

7.0 WASTE WATER TAXES

7.1 Introduction

User charges for waste water treatment are applied in most EU member states, although with different degrees of cost-coverage. Several member states combine user charges with subsidies for sewage treatment, either from domestic sources or from the EU's structural funds.

User charges do not affect entities which for historical or technical reasons, are not connected to municipal sewage treatment plants, but such direct dischargers will have to carry the costs themselves of treatment according to specified standards (either the Urban Waste Water Directive or stricter national standards).

Within the framework of the present study, we are concerned with waste water *taxes*, which are defined as compulsory payments independent of any service received. Waste water taxes apply to direct dischargers, i.e. those entities which discharge directly into a recipient water, and possibly to the residual discharge from sewage treatment plants after treatment.

The waste water tax is a classical emission tax on a flow pollutant and was among the first economic instruments to be introduced in environmental policy. There are, as a result, some interesting lessons to be learnt over the relatively long timespan over which they have been in operation.

A waste water tax scheme was introduced in France and in the Netherlands around 1970, while Germany followed suit with a scheme that took effect in 1981. Denmark recently introduced a waste water tax which took effect in 1997. In other Member States waste water taxes are applied at the regional level, such as in Flanders (Belgium) and in Italy and Spain.

The rest of this section focuses on the Dutch, German and Danish experiences, because they represent different types of tax schemes – presented in sections 7.2 to 7.4 respectively. The Dutch scheme is a uniform scheme for all dischargers. The German scheme is closely coupled with obedience of emission standards. Denmark's new scheme, whilst applying to all dischargers and to municipal/industrial sources and individual dwellings not connected to sewers, offers considerable reductions for large industrial dischargers, and has combined fiscal and environmental purpose (part of green tax shift).

7.2 The Waste Water Levy in the Netherlands

Design and Development of the Levy

A levy system was first introduced by individual Water Boards, which traditionally organise and finance Dutch water management. In the late 1960's the water boards were reorganised and they were provided with the responsibility of collecting levies for discharges. A proposal for large-scale state subsidies to the Water Boards for the construction of local sewage treatment plants was turned down. This resulted in a full-cost recovery scheme based on revenues from emission charges (in accordance with the polluter-pays principle). In 1970, the Dutch waste water levy was set up with the 1970 Surface Waters Pollution Act and came into effect in 1971.

The levy applies to discharges of organic material, nitrogen, mercury, cadmium, copper, zinc, lead, nickel, chromium and arsenic. It now stands at 65 guilders (29 Euro) per pollution unit for state waters. For Water Boards the rate is on average 82 guilders (37 Euro) per pollution unit, ranging from 59 to 138 guilders per p.u. (27-63 Euro). The state water levy is thus at the lower end of the spectrum.

The levy is imposed on all direct discharges to surface waters as well as on all indirect discharges. The levy covers the costs of sewage treatment and therefore resembles an ordinary user fee. However, in two important respects, it deviates from a straightforward cost recovery charge. Firstly, the levy does not cover the costs of the sewer network, which is financed by a separate municipal fee. The levy also applies to direct dischargers, i.e. industries and municipal treatment plants which discharge directly to surface waters. The Dutch waste water levy is therefore a more integrated and comprehensive system than ordinary user fees. Secondly, the tax base is not the hydraulic load (cubic meters of waste water), as is the case with conventional user fees, but the specific pollutants discharged.

The levy rates have increased many times since the introduction in 1971. From 1972 to 1990 the levy rate tripled and from 1990 to the end of the 1990's the levy rate doubled once again.

Revenues and Use of Revenue

The revenue from the state water levy has been recycled both for support of municipal sewage treatment plants and to support in-house pollution abatement in industry. This was a particularly important activity in the early years of the levy scheme, which assisted several of the most polluting industries in curbing their emissions. In 1996 the subsidy scheme for industry was abolished.

The water pollution control levy raised 1,940 million guilders in 1996, the majority of which (1,600 million) was raised by the Water Boards. State waters only raised 110 million guilders and the remaining 230 million was collected by provinces and the municipality of

Amsterdam. As is stated above, the water pollution control levy does not cover costs of sewer networks. These are financed by a separate levy, which in 1996 raised 1,078 million guilders (CBS, Kosten en Financiering).

Organisational Roles and Administration

Surface waters are classified as either *state waters* (Rijkswaater) or regional waters. State waters are defined as the main rivers as well as the North Sea and are administered by *Rijkswaaterstaat*, which collects and processes the revenue collected by the levy. The Rijkswaaterstaat is the department in the Ministry for Transport and Public Works which is responsible for water management.

The 27 regional Water Boards collect levies for discharges to regional waters and to their sewage treatment plants. The Water Boards are given operational powers by the Provinces, but three (of fourteen) Provinces have retained responsibility themselves for water management and the collection of levies. Also three municipalities, including Amsterdam, have their own systems in place.

Monitoring of pollution is done by the dischargers themselves, but they are subject to sample control from the relevant authorities.

Complementarity within Portfolio of Policy Instruments

Discharges are regulated by means of discharge permits. The levies are mainly a financing instrument for the promotion of water quality, but were also accorded a certain incentive function in the preparations of the Pollution of Surface Waters Act (PSWA).

Environmental Effect

Several scholars have assessed the incentive function and effectiveness of the Dutch water pollution levy. Bressers (1988) uses a regression analysis to show a systematic relationship between the increase of the levy rate and the degree to which different industries control pollution. Schuurman (1988) conducted interviews with 150 enterprises and asked them to rank the significance of different policy instruments in their effort to control discharges. 54 per cent of the enterprises which had reduced pollution pointed to the significance of the levy, while 20 per cent claimed that permit requirements was the reason. The remaining referred to non-policy reasons. Inter-industry differences were also recorded with the levy being cited as the most significant reason in the food-processing industry, while permits were more important in the chemicals industry.

In terms of discharge reduction, the net load on surface waters from discharges has been reduced from 45 million inhabitant equivalents (i.e.) in 1970 to 4.6 million i.e. in 1996, which is a significant (90%) reduction compared to 1970 levels. Gross organic discharges from

industry have been reduced from 28 million i.e. in 1970 to 3.3 million i.e. in 1996, or to 12 per cent of the original 1970 level.

Andersen (1994) has shown that the Dutch water pollution control policy was comparatively more efficient than similar programmes in neighbouring countries, because of the levy system and the emphasis on cleaner technology measures, many of which were promoted by subsidies from the levy.

Moreover, the revenue recycling to support municipal sewage treatment plants and in-house pollution abatement in industry was a particularly important activity in the early years of the levy scheme, which assisted several of the most polluting industries in curbing their emissions.

Effects on Producers

The introduction of the levy was a controversial decision and there was considerable concern about the impact of such environmental costs on Dutch industry and the economy as a whole. Some water-intensive production processes were particularly affected by the levy scheme such as the pulp and paper industry. A few potato-flour industries were responsible for nearly one third of industrial organic emissions and so a special arrangement was made for these industries.

The most recently published data show, that in 1995 the costs of water pollution control for industry amounted to 1,698 million guilders, of which 863 million were the costs of own activities and 896 million were payments of levies. 61 million was received in the form of support. Water pollution control costs made up about 25 per cent of total environmental costs in the financial year 1995, and this item was second largest after waste management. Of the 863 million in expenditures in 1995, 225 millions were for new investments, whilst the remainder was accounted for in terms of personnel, equipment, interest and depreciation costs.

The cost of the levy amounted to 0.3 per cent of sales value, 1 per cent of value added and 3.9 per cent of the net profits in 1996.

According to forecasts by the Ministry of Public Health and Environment in place at the launch of the levy, the Dutch water pollution control policy would increase the environmental costs from 1 per cent to 2.5-3 per cent of national income over the period 1970-80. Furthermore, according to a macro-economic study by the Central Planning Bureau (CPB, 1998), the costs of the Dutch water pollution control policy would amount to an accumulated loss in GDP of 3.5-4.5 per cent over a ten year period (cited from MTPW, 1975). Neither estimates took into account the source-related measures employed in many of the Dutch industries, but they did forecast continued economic growth at an annual rate of 4 per cent throughout the 1970's. In addition the CPB-study assumed that the Netherlands would be alone in requiring sewage treatment, thus exposing its industry to international competition

(this assumption was perhaps a little unrealistic, given the much earlier development of such measures in neighbouring countries such as Germany and France). The CPB-study on the macro-economic effects was updated in 1980 (MTPW, 1980). Despite the lower actual economic growth rate experienced in the 1970's, the effect of the water pollution programme on GDP was much lower than expected. The main reason for this was "attributed to the anticipated lower need for municipal sewage treatment capacity" (as a result of cleaner technology measures reducing pollution at source within industry) (MTPW, 1980: 36).

Competitiveness and Trade Impacts

There are no current discussions on the system or on its impact on competitiveness. Clearly, the design of the levy has taken into account some potential concerns, not least in the way in which support has been given for the identification and adoption of clean technologies.

Internal Market Effects

The levy system was introduced before the completion of the internal market. It formed the background for the Commission's 1975 Communication on the Polluter-Pays Principle, which allowed the recycling of revenues for support to industries.

There appear to be no concerns arising in respect of Internal Market issues.

Impact on Employment

No studies have been undertaken into possible negative effects of the tax on employment among industries liable for the tax but these are likely to be insignificant. This is largely because the introduction of the tax was accompanied by significant efforts on the part of both government and industry to encourage better industrial process design (as opposed to simple 'end of pipe' solutions) to minimise the cost to businesses. More over, as mentioned above, the cost of the levy amounted to a very small share of the sales and net profit by industry in 1996.

The use of the revenue for investments in sewage treatment plants may have had positive employment effects through the actual investments themselves and the associated multiplier effects.

Impact on Consumers

When the levies were introduced, several thousand consumers took part in an organised boycott campaign against their payment, as the levies were seen as unjust and the Water Boards as illegitimate. Consumers did not think of themselves as polluters. As the levy system from the consumer's perspective is similar to conventional user fees for waste water treatment, the cost has to be accepted from the point of view of the polluter-pays principle. However, because of the efficiency of the programme for Dutch industry, there was less need for investment in public sewage treatment capacity, and hence lower costs to the Dutch

household. From 1976-1987 the Dutch policy required an investment of 78.5EUR/capita in public sewage treatment, while in Denmark the cost was 126 EUR/capita (Andersen, 1994: 184). Because the coverage of sewage treatment was already at more than 50 per cent in Denmark, but only about 20 per cent in the Netherlands, it appears that the Danes paid four times as much for their water pollution control policy as the Dutch. From the point of view of the Dutch consumer the scheme was therefore highly effective, although it was not initially appreciated as such.

Equity and Distributional Effects

Households pay a flat rate according to a presumed household population of three persons. Households with only one inhabitant can apply for a corresponding reduction in the levy. With no account of income levels being taken, the levy has a regressive effect on poorer households within society. However, the scheme is regarded as fair, and there is currently no discussion on its distributional aspects in the Netherlands.

7.3 The German Waste Water Tax (*Abwasserabgabe*)

Design and Development of the Tax

The tax was first proposed in 1974 by the independent Council of Advisors on the Environment (Sachverständigenrat für Umweltfragen). The federal law on the German waste water tax (*Abwasserabgabengesetz*) was passed in 1976. The tax regime remains regulated by this law as amended in 1986, 1990 and 1994.

The federal law had to be transposed into Länder legislation, and the tax came into effect in the majority of Länder in 1981, with some following in 1982-83. Upon unification, the tax regime was extended to the five new Länder with effect from 1991, and in the case of industries not liable to previous GDR-waste water taxes, from 1993. According to the original law, the rate of the tax was scheduled to increase from 12 DM per damage unit to 40 DM from 1981 to 1986. It was subsequently increased to 50 DM in 1991, 60 DM in 1993 and 70 DM in 1997.

The tax affects only direct dischargers, i.e. discharges from industries and municipal sewage outlets. Indirect dischargers are affected by the tax via the ordinary waste water user fee. There are about 8,000 municipal sewage treatment plants and 4,000 industrial direct-dischargers (Hitchens et. al., 1998: 166). The latter belong to Germany's largest industries.

Since January 1, 1997, the tax rate has stood at 70 DM (36 EUR) per damage unit. A damage unit represents either 50 kg of chemical oxygen demand (COD), 25 kg nitrogen, 3 kg phosphorus, 2 kg organic halogens, 20 g mercury, 100 g cadmium, 500 g chromium, 500 g nickel, 500 g lead, or 1,000 g zinc (See RIZA, 1995b: 102 for full details). 50 kg of COD translates into about 2.5 inhabitant equivalents (i.e.), so that the effective rate per i.e. is presently 27.50 DM (14.4EUR) per i.e. Expressed per kilogram of nitrogen, the tax rate is 2.80 DM (1.4 EUR), and per kilogram of phosphorous, the tax rate is 23.33 DM (12 EUR).

The tax interacts with standards for sewage discharges in a fairly complex way. The tax is reduced when standards are adhered to, and further reduced if dischargers manage to keep their effluent at a quality level that exceeds that set in the regulations, provided that the target for this improved performance has been set in advance and is subsequently verified.

Revenue and Use of Revenue

The revenue raised by the tax is spent by the Länder authorities on municipal sewage treatment and on Länder administration of water quality programmes. The practice varies from Länder to Länder, but in the main, the revenue is recycled for support in investments in municipal sewage treatment plants.

The Federal Environment Agency (Umweltbundesamt) estimates that 60 per cent of the revenue is derived from municipalities and 40 per cent from industry (RIZA, 1995: 107).

According to information from UBA's water office, a figure for the revenue at federal level is not available (interview). Still, such information for 1998 is given in one publication by the Ministry.

Between 1981 and 1998, the total revenue raised increased by 320% from 87.4 MEUR to 368 MEUR in 1998 (see Table 21), due to the steep increase in tax rate from 12 DM to 70 DM per damage unit.

Table 21: Tax Rate and Revenue from the German Wastewater Tax

Year	Tax Rate per Damage Unit in DM (EUR)	Revenue in million DM (million EUR)
1981:	12 (6.1)	171 (87.4)
1982:	18 (9.2)	137 (70)
1983:	24 (12.3)	237 (121.2)
1984:	30 (15.3)	341 (174.4)
1985:	36 (18.4)	409 (209.1)
1986:	40 (20.5)	467 (238.8)
1987:	40 (20.5)	496 (253.6)
1988:	40 (20.5)	432 (220.9)
1989:	40 (20.5)	308 (157.5)
1990:	40 (20.5)	321 (164.1)
1991:	50 (25.6)	337 (172.3)
1992:	50 (25.6)	284 (145.2)
1998:	70 (35.8)	720 (368.1)

Source: Sprenger et al. 1994: 121 and BMU, 2000

Intentionality of the Tax

The purpose of the tax was to make dischargers, private and municipal, comply with the prescribed standards. In the past there were considerable problems with non-compliance. Because of the interplay with the Mindestanforderungen, the German tax is effectively a penalty tax (for non-compliance with standards). Despite the reduced exemptions since 1999, the character of the tax has not fundamentally changed.

Organisational Roles and Administration

The Länder authorities are responsible for the collection of the tax. The tax payment follows from the discharge permit as well as from possible declarations from the dischargers as to whether they will discharge below the permitted quantity. In case the permitted discharge concentration is exceeded more than once, additional payment will be imposed by the Land water authorities.

The administrative costs of the entire tax scheme are to some extent disputed. As the tax is linked to compliance with the *Mindestanforderungen* much depends on costs of control and monitoring. The costs may vary among Länder, but the question is whether it is fair to link all control- and monitoring costs to the tax, and not to the waste water legislation as such.

In 1982 several Länder spent about 50 per cent of the revenue on administration, while one (Bavaria) accordingly spent more on administration than the revenue earned (Hitchens et. al., 1998: 163-164). In the mid-1980's administration costs were reduced to a level of 25-30 per cent (Hitchens, et al, 1998).

In the 1990's the administrative costs were brought down to a level of about 10 per cent of the revenue. In 1998 the share was 10,6 per cent or 76 million DM (EUR 38.9 million) (Bundesministerium, 2000: 31).

Complementarity within Portfolio of Policy Instruments

The waste water tax law interacts closely with the basic Water Household Act (Wasserhaushaltsgesetz). The interplay with standards has been refined over the years, cf. the changes of the water household act. The change from a GATS-regime to BAT-standards in 1986 was particularly significant (GATS refers to *Generally Accepted Technological Standard*, while BAT refers to *Best Available Technology*, the latter being more stringent).

The scheme for tax reduction is dependent upon the affected entities complying with specific standards for municipal sewage discharge, or with specific discharge standards (of which there are more than 100) - *mindestanforderungen*.

The reduction scheme is codified within the law and requires generally adherence to BAT (best-available-technology). Standards for BAT are approved and passed as legislative text by the Bundesrat (Upper House of Parliament). They are prepared through negotiations between federal authorities (Umweltbundesamt) and the Länder. There is little discretion in setting the BAT standard, as this follows from actual performance by companies.

By respecting the BAT or GATS guidelines in the permit, industrial dischargers may obtain a 50 per cent reduction of the tax, whilst those discharging municipal sewage can benefit from a 15 per cent reduction¹.

Municipalities which make investments for improved sewage treatment can receive a 3 year exemption from the tax, provided that the minimum standard will be met. If not, the tax has to be paid retrospectively.

¹ BAT applies to toxic effluent, while GATS (Generally Accepted Technological Standard) applies to non-toxic material such as COD.

Environmental Effect

The main effect from the tax lies in its impact on compliance with standards. A secondary effect is a more general incentive to reduce discharges liable to the tax.

Compliance rates for public sewage treatment plants are reported to be very high following the introduction of the tax. No baseline data is available to judge the effect of the tax, but whereas discharges from industries were increasing until 1981, since that year, a decline has taken place (as regards production specific waste water excluding cooling water). The decline from 1981 to 1995 has been 31 per cent, when referring to discharges on the territory of the old Länder (Statistisches Bundesamt, 1998). Many companies have found it cheaper to improve water use in production processes, than to introduce or extend sewage treatment (Bucksteeg, 1991).

The burden of the tax depends on whether the discharger is in compliance with the standards. For public sewage treatment plants which do not comply with the BAT standard, the effect of the tax is to increase costs by up to 10 per cent of total operating costs. For plants that comply the cost share of the tax is only about 2 per cent.² In addition to this there is a risk to the sewage manager in cases of non-compliance, which entails the need for extra finance after the ending of the budget year (Rudolph, 1989).

Effects on Producers

When the tax was introduced several industries were concerned about the costs being imposed. In one of the surveys in Cologne about 10 per cent of the companies stated that the tax threatened their future existence. However, concerns appear to have been exaggerated, since the rate of the tax was on average 0.08 DM/m³, within a range from 0.07-0.14 DM/m³. Information on the tax expressed as % of total production cost was not available at the time of the study.

In the first decade of the tax regime, a special '*härteklause*l' allowed for a reduction or even annulment of the tax. According to a BMI-report from 1983 the federal authorities received requests from a range of industries, including fish processing, paper- and pulp, kali industry, pectine industry and 7 others, who asked for exemptions or derogations. The BMI was in favour of a restrictive policy towards exemptions, and it seems that a special arrangement was reached only with the paper- and pulp industry (BMI, 1983: 30). The possibility for obtaining exemptions according to the *härteklause*l was removed in 1989.

The share of environmental investments was 5.5 per cent of total industrial investments in Germany in 1995 (latest published data). Investments related to water were about 2.2 per cent of total industrial investments. About 1/5 of these investments were carried out as process-integrated investments, whereas the remainder were investments in separate equipment, machinery and real estate (Statistisches Bundesamt, 1998).

² These figures are based on the 40 DM tax rate and needs to be recalculated according to the 70 DM tax rate,

It seems that a smaller part of the revenue from the tax also has been used as subsidies for industrial dischargers, but no specific information on this is available, and the practice is likely to vary between the Länder.

Impacts on Competition and Trade

A comprehensive comparative study of environmental costs in two water-intensive industrial sectors, dairy and meat production, was carried out by Hitchens et. al. (1998) in Germany, Ireland and Italy. The main finding of the study was that similar industries face different costs for sewage in the same country, depending on local tariff structures and depreciation schemes etc. However, the costs for sewage tended to be generally higher for German firms than for firms in Italy and Ireland. The costs of sewage were in average 1.02 EUR/m³ in (Western) Germany while it was 0.44 EUR/m³ in Ireland and 0.33 EUR/m³ in Italy (ibid. 92). Costs in the dairy industry were 0.87EUR/m³ in Germany and 0.25-0.26 EUR/m³ in Ireland and Italy. The main reason for the difference is not the German waste water tax, but the more advanced treatment applied in Germany, a difference that is expected to narrow as full implementation of the Urban Waste Water Directive proceeds in all Member States.

German dairy companies were on average less water intensive than the Irish and Italian counterparts (ibid.; 84-85). In fact, output per litre of water used was twice as high in German firms as in Irish and Italian ones. This finding suggests that German dairy producers had responded to the higher factor costs of water by minimizing use, suggesting that the price has an inducement effect on technological choice. The fact that a similar observation could not be made for the meat industry in Germany suggests that the marginal costs of water savings may differ in this industry. The reason could also be that German standards for this industry might be relatively less stringent, so that the incentive for reducing exposure to the tax are less strong. It is also likely to be less water-intensive than the dairy industry.

Overall the German tax has had little effect on competitiveness, because the tax was reduced with 75 per cent when the dischargers were in compliance with the guidelines. Since 1998 the reduction has been changed to 50 per cent. The impact is discussed further in the Tier 3 analysis (see Chapter 16).

Internal Market Effects

There are not any evident negative impacts on the functioning of the internal market from this tax.

Impact on Employment

Given that the tax represented on average 0.08 DM/m³, its impact on industry production costs was limited. The employment effect can be expected to be small.

Impact on Consumers

The share of the waste water tax is about 2 per cent of the municipal user fees for waste water, and consumers will generally not know about the tax as it is not explicitly identified on their bills. Since waste water user fees vary considerably among different municipalities, the tax is of relatively minor significance in itself. German user fees for waste water treatment are among the highest in Europe, so consumers are likely to be affected by these even without the tax.

Equity and Distributional Effects

There seems to be no significant equity issue related to the tax despite the flat rate being independent of income.

Data Availability and Reliability

Data on the annually discharged amount of damage units (*schadeinheiten*) as defined by the waste water tax law are not available. Nor is their distribution on the different parameters, or on their regional variation. However, official data on waste water discharges, and investments in industry are detailed in several publications from the Statistisches Bundesamt. The problem is that they can not be linked directly to the relevant parameters of the tax. These circumstances seriously impede a proper assessment of the environmental effects of the tax.

7.4 The Danish Waste Water Tax (Spildevandsafgift)

Design and Process Development

The Danish law on the waste water tax (*Lov om afgift af spildevand*) was proposed by the Government (e.g. the Ministry of Taxation) in April 1993 and approved in principle by the parliament two months later. The tax was part of the 1993 tax reform, known as a partially 'green' tax reform since taxation was shifted from income to a broader tax base.

Environmental taxes accounted for about 25 per cent of the tax shift. The 'green' tax reform introduced significant changes in the general tax base, which were gradually phased in over the period of 1994-1997, with the waste water tax projected for introduction in the final year. Since the tax was part of the broader tax reform, a target for the revenue was set, but the tax itself was detailed only with the 1996 proposal for the legislative text. The revenue target set the framework for the necessary tax rates, and the waste water tax was not developed from any valuation of the external effects of discharges. The Law on the waste water tax was passed by the Danish Parliament in June 1996, and the tax came into effect on January 1st, 1997.

The tax was phased in such that in the first year (1997) the tax rates applied were 50 per cent of their proposed level. The full tax rates only came into effect on 1st January 1998. The tax has been imposed for 3 full years and is now in its fourth year. The rates have remained constant throughout the period from the beginning of 1998.

The tax applies to discharges of organic material (BOD - biological oxygen demand), nitrogen and phosphorous from direct dischargers, i.e. waste water treatment plants, industries with direct discharges and dwellings not connected to the sewerage network. The standard rate of the tax is 11 DKK per kg of BOD, 20 DKK per kg nitrogen and 110 DKK per kg phosphorus (1.48 Euro/kg of BOD; 2.69 Euro/kg of N; 14.78 Euro/kg of P).

Exemptions

The law allows exemptions for six types of industrial processes, who can have their tax payment reduced by respectively 97 and 70 per cent of the annual proceeds liable to payment above 20,000 DKK (EUR 2,686). The reductions are allowed only upon application to the Customs and Tax Agency. The fish processing, cellulose and sugar beet industries are eligible for a 97 per cent reduction in liability for the tax. Industries producing organic pigments, pectins or vitamins are eligible for a 70 per cent reduction. In both cases eligibility for the exemption applies only if more than 80 per cent of their tax payment is related to production of the products mentioned.

There were no attempts to model the impact of the tax, but quite detailed calculations were carried out concerning the costs which different industries would incur.

Revenue and Use of Revenue

The revenue of the tax accrues to the national treasury. As part of the political compromise in parliament, a substantial sum was devoted to an independent Water Fund, the purpose of which is to finance projects which protect groundwater resources. The revenue from the tax has been significantly lower than initially expected (see Table 22).

Table 22: Revenue from Danish Waste Water Tax (in million DKK (MEUR))

	1997	1998
Gross revenue	178 (23.9)	417 (55.9)
Reductions	38 (5.1)	107 (14.3)
Net revenue	140 (18.8)	310 (41.6)
Expected	185 (24.8)	425 (57.0)

(* *Danmarks Statistik, 1999:19, claims a net revenue of 305 mill. in 1998 and 164 in 1997*).

Emissions of nitrogen and phosphorous liable to the full tax rate have been less than 1/3 of the expected level (3-4 mill. tons N against 11.6 mill. tons; 0.4-0.5 mill. tons P against 1.8 mill. tons), and emissions of BOD have been about 2/3 of the expected level (7-9 mill. tons BOD against 14 mill. tons) (Finansministeriet, 1999).

The main reason for the marked differences is that the Ministry of Taxation used the 1994-emissions when it calculated the expected revenue, and did not take into account the ongoing decline in emissions as a result of technological standards.

As part of the political agreement on the tax, 70 million DKK (EUR 9.38 million) annually was granted to an independent Water Fund, with the purpose of protecting and securing future water supply, in particular from the smaller water works.

Intentionality of the Tax.

The tax is a combined fiscal and environmental-purpose tax. The main reason for its introduction was to allow a tax shift which reduced income taxation. This was a one-off shift, and there is no direct link between the reduced revenue of income taxation and the proceeds from the new taxes.

The tax was also expected to improve compliance with the new and strict discharge standards of the Danish Plan for the Aquatic Environment, and to provide an incentive to reach even lower emission levels. In addition the tax was expected to provide an incentive to decrease use and discharge of water in general. It was also expected to provide a further incentive to introduce rainwater separation and to seal sewer networks, to avoid additional water seeping in. There are about 100 direct industrial dischargers in Denmark, but among them are some rather large polluters. In terms of BOD they discharge about 3 times as much as all sewage treatment plants (Miljøstyrelsen, 1999)

Organisational Roles and Administration

The tax was developed by the Ministry of Taxation with the operational wing of the ministry, the Customs and Tax Agency being responsible for its collection. The tax is administered by the regional Customs and Tax inspectorate along with other duties and taxes. Dischargers are obliged to register with the regional office of the Customs- and Tax Agency. The only exception to this system relates to discharges from local dwellings not connected to the public sewer network. In this case, the tax is collected instead by the local municipality.

The tax is calculated either on the basis of monitoring of discharges or according to a table of hydraulic discharge standard values. For most large dischargers, sewage treatment plants and industries, the environmental permit already requires continuous monitoring of discharges, and the tax is calculated on the basis of this monitoring. Monitoring is done by the discharger, but is verified through sampling by the local environmental inspector.

Non-industrial dischargers may choose to pay the tax according to metered water consumption coupled with standard rates according to the type of treatment applied. Water consumption is normally metered for the purpose of the collection of water tariffs. Where this is not the case, a pro rata consumption level is estimated. Where water consumption is the tax base, a 50 per cent surcharge is added to the tax, except where less than 10 dwellings are affected.

The Tax and Customs Agency assessed the administrative requirements as amounting to 4 staff and 0.5 mill. DKK. Direct dischargers need to register and report their discharges, but the figures are already known from existing systems. This is not the case for indirect dischargers who may wish to claim allowances.

The Ministry of Finance's assessment is that the administrative costs of the tax mainly relate to the need for improved monitoring at some sites (Finansministeriet, 1999).

Complementarity within Portfolio of Policy Instruments

The waste water tax is a supplementary instrument to the basic technological and procedural requirements as regards waste water discharges. The Plan for the Aquatic Environment sets specific standards for municipal sewage treatment plants. For 38 direct industrial dischargers it requires the use of best available technology (BAT). In total these are responsible for about 90 per cent of direct industrial discharges.

In tandem with the waste water tax, a tax on piped water supply was introduced. The latter generates more revenue, although it explicitly exempts industry.

Environmental Effect

The 30 exempted companies account for 66 per cent of the total organic material (BOD) discharges, 11 per cent of nitrogen discharges and 11 per cent of phosphorus discharges

(1998-data; Miljøstyrelsen, 1999: 129, see Table 23). As a result, the tax mainly affects public sewage plants. Of the revenue about 15 per cent is paid by industry, while the remainder is paid by municipal sewage treatment plants.

Table 23: Discharges of Substances Subject to the Tax by Weight and Percentage Contributions.

Discharges (tonnes)	Biological Oxygen Demand (BOD)	Nitrogen	Phosphorus
Municipal sewage treatment plants	3525 (25%)	5166 (78%)	601 (83%)
Direct dischargers	10733 (75%)	1428 (22%)	124 (17%)
of which: exempted dischargers	9400 (66%)	750 (11%)	77 (11%)
Sum	14258	6594	725

Data for direct discharges of nitrogen and phosphorus have been published for 1997 and 1998, the first two years with the new tax regime (Miljøstyrelsen, 1998; 1999).

The discharges from sewage treatment plants have declined by 20-25 per cent from 1996 to 1998, for BOD, phosphorus and nitrogen. Emissions from industries with direct discharges have increased since the introduction of the waste water tax. The increase is 15-20 per cent for both BOD, phosphorus and nitrogen (Miljøstyrelsen, 1999: 39).

The role of the tax has to be set in context with the effects of other policies. For both sewage plants and industries a general and marked decline in emissions of BOD, nitrogen and phosphorus has taken place since 1989. The overall decline since 1989 is regarded principally as a result of the technical guidelines in the Plan for the Aquatic Environment.

In the past municipal sewage treatment plants often failed to comply with their discharge permits. In 1989, 39 per cent were not in compliance, and in 1996 non-compliance remained high at 30 per cent. However, the non-compliance rate was reduced to 20 per cent in 1997 and to 16 per cent in 1998 (Miljøstyrelsen, 1999b: 29). The improvement in compliance is mainly the result of improved enforcement, but the tax did play a supplementary role. Many of the municipal sewage treatment plants discharge below the requirements (*ibid.*, pp. 20-21).

The Danish EPA is currently evaluating the tax. There are indications that in particular the current rate of the tax for phosphorus-discharges make improved control profitable, that is, it is in excess of the abatement cost (Interview).

Effects on Producers

The tax mainly affects public sewage treatment plants, who in turn rely on the connected households and commercial enterprises for their income. The tax was expected to increase the total costs of public sewage treatment by less than 10 per cent (L249: 7). In 1998 the share of

the revenue of the tax from sewage plants was about 5 per cent of the total sum of user fees for sewage treatment.

For the connected industrial enterprises (indirect dischargers) the 5 per cent cost increase figure is less than 0.01 per cent of the wage sum.

Among the direct dischargers with a 70 per cent reduction, the tax amounts to an additional cost of about 0.2 per cent of turnover or 2,500 DKK or EUR 335 per employee. Among the direct dischargers eligible for a 97 per cent reduction, cellulose production is most affected (0.3 per cent or 6500 DKK or EUR 871 per employee), while fish processing (0.1 per cent or 2-2500 DKK/EUR 268-335 per employee) and sugar beet production (1500-3000 DKK/ EUR 201-402 per employee) is less so.

Overall, the impact of the tax on producers seems to have been very low, almost negligible. Even if the full tax rate had been applied to the industries that enjoy the reduced rate, the tax revenue would generally not have exceeded 1 per cent of turn-over for those companies with a 70 per cent reduction. Only for cellulose production and the sugar industry would the tax have had a major impact in a static case, without dynamic adjustment to the tax. Because of the poor profitability of fish processing, the tax would also have been likely to have a serious impact on some producers here (Andersen et. al., 1994). It is the impression that the reduction clause came to apply to all industries who were concerned about the impact of the tax, and that some of the reductions deserve more careful analysis.

Competitiveness, Trade and Internal Market Impacts

The industries that could be most seriously affected by the tax received very considerable exemptions, which may explain why the Confederation of Danish Industry has not raised issues regarding the specific impact from the waste water tax on competitiveness. Owing to the exemption and allowance schemes, the tax has been notified to and approved by the European Commission. Hence, this tax does not have any significant effect on competitiveness and intra-Community trade.

In fact the tax rates appear to have been set according to a level of reasonable burden (about 0.2 per cent of turnover), and not according to any desired environmental target. If correct this appears to confirm the view stated above that the effect on competitiveness of the tax has probably been minimal. The tax, and more precisely the reductions offered, appears to have been designed with the intention in mind that no industry should be seriously affected.

To avoid unfair competition between direct and indirect dischargers, the exemptions in principle apply also to similar industrial dischargers connected to municipal sewage treatment. They may, upon application, receive an allowance for the incurred cost on their sewage bill. No figures on their share of the reductions are currently available.

The allowance scheme for indirect dischargers within the exempted industries is critical to internal market concerns, because it allows certain industries a partial refund of their sewage bill.

Impact on Employment

The individual effect of the waste water tax has not been analysed, but in particular the recycling of revenue for the Water Fund is believed to have a substantial employment component. The employment effect of the green tax shift is positive, but just moderately so.

Impact on Consumers

The tax increases the sewage treatment bill by about 5 per cent, depending on the exact circumstances of the municipal plant. The average for the sewerage user fee is currently 11 DKK/m³ (EUR 1.22) with a variation from 4 DKK to 30 DKK (EUR 0.54 - 4.02), depending on treatment type, sunk costs and depreciation of investments and other costs. The impact of the waste water tax is largely invariant with respect to these and translates thus into an average cost increase of about 0.50 DKK(EUR 0.07) /m³ water.

Because sewerage fees are liable to VAT, an additional 25 per cent cost increase is incurred, so the total increase faced by users is of the order 0.62 DKK/m³ water (EUR 0.08).

Consumers are not expected to be aware of the specificities of the waste water tax, but since sewerage fees have increased significantly over the last decade, water use has generally become much more expensive, and consumers are generally conscious about making possible savings, either through reducing water use (at source) or through installation of water saving technologies (see Chapter 6, Section 6.3 on the Danish water supply tax).

It should be pointed out in this respect, that water use is generally metered in individual households in Denmark. Dwellings in apartment blocks rely on collective meters and the water costs are included in the calculation of monthly rent, though often with a timelag of one or more years. This reduces the incentive of individuals to conserve water.

Equity and Distributional Effects

The reductions granted to specific industrial dischargers were not foreseen when the tax was originally agreed. If the reductions had not been introduced, the affected industries would have been liable to a payment annually of about 100 million DKK (EUR 13.4 million).

The tax does have certain possible regressive effects because the unit costs of water do not vary according to consumption levels (so will affect poor households more, because water charges generally make up a proportionally greater fraction of their overall expenditure).

7.5 Summary

The three surveyed tax schemes differ considerably, and are hence illustrative of the range of options which may combine environmental effectiveness with economic and administrative feasibility.

The emphasis on the competitiveness issue was also pronounced in the 1970's when the Dutch and German schemes were introduced, as evidenced by the numerous studies concerning their effects in particular on enterprises. The static *ex-ante* modelling in the Dutch experience seems initially to have exaggerated the costs of the policy, and later *ex-post* modelling as well as comparative work indicates that there were advantages associated with dynamic efficiency gains through more efficient production processes which were seized as a consequence of employing the levy. The Dutch scheme also successfully combined the tax with a recycling of revenue for technology innovation and for process engineering by experienced institutes.

The German waste water tax is closely coupled with the system of standards, which makes it difficult for many dischargers to understand why they are liable to a (reduced) tax even when they comply with the standard. It is difficult to test its environmental effectiveness, because the authorities do not record the number of damage units emitted, but it does nevertheless seem to have influenced discharges in a downward direction. German dairy companies are reported to be more efficient in their use of water than Italian and Irish competitors, while the difference is negligible for slaughterhouses.

The Danish waste water tax has been introduced under the heading of green tax reform, and has hence had a fiscal impact different from the two other taxes. Due attention has been paid to large dischargers, and the tax reductions offered seems to have made the waste water tax ineffective in dealing with industrial effluent, which is increasing (though whether this increase would have been greater in the counterfactual situation is not known). As regards municipal waste water treatment plants there is evidence to suggest that compliance with standards has improved considerably after the introduction of the tax. The administrative system is simple, even though it also includes dwellings without sewer connection, and relies on the combined expertise of the Customs- and Tax Agency and the local municipal authorities.