina Nuclear Power Plant (between 2005-2009).

Notice, however, that in both arguments the word *environment* is not mentioned. When it comes to EU, in terms of prices in 2000, the average damage caused in general by one ton of pollutant emitted over rural areas is put at 14000 Euro if the pollutant is fine particles ($PM_{2.5}$), 5200 if it is SO_2, 4200 for NO_X, and 2100 Euro for volatile organic compounds (VOCs). These being average figures, they mask however the great variations between member states and the figures for urban areas is much higher.[64] Hence, the rational of implementing taxes (and charges) is also based on the

[64] www.acidrain.org

existence of environmental externalities. One proof of externality existence is the implementation of ceiling for Lithuania. According to EU there are ceilings for Lithuania concerning among other things CO_2, SO_2 and NO_2.

In order not to increase taxes but to reduce externalities, other measures may be implemented. recall, from the previous chapter that:

1 when it comes to district heating or the demand for heat we found that this covariate is negative and less sensitive to prices meaning that there is rum to increase these prices.

2 when it comes to transport increasing prices of both gasoline and diesel is to be considered especially for private cars where driving is assumed to be a luxury (when common transportation is efficient);

3 When it comes to industry the overall conclusion has been that environmental taxes (being low) did not impact significantly on production. This implies that there is room for increasing both energy taxes and/or charges. Recall that when it comes to competition both in internal markets and with the rest of the world the general finding is that environmental taxation has been rather positive from the point of view of employment, competition and trade. However, some sectors or industries that are not efficient or non competitive may have difficulties to sustain and having low taxes/charges in these sectors (industries) would be seen as a subsidy. Moreover, environmental taxes or charges may help to produce environmentally sustainable products that are competitive because of their characters.