EXPERIENCES WITH THE DANISH CO_2-TAX SCHEME FOR INDUSTRY AND THE COMMERCIAL SECTOR AND ITS EVALUATION

Ms. Lisbeth Nielsen

Denmark

Abstract: *In 1995 Denmark decided on a green tax scheme for commercial sectors and industry. The main purpose was to reduce CO_2 emissions and to stimulate employment by shifting a part of the tax on labour to a tax on energy. To overcome the competitive problem the tax revenue is recycled, and the tax is graduated. Energy intensive industries can get a reduced tax if they enter into a binding agreement on energy savings, and for a period subsidies are given to adjust the technology and production to the new tax structure. An evaluation has now concluded, that the tax package results in a very considerable environmental impact in an economically efficient manner. The energy tax system is expected to lead to a 3.8% reduction in the total CO_2 emissions from 1988 levels by 2005. Due to the recycling of increased taxes, the macroeconomic effect of the energy tax system has been very moderate. The experience shows it is possible to establish an energy tax system that lead to a reduction in CO_2-emissions, without causing a decrease in the competitiveness of industry and the commercial sector.*

Background

In 1994 an inter-ministerial committee found that it was not possible to reach the Danish reduction target for CO_2, without additional measures being taken. In the same period it was the political intention to introduce a gradual shift in the balance of the taxes on Danish companies – away from tax on labour, towards tax on pollution and depletion of scarce resources. A CO_2-tax was implemented a few years ahead. This tax was at a high level for the household sector, and a low level for industry and the commercial sector, so the price structure and the incentive to energy savings were not the same in all sectors. The most efficient means of receiving further reductions was found to be to increase taxes on energy consumption in industry and the commercial sector. On that background Denmark decided on a green tax package with an increased CO_2 tax as the main element.

Selection of measures

The packages should fulfil several conflicting objectives. The economic effect should be high enough to have a significant effect on the emissions. On the other hand the tax burden should not be so large as to effect the competitive positions of the companies. Especially the competitiveness of energiintensive companies had to be taken under consideration.

The distribution of the tax burden should be fair, but on the other hand the scheme shouldn't be too complicated to administer.

Since taxes were introduced unilaterally, the question of the competitiveness of Danish industry was important. Danish industry is characterised by the fact that a small number of large, energy-intensive companies account for a sizeable proportion of all industrial energy use. Approximately 15 companies consume 40% of all industrial energy use. If taxes on energy use were to be imposed on these companies, the tax burden would be so excessive that it could force the companies to close down or move abroad. However, this would not affect the aggregate demand for goods produced by these industries, and hence global CO_2 emissions would not be affected.

However, the trade and service sector in general is not affected by foreign competition to the same extent, and therefore trade and service sector companies are more resilient to new taxes on energy use.

In the selection of the combination of measures, all of these objectives had to be taken under consideration.

The package

The green tax package consists of a number of different elements. The most important are the taxes, which are levied on the energy use of trade, industry and services. However, all additional revenue is recycled primarily through the lowering of non-wage labour costs, subsidies to energy-efficiency investments, and by granting tax subsidies to energy-intensive companies on condition that they enter into an agreement on energy efficiency with the Danish Energy Agency.

Taxes

The package passed higher CO_2 taxes for industry and the commercial sector, and introduced energy taxes on space heating and SO_2 taxes on emissions. Fully effectuated, the additional taxes entailed by the Energy Package are estimated to be DKK 2,5 billion annually.

CO_2 taxes influence the CO_2 emissions with several mechanisms:

- The tax encourage trade and industry to choose fuels containing less CO_2
- The tax gives an intensive to energy savings
- The tax gives a competitive advantage for energy efficient companies in relation to less energy efficient companies.

To protect energy-intensive companies from being subjected to a high tax burden, which could affect their competitive positions, a system of differential tax rates was devised. Energy use is divided into three categories according to how the energy is used. The system distinguishes between heavy processes, light processes and space heating. Certain energy-intensive processes are defined as energy-heavy processes if the energy use is high in relation to the value added by the production processes. Light processes are defined as all other industrial processes, while space heating is defined as energy used to heat room space.

The SO_2 taxes are applied to all energy uses at the same rate. The CO_2 tax is applied to all energy uses at differential rates: the tax rate for space heating is high, the rate for light processes is lower, and the rate for heavy processes is the lowest. The energy tax is only applied to space heating. This is illustrated in Table 1.

Table 1. *Application of taxes by 2000 (DKK 100 = $ 13)*

	Energy taxes	Sulphur taxes	CO_2 taxes
Space heating	~ DKK 48 per GJ	DKK 20 per kg sulphur	DKK 100 per ton CO_2
Light processes	No taxes	DKK 20 per kg sulphur	DKK 90 per ton CO_2
Heavy processes	No taxes	DKK 20 per kg sulphur[1]	DKK 25 per ton CO_2

1) Lower sulphur tax rates for certain fuels are used for heavy processes if an agreement is entered.

A total of 35 processes have been defined as heavy processes. Heavy processes account for 61% of all energy consumed by *industry*. The remainder is divided between light processes (27%) and space heating (11%). Within *trades and services*, energy use is divided between light processes and space heating. If a company uses the same energy source for different purposes, several meters are required within the company.

Recycling

All additional revenue is recycled. Primarily through the lowering of labour market contributions. It was decided that the taxes should be recycled by lowering the non-wage labour costs of individual companies instead of lowering income taxes in order to achieve a rapid response in the economy. This way, the energy tax system will contribute to a gradual shift in the balance of the taxes on Danish companies away from tax on labour towards tax on pollution and the depletion of scarce resources.

In order to help companies to adjust to the higher energy prices, for a period (1996-99), a part of the revenue has been recycled through subsidies to energy-efficiency investments. Subsidies are granted for changing to more effective energy technologies and methods of production. Investments projects as well as projects of developmental character can apply for subsidies. Criterias are set up to secure, that subsidies are given to projects, which would not have been implemented without subsidies. In general, subsidies are granted for up to 30 % of investments in energy-efficiency projects. A total of DKK 1800 million has been set aside for subsidies.

As stated above, very energy-intensive companies would have difficulties operating in the competitive international market if taxes on energy use were too high. Therefore, a system has been worked out whereby energy-intensive companies can reduce taxes by entering into a binding agreement on energy efficiency.

To qualify for a lower tax rate, energy-intensive companies can enter into an agreement with the Danish Energy Agency, which is valid for up to three years. Agreements must be renewed after three years. The agreement system has been established to ensure that these companies operate energy efficiently, even though they as part of the agreement actually are taxed at a lower rate. The tax subsidy in the case of an agreement will be DKK 22 per ton of CO_2 by 2000.

The agreement system is based solely on the green tax system, and cannot be seen as an individual instrument. If the companies were not to pay CO_2 taxes, there would be no incentive for entering into an agreement.

Evaluation
The Danish green tax system has undergone an evaluation in 1998-99 to assess the economic and environmental effects of the new energy tax system.

The general conclusion of the evaluation is that the tax package results in a very considerable environmental impact in an economically efficient manner. The energy tax system is expected to lead to a 3.8% reduction in the total CO_2 emissions from 1988 levels by 2005. The system seems to have had almost the expected effect. Due to the recycling of increased taxes, the macroeconomic effect of the energy tax system has only been moderate.

Evaluation methods
The evaluation methods have varied depending on the measure evaluated. Taxes are evaluated with the use of macroeconomic models, subsidies are evaluated on a project to project basis, and the agreement scheme is evaluated by interviews with a part of the companies.

The effect of the taxes can only be evaluated meaningfully with the aid of a model analysis. This is due in part to the fact that experience has shown that trades and industries react with some delay to changes in taxation. Moreover, the most important CO_2 changes in the tax system have not been implemented until the time of the evaluation and thereafter. It would therefore not be possible to evaluate the effect of the taxes by means of interviews etc. Finally it is doubtful if more direct gauging of the effect of the taxes would be able to isolate the effect of the taxation changes in relation to other conditions which influence energy consumption.

The environmental effect of the taxes has been estimated on the basis of model calculation, using the macroeconomic model EMMA. In this model, the estimated demand for energy is based on historical data. The demand for energy is dependent upon production, the relative price of energy and the assumptions of technical progress etc.

The energy savings from subsidies are calculated on the basis of the subsidies, which have been granted. The basis is the information given by applicants on the expected savings, changes in fuels etc. These figures have been adjusted in view of the fact that, in practice, there are typically fewer savings than indicated in the applications. The effect has in practice been studied on the basis of e.g. interviews. On the whole, this adjustment means that the effect of the subsidies on CO_2 emission is approximately halved compared to the applications received from companies.

An extensive study has been carried out of the effects of the agreements, which have been entered hitherto. On this basis the energy savings connected with agreements have been estimated.

The effect on the environment

The evaluation shows that the tax system ensures a very significant environmental effect in an economically efficient manner, which simultaneously takes international competitiveness into consideration.

Thus the environmental effects of the energy package live up to the original expectations. The energy package will contribute to a reduction of CO_2 emission of almost 4% in 2005 and thus represents a very important element of the efforts to reduce Danish CO_2 emissions. The environmental effect is better than expected with respect to sulphur.

Total, annual CO_2 reduction resulting from subsidies and agreements has been calculated at approximately 1.1 million tons of CO_2, corresponding to 1.8 % of Denmark's total emission in 1988. The reduction by means of the agreement scheme and related projects receiving support comprises approx. 0.4 million tons of this, while the subsidy scheme gives a reduction of approx. 0.7 million tons of CO_2.

It is assessed that the taxes will result in an annual CO_2 reduction of 1.2 million tons, corresponding to 2% of the emission in 1988.

Thus the energy package is making an important contribution to the fulfilment of Denmark's national reduction targets and to the fulfilment of the joint commitment of the EU Member States in connection with the Kyoto agreement.

The energy package will more than fully contribute to the expected reductions in SO_2 emission. It is estimated that as a result of the package SO_2 emission will have been reduced by 34,000 tons in 2005.

Distribution effect
Additional taxes and recycling for trade and industry have been calculated in the evaluation. The evaluation does show two imbalances in the effect of the package in relation to the preconditions that were applied when the energy package was adopted.

In the first place, calculations show that the manufacturing industries are under more strain than was expected when the package was adopted. Conversely, the other sectors are under less strain than previously foreseen.

In the second place, companies with high space heating consumption are under greater strain from the tax system than expected. Space heating consumption comprises a small part of overall costs in the case of most companies. But for various reasons a small group of companies have large-scale energy consumption for purposes of space heating in relation to the size of the heated space. This applies, inter alia, to certain companies where the ventilation is high due to the working environment. These companies pay a relatively high tax.

Macroeconomic effect
Due to the recycling of increased taxes, the macroeconomic effect of the energy tax system inaugurated in 1996 have only been moderate. For the industrial sector, which are the most affected sector, the negative effect are estimated to be approximately 0,2% of the added value

in year 2000 (this estimation does not include subsidies to promote energy efficiency).

Furthermore, a comparison of prices and taxes among the European countries as part of an evaluation of the green tax system in 1998-99 has shown that the green taxes only form a small part of the total prices of energy.

The administrative effect
The evaluation shows, moreover, that the energy package is relatively complicated to administer for the companies. Particular attention is drawn to the fact that the non-recurring administrative costs in introducing the package and the administrative burden when agreements are made are relatively high.

It is estimated, that the administrative costs for companies are 1 to 2 % of the tax itself

Adjustments of the green tax package

On the basis of the evaluation and the recommendations made in that connection, in brief the Danish government decided to retain the general structural contours of the present tax system and actual level of rates in the energy area. In this connection the Danish Government found it decisive that the energy package makes a very important contribution to the fulfilment of the national CO_2 objective and the international commitment to reduce CO_2 emissions.

However, in order to improve the package and to compensate for the imbalances in the distribution effect specified in the above-mentioned evaluation, the Danish Government decided to carry out minor adjustments to the package with the following main objectives:

- The environmental effect of the package is to be further enhanced.
- The distribution effect for the manufacturing sector is to be adjusted to bring it better into agreement with the preconditions applied when the package was adopted in 1995. This includes easing the space heating tax for companies who are placed under special strain.

The main elements in the adjustment are the following:

Companies who by an objective criterion are under special strain due to the space heating tax will have the possibility of obtaining subsidies to pay the tax, if they enter into a binding agreement with the Danish Energy Agency concerning energy efficiency. The general agreement scheme will be adjusted to simplify it administratively, while the environmental effect is maintained.

DKK 175 million per year is to be provided for the subsidy scheme targeted at industry. As hitherto, this support is only granted for investments in energy efficiency, which the companies would not have carried out without the support. In addition an annual DKK 60 million is allocated for a subsidy scheme for cleaner products in industry.

The adjustment is expected to be cost-neutral for trade and industry as a whole. Increased costs involved in the adjustment of the other elements in the package will be financed by

increasing the ATP contribution (ATP = Danish Labour Market Supplementary Pension Scheme).

The expected effect of the adjustments

With respect to the environment, the adjustment of the green package will further sharpen the environmental profile of package. The increased pool for energy savings in industry will make a significant contribution to reducing CO_2 emissions and emissions of other greenhouse gases, and will reduce emissions of SO_2 and NO_x. In addition the scheme will lead to a reduction of energy consumption. The extra subsidy pool is expected to lead to a CO_2 reduction of 0.7% of Denmark's total emission in the year 2005 (in relation to 1988 emission-levels). This is a further reduction in excess of the 3.8% which the green tax package is expected to result in by the year 2005.

The increased subsidy pool for cleaner products will enable the total environmental impact to be reduced from products in connection with development, production, marketing, sale and application, including a certain CO_2 reduction.

The other adjustments are expected to be largely environmentally neutral, as it will be ensured that the agreements that replace the tax payments will have at least the same environmental effect as the taxes, which they replace.

With respect to the distribution effect, the adjustment will lead to a revenue neutral redistribution which benefits industry, financed by a corresponding additional burden on the rest of the business sector. This corrects the fact that the evaluation showed that industry was under a greater burden in compared to what originally was expected.

All in all, the adjustment will lead to the green tax package being an even more efficient environmental instrument, which will make a significant contribution to the fulfilment of the climate targets on both national and international level.