

# Economic Instruments in Environmental Policy

Summary of a Government Assignment Report  
by the Swedish Environmental Protection Agency  
and the Swedish Energy Agency



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SWEDISH ENVIRONMENTAL  
PROTECTION AGENCY

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# Preface

This publication is a special edition with the English summary of a Swedish Government assignment reported in October 2006 (English translation, Report 5678). The project has been carried out by the Swedish EPA and the Swedish Energy Agency. The report reviews existing economic instruments in the environmental field in Sweden. Evaluations of the various economic instruments have been summarised. Particular emphasis has been given to four of the 16 environmental objectives in Swedish environmental policy and protection. These are Reduced Climate Impact, A Non-Toxic Environment, Sustainable Forests and Zero Eutrophication. A problem common to these objectives is that they are considered to be very difficult to achieve within the stated deadline. The analysis made is also linked to the three action strategies: (i) More efficient energy use and transport; (ii) Non-toxic and resource-efficient cyclical systems; and (iii) Management of land, water and the built environment.

Our approach is based on the long-term socio-economically efficient use of instruments to achieve environmental objectives. Since only a few evaluations include socio-economic evaluation methods, we have defined three criteria for determining whether a given instrument is an effective long-term aid to achievement of the environmental objectives. Market-based systems, i.e. the electricity certificate scheme and the EU emissions trading scheme, are not described separately; they are described to the extent the systems act in conjunction with other economic instruments. The economic instruments covered can be divided into groups: taxes, charges, tax relief and grants.

This project has been carried out over a fairly short space of time, and we have therefore been unable to fully review the literature. Nonetheless, our survey includes nearly two hundred evaluations.

There has also been consultation with the National Institute of Economic Research and the Swedish Tax Agency and other agencies responsible for environmental objectives or sectors. The study is a preliminary study in preparation for a government report on economic instruments and also forms part of the in-depth review of environmental objectives to be performed in 2008.

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SWEDISH ENVIRONMENTAL PROTECTION AGENCY  
Economic Instruments in Environmental Policy  
Summary

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# 1 Background

In their respective letters of instruction for 2006, the Swedish Energy Agency and the Swedish EPA were given the following assignment by the Government:

*The Swedish Environmental Protection Agency and the Swedish Energy Agency in consultation with the National Institute of Economic Research and the Swedish Tax Agency, following consultation with other agencies concerned with the environmental objectives, and sectoral agencies, are instructed to prepare a summary of existing knowledge on the effects of economic instruments in relation to Sweden's environmental objectives. Where there are no evaluations of environmentally-related economic instruments, or where the quality of evaluations is inadequate, new evaluations are to be made. The scope of those evaluations is to be agreed with the Government Offices. The analysis made is also linked to the three action strategies: (i) More efficient energy use and transport; (ii) Non-toxic and resource-efficient cyclical systems; and (iii) Management of land, water and the built environment. The report should focus on the long-term socio-economically effective use of instruments to achieve environmental objectives. The potential synergies created by various economic instruments in relation to one or more environmental quality objectives are to be taken into account, as are any counter-effects. The analysis should therefore be linked to the three action strategies: (i) More efficient energy use and transport; (ii) Non-toxic and resource-efficient cyclical systems; and (iii) Management of land, water and the built environment.*

*The report should focus particularly on the environmental quality objectives and interim targets that will be difficult or very difficult to achieve within a generation according to the Environmental Objectives Bill (2004/05:150). For the purposes of this report "economic instruments in the environmental field" means taxes, including relief, allowances, rebates and refunds, charges and direct grants. The agencies involved should describe the way these instruments operate in conjunction with emissions trading and electricity certificates. The report should also cover taxes and charges whose primary function is to generate revenue, but that have an impact on the environment and may therefore counteract the effects of other instruments. The agencies may divide tasks between themselves on the basis of their areas of expertise and responsibility. This report is the first of two parts of a study that will form part of the in-depth evaluation in 2008. It is also a complement to the efforts being made by the agencies concerned by environmental objectives to propose measures, including economic instruments, under their respective objectives. The "Checkpoint 2008" review of Sweden's climate strategy should particularly be taken into account. The report must be submitted by 1 October 2006.*

Following further discussions with the Ministry of the Environment, it was decided that the main emphasis of the report would be a survey and review of evaluations of existing environmental economic instruments, which includes identifying areas where new evaluations are needed. Overall conclusions have also been drawn on

the basis of the evaluations reviewed. No new evaluations have been made as part of this report.

## 2 Summary and conclusions

The contents of this report are based on a review of evaluations of economic instruments in the environmental field. Particular focus has been placed on instruments relating to the following Swedish environmental objectives: Reduced Climate Impact, Zero Eutrophication, A Non-Toxic Environment and Sustainable Forests. It is considered that these objectives will be particularly difficult to achieve within the set time limit. The analysis made is also linked to the three action strategies: (i) More efficient energy use and transport; (ii) Non-toxic and resource-efficient cyclical systems; and (iii) Management of land, water and the built environment. The term "economic instruments" mainly refers to taxes, tax allowances and relief, grants and charges. Electricity certificates and the EU emissions trading scheme, which are market-based systems, are described insofar as they interact with other economic instruments. This project has been carried out over a fairly short period, and is intended to provide background material for a forthcoming government report on economic instruments. At the same time, instruments are also being analysed as part of the in-depth environmental objectives evaluation. Further analysis of instruments will be initiated during the forthcoming "check-point" review of Sweden's climate strategy. These projects also involve non-economic instruments, however.

The project has been carried out by the Swedish Environmental Protection Agency and the Swedish Energy Agency in consultation with the National Institute of Economic Research and the Swedish Tax Agency, following consultation with other agencies concerned with the environmental objectives, and sectoral agencies. The agencies involved have summarised the results of evaluations performed and also present their views on additional evaluations that may be necessary. We have also used existing evaluations and economic theory as a basis for drawing some general conclusions that may serve as guidance in future efforts to identify sustainable and effective socio-economic instruments to achieve our environmental objectives.

### Summary conclusions

- We refer to almost 200 evaluations/follow-up studies on economic instruments in the environmental field. We have not made a comprehensive review of academic studies, however.
- Our review shows that the aim of most studies has been to monitor achievement or evaluate the effects of a given instrument, particularly in relation to its main objective, and that further consequences are sometimes analysed. Comprehensive socio-economic analyses are very rare.
- Many economic instruments aimed at helping to achieve the **Reduced Climate Impact** objective are used. Generally speaking, multi-sectoral taxes, such as the carbon dioxide tax, are the instruments with the greatest socio-economic potential for influencing behaviour in the interests of

sustainability. However, the agencies consider that the potential for future deployment of taxes is limited to some extent. (See explanation later in this summary). Since grants and tax relief are generally thought to be less effective in the long term, we consider it important to include other instruments in the analysis before designing future instruments. A coherent forward-looking evaluation of the various economic instruments used in the transport sector is needed. It is also essential to take account of international aspects, such as industrial competitiveness and the EU emissions trading scheme. Internationally coordinated or harmonised instruments should be given priority.

- There are a few economic instruments aimed at specific sectors concerned by the **Zero Eutrophication** environmental objective. The NO<sub>x</sub> charge is one example of an effective instrument for the sources it covers, but further use of instruments is required in many areas. The nature of the environmental problem necessitates geographical differentiation of instruments to create scope for cost-effective allocation of measures. Since there is considerable doubt about the causes of this environmental problem, action and instruments used to mitigate leaching of both phosphorus and nitrogen should be given priority. Here too, international efforts are of great importance – particularly as regards other countries impacting on the Baltic Sea environment.
- Very few economic instruments are being used to help achieve the **Non-Toxic Environment** objective, but we do not consider they are the best means of combating chemical pollutants. This does not mean that they cannot perform an important complementary function in specific instances. International efforts are often of great importance. Funding for site remediation is essential if the relevant interim targets are to be met. We consider that an evaluation should be made of whether this funding is being used cost-effectively, and whether the level of funding is sufficient to achieve the relevant interim targets.
- Substantial funding has been made available under the **Sustainable Forests** objective for protection of land, which is essential to achieve this objective. Evaluations (mainly follow-up studies) have revealed that, given the current price of forest and forest land, funding will have to be increased to achieve the targets that have been set. We consider it necessary also to analyse funding forms to ensure they are as cost-effective as possible.
- The new market-based instruments systems, i.e. electricity certificates and the EU emissions trading scheme, mainly act in concert with other economic instruments to achieve the Reduced Climate Impact objective. These instruments are aimed at actors in the energy production sector and

in energy-intensive industries. The market-based instruments affect the behaviour of actors and the scope for introducing other instruments that should be used in combination with these systems.

- As a general comment, we consider that further efforts in this field should include an account of developments in the EU. In some cases EU-coordinated or harmonised instruments may be a more effective means of reducing environmental impacts as cost-effectively as possible. The EU Commission intends to instigate a number of studies over the next few years. These may bring about a discussion of economic instruments at EU level.

**The agencies' proposals for further priority evaluations:**

- An overall evaluation of economic instruments in the transport sector. Examples include the interplay between motor fuel taxes, the carbon dioxide differentiated vehicle tax, and other taxes, and also ways of encouraging the use of alternative motor fuels. The analysis should include relevant environmental objectives, action strategies and other key societal goals within the sector. Potential joint EU-harmonised instruments should also be examined.
- Analysis of the effects of raising the energy tax or the carbon dioxide tax in sectors not covered by the EU emissions trading scheme. Environmental effects as well as the impact on corporate competitiveness should be included. It will also be necessary to examine the legal scope for this, particularly bearing in mind that the situation has changed, following the implementation of the EU emissions trading scheme.
- Examination of whether or not raising green taxes and lowering other taxes yields twin gains. If it is concluded that the current system is of dubious benefit, then, if possible, an alternative approach should be presented.
- Evaluation of whether the funding allocated for Sustainable Forests is sufficient to achieve the objectives. Evaluation of funding forms to ensure they are as cost-effective as possible.
- Evaluation of whether the level of funding for site remediation is sufficient to achieve the relevant interim targets, and whether funding is being used cost-effectively.
- Evaluation of whether funding for liming of lakes and watercourses is sufficient. Evaluation of funding forms to ensure they are as cost-effective as possible.
- We also wish to point out that some of the analyses we have proposed here may be performed as part of the in-depth environmental objectives evaluation and in the forthcoming "checkpoint" interim review of Sweden's climate strategy in 2008.

### **Effective long-term environmental policy**

Our terms of reference state that our approach should be based on the long-term socio-economically effective use of instruments to achieve environmental objectives. This approach encompasses an overall view of the gains yielded by the environmental improvements (in fact an evaluation of the defined environmental objective), and the costs to society of the instruments used to achieve the environmental objective. This is an extremely broad approach and is hardly ever adopted in a single analysis. We have taken the environmental objectives for granted in our analysis, which means that it is the cost side that must be socio-economically effective in the long term. Even a comprehensive analysis of this kind involves a great deal of work, and few evaluations include comprehensive impact analyses of socio-economic effectiveness. Here, we have therefore defined three criteria in an attempt to describe the ability of an instrument to achieve environmental benefits effectively in the long term. These criteria are: (i) cost-effectiveness (taking the least expensive measures first); (ii) dynamic efficiency (the capacity of an instrument to generate technological development and encourage the most cost-effective solutions over time); and (iii) achievement of objectives (how well an instrument achieves a stated objective). The report uses the phrase "long-term effective use of environmental instruments" to refer to all these criteria together. In general, multi-sectoral taxes are regarded as effective instruments, whereas narrowly targeted grant schemes are considered less effective.

### **One step forward**

The problems entailed when analysing instruments are often complex, i.e. there are many interrelationships to be described. Various delimitations are usually made. For instance, this report is largely confined to *four* environmental objectives, *economic instruments* and existing *national* instruments. The report does not give a comprehensive account of the way the economic instruments described affect and are linked to related objectives such as other energy policy goals, other environmental objectives and other societal goals in various sectors. This survey should therefore be seen as *one* step towards understanding the approach the state should adopt to achieve Sweden's environmental objectives.

### **Reduced Climate Impact**

The economic instruments used to mitigate emissions of greenhouse gases in Sweden are fairly numerous. Some of them span several sectors, such as energy (electricity and fuels), the carbon dioxide tax and KLIMP (local climate investment programmes). Other instruments aimed at specific sectors, such as carbon dioxide differentiated vehicle tax and tax exemption for alternative motor fuels in the transport sector, conversion grants for individual heating systems, grants for conversion and improved energy efficiency in public buildings and solar heating grants in the housing sector, the NO<sub>x</sub> charge system and the PFE programme for improved energy efficiency in industry. There are also economic instruments that partly counteract the environmental objectives, such as company car taxation and travel allowances in the transport sector, and reduced-rate energy and carbon

dioxide taxes for industry. In addition, some instruments have a different primary purpose or a number of different purposes. Examples include vehicle tax, company car tax regulations and reduced-rate energy and carbon dioxide taxes. For instance, the aim of the PFE programme for improved energy efficiency is that the effects on electricity consumption should be equivalent to the effects that would otherwise have been achieved by the EU minimum tax (which is also reduced for companies). The ultimate effect on the Reduced Climate Impact objective depends on how the reduced energy consumed would otherwise have been produced.

#### LOWER AND HIGHER TAXES?

In terms of economic theory, multi-sectoral taxes such as the carbon dioxide tax, are cost-effective both in the near and the long term. This means that the tax has the potential to cause actors to take what they consider to be the cheapest measures first, while also sending a clear signal to market players, which creates an incentive for technological development (dynamic efficiency). But this is a less certain way of achieving objectives than regulation. It may be deduced from the evaluations and follow-up studies performed that the energy tax and carbon dioxide tax have had a major impact on emissions, particularly from district and individual heating systems. The studies also reveal that current tax levels have a pronounced effect on behaviour. We are therefore of the view that a further increase in the tax on heating might accelerate emission reductions and generate higher tax revenues for a limited period (since a gradual adaptation to a reduced use of fossil fuels is taking place), but would not improve the end result. One study also shows that the reduced energy and carbon dioxide taxes for private industry may be cost-effective if account is taken of the risk of manufacturing operations being relocated to other countries.

Although taxes are generally attractive in terms of their cost-effectiveness, the agencies consider that they offer limited additional potential for achieving the Reduced Climate Impact objective. Aside from the fact that these taxes (on energy and carbon dioxide) already have a marked impact on certain kinds of fossil fuel use, the recently introduced emissions trading scheme also influences the way that Sweden should use the carbon dioxide tax.

Nonetheless, we consider there are some areas where it should be analysed whether the tax can be developed and its use possibly extended. One concerns those industries not covered by the EU trading system. The analysis should include the environmental effects that may be expected, as well as the effects of a higher tax on the international competitiveness of Swedish companies. There has been no evaluation analysing the interplay of various economic instruments in the transport sector. Those instruments include several taxes, such as the carbon dioxide differentiated vehicle tax, motor fuel tax and the tax regime for company cars. The findings presented in various evaluations/follow-up studies are that increased carbon dioxide differentiation of the vehicle tax and the tax regime for company cars would influence behaviour, particular if differentiation were sharp. However, there has been no analysis of ways of combining higher motor fuel taxes with these, or of the scope for devising EU-harmonised solutions so as to increase the positive impact on the environmental problem and increase cost-effectiveness.

## REDUCE THE NUMBER OF GRANTS

The grants in use have not really been evaluated; they have been monitored. The agencies do not consider grants to be the first choice as a means of reducing climate impact. If taxes are not practicable in specific instances, grants may be one of several options requiring analysis (for possible use). Any such analysis should include all possible alternatives. Cost-effectiveness and achievement of objectives to reduce emissions are generally lower where grants are used instead of taxes, for example, particularly if grant eligibility is narrowly framed. Moreover, there is a theory in economics that the best approach to dealing with phenomena causing negative external effects is to internalise the environmental cost (i.e. include it in the price), perhaps by means of a tax, not to offer grants for alternative solutions. It is also hard to retroactively evaluate the effects of grants on greenhouse gas emissions alongside existing taxes (particularly the taxes on energy and carbon dioxide). This problem has been mentioned in relation to conversion grants for individual heating systems and to some extent also KLIMP grants. Moreover, grants necessitate central government funding, and each grant scheme requires administration, which in some cases may be disproportionate to the expected results of the grant scheme. One such example is the conversion grant scheme administered by county administrative boards.

Some grants may have a narrowly defined purpose, such as grants for solar collectors and solar heating, where the main aim is to encourage use of this technology. Other grants may serve various purposes. One example is KLIMP, where one aim is to increase local support for action to combat climate change, and the grant for improved energy efficiency and conversion of public buildings, where an express aim alongside the energy and climate objectives is to increase employment. One problem identified here is the shortage of installation technicians arising following the introduction of numerous grants in the housing sector. It is also uncertain whether *tax relief* on the cost of installing energy-efficient windows and new biofuel boilers is cost-effective or dynamically efficient. This inference is based not on any evaluation made, however, but on interviews with builders and window manufacturers, and with the Tax Agency, which administers the tax relief.

**One final conclusion** is that the scope for further use of economic instruments to achieve Reduced Climate Impact is limited in some respects (assuming that they must be effective in the long term). It is therefore essential that future evaluations include the other instruments available. For instance, it may be useful in the housing sector to ascertain how standards, building regulations and information can serve as a complement to the present tax regime.

## Zero Eutrophication

### SEVERAL ECONOMIC INSTRUMENTS CONTROLLING NITROGEN EMISSIONS

Although the tax on nitrogen has had a limited impact on the sale of artificial fertilisers, its indirect effects have been greater, in that the tax has funded environmental compensation payments, which have reduced leaching of nitrogen as well as phosphorus. The NO<sub>x</sub> charge scheme for power plants is a cost-effective instrument and a complement to emission conditions set in operating permits. The charge scheme has yielded a quicker and cheaper reduction in emissions than could have been achieved using the more static instrument of emission conditions alone.

EU agricultural support has done much to create agricultural surpluses, a situation which exacerbates nutrient leaching from agriculture. An analysis of the effects of direct support (cash support based on area of cultivated land or livestock numbers) and environmental compensation (e.g. support for pasture land, organic production and wetlands) shows that positive and negative environmental impacts are often linked, and that grants may even counteract each other. Following the recent reform of EU agricultural support, many of these effects are expected to disappear, but it is too early to evaluate the results. The projected effects of the EU agricultural reform in 2003, implemented in Sweden in 2005, indicate a reduction in nitrogen leaching.

### NEW OPPORTUNITIES OFFERED BY THE IMPLEMENTATION OF THE WATER FRAMEWORK DIRECTIVE

The Swedish implementation of the EU Water Framework Directive (WFD) will provide additional means of safeguarding water quality. Although it only concerns surface water, groundwater and coastal areas, measures taken within catchments usually also benefit the marine environment. The WFD emphasises the use of pricing policies and enshrines the "polluter pays" principle and the aim of achieving the objectives cost-effectively. The WFD recommends instruments that are self-financing as well as cost-effective, which suggests there is scope for greater use of economic instruments in particular, since only they can meet these criteria.

### NEED FOR GREATER USE OF INSTRUMENTS

First and foremost, there is great potential for developing economic instruments designed to reduce leaching of phosphorus, since economic instruments in Sweden to date have largely focused on reducing the nitrogen load. Improved management of farmyard manure is considered to offer great potential for reducing phosphorus and nitrogen emissions at a low cost. This kind of action will require an instrument that creates financial incentives for farmers to make the necessary investments so that farmyard manure can be stored until it can be spread at the right time. An evaluation of whether economic instruments could help to improve treatment at sewage treatment plants is also desirable.

To reduce emissions of nitrogen oxides, perhaps the greatest development potential concerns emissions of nitrogen oxides from shipping, since other forms of transport will be covered by the new EC directive imposing tighter standards on exhaust emissions from heavy duty vehicles. However, there is a need for international instruments in this area, since shipping faces international competition, which limits the effect of national instruments.

In general, it may be said that since instruments designed to achieve action in Sweden have a limited impact on eutrophication in the Baltic Sea, there is a need to create international instruments also impacting on emissions from other countries polluting the Baltic Sea. And, to maintain our credibility in international environmental cooperation, Sweden should also take additional measures.

#### GEOGRAPHICAL DIFFERENTIATION

Although there are now quite a number of economic instruments aimed at nitrogen emissions, there is a need to redesign them to better reflect their actual impact on eutrophication by means of geographical differentiation. Unfortunately, at present there is both considerable doubt and considerable disagreement about transport of nutrients from source to receiving water body, and their effects on the water body.

### **A Non-Toxic Environment**

#### ECONOMIC INSTRUMENTS SECOND A SECOND BEST SOLUTION

One study analysing whether economic instruments can be used more to achieve the Non-Toxic Environment objective has said that taxation of chemicals use is mainly justified by the existence of negative external effects along the production chain. The report also says that these diffuse effects are difficult to control directly, and it may instead therefore be advisable to tax use or manufacture of the chemicals causing the problems. But doubt about the marginal cost of reducing chemicals use, combined with an often steeply rising marginal damage effect above a critical level, means that quantitative controls (or even bans) may be a more effective means of limiting chemicals use than taxes. Hence, taxes on chemicals do not offer any general solutions to environmental problems associated with the Non-Toxic Environment objective; their effectiveness relative to other instruments must be assessed on its merits in each case. This does not prevent economic instruments from serving as an important complement in certain cases.

Since product streams are often international, it is important that economic instruments in this field are supported by international organisations, and do not conflict with international agreements.

#### RESULTS FROM ONGOING STUDY PENDING

There is an ongoing study initiated by the National Chemicals Inspectorate aiming to identify the areas of chemicals manufacture and use for which economic instruments may be appropriate, either to reinforce existing instruments in the form of laws and regulations, or for substances or areas in which there are currently no

instruments. We consider that we should wait until the results of that study are published before drawing any definite conclusions about the way economic instruments can be used to help achieve the Non-Toxic Environment objective.

#### FUNDING IMPORTANT BUT IN NEED OF EVALUATION

The funding that has been made available for site remediation is of great importance in achieving one of the difficult environmental objectives (Non-Toxic Environment), besides being a very large sum of money.

Funding of site remediation and clean-up activities in general have been undergoing a phase of rapid expansion and development. This notwithstanding, it is considered that the relevant interim target will be hard to achieve on the basis of current available funding. We therefore consider it a priority to evaluate the system so as to assess the amount of funding required to achieve the relevant interim targets and whether this can be done more cost-effectively.

#### **Sustainable Forests**

There are few specifically environment-related economic instruments aimed at achieving the Sustainable Forests objective. However, tax policy exerts a powerful influence over forest owners and their forests. Hence, from an environmental objective viewpoint, it is essential to analyse tax effects and consider instruments that promote, or at least do not hamper, achievement of the objective.

Follow-up studies have shown that, given the current price of forest and forest land, the funding available for formal forest protection must be increased if the stated objectives are to be achieved.

Current *capital gains taxation* regulations hinder the creation of nature reserves. These regulations should be reviewed with a view to encouraging and facilitating the creation of nature reserves. A change in *the right to treat income received under nature conservation agreements in accordance with accrual accounting principles*, which is one of the major obstacles to concluding agreements of this kind, is also considered a priority.

Although budget appropriations for purchase of land and payment of compensation for land-use restrictions and land management have risen sharply in recent years, funding is considered to be inadequate. Monitoring and evaluation of the land management appropriation needs to be developed and improved. In our opinion, there is an urgent need to evaluate the environmental effects of these appropriations, to determine whether they are cost-effective instruments.

The Swedish Agency for Public Management has been instructed by the Government to evaluate existing nature conservation instruments (nature reserves, biotope protection areas and nature conservation agreements) and their long-term cost-effectiveness, and also how state forests can be used to help achieve the entire Sustainable Forests objective. The Agency's report is to be submitted by 30 September 2007.

## **Economic instruments and the three action strategies**

We have also been asked to relate our evaluations of the economic instruments to the three defined action strategies. Our general conclusions on economic instruments are not altered when they are described in terms of the "intersection" in various strategies. All three strategies involve the use of economic instruments to achieve their ends. Instruments are most frequently used in the strategies for More Efficient Energy use and Transport and least frequent in Non-toxic and Resource-efficient Cyclical Systems. One aim in developing the strategies is to identify instruments serving several environmental objectives and covering many measures and sectors. The energy tax, carbon dioxide tax, sulphur tax and, to some extent, KLIMP grants, are examples of such economic instruments. The taxes in particular also meet the long-term effectiveness criteria. The international perspective and improving energy efficiency are of particular importance to the strategy for More Efficient Energy use and Transport and the strategy for Non-toxic and Resource-efficient Cyclical Systems. In theoretical terms, general use of energy taxes is considered to be a cost-effective means of improving energy efficiency. This has also been confirmed by interviews with builders, window manufacturers and in a number of energy-intensive industries. High energy prices are cited as the single most important reason for improving energy efficiency. Instruments leading to more efficient use of electricity, e.g. the electricity consumption tax and the PFE programme for improved energy efficiency, are fairly complicated to evaluate from an environmental objectives perspective. One problem is that the environmental effect materialises at the production stage, rather than the consumption stage. Moreover, electricity is produced in a Nordic market, which means that the effect of measures in Sweden on emissions may occur in other countries.

### **OBVIOUS GOAL CONFLICTS**

In the agencies' view, it may be important when developing strategies to consider the attitude to be adopted towards instruments/measures where there are potential goal conflicts. In general, it may be said that goal conflicts are seldom examined in the studies we have read. One example of a goal conflict is increased use of ethanol as a motor fuel (largely due to various economic instruments such as exemption from energy tax, lower taxation of company cars, local incentives such as free parking etc), and a desire to increase the rate of improvements in energy efficiency. The use of ethanol (based on renewable energy sources) reduces greenhouse gas emissions from the transport sector, but also reduces energy efficiency, since converting solid biomass into liquid ethanol requires more energy than does the manufacture of petrol and diesel. This goal conflict in the strategy for More Efficient Energy use and Transport is highlighted because increased use of renewable fuels and energy efficiency are both important elements of the strategy. Another goal conflict may be a sharp increase in use of biofuels (encouraged by economic instruments, among other things) and the Sustainable Forests and Rich Diversity of Plant and Animal Life objectives. If biomass use does increase sharply, the effect of this on these other environmental objectives should be made clear. In addition, new production of electricity from renewable sources may conflict with some of

the environmental objectives falling within the framework of the strategy for Management of Land, Water and the Built Environment. Building a power plant does not always intrude and impact on the surrounding environment, however.

### **Coordination with the electricity certificate scheme and the EU emissions trading scheme**

The EU emissions trading scheme forms part of the joint EU climate strategy and was introduced as a harmonised instrument in 2005. The system covers the energy production sector and most energy-intensive industries, and is also linked to global trade in that some emissions can be covered by credits under the project-based mechanisms. It has therefore become important to take account of the effects of this system in analyses of instruments covering Swedish emissions in the trading sectors. In particular, the system operates together with the carbon dioxide tax and the electricity certificate scheme. The latter was introduced primarily as an incentive for electricity production from renewable energy sources, thereby helping to secure energy supply in the EU. However, the system has clear effects on the environmental objectives, since it favours renewable energy production over natural gas-based electricity production, for example. The PFE programme for improved energy efficiency in industry also acts together with these systems. Measures taken under PFE and the EU emissions trading scheme can complement each other. It is not possible to make a final assessment of the effects of PFE, as the programme has not yet been evaluated.

Several studies have concluded that, as a matter of principle, the carbon dioxide tax should be abolished in the sectors covered by the EU emissions trading scheme. The tax and the trading system act in the same way and duplicate instruments are inefficient. However, one study points out that the carbon dioxide tax should remain for parts of the energy production sector, i.e. the district heating sector, so as not to forfeit progress already made in achieving a higher proportion of biofuels used in production. The agencies also wish to highlight another consequence of the EU trading system. In the near term (during the current allocation period for emission allowances) the effects on total EU emissions of lower electricity consumption (effects of the consumption tax on electricity and conversion grants for buildings heated by electricity) or a greater proportion of renewable electricity production (the electricity certificate scheme) remain unchanged. This is because lower emissions from the Nordic electricity system at the same time allow higher emissions in another EU country under the EU emissions trading scheme. Eventually, when new trading periods begin, lower emissions resulting from these instruments may affect the scope for future allocation of emission allowances.

### **Examine the scope for more joint EU instruments**

Lastly, we wish to emphasise the importance of also examining the scope for further development of joint EU instruments. The Commission will be presenting a green paper on market-based instruments in early 2007. The European Environment Bureau has proposed a programme of tax reforms using the "open coordination" method. The new sustainability strategy adopted at the EU summit in June

2006 urges member states to continue the shift towards green taxation. The Commission will be presenting a report in 2007 on current systems used by member states. In 2008 the Commission will be presenting a report containing proposals on ways of phasing out the most environmentally harmful subsidies. Environmental problems associated with Reduced Climate Impact, the strategy for More Efficient Energy use and Transport, the Zero Eutrophication, Non-Toxic Environment objectives, and the strategy for Non-toxic and Resource-efficient Cyclical Systems are not confined by national boundaries. Joint EU economic instruments should therefore be included in the analysis of the Sweden's approach to developing economic instruments to achieve the stated environmental objectives. It may be added that trade and industry have demanded more international harmonisation and coordination, since many companies make and sell their products in an international market. Developments in the R&D field (both in the private sector and the academic world) also often take place in an international arena.

### **A final coherent strategy must also consider other instruments**

A comparison with other instruments must also be made to determine whether an economic instrument is the most effective one. Moreover, instruments often act in concert. For instance, the NO<sub>x</sub> system operates in parallel with operating permit application procedures, which means that all existing and potential instruments should be analysed in parallel to evaluate their effects and potential.

### **Defining the terms used in future evaluations**

Finally, we wish to refer back to our introductory comments on various concepts and definitions describing the socio-economic effectiveness of our approach to achieving the environmental objectives. Going forward, it is essential that the terms used are defined clearly and used consistently. A comprehensive socio-economic analysis should also analyse and evaluate the definitions of the objectives themselves. The socio-economic impact analysis should also examine the consequences for other societal objectives. We would here like to stress that adverse effects on other societal objectives may sometimes be a reason to modify the instrument, but not in all cases. Other government measures can also be used to alleviate the negative effects of the instrument.

## Summary of the need to evaluate economic instruments

**Table 1** Has the instrument been sufficiently evaluated and is it considered to be effective in the long run? A summary of the instruments surveyed.

| Instrument | Has the instrument been sufficiently evaluated? | Is the instrument a long-term effective means of furthering environmental interests (based on the criteria of cost-effectiveness, dynamic efficiency and achievement of objectives)? | Main objective(s) |
|------------|---|--|-------------------|
|------------|---|--|-------------------|

### Multi-sectoral

|   |   |  |   |
|---|---|--|---|
| General comments on energy and carbon dioxide taxes       | Yes, except for reduced-rate taxes for industry outside the EU emissions trading scheme   | Yes, tax reductions may be justified for trade and industry policy reasons.  | Reduced Climate Impact.<br>Fiscal.<br>Energy system transition.   |
| Sulphur tax   | Essentially yes, but the effect of lowering the tax exemption limit needs to be examined. | Yes.   | Zero Eutrophication.<br>Natural Acidification Only.<br>Clean Air. |
| KLIMP (local climate investment programmes)               | Yes.  | Probably not, but fairly effectively for a grant system, owing to broad coverage and flexible choice of measures.                | Reduced Climate Impact.<br>Energy system transition.              |
| Grants for market launch of energy-efficient technologies | No.   | More analysis is needed. With the right design, the instrument is thought to have the potential to complement other instruments. | Energy system transition.   |

### Manufacturing industry and energy production

|   |   |  |   |
|---|---|--|---|
| Financial support for wind power, including environmental bonus | No, no evaluations made.                  | No.  | Energy system transition.   |
| Programme for Improved Energy Efficiency (PFE)                  | No.                                       | Doubtful, although the effects of this instrument interact positively with other economic instruments. | Trade and industry policy.<br>Energy system transition.           |
| Property tax on wind power and hydro-power                      | Not in terms of its environmental impact. | Unclear.   | Fiscal.   |
| Nuclear power output tax  | Not in terms of its environmental impact. | Unclear.   | Fiscal.<br>Energy system transition.                              |
| NOx charge  | Yes                                       | Yes, for sources included.   | Zero Eutrophication.<br>Natural Acidification Only.<br>Clean Air. |

| Instrument | Has the instrument been sufficiently evaluated? | Is the instrument a long-term effective means of furthering environmental interests (based on the criteria of cost-effectiveness, dynamic efficiency and achievement of objectives)? | Main objective(s) |
|------------|---|--|-------------------|
|------------|---|--|-------------------|

**Housing and services etc.**

|   |  |  |   |
|---|--|--|---|
| Tax relief for installation of biofuel unit serving as main heating source in new houses and for installation of energy-efficient windows in existing houses. | No.  | No. Narrow focus.  | Reduced Climate Impact.<br>Energy system transition.                          |
| Grants for improved energy efficiency and conversion in public buildings (OFFROT).  | No. The Board of Housing, Building and Planning presented a plan for monitoring and evaluation of these grants in June 2005. | No. May have brought measures forward, but they are often profitable even without grants.                      | Reduced Climate Impact.<br>Energy system transition.<br>Increased employment. |
| Conversion grants for homes and related premises  | No. The Board of Housing, Building and Planning presented a plan for monitoring and evaluation of these grants in June 2005. | No. May have brought measures forward, but they are often profitable even without grants.                      | Reduced Climate Impact.<br>Energy system transition.                          |
| Property taxation   | Not in terms of its environmental impact.  | Possibly counterproductive, but probably limited.  | Fiscal.   |
| Solar heating and solar panel grants (solar panel grants under OFFROT)  | No, monitored, if anything.  | No. The main aim is to encourage the use of a given technology. The design of the scheme is in need of review. | Energy system transition.   |

**Transport sector**

|  |      |  |   |
|--|------|--|---|
| Motor fuel tax   | Yes. | Yes. The effect on other societal goals may limit the scope for using motor fuel tax.              | Fiscal.<br>Reduced Climate Impact.<br>+ other external effects (noise, road wear etc).    |
| Tax exemption for biofuels   | No.  | Unclear. Its effect alone and with other instruments needs to be examined.                         | Reduced Climate Impact.<br>Energy system transition.                                      |
| Vehicle tax  | No.  | Probably not. Its effect in conjunction with other instruments in the sector needs to be analysed. | Fiscal.<br>Reduced Climate Impact.  |
| Environmental classification of motor fuels and differential taxes | Yes. | Yes.   | Natural Acidification Only<br>Clean Air<br>Zero Eutrophication.<br>Non-Toxic Environment. |

| <b>Instrument</b>  | <b>Has the instrument been sufficiently evaluated?</b> | <b>Is the instrument a long-term effective means of furthering environmental interests (based on the criteria of cost-effectiveness, dynamic efficiency and achievement of objectives)?</b> | <b>Main objective(s)</b>   |
|--|--|---|--|
| Taxation of company cars and free motor fuel                         | No.  | Counterproductive. Amended regulations combined with other economic instruments in the transport sector should be analysed.   | Fiscal.<br>Clean Air, Natural Acidification Only, Reduced Climate Impact.<br>(Amended regulations) |
| Road charges for certain types of heavy-duty vehicles                | No.  | No. Different main purpose. Effects combined with other economic instruments in the sector should be analysed.  | Fiscal.<br>Acidification, Clean Air.<br>(Differentiation)  |
| Subsidised public transport.   | Yes.   | Doubtful. Other aspects need to be taken into account, however.   | Several traffic policy objectives<br>Reduced Climate Impact.<br>Energy system transition.          |
| Car-scrapping premium  | Yes.   | Not in terms of encouraging people to scrap old vehicles. Does encourage people to take their scrap vehicles to scrap yards.  | Non-Toxic Environment.<br>Natural Acidification Only.<br>Zero Eutrophication.<br>Clean Air.        |
| Congestion tax (trial in Stockholm)                                  | Yes.   | Yes.  | Clean Air.<br>Fiscal.<br>Reduced Climate Impact.   |
| Transport funding  | Yes.   | Probably marginal effect.   | Regional policy.   |
| Lower tax on alkylate petrol   | No.  | Unclear. More incentives needed.  | Non-Toxic Environment.   |
| Aviation tax   | No.  | No. Does not influence technical development. Global markets entail a risk of carbon dioxide "leakage".   | Reduced Climate Impact.<br>Fiscal.   |
| Environmental shipping lane dues                                     | No.  | No. Increased use of internationally harmonised instruments needed.   | Zero Eutrophication.<br>Natural Acidification Only.<br>Clean Air.                                  |
| Environmental landing fees   | Yes.   | No. Increased use of internationally harmonised instruments needed.   | Zero Eutrophication.<br>Natural Acidification Only.<br>Clean Air.                                  |
| Grants for disposal of oil waste from ships                          | No evaluations made.                                   | No. Essentially regulation. Very few grant applications received.   | Balanced Marine Environment.   |
| Agriculture, forestry, fisheries                                     |  |   |  |
| Grants for planting of energy forest and cultivation of energy crops | Yes (white paper under preparation)                    | No. Design of the scheme may be in need of review.  | Reduced Climate Impact.<br>Energy system transition.   |

| <b>Instrument</b>   | <b>Has the instrument been sufficiently evaluated?</b>             | <b>Is the instrument a long-term effective means of furthering environmental interests (based on the criteria of cost-effectiveness, dynamic efficiency and achievement of objectives)?</b> | <b>Main objective(s)</b>                             |
|---|--|---|--|
| Grants for conservation of natural and cultural heritage, and management of broad-leaved deciduous woodland             | No, but not a priority.  | Difficult to say. But there has been a positive effect on natural and cultural assets in woodland.  | Sustainable Forests.                                 |
| Tax incentives in the forest sector   | Yes.   | Counterproductive: Regulations in need of review.   | General taxation principles.<br>Sustainable Forests. |
| Purchases, compensation for land-use restrictions and management of forest land   | No. Environmental effect and level of funding should be evaluated. | Unclear.  | Sustainable Forests.                                 |
| Tax on cadmium in artificial fertiliser   | Yes.   | Yes, nationally speaking  | Non-Toxic Environment.                               |
| Tax on nitrogen in artificial fertiliser  | Yes.   | No: Geographical differentiation desirable.   | Zero Eutrophication.                                 |
| Pesticide tax   | Yes.   | Limited effect  | Non-Toxic Environment.                               |
| Agricultural environmental compensation   | No, needed continuously.   | Unclear, acts for and against.  | Varied Agricultural Landscape.<br>CAP.               |
| Tax relief on light heating oil (EO1) used in agriculture and forestry for purposes other than operating motor vehicles | No.  | Counterproductive.  | Trade and industry policy.                           |
| Tax relief on use of diesel in agriculture, forestry and fisheries  | No, but not a priority.  | Counterproductive.  | Trade and industry policy.                           |

#### Other economic instruments

|   |  |  |  |
|---|--|--|--|
| Landfill tax  | Yes.   | Yes (may require differentiation).                                   | Reduced Climate Impact.<br>Good Built Environment.<br>EU waste strategy. |
| Funding of site remediation                           | No, effectiveness and funding level should be evaluated. | Unclear.   | Non-Toxic Environment.<br>Good Quality Groundwater.                      |
| Tax on natural gravel                                 | Yes.   | Limited contribution – main impact via permit application procedure. | Good Built Environment.  |
| Water pollution charge                                | Yes.   | Unclear link but probably prevents emissions.                        | Balanced Marine Environment.   |
| Batteries charge                                      | No, the charge should be evaluated.                      | Unclear.   | Non-Toxic Environment.   |
| Radon grants  | Yes.   | Can probably be made more effective. Greater incentive needed.       | Good Built Environment.  |
| Government grants for liming of lakes                 | No, effectiveness and funding level need evaluating.     | Unclear.   | Natural Acidification Only.  |
| Government funding of fisheries conservation measures | No, better monitoring needed.                            | Unclear.   | Flourishing Lakes and Streams.   |



# Economic Instruments in Environmental Policy

Summary of a Government Assignment Report  
by the Swedish Environmental Protection Agency  
and the Swedish Energy Agency

We have resolved to hand on an ecologically sustainable society to future generations, a society in which the major environmental problems have been solved.

In Sweden, 16 environmental objectives have been established as benchmarks for all environment-related development. Various environmental instruments have been introduced to attain our objectives. The use of economic instruments has generally been an effective means of implementing Swedish environmental policy.

This publication is a special edition with the English summary of a Swedish Government assignment reported in October 2006 (English translation, Report 5678). The project has been carried out by the Swedish EPA and the Swedish Energy Agency. The report contains a review of evaluations of existing environmental economic instruments in Sweden. Almost 200 evaluations are referred to. Particular focus has been on instruments relating to the Swedish environmental objectives: Reduced Climate Impact, Zero Eutrophication, A Non-Toxic Environment, and Sustainable Forests. As it is considered that these objectives will be particularly difficult to achieve within the set time limit of 2020.

Some areas are identified where further evaluations are needed. These include green tax shift, a comprehensive evaluation of economic instruments in the transport sector, effects of abolishing the lower-rate energy, and carbon dioxide taxes for non-energy-intensive manufacturing industry.

