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Effectiveness of urban wastewater treatment policies in selected countries: an EEA pilot study

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Executive summary

Water pollution caused by wastewater persists despite three decades of effort to clean up European surface waters and despite the requirements of the Urban Waste Water Treatment Directive (UWWTD). Several EU Member States have yet to satisfy the requirements of the directive. A European Commission report released in 2004 noted that several countries had failed to designate sensitive areas and were behind schedule in establishing the capacity of sewage treatment as required by the directive deadlines in 1998 and 2000. As the next deadline is approaching at the end of 2005, for extending sewage treatment to urban areas with more than 2000 inhabitants, the EEA has acknowledged the need to improve our understanding of the inherent implementation problem.

This pilot study examines the effectiveness of wastewater policies and measures in six Member States in order to identify and understand the reasons for both the successes and the shortfalls in implementation. Two of these countries have almost fully implemented the directive, two have yet to do so, and two have only recently acceded to the EU and are therefore allowed more time to accomplish the environmental *acquis*. The report seeks to clarify the role of local authorities, policy instruments and financial mechanisms in securing effective implementation, and it also addresses the issue of cost-effectiveness. The report focuses on the extension of sewage plants with appropriate levels of treatment (biological or advanced) and trends in discharges to surface waters.

Denmark has fully and the Netherlands has nearly fully implemented the requirements of the directive, but France and Spain remain rather far from the targets. The two new Member States, Poland and Estonia, are making good progress in some respects, particularly Estonia where 70 % of the population is served by wastewater treatment.

The effectiveness analysis shows that clear lines of institutional responsibility were helpful for implementation in Denmark and the Netherlands. Overlaps of responsibilities between authorities at the local, regional and national level in Spain and France, together with large investment needs and bottlenecks in financing, appear to be important reasons for not implementing the directive requirements in time. In particular, the fact that local municipalities in Spain and France are responsible for the provision of sewage treatment, while being largely deprived of their own financial resources, leads to lengthy negotiations on financing that are not supportive of the agreed measures.

Denmark complies fully with UWWTD and discharges of organic matter as BOD to surface waters have decreased by more than 90 %. However, the Danish approach to implementation appears to have been somewhat costly. Construction of sewage treatment plant capacity and the associated investment have been notably higher per capita than in the comparable case of the Netherlands.

France has not responded fully to the challenge of the UWWTD, as in sensitive areas 58 % and in non-sensitive areas 37 % of wastewater plants do not meet the requirements (EC, 2004a). France does not appear to be reaping the full benefits of its advanced management system with river basin management, full-cost pricing and a water-pollution control levy. French water-pollution levies remain modest by European standards, and the system could be fine-tuned to address the implementation gap

The Netherlands is close to compliance with the UWWTD. It has not installed sufficient advanced treatment for nitrogen in some large cities, but discharges of BOD to surface waters have decreased by more than 90 %. The Netherlands spends a lower share of GDP on water pollution control than the other Member States. Economic instruments have been used to provide incentives to polluters to reduce pollution at source, rather than opting for the more expensive end-of-pipe solution of public sewage treatment.

Spain has not achieved compliance with the UWWTD. The continued implementation gap in Spain is notable, as the EU has supported its implementation of the UWWTD with large subsidies. Between 1993

and 2002 more than 3.8 billion Euro were provided in support from the Cohesion Fund, covering about half of Spanish investment in sewage control and up to 85 % of individual sewage treatment plant investments.

Estonia, as a new Member State, has until 2010 to comply with UWWTD. As a result of waste water investments, and of industrial decline, discharges of BOD to surface waters have been reduced by more than 90 % in just ten years. The Estonian water pollution levy is modest, however, and domestic environmental financing will hardly suffice if UWWTD requirements are to be implemented in time, so there will be substantial reliance on EU support in the future, as there has been on western donors in the past.

Poland has also been allowed until 2010 to comply with the UWWTD for industry and large cities. Discharges of BOD to surface waters were reduced by about 24 % during the 1990s. Polish industry has made substantial investment, up to 0.5 % of gross value added annually, on water-pollution control. EU support is now available from the Cohesion and Structural Funds, but new methods of distributing these funds, that promote implementation and cost-effectiveness, could be useful.

There is a strong case for more emphasis on eco-efficiency in wastewater management. This becomes clear from a careful review of the approach adopted in the Netherlands. The use of economic instruments in the Dutch case, as an incentive to make industry reduce discharges at source, has reduced the need for public sewage-treatment plant capacity — and public investments — to a level well below that in other countries.

In contrast, the water pollution taxes are rather low in France, Spain and Estonia, and full-cost pricing of sewage treatment is not in place in Poland, Spain or Estonia. The absence of economic incentives to promote eco-efficiency gives reason for concerns as to whether Member States will be able to meet the requirements of the UWWTD cost-effectively.

The Dutch approach demonstrates that substantial savings in investment costs can be made if advantage is taken of water pollution control levies and the incentives they provide for controlling the sources of pollution. Wastewater treatment plants are only part of the costs imposed by the UWWTD, which also calls for appropriate sewer networks. There is a need for operational expenditure as well as investment.

The efficiency of the incentive approach appears to be reflected in the fact that water pollution control expenditure in the Netherlands, only 0.6 % of GDP, is about 20 % lower than in France (0.8 % of GDP), despite a higher degree of compliance with the UWWTD.

The Dutch-Danish comparison suggests that Member States with low or inadequate water pollution levies (Spain, France and Estonia) or no full-cost pricing of sewerage (Spain, Estonia and Poland), may over-invest in excessive capacity if they do not take account of the potential for reducing discharges from industrial sources. Most of these countries are eligible for considerable EU subsidies (75–85 % of investments), so there is a risk of less efficient use of EU funding if wastewater treatment plant capacity is not optimised. There is also a risk that these countries will incur larger operational costs than necessary, which they will have to meet themselves.

The main reason for delays in implementing the UWWTD is the costs involved, so eco-efficient approaches that minimise investment deserve more attention. Greater emphasis on eco-efficiency, and economic incentives that promote wastewater reduction at source, are likely to be the keys to more timely and cost-effective implementation of the UWWTD in Member States.

It is expected that the cohesion policy, through the Cohesion and Structural Funds, will continue to support sewage treatment plants from its proposed 336 billion Euro budget for 2007–2013 for all 10 new Member States. Support is greatly needed as current investments in Poland and Estonia are at the level of 5–10 Euro per capita (not PPP-adjusted), and will need to be increased to a level of about 40–50 Euro per capita to comply with the agreed deadlines.

Nevertheless, the Cohesion and Structural Funds could address the polluter-pays principle more systematically. If there are not economic instruments in place to provide industries with an incentive to promote eco-efficiency and to reduce

pollution at source, there appears to be a considerable risk that EU subsidies will lead to excess investment in sewage-treatment plant capacity. The right balance between prevention and adequate sewage treatment capacity needs to be found, as sewage treatment is one of the most capital-demanding environmental measures.

Water-pollution control costs account for about 0.8 % of GDP in several Member States and have absorbed more than 50 % of all environmental investment in recent decades, so despite the relative triviality of sewage compared with many other environmental problems, it can crowd out other needs if not managed wisely. Affordability and competitiveness concerns are legitimate, but the good news is that there is evidence that the polluter-pays incentives can smooth implementation by helping to control costs.

1. Setting the scene: the EEA and policy effectiveness evaluations

1.1 European clean water policies

Concerns about the pollution of Europe's waters have historically been at the heart of European environmental policy-making. The Paris Summit in October 1972 is usually viewed as the official starting date for the EU's environmental policy. At that meeting the heads of state agreed that the Commission should draw up the first environmental action programme. The summit took place only a few months after the UN's Stockholm conference, an event that was an occasion for many countries to finalise and present initiatives and plans for their national environmental policies. Yet, had it not been for the concern voiced by the European Parliament since the late 1960s, a European environmental policy might not have emerged so soon. In 1970 the Parliament passed a resolution which called for measures to protect water quality and public health from the dangers of pollution. This early resolution called for special attention to be paid to the pollution of the river Rhine and other surface waters.

Early European environmental policies relied mainly on coordination of Member State efforts, but a new impetus resulted from the environment being officially included as an area for harmonisation in the Treaty in 1987. For clean water policies the Treaty amendment led to a series of significant directives, notably the Nitrate Directive and the Urban Waste Water Treatment Directive (UWWTD). These directives established minimum requirements for urban wastewater treatment and placed limits on the surface application of nutrients. The impetus also helped the environment to become a topic for pan-European cooperation in the context of the Environment for Europe process that from 1991 involved central and eastern European countries, and which in the environmental area paved the way for the recent expansion of the EU. Clean-up measures for surface waters was one of the cornerstones of this process, as environmental assistance was made available and measures were taken to implement directive requirements by all EU members.

The time would now appear ripe for an evaluation of the effectiveness of the European deliberations on the clean-up of surface waters. Three decades have been available to achieve the improvements demanded by European institutions, at least for the EU-15 Member States, although the past decade may have been especially significant, due to the binding requirements issued in 1991. Although some Member States only recently joined the EU, a somewhat parallel effort to comply with similar targets and deadlines became apparent during the 1990s. EU-15 Member States had to comply with the mandatory requirements of European directives, but acceding countries knew that they would have to meet similar requirements to obtain membership, and from the outset they targeted their environmental efforts towards compliance with the EU standards.

1.2 Meeting information demands

The sixth environment action programme (6EAP) of the European Community highlights the need to undertake '*ex-post* evaluation of the effectiveness of existing measures in meeting their environmental objectives'. Such evaluations require a better understanding of policy measures and an examination of the mechanisms that lead to their observed effects. What measures have been implemented in response to the given directive, what were their effects and what is the national context in which they are supposed to operate?

For a number of years, the European Parliament has clearly expressed its wish for the EEA to provide information on the implementation of policies in Member States and to analyse the effectiveness of past policies in the EU. The Parliament is particularly interested in information and analysis on the implementation of EU legislation in the Member States.

The European Commission is also in need of analysis and knowledge on the extent to which directives and measures are working in Member States. Reporting by Member States on the implementation of directives seldom covers information on the

effectiveness of the measures put in place in the countries. The EEA can help to fill this knowledge gap.

EEA member countries, including all 25 EU Member States, face increasing demands for information and knowledge about the extent to which the policies they put in place give 'value for money'. They are also very interested in knowing what policies have worked under what conditions in other countries, and which did not work. This is particularly the case for the 10 new Member States who now face a significant challenge to implement EU directives as soon as possible, and without repeating the mistakes and problems that the EU-15 Member States have encountered.

1.3 EEA policy effectiveness evaluations

In the past, the focus of much of the EEA's work has been to provide information on and analysis of the state of the environment in Europe, including the underlying driving forces and the pressures on the environment from economic activities. As a result, the Response dimension of the DPSIR framework (Driving Force — Pressures — State — Impact — Response) has often received less attention.

The EEA report 'Reporting on environmental measures — are we being effective?' (EEA, 2001) concluded that little is known about the extent to which past environmental policies and instruments have had an effect on the environment.

In 2003, the EEA initiated two pilot studies on policy effectiveness to gain experience on undertaking such evaluations and their methodologies, and provide the Parliament, the Commission and member countries with analyses of the effectiveness of policy measures in a few areas and countries. It was decided that one pilot study would evaluate the effectiveness of packaging waste management systems in five EU Member States while the other would evaluate the effectiveness of urban wastewater treatment policies in six EU Member States.

1.4 The approach of this study

This study builds on and extends previous research findings on the effectiveness of clean water policies in Europe (Andersen, 1994; 1999), in which the efforts in the 1970s and 1980s were analysed in a comprehensive study covering a selection of the EU-15 Member States. This EEA pilot study employs a similar methodology, but

Box 1 Policy effectiveness evaluation and the EEA strategy 2004–2008

The EEA strategy, adopted in 2003, sets out the main priorities of the Agency for 2004–2008. It identifies ex-post policy effectiveness analysis as one of its priorities for the future.

In his foreword to the strategy, the Chair of the EEA Management Board Mr. Lars-Erik Liljelund states that:

'Increased emphasis will be placed on evaluation of policy effectiveness. Environmental policy is no longer a free ride. In order to be able to convince politicians and the public alike that environmental policies are necessary and good for society as a whole, we must be able to demonstrate that they are delivering real results in an effective way. I welcome the fact that the European Commission also sees a clear role for the EEA in this field. We will work closely with the Commission to deliver real results'.

The strategy identifies the following outputs of EEA work on policy effectiveness in 2004–2008:

- Pilot studies (e.g. urban wastewater and packaging policies) including economic aspects;
- Analyses of effective policy mixes and cross-compliance;
- Support for the network of European Protection Agencies, including analyses of specific policy implementation in member countries;
- establishment of a network of policy analyst professionals to support the development of a methodological guide and framework for undertaking policy effectiveness evaluations.

applies a more extended focus both in time and space. It focuses on developments during the 1990s, but policies and measures since 1970 are also taken into account. The reason for this is that many legislative and institutional reforms of significance for the implementation of the binding EU directives were put in place in earlier decades. We also extend the geographical coverage by including new Member States. Spain, Poland and Estonia are covered in addition to France, the Netherlands and Denmark. While Poland and Estonia have only recently joined the European Union, Spain represents a group of southern countries that did so in the 1980s. The criteria for selecting these countries were: ensuring variety in the measures and institutional structures in the countries; ensuring as far as possible a geographical balance across Europe; representation of both old and new, and large and smaller Member States; and access to data and information in the countries. The study focuses on both environmental and economic effectiveness, including the role of economic incentives as a policy instrument. The scope of the study encompasses point-source discharges that affect water quality.

The approach is first to investigate the extent to which the desired and required environmental measures have been implemented. Measuring environmental effectiveness is far from simple, and the methodological assumptions and requirements are presented in the next chapter.

The remaining chapters aim to evaluate *ex-post* the relative effectiveness of the policy institutions and instruments employed in the national approaches to implementation. Member States decide for themselves how best to combine policy institutions and instruments. However, the report addresses the significance of the national approaches for successful implementation, because it is important for policy-makers to understand the advantages and disadvantages and their relative success in environmental and economic terms. The study builds on and extends more legalistic studies of the implementation of the UWWTD that have been undertaken by units of the European Commission (e.g. 2004a), but the concern here is with effectiveness from a broader economic and public management perspective.

2. Methodological considerations

2.1 Introduction

The need to supplement indicator-based state of the environment reporting with *ex-post* assessments of the environmental effectiveness of policies was recognised by the EEA in its Strategy 2004–2008. One of the priorities of the Strategy is to support understanding of the effects and effectiveness of policies by encouraging an exchange of information on policy implementation, and developing targeted assessments of selected environmental policy measures.

Everyone is in favour of effectiveness, but perceptions of what constitutes an effective environmental policy vary considerably. No doubt some observers would regard an environmental policy as effective only if it solves the ecological problems faced by industrial society. However, it is important that an effectiveness analysis does not adopt too normative a view by assessing outcomes according to standards beyond those desired by policy-makers. 'Effectiveness' addressed in an implementation analysis is merely a measure of the timely and efficient implementation of policies agreed by democratically elected bodies. The analysis goes beyond the legal transposition of EU regulations into national law, however, since it addresses implementation and delivery of policies in the physical world, often by authorities at the regional or local level.

A policy is only a piece of paper. The 'moment of truth' occurs when the policy is delivered to the citizen in terms of a service, an obligation or a monetary transfer. It is the implementation and transformation from paper to reality which is addressed by an effectiveness analysis.

According to the terminology described by the EEA in the report 'Reporting on environmental measures: are we being effective?' (EEA, 2001) an environmental effectiveness analysis should comprise three different elements:

— **the effects of an environmental measure:** the outputs of a measure that can be directly attributed to its implementation. This requires a direct causal link between the policy action and the output which can be observed**;**

— **the effectiveness of an environmental measure:** a judgement about outcomes: whether or not they have resulted in the objectives and targets of the policy measure being achieved. This goes beyond output, by comparing the broader outcomes of the measure with the precise objectives intended and desired by policy-makers;

— **the cost-effectiveness of an environmental measure:** a comparison of the effects of a measure with the costs of implementing it. A more cost-effective measure will have achieved desired results for less money. This part of the analysis will often require benchmarking.

Studies of the effectiveness of environmental policies are a complex undertaking. A number of highly different disciplinary skills need to be combined in order to provide a proficient assessment. There must be a good understanding of the relationships between the formal policy aims, the technological remedies available and the achieved changes in environmental quality, as well as of independent and more autonomous developments affecting environmental quality and outcome of policies.

The methodological assumptions behind the analysis of the effectiveness of wastewater policy implementation in this report are presented below.

2.2 Policy in focus

Provision of wastewater treatment of urban and industrial sewage discharges is one of the cornerstones of pollution control. Although perhaps regarded as somewhat trivial by many, it has in fact accounted for as much as 50–60 % of the total investment for environmental protection in industrialised countries since 1970.

The UN Stockholm Conference in 1972 provided the starting signal for more systematic legislation to promote wastewater treatment at the national level. Policies for this purpose were agreed in most

Box 2 Urban Waste Water Treatment Directive requirements

The UWWTD requires that Member States designate their surface waters as **sensitive** and **non-sensitive** areas. It is freshwaters and estuaries that can be classified as sensitive if endangered by eutrophication. Non-classified waters and coastal areas are regarded as non-sensitive. A Member State may decide to designate all of its territory as sensitive.

The requirements for wastewater treatment levels differ between sensitive and non-sensitive areas.

For **sensitive** areas the UWWTD requires a stringent collection and treatment system by the end of 1998 for all agglomerations larger than 10 000 inhabitants. Stringent is understood as wastewater treatment with both secondary (biological) and tertiary (nitrogen/phosphorous nutrient removal) stages.

For **non-sensitive** areas the UWWTD requires a sewage system with secondary (biological) treatment by the end of 2000 for all agglomerations larger than 15 000 inhabitants. Provided that adverse effects on the environment do not occur, primary (mechanical) treatment may suffice for discharges to coastal areas.

Secondary treatment is also likely to be required by end of 2000 for all food-processing industries discharging more than 4 000 person-equivalents of BOD (biological oxygen demand), subject to decision by national authorities.

The UWWTD further requires that Member States extend their sewage treatment systems in both sensitive and non-sensitive areas to agglomerations down to 2 000 inhabitants, before the end of 2005.

However, in accordance with Article 5(8) of UWWTD a Member State does not have to identify sensitive areas if it applies stringent (tertiary/advanced) treatment over all of its territory. Alternatively, if it can be shown that nitrogen and phosphorous is reduced with 75 % in a sensitive area as a whole, requirements for individual plants need not apply. The new Member States have in most cases obtained a transition period, postponing the deadline for implementation to 2010 and later. The above-mentioned deadlines apply to the EU-15.

industrialised countries, in some instances as amendments to existing laws. Regional conventions were also agreed. Under the Helcom (The Helsinki Commission) Convention for the Baltic Sea and the Paris Convention for the North Sea, countries agreed on reduction targets for discharges. The EU agreed the Urban Waste Water Treatment Directive 91/271/EEC in 1991; this sets minimum requirement standards and guidelines for efforts to extend sewage treatment. A predecessor to the directive's requirements was the 50 % reduction targets agreed in the Paris Convention in 1988.

For the purposes of this study we can regard policy formulation as a two-step process; first one of mainly national and regional initiatives (from around 1972), and second one of minimum standard requirements and legally binding efforts (1991).

The policy targets from 1972 are broad and not very precise, whereas the EU's minimum standard requirements approach from 1991 establishes fixed deadlines and prescribes specific treatment technologies, allowing only a modest degree of flexibility. Performance and effectiveness with regard to attainment of the 1991 targets can, therefore, be judged with limited uncertainty.

The requirements and deadlines in the UWWTD are quite explicit (see Box 2). They are also rigorous in terms of definitions and possible exemptions, which are few and limited. Unlike more framework-oriented and procedural pieces of EU-legislation, this makes the UWWTD a rather straightforward basis for an effectiveness analysis.

2.3 Effects: outputs of urban wastewater treatment policy

Two types of outputs from the UWWTD are relevant for this study.

The first and most obvious is the construction of sewage treatment plants, whether by public authorities, private

operators or industry. This is a key requirement of the directive and the most obvious output to look for.

However, a second effect may occur if economic instruments have been introduced, so that dischargers are charged for the effluent they produce; an incentive is then provided to reduce effluent at source — preventing pollution rather than discharging it for end-of-pipe treatment.

The likely outcome of policies is a combination of treatment and prevention, resulting in a decrease in effluent discharges to surface waters. The balance between discharge reductions by treatment and by source-related prevention measures depends on the relative costs of each abatement option.

Whether sufficient capacity has been constructed to deal with discharges from households and industry can be assessed by reference to the requirements of the UWWTD and the associated compliance deadlines. Successful achievement of the required policy output, in terms of construction of sewage treatment plants and introducing economic instruments, is likely to be a necessary condition for a successful policy outcome, although it may not prove to be a sufficient one.

With this approach we deliberately restrict the study to focus on sewage treatment, and leave aside the issues of sewage sludge treatment requirements, as well as sewage networks.

2.4 Effectiveness: outcomes of urban wastewater treatment policy

The aim of wastewater treatment policy is to improve the quality of surface waters — fresh (rivers and lakes) as well as marine waters (estuaries, coastal waters and open sea).

The complexity involved in evaluating the attainment of this apparently simple aim lies both with the multitude of parameters with which 'quality' can be characterised, and with the multitude of sources that affect water quality.

Essentially, quality parameters are variable, and rely on base-level environmental conditions. The chemical variables indicating water quality are bound to differ between, say, a calm river such as the Seine, and a faster flowing one such as the Loire. Differences in baseline conditions are also numerous within lakes and coastal areas.

For this reason biologists have developed systems for classification to characterise differences in water quality; these rely on judgmental observations of the state of the surface waters as compared with their natural properties.

Figure 1 provides an overview of water quality classifications of rivers in the six Member States in 2001 measured in terms of biological oxygen demand (BOD) and phosphate concentrations (mgP/l). Such aggregate figures allow for a ranking of Member States, with Denmark and Estonia having the best results for BOD and the Netherlands and Estonia for phosphate concentrations. Poland ranks low for both indicators.

However, each country has its own system of river classification, with the result that such a comparison between countries is not always meaningful.

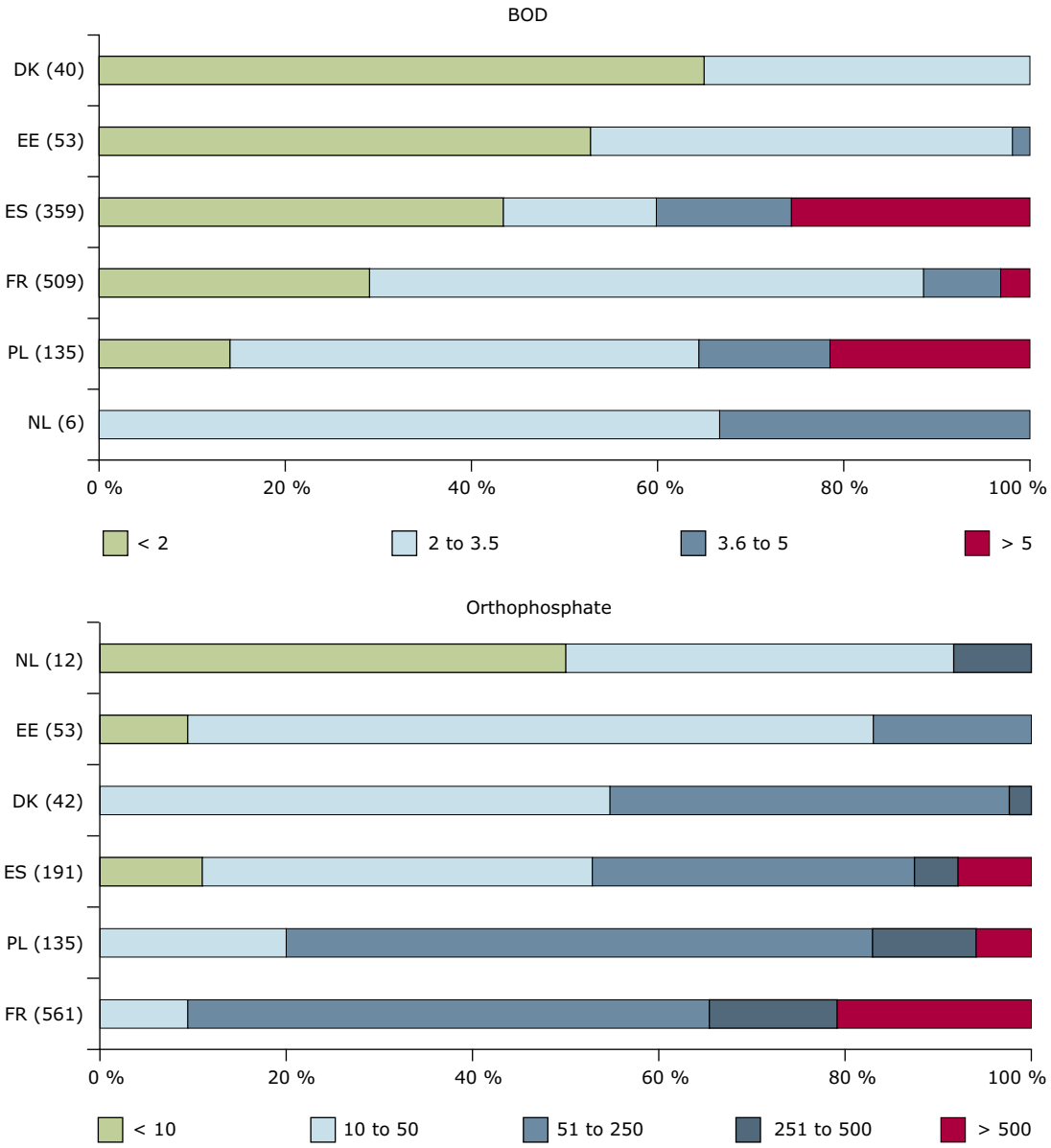
As an alternative, one may consider the temporal trends for each country separately. This approach also encounters difficulties, if one is seeking to clarify the impact of a particular policy instrument (see the discussion in Box 3).

Due to the difficulties in interpreting the specific links between policy measures and water quality, we opt instead in this report for the use of a pressure indicator related to point sources only.

In each country chapter the report first provides information on the extension of public sewage treatment plants to domestic sources (households) with the treatment levels prescribed in the UWWTD. This is an almost classical indicator, which has appeared in OECD Environmental Data since the 1970's.

Secondly, the report provides information on the net load of organic discharges from point sources on the surface waters. The advantage of the indicator is that it relates to the point sources addressed by the UWWTD, both households and industry. The net load is the final discharge to surface waters, after the reductions achieved through various types of treatment. The net load differs from the total discharge, which

Figure 1 Percentage of rivers distributed on water quality classes for BOD (1) (mgO_2/l) and orthophosphate (mg/l) in 2001 (1997 for the Netherlands)



Source: EEA through its European Topic Centre on Water.

Note: River classification based on annual average concentrations from a representative subset of river monitoring stations. Numbers refer to number of river stations.

is the discharge entering the sewer networks and treatment plants plus the unregulated discharges. The net load is measured in person equivalents of organic discharges, either as biological oxygen demand (BOD) or chemical oxygen demand (COD). A person-equivalent is the discharge which can be attributed to one person (urine/faeces), usually 60 g/day. It can also be calculated for N and P, but data-availability is generally not sufficient to allow for a good analysis of the selection of Member States included here. The analysis is consequently constrained to the use of the organic pollution load indicator

This net load indicator was first developed in the Netherlands, where water quality

(1) BOD is a key indicator of the oxygenation of water bodies. BOD is the oxygen demand brought about by organisms in water and sediment acting on oxidisable organic matter. UWWTD aims to decrease BOD-loads.

improvements were hard both to observe and assess because of trans-frontier transport of pollutants. However, also the French state of the environment reports of the 1980s used a similar indicator to monitor the impact of point source discharge reductions.

Data is available for net loads, either directly or they can be computed on basis of total discharge data and treatment effects. For Netherlands, Denmark and France data is available since the early 1970s, and for Poland and Estonia since the early 1990s. For Spain data is not available on discharges from industry, mainly because of the largely unregulated character of discharges from this sector up to 2000, and the net loads can hence not be computed.

2.5 Explaining differences

An effectiveness analysis needs to measure progress in reaching the objectives and the associated costs, but also to provide explanations for differences in performance. Why is it that some Member States have been more successful in implementation than others?

Such questions can only be answered by considering both the way the EU requirements have been integrated into national water policies and the institutions and mechanisms in place to implement the policies.

As regards the **objectives,** national policies have been developed since 1972 and may have played a significant role in some Member States in attaining the legally binding targets agreed in 1991. In order to explain differences in effectiveness there is therefore a need to consider implementation of the UWWTD in the context of national objectives.

As regards **institutions,** one needs to identify which authorities at the local, regional and national level have been made responsible, and their administrative and financial capabilities. Some Member States may have been more successful than others because they have a range of interdependent resources and the ability to ensure that their efforts are coordinated.

As regards **mechanisms** one needs to consider which policy instruments, both legal and economic, have been in place

Box 3 Water quality — not a feasible criterion for UWWTD effectiveness evaluation

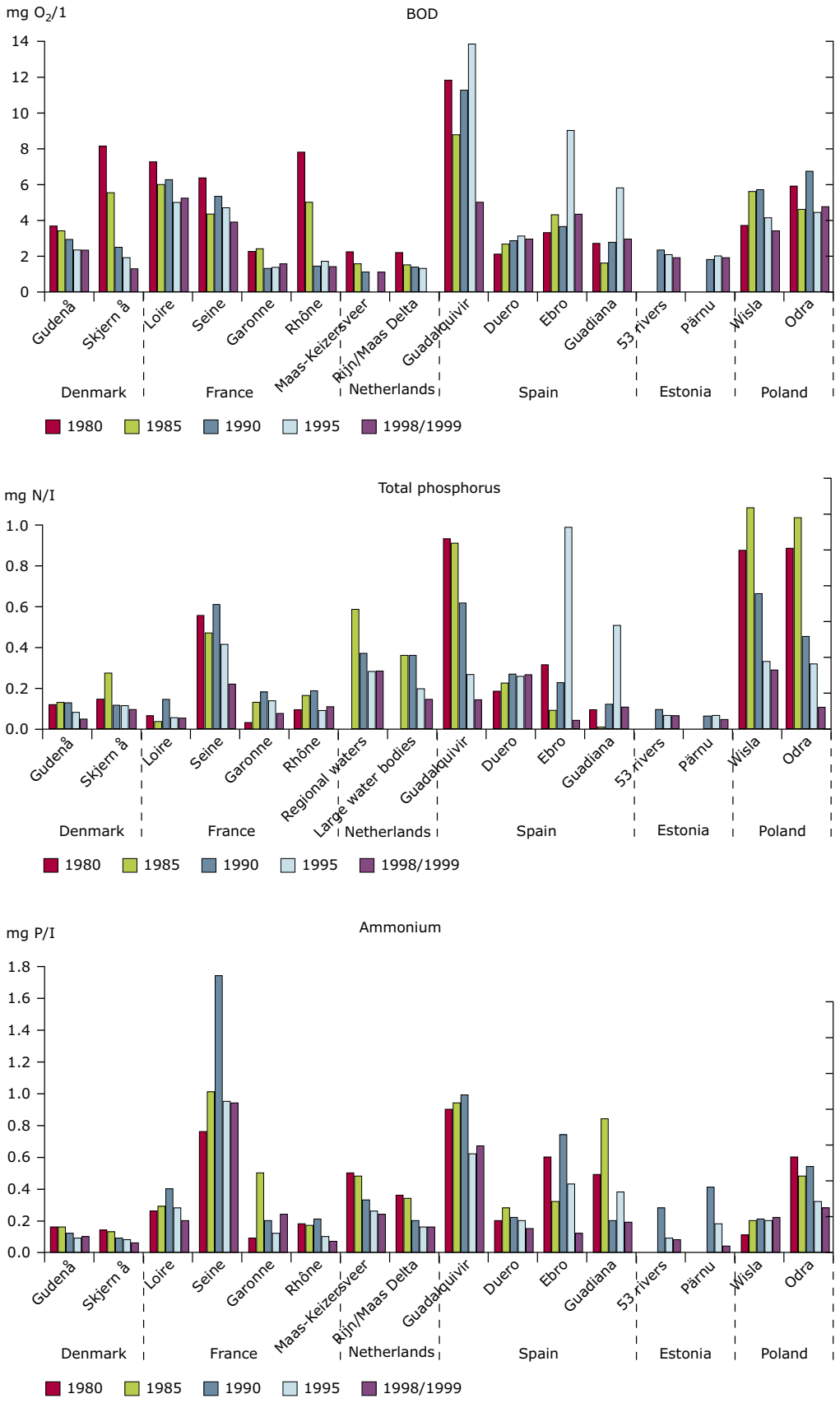
Figure 2 provides data on water quality in major rivers in six Member States (Denmark, Estonia, France, Spain, the Netherlands and Poland) for the period 1980–1999. Water quality can be assessed on the basis of various pollution parameters, of which BOD, and phosphorous and ammonium concentrations are among the most important.

For all three pollution parameters the general trend is a decrease, so that water quality in nearly all rivers in 1999 shows improvements compared with earlier years. There are exceptions to this general picture, however, such as the Duero (Spain) for BOD and phosphorous and the Wisla (Poland) for ammonium. For the Netherlands, water quality is measured downstream, close to the North Sea, but is also affected by impacts from countries situated upstream — the improvements therefore reflect the combined efforts in upstream countries and the Netherlands.

Water quality is of course affected by policy measures such as the UWWTD, but the extent to which this occurs is hard to estimate precisely. There are also likely impacts from sources other than point sources, notably from nutrient run-off from agriculture. Airborne emissions may also have an impact.

In order to disentangle causal effects we would need to account for the relative influence of those point sources that are subject to sewage treatment and other sources. Such disentangling requires a suitable model, which can simulate and interpret water quality for a receiving water body, taking into account the various pollution impacts. Such models have been developed for certain recipients, but they are diverse, and no single authoritative model is yet readily available to allow a consistent comparative analysis across Europe. For specific suggestions regarding further work related to the effectiveness of urban wastewater treatment policies see the annex to this report.

Figure 2 Water quality of rivers in six Member States 1980–1999



Source: OECD Environmental Data Compendium 2002 and EEA

Note: Estonia 1990 = 1992; The Netherlands 1995 = 1992.

to support the implementation of the requirements. Financial and economic instruments are of particular interest, since a prerequisite for implementation is the availability of funding.

These three elements are considered in the chapters on the separate Member States. In the final comparative analysis, the report returns to these issues to discuss their relative significance.

2.6 Cost-effectiveness

Cost-effectiveness analysis seeks to establish whether pollution reductions have been attained at a reasonable cost. This report therefore considers investment in wastewater pollution control by both public authorities and industry. Such figures have been compiled by Eurostat for recent years, but the report also draws on historical time-series from national statistical agencies. Data on investment costs enable benchmarking and an analysis of whether sewage treatment capacity has been established efficiently. We abstain from an analysis of operational costs, as this would require a different level of detail. Pollution reduction in industry is often cheaper if source-related in-house or in-plant measures are used, rather than the passive end-of-pipe process of sewage treatment. The key to considerations of cost-effectiveness is therefore the relationship between public sector involvement and clean-up measures by industry.

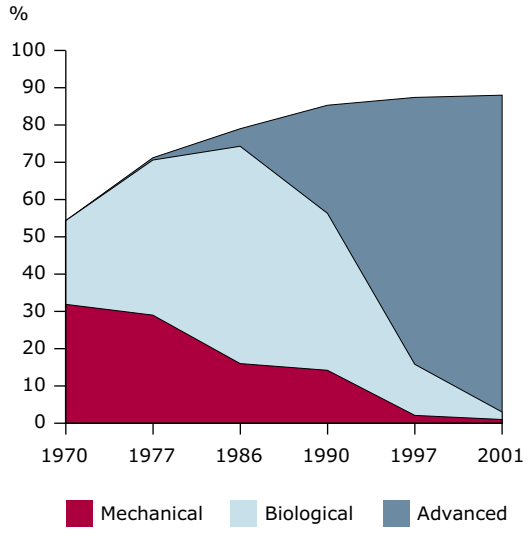
3. Denmark

3.1 Water quality situation

Denmark consists of a peninsula and several hundred islands, the largest of which is relatively urbanised and houses the capital, Copenhagen. There are few rivers, but an extensive network of streams connects with vulnerable fjords along the coastline. The impact pathways from land-based sources to the marine environment are of extraordinary significance for water quality. Sewage treatment is extensive, with advanced treatment in most places, and leaching of nutrients from intensive agricultural livestock industry is now the main water quality problem. Although BOD levels in Danish watercourses have decreased, reflecting a significant environmental improvement, Denmark falls short of its domestic nitrogen goals for surface water quality. The main cause of continuing eutrophication is pollution from agricultural sources.

Around 90 % of households and 80 % of industries are connected to municipal sewage treatment plants. At the 1 558 sewage treatment plants, 86 % of the wastewater receives advanced treatment.

Figure 3 Share of population served with public wastewater treatment in Denmark 1970–2001



Sources: OECD and Eurostat.

About 100 industries discharge directly to surface waters, the most significant being food-processing industries.

The targets for the UWWTD have been met on time, as acknowledged in the Commission's 2004 implementation report.

3.2 Water quality policy objectives

Policies in the 1970s relied heavily on local planning and designation of quality objectives. By the mid-1980s, 75 % of discharges received secondary treatment, and many industrial discharges had been connected to the public sewage systems. The policy approach was nevertheless regarded as too lenient for major polluters and local quality objectives were adjusted to take account of the presence of large dischargers. The Action Plan for the Aquatic Environment (1987) established national reduction targets for discharges: 50 % for nitrogen and 80 % for phosphorous. It also fixed mandatory thresholds for discharge concentrations. These targets overruled local planning provisions and also helped address nutrient runoff. Various international conventions specified similar targets in subsequent years, but these were less demanding than the Danish ones. For instance, the Paris/Oslo conventions and the Helcom convention require a 50 % reduction for both nitrogen and phosphorous. The Danish plan preceded the UWWTD, which had only minor implications for Denmark. When the directive was implemented into Danish law in 1994, tertiary treatment had become the dominant mode of treatment.

The reduction targets established in the 1987 plan were not translated into specific quality objectives. They were merely a means to 'do something'. Quality objectives for lakes, rivers and coastal areas are set by the regional authorities, the counties.

3.3 Institutional context

Environmental responsibilities are largely decentralised to municipalities and counties, with the Ministry of the Environment and the Environmental Protection Agency both

being given a mainly supervisory role. The basic legislation is the Environmental Protection Act, which prescribes competencies and establishes a framework for the efforts of local authorities. Originally the 275 municipalities were the main executing institutions, but over the years the 14 regional counties have acquired a greater role and more powers over implementation.

While the counties are responsible both for planning and designation of surface water quality, as well as for monitoring and some inspection, the local municipalities are responsible for building and operating sewage treatment plants. Permits for industries for discharges directly to surface waters are issued by the county authorities.

An Environmental Board of Appeal can deal with cases involving issues of principle if it receives complaints about decisions taken by local authorities.

Responsibility for enforcement lies with the local and regional authorities, and is sometimes influenced by the politically-elected bodies, but the Environmental Protection Agency can intervene.

The municipalities and counties enjoy great financial autonomy, as most of their revenue comes from locally agreed income and property taxes. These local taxes constitute more than 35 % of all tax revenues, reflecting the significance of the local authority level in the Danish institutional set-up.

3.4 Policy instruments

The basis for issuing permits and for decisions on wastewater treatment levels was initially the quality standards established by the local or regional authorities. These standards were subsequently overruled by the reduction targets and treatment requirements laid down in the Action Plan for the Aquatic Environment.

Full-cost recovery of water pollution control costs was not required in the earlier decades. Sewage treatment plants were partly subsidised by local authorities out of general tax revenue, but this practice was phased out during the 1980s. In 1988 a bill was introduced which made full-cost recovery for discharges to sewage treatment plants mandatory. The bill also set out in detail how large dischargers should be charged according to their environmental burden.

In 1995 a national wastewater tax for direct dischargers (industry and sewage treatment plants) was agreed, but it offers reduced rates for the larger industrial polluters. A national water supply tax for households was introduced alongside the wastewater tax. Both taxes apply in addition to user fees. For households, the water supply tax, on top of increased user fees, resulted in steep increases in water prices.

3.5 Observations on effectiveness

Studies demonstrate that the most significant impact on discharges and improved water quality was achieved by the command-and-control approach of the 1987 plan. Before that plan, from 1972 to 1987, the local planning approach was not effective and gross discharges remained unchanged (Andersen, 1994). Since 1987, however, discharges have been reduced.

A main problem has been the strong focus in the 1970s and 1980s on connecting industries to public sewage treatment, with attention to opportunities for the application of in-house, cleaner technologies within industry arising only in the 1990s. No economic incentives existed to push industries to introduce in-house improvements until much later — when full-cost recovery via user fees was introduced. At that point, industries became highly active in the management of pollution discharges with the result that the financing basis for the municipal sewage treatment plants sometimes was eroded due to the discharge reductions achieved.

The 1995 wastewater tax was introduced 'on top' of the existing regulations and, as such, had limited additional effect. However, the effect of the tax has been helpful in bringing about improvements in the rate of compliance by public sewage treatment plants. Before the mid-1990s nearly 30 % of the sewage treatment plants did not comply with the discharge standards; now nearly full compliance has been achieved.

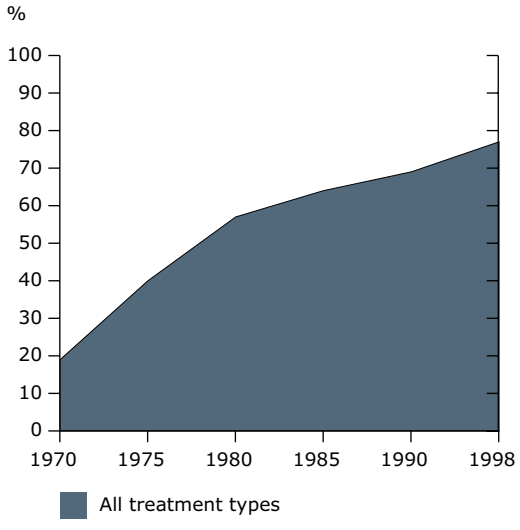
4. France

4.1 Water quality situation

France has five major river systems comprising more than 270 000 km of watercourses, an extensive coastline, and a rich variety of lakes and wetlands of great ecological value. Water resources are, however, unevenly distributed, both geographically and seasonally, which can result in high discharge rates or floods as well as periods of drought. Control of point-source discharges has improved steadily since the 1960s and has been strengthened as a result of the National Environmental Plan (1990) and the UWWTD. Despite organic discharges having been reduced, concentrations of nutrients have increased in many places, with the result that one third of all rivers and half of all lakes are classified as vulnerable to eutrophication. Droughts affected freshwater quality negatively in the 1990s. The situation in coastal areas has not really improved, and conditions for shellfish are critical in many estuaries.

About 77 % of households are connected to public sewage treatment plants (IFEN, 2002: 223) while in rural areas individual treatment (e.g. septic tanks) has been promoted, and account for 17 % of French households. Of the wastewater passing through the 16 100 (2001) municipal sewage treatment plants, 36 % receives advanced, 60 % biological and 4 % mechanical treatment. Around half of the industries have in-house sewage treatment and discharge directly to surface waters (Barraque, 1997: 298).

Figure 4 Share of population served with public wastewater treatment in France 1970–1998



Sources: OECD, Institut Francais de l'Environnement and Ministére de l'ecologie et du developpement durable.

The extension of sewage and wastewater treatment plants came to France relatively recently compared with its EU neighbours (Jordan, Ward and Buller, 1998: 1399). The UWWTD is a challenge to French policies, and its requirements are far from fully implemented, despite construction and upgrading activities during the 1990s.

4.2 Water quality policy objectives

Policies in the 1970s relied mainly on the initiatives of the River Basin Agencies, although formally also on local planning and designation of quality objectives. The River Basin Agencies were guided in turn by the 1964 Loi sur l'Eau, which addressed surface water quality in the context of integrated water management. However, in 1982 the Ministry of Finance imposed a spending limit on the River Basin Agencies, effectively squeezing their capacity. By the late 1980s about 70 % of the population were connected to sewage treatment plants, but treatment remained inadequate for many large cities. Industries were granted permits on the basis of a 1917 Industrial Classification act, with inspection duties delegated to administrations under the Ministries of Industry or Agriculture, thereby causing the policy to be labelled by some as one of tolerance towards polluters. Nevertheless reductions in industrial discharges (56 % for BOD and 80 % for toxic discharges between 1974 and 1998) have been notably more effective than those for domestic wastewater to public sewage treatment plants.

The National Environmental Plan (1990) provided a new impetus for French environmental policy. It allowed for an increase in the budgets of River Basin

Agencies by means of a tripling of water levies. The National Environmental Plan also overruled the local planning system and established national targets for water quality improvements. These included a 60 % reduction in wastewater discharges within 10 years and an 80 % reduction of nitrate and phosphorous discharges in vulnerable areas. The plan was followed by the 1992 amendments to the Loi sur l'Eau and a revitalisation of the activities of the River Basin Agencies. The National Environmental Plan helped to promote regional and local implementation, but its impact levelled of as consumers reacted negatively to water price increases. Some local authorities in turn hesitated to implement the requirements of the UWWTD in view of the perceived costs.

Of the 486 cities in non-sensitive areas which are required to comply with the UWWTD Directive, 179 were not equipped with the mandatory secondary treatment. Large coastal cities such as Cannes, Marseilles and Perpignan are not in compliance (EC, 2004a: 61). In sensitive areas the situation is not better, as 205 of 348 cities lack the required advanced treatment. In its UWWTD compliance review the Commission has criticised France for having failed to designate a number of sensitive areas, and the European Court of Justice subsequently has ruled that France has failed to fulfil its obligations under the UWWTD ([2]).

4.3 Institutional context

Although France established a Ministry of the Environment as early as 1971, competencies in water management are shared with the River Basin Agencies and with regional and local authorities. The institutional context is complex and marked by a traditional tension between the strong vertical lines of the state and the horizontal ties of society (Buller, 2004).

The Loi sur l'Eau, passed in 1964, established the six River Basin Agencies. These are innovative despite the absence of direct management activities. They were set up on a catchment basis. Committees, with equal representation of national and local government and water-consumers, specify water policy guidelines in more detail. The agencies impose levies on dischargers and have recycled the revenue for clean-up programmes. Each river basin agency must present a master plan for integrated water management.

Wastewater treatment remains a municipal responsibility, although the architects of the establishment of the river basin agencies would have preferred the task to have been with the agencies. French municipalities are relatively small by European standards, and often group together to share responsibilities and operate in more efficient units. There is a long tradition of using private operators. Full cost recovery with user fees on the dischargers to cover costs was introduced as early as 1959, requiring municipalities to separate the financing of sewage treatment from that of their general operations, although some possibilities for escaping the full cost recovery principle in case of large investment costs persist.

An important administrative reform introduced decentralisation in 1982, resulting in the creation of a new regional administrative level on top of the Departements. The regional environmental directorates (DIREN) that were created, however, have no regulatory powers. Competencies for water management and issuing of permits to industrial polluters remain with the specific directorates for industry (DRIRE), responsible for monitoring and inspection. Furthermore, within the Departments the industry directorates also have the upper hand as no environment directorates exist at this level. Discharge permits are granted according to a BATNEEC principle (Best Available Technology Not Entailing Excessive Costs).

4.4 Policy instruments

Initially, quality standards established by local authorities guided clean-up programmes and set requirements for industrial discharges. These standards have since been partly overruled by the required reduction targets and treatment prescriptions of the National Environmental Plan and the UWWTD.

Full-cost recovery for discharges to sewage treatment plants has represented a financing opportunity from the outset, yet many municipalities hesitated to construct or improve sewage treatment facilities

([2]) Case C-280/02.

until the late 1980s. This implementation shortfall was due partly to the close vicinity of a number of the larger cities to robust marine recipients, but may also need to be understood against the backdrop of the limited environmental concern among decision-makers in France before 1990. Furthermore, the tax and spending limit imposed on the river basin agencies by the Ministry of Finance around 1980 gave a signal to all parties concerned of the low priority of water quality improvements.

As a result of the above, the levies imposed and collected by the river basin agencies for initiating new clean-up programmes remained modest until the end of the 1980s. Increases in the levies simply reflected inflation, as was the original intention (Andersen, 1994: 175). This led to the criticism that the levies merely represented payments for being allowed to pollute. The revenues that were recycled were, however, actually rather significant in targeting investment towards the most polluting industries. In particular, the Industrial Sector contracts of the early 1970s have been acknowledged as a very effective approach, as can be seen from previous evaluations. Under these contracts the revenues from the levies were used to co-finance clean-up with the biggest polluters. This revenue recycling to industries was discontinued after 1978 as required by the European Commission, which regarded it in this case as illegal state aid (Barraque, 1997: 301).

4.5 Observations on effectiveness

Despite an early start for clean water policy in France with the 1964 water law, provision of sewage treatment for household discharges proceeded somewhat gradually, so that in 2001 about 77 % of, the population was connected to treatment works. Septic tanks were promoted in rural areas, so that in total 94 % of households are covered. Success in the field of industrial discharges was notable much earlier. The sectors paper and pulp, chemicals and sugar, which were targeted in the Industrial Contract programmes of the river basin agencies and supported by revenue from the water pollution levies, achieved significant reductions in discharges by means of efficient in-plant measures (Andersen, 1994: 179).

The municipalities are in most cases too small to possess specialised water staff, but have had sufficient political strength to prevent the River Basin Agencies from assuming full responsibility for wastewater management, as was proposed in the draft Loi sur l'Eau and as is the case with the water boards in the Netherlands. Many municipalities have been reluctant to establish sewage treatment facilities with appropriate treatment levels, despite the possibilities for some financial support from the Agencies. In France the policy directives from the state level are crucial, but also this level, in particular the Ministry of Finance, has tended to support municipal policies.

In September 2004 the European Court of Justice ruled that France had violated the UWWTD by not designating a sufficient number of sensitive areas.

The lack of compliance with the UWWTD, also prominent in several large cities, is notable in view of the availability of funding and the pioneering 1959 French wastewater legislation, which established the institutional framework for an integrated and river basin oriented management system.

5. The Netherlands

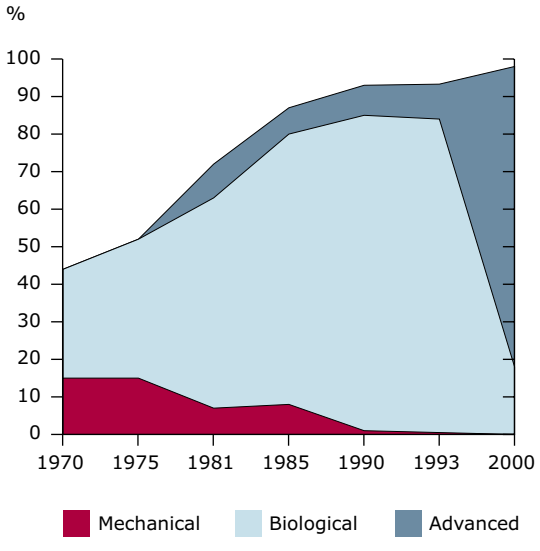
5.1 Water quality situation

Water has been regulated meticulously in the Netherlands since the early middle ages; one third of the country lies below sea level, and another third faces possible flooding if canals and dikes are not effectively maintained. The three main Dutch rivers, the Rhine, the Meuse and the Schelde, originate outside the country, and pollution imported by these rivers adds to domestic pollution discharges. During the 1960s, this led to the Netherlands coordinating pollution control with the upstream countries. Control of point-source discharges was introduced with the Surface Waters Pollution Act in 1970 and by the late 1980s sewage treatment had been extended to 85 % of households and many industries. During the 1990s, connection to households was essentially completed and a programme of improvement of sewage treatment plants to include advanced treatment (phosphorous and nitrogen removal) was introduced.

About 98 % of households are connected to municipal sewage treatment (OECD, 2003: 67). About 600 companies undertake sewage treatment independent of the public system, 150 of which discharge directly to surface waters, mainly into the larger rivers and the sea (CBS, 1999: 8). At the 400 public sewage treatment plants (with a combined capacity of about 26 million inhabitant equivalents) 80 % of the wastewater receives advanced, while the remainder receives biological treatment. Nevertheless, improvements in water quality have levelled off in recent years. In many of the nationally managed state waters, pollution concentrations exceed basic quality levels by a factor of two, and in a number of regional waters, managed by regional water boards, by a factor of up to three (OECD, 2003: 70–71). Water quality in the main rivers depends mainly on efforts in upstream countries, and there were improvements during the 1990s, except in the case of the Meuse.

The UWWTD target for P-removal was achieved as early as 1998. However, the Netherlands does not yet comply with the target for N-removal. The removal rate of 68 % remains well below the 75 % requirement. Some large cities have yet to introduce N-removal.

Figure 5 Share of population served with public wastewater treatment in the Netherlands 1970–1999



Sources: OECD and Eurostat.

5.2 Water quality policy objectives

Water policies in the 1970s were guided by special five-year plans, termed IMPs (Indicative Multi-year Planning) for water, the same practice as for other environmental sectors. The first IMP-Water (1975) was remarkable for its clear focus not only on sewage treatment but also on eco-efficiency, i.e. industrial in-plant measures, often proclaimed as the most effective and least expensive way to restrict effluent and residual waste products. The focus was clearly placed on changing or adapting industrial processes to reduce the volume of effluent and the quantity of waste matter (MTPW, 1975: 18).

The Dutch National Environmental Policy Plan (1989) was a product of the cycle of five-year IMPs, but represented increased ambitions in addressing pollution problems and achieving sustainability.

The short-term (2006) water quality objective is to reduce pollutant concentrations below Maximum Admissible Risk (MAR) levels, broadly equivalent to 'good surface water chemical status', as defined in the EU Framework Directive. In the longer term, the target is to reduce concentrations to below the negligible risk value.

The Netherlands has promised to apply the measures for sensitive areas for the whole territory. Although the targets are stricter for sensitive areas, according to article 5(8) of the UWWTD, more freedom is permitted as to methods of attainment. In spite of a requirement for 75 % of P and N to be eliminated for the country as a whole, P and N-removal is not required at each individual sewage treatment plant.

5.3 Institutional context

Water quality and water quantity management in the Netherlands are closely related and require coordination between the Ministry of Spatial Planning, Housing and the Environment and the Ministry of Transport, Public Works and Water Management. Although the Surface Waters Pollution Act vested competencies for quality management with the Provinces, as far as responsibility for implementation was concerned these had, in turn, to rely on the traditional water authorities; the local water boards. It is these water boards, and not the municipalities, that have been responsible for building sewage treatment plants.

The water boards are important and influential institutions in Dutch society as they are responsible for integrated water management — originally of water quantity and canals, but now also including the provision of sewage treatment services to households and industries. The water boards are governed by the water users and have traditionally relied on a system of user levies for their services. With this background, the country has abstained from government subsidies for sewage treatment, and a system of full-cost pricing for sewage discharges was established as early as 1970. Historically there were hundreds of water boards, but an administrative reform during the 1970s reduced the number to just 37 by means of mergers on the basis of the hydrological principles of catchment areas. The reform secured the transition of the traditional Water Board structure, transforming them into modern entities with the capability and expertise to take charge of integrated water management. The remaining two provinces handed over implementation responsibility to the water boards during the 1990s.

There is a distinction between water board management areas and state waters, which comprise coastal waters, the river Rhine and some other rivers and waters of national interest. As the state waters are outside the management system of the local water boards, these have been administrated directly by the Rijkswaterstaat, the influential national agency of the Ministry of Transport, Public Works and Water Management. Many of the larger industrial installations discharge to state waters and a system of levies has also been established for these. The administrative structure in the Netherlands represents a rather complex compromise, but is also tailor-made to address a variety of problems and priorities.

5.4 Policy instruments

The main policy instruments foreseen in Dutch legislation were the discharge permits and the system of levies, both placed within the framework of indicative national planning for the water sector. It was as a consequence of the Surface Waters Pollution Act that these two policy instruments were introduced.

Although the Dutch commonly refer to the levies as one coherent system, analytically they are both user fees and taxes. The levies paid by households and industries discharging via a sewer system to a sewage plant are a payment for a service and are akin to user fees paid in other countries. The levy paid by those who discharge directly to surface waters is more clearly an environmental tax instrument since no service is provided in direct return for the payment.

The state water levy has the character of an environmental tax. It has played a dual role, as revenue from the levy has been recycled for control measures in industry and for building of treatment plants. Under the Rijkswaterstaat, a sewage treatment research centre and advisory service, RIZA, has been established, with responsibility for providing technical advice regarding permits for dischargers. As a national unit, RIZA was in a position to gain an overview of possible in-plant measures to reduce

discharges and could communicate this knowledge to water boards and companies as part of permit considerations. At the same time, efforts to identify cost-effective solutions rather than simply build a company sewage treatment plant were common. Often, it was a combination of in-plant measures and end-of-pipe treatment that proved most efficient.

Certain exemption mechanisms relating to the levy existed in the early years of the scheme. For instance, a company could obtain an exemption under general clauses in tax legislation ('hardheidsclausule') if the burden was substantial. The exemption would require a reduction in discharges from the company and, at the end of the exemption period, the levy would be applied to the reduced level of discharge achieved, including the years when the exemption applied. The exemption clause was applied only in very few instances.

5.5 Observations on effectiveness

The Netherlands managed to establish nationwide coverage with regard to sewage treatment before the end of the 1980s, mainly as a result of the water boards. They had been obliged to treat discharges and met few restrictions in doing so. In fact, since the committees of the water boards were dominated by farming interests, with point source dischargers representing a minority, there was little to hinder implementation. The few delays in the extension of sewage treatment resulted from planning regulations and problems relating to decision-making on the location of treatment plants. Additional measures, such as phosphorous removal, were generally not accepted by the water boards, until concerted efforts were agreed at the European level.

Success with regard to the control of industrial discharges has been especially evident: in the first years of the 1970s, industrial wastewater discharges were reduced by about 50 % (in terms of BOD). Notably, these effects were achieved even before the first administrative permit guidelines on wastewater were issued in 1975, demonstrating that the levy system, and not the permit procedure, had the greatest impact.

Two widely-quoted Dutch studies (Bressers, 1983; 1988; Schuurmann, 1988) showed that pressure from the levies prompted industries to undertake large reductions in effluents. Bressers investigated the response to levies within the water board districts. Although several large dischargers and the reductions they achieved were excluded, the study revealed a clear relationship between increases in levy rates and decreases in pollution discharges.

6. Spain

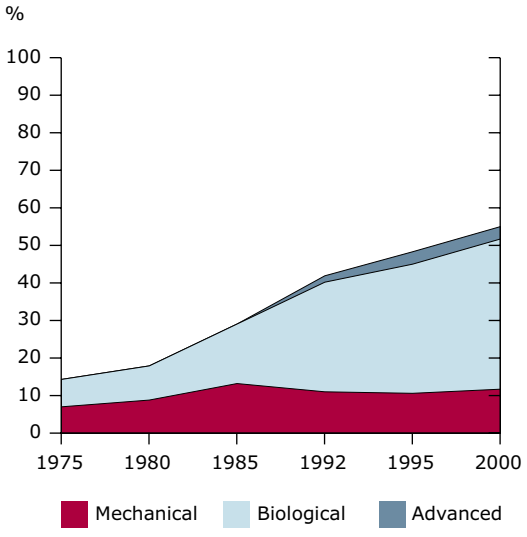
6.1 Water quality situation

The Cantabrian mountain range divides Spain into a smaller oceanic region with high precipitation levels, and a drier interior and coastal region with high evaporation levels and water shortages. One third of the country is affected by erosion and desertification. The main rivers are rain-fed and have an irregular flow regime, except in the northern regions. Many of the large cities are situated along the 8 000 km coastline and have been able to take advantage of the sea for sewage discharge. Traditionally water management in Spain has focused on the issue of water supply. Water has been a key to economic development in the southern and interior regions, and despite the sizeable tourist industry, the issue of water pollution only appeared on the agenda in the late 1980s. The three factors that helped the control of point-source discharges to improve in the 1990s were membership of the EU, the UWWTD and economic support from the Cohesion and Structural Funds. However, many rivers remain highly polluted, particularly in areas with large concentrations of industry. Water quality in estuaries and coastal areas has, in certain locations, been severely affected by sewage and industrial discharges. The impact on bathing water quality is difficult to judge, however, as Spain frequently has declassified monitoring points not in compliance.

About 55 % of households are connected to municipal sewage treatment (OECD, 2004: 33). Connection rates are lowest in coastal areas. At the municipal sewage treatment plants, 40 % of wastewater receives secondary treatment, and only 3 % receives advanced treatment. Nine thousand industries discharge directly to surface waters, half of which are not yet regulated by permits (further information on progress with implementation of the UWWTD in Spain can be found on the website of the Spanish Ministry of Environment, Ministerio de Medio Ambiente, 2005).

Despite generous opportunities for economic support from the cohesion policy, especially the Cohesion Fund, which provides 85 % subsidy for construction of sewage treatment plants, compliance with the UWWTD remains an administrative and technical challenge.

Figure 6 Share of population served with public wastewater treatment in Spain 1975–2000



Sources: OECD and Eurostat.

6.2 Water quality policy objectives

A modern Water Act was passed in 1985 and replaced a seminal piece of legislation from 1879. The emphasis in the Water Act centres on supply, and it establishes a hierarchy of water use with urban supply and irrigation given the highest ranking. But the Act also prescribes protection of water quality and a more rational use in harmony with environmental conditions. It requires the government to establish a National Hydrological Plan as a framework to deal with all water management issues. However, approval has been a contentious issue since the first proposal in 1993 and to date only one component, the National Irrigation Plan, has been adopted. In addition, water plans have been drafted at the river basin level.

The 1995 National Sewerage and Waste Water Treatment Plan was drawn up in order to meet the requirements of the UWWTD. This

plan is expected to cost about 11–12 billion Euro to implement — about half for sewage treatment plants and the rest for sewer networks — in fact substantially more than the investment foreseen for the National Hydrological Water Plan. In addition, a plan for regularisation of industrial discharges is estimated to cost up to 6 billion Euro to implement.

The 1985 Water Act also regulates the financial aspects of water use and discharges. The polluter-pays principle has been introduced and river basin planning, based on user involvement, has been provided for. However, substantial EU subsidies are foreseen for implementation of wastewater treatment.

Of the 521 cities which were required to comply with the UWWTD non-sensitive area standards by 2000, 137 had not by 2003 been equipped with the mandatory secondary sewage treatment. Among these are large cities such as Alicante, Valencia and Granada, while Barcelona had no sewage treatment at all until 2004. For sensitive areas, the Spanish authorities indicated that in 2003 46 of 114 cities had not yet installed the advanced treatment required by 1998. However, in response to criticism from the European Commission Spain has recently designated more sensitive areas, so that the implementation shortfall here is likely to be underestimated.

6.3 Institutional context

When Spain joined the EU in 1986, a national Ministry of Environment did not exist. Environmental responsibilities were shared among several different ministries, in particular the Ministry of Public Works, Transport and the Environment and the Ministry of Agriculture, Fisheries and Food. Inter-ministerial commissions were established for specific policy issues. In practice, most environmental issues became the responsibility of the regions and lower levels of government.

In 1996 a Ministry of Environment with broad responsibilities for water, air, waste and nature conservation was created. Within the new ministry a Directorate-General has responsibility for water policy and deals with both quantity and quality issues.

River Basin Authorities play a key role in water management. They were established as early as 1926 under the former Water Act. These authorities prepare investment plans for water supply and sewage treatment, which are, in turn, implemented by the municipalities. The River Basin Authorities are also in charge of administering the permit system for direct discharges to surface waters; they also monitor and carry out inspections.

Provision of wastewater treatment is a municipal responsibility, but about 15 % rely on inter-municipal syndicates or private operators. In terms of funding, the municipalities depend largely on transfers from other authorities. In general the dependence of the regions on transfers from central government is substantial, with more than 80 % of fiscal revenue being controlled at the state level.

There is full-cost pricing for water supply, but not for wastewater. Water management policy has been embedded in complex subsidy schemes, because of the national significance attached to water supply transfers to dry regions since the beginning of the 20th century.

6.4 Policy instruments

Point-source discharges (industrial and municipal) to surface waters require a permit from the River Basin Authorities, which prescribe the quantity and quality of the effluent. In 1993 only 17 % of industries operated with a discharge permit; this share has been increased, but in 2002 half of industry continued to discharge without a permit (OECD, 2004: 34).

The Water Act requires that a wastewater levy is imposed on all point source discharges. The original scheme (*canon de vertido*) was fairly complex and comprised mainly six different pollutants (from a list of 41), but in 2003 the levy was simplified, so that it now basically depends on the volume discharged. The original levy applied only to dischargers with a permit, whereas after the reform it came to apply to all dischargers, regardless of permits.

The original scheme was changed with the reform that took effect from 2003. The basic levy rates were increased and are now per m^3 of wastewater 0.01 Euro for households and 0.03 for industry. The levy also applies factors to scale payments up or down according to the characteristics of the discharger, the

degree of contamination and the ambient quality of the receiving waters. The levy is for instance halved for sewage treatment plants that comply with standards while that for industries is multiplied by coefficients. The maximum factor of four applies always to unauthorized dischargers. With normal water consumption the levy appears to amount to about 2.95 Euro per inhabitant equivalent per year, which is the lowest among the Member States included in the assessment here. The revenue from the levy has supported the protection of surface waters, for example through the construction of sewage treatment plants, but for some years municipalities and industries did not pay. OECD reports that in the mid-1990s, 70 % of the municipal and 40 % of the industrial levies were not paid (OECD, 1996: 40). As a result of a stronger administrative approach the collection rate has now increased to about 85 %.

According to information from the Spanish Ministry of the Environment the annual revenue collected has been about 30–40 million Euro (from 1998–2002). On basis of these and previously-released revenue figures it appears that since 1991 the levy has raised just 1.5 % of the sum required for full implementation of the UWWTD. This is in contradiction with the original intention of the waste water levy law which was to establish a rate sufficiently high to raise the necessary revenue to finance sewage treatment extension, as agreed in the Hydrological Plan. However, as the plan has never been finalised as regards sewage control, the basis for adjusting the levy did not exist. The 2003 reform abandoned the link between levy rate and the investment needs, effectively shifting revenue raising to other sources, such as EU subsidies.

The shortfalls of the permit and levy systems of the Water Act has resulted in a number of autonomous regions establishing their own parallel systems.

The main instrument to implement the UWWTD is bilateral agreements between the Secretary of State of the Environment and the regions, backed by EU support from the Cohesion Fund. In 1995 a burden division of 25/75 between the Spanish state and the regions for the construction of sewage treatment plants was agreed.

However, sewage treatment plants approved under the Cohesion Fund scheme receive 85 % support for construction from the EU. Spain received a total of 3 869 million Euro for investment in this area from the EU's Cohesion Fund between 1993 and 2002. This is equivalent to 49 % of total investment.

6.5 Observations on effectiveness

The UWWTD was agreed in the Council of Ministers at a time when such legal acts required unanimity, which means that Spain supported the measure. As the costs were realised, in 1992 Spain, in the context of the Maastricht Treaty, negotiated additional financial support for the countries under the Cohesion Fund (Spain, Portugal, Greece and Ireland) to support construction of sewage treatment plants.

The identification of projects eligible for EU support is slow and cumbersome, depending on negotiations between many authorities at the regional and state level. The municipalities responsible for provision of sewage treatment are short of financial resources, as most tax revenues are imposed and collected at the state level. If measures are not eligible for EU support, there are few other sources to rely on. Some regions have, however, made supplementary funding available. The very principle of decentralisation of environmental responsibilities to local authorities is at odds with the centralisation of tax revenue control. In addition, concern in Spain is directed more to water supply than water quality (Pedersen, 2000).

More sewage treatment plants are under construction and OECD estimates that about half of the basic capacity needed is underway (OECD, 2004: 33). Whether treatment levels will be sufficient to meet the requirements of the UWWTD remains to be seen, however, as there are continuing negotiations between Spain and the European Commission on the lack of areas designated as sensitive. If further sensitive areas are identified, more sewage plants will need to apply advanced treatment. In 2001 only 171 of 1 326 treatment stations had been equipped with advanced treatment (OECD, 2004: 33). According to the Spanish Ministry of the Environment this number increased to 189 of 1485 treatment stations in 2003.

Spain has declassified 65 % of its inland bathing sites over the past decade, thereby avoiding continued reporting under the 1976 Bathing Water Directive. In 2004 Spain was fined about 10 million Euros by the European Court of Justice (C-278/01) over beach water quality.

7. Estonia

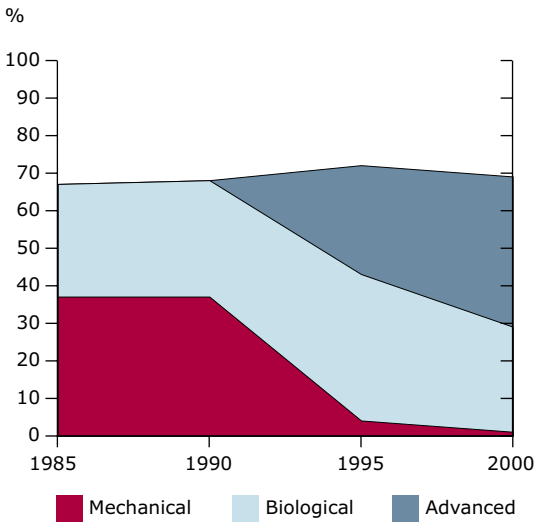
7.1 Water quality situation

Estonia is a lowland country with many lakes and two large islands. Several rivers, of which the Pärnu is the longest, cross the country. The entire territory lies within the Baltic Sea catchment area, and drains, in part, into the Gulf of Finland and the Gulf of Riga, both of which are vulnerable and quite polluted.

Among the former Soviet republics, Estonia was at the forefront in municipal sewage treatment as plants were installed in 40 % of towns. The establishment of the Environmental Fund as early as 1983 was instrumental in this development. On the other hand, industrial discharges were largely unrestricted in many areas and bathing waters were of rather bad quality during the 1980s.

There was significant progress in renovating and upgrading municipal wastewater treatment plants during the 1990s. Foreign environmental assistance, in particular from neighbouring Nordic countries and from international financial institutions, played a role in this development, but Estonia also committed significant domestic financial resources.

Figure 7 Share of population served with public wastewater treatment in Estonia 1985–2000



Source: EEA through its European Topic Center on Water.

About 70 % of households are connected to municipal sewage treatment. 40 % of municipal wastewater receives advanced treatment (mainly dephosphorisation), and 28 % receives biological treatment. Industrial and domestic wastewater is usually treated in a common wastewater plant — only a small part is discharged directly into surface waters (Pachel, 2002: 101). Despite the progress in water pollution control during the 1990s, compliance with the UWWTD remains a serious financial challenge.

7.2 Water quality policy objectives

Estonia, as part of the former Soviet Union, was a signatory to the 1974 Helsinki Convention on Protection of the Baltic Sea. An Estonian was Chairman of Helcom for several years. Since Estonia regained its independence in 1991 it has been able to formulate its own water quality policy objectives. For some parameters these are stricter than those laid down in the UWWTD, as a result of the Estonian-Finnish agreement on water protection (Pachel, 2002: 100).

The 1992 National Report by Estonia to the UN Conference on Environment and Development (UNCED) was the first policy document to indicate and establish priorities. The need to introduce biological wastewater treatment and remove nutrients — phosphorous and nitrogen — as well as the use of low-waste technologies in industry, were mentioned as essential. The document also stresses the need for an efficient and reliable monitoring system for water quality, which did not exist during the Soviet period.

It was agreed to focus on the hot-spots identified through Helcom activities. An Estonian water protection programme for the period 1995–2000 was adopted in 1994 incorporating the goals and targets of Helcom and specifying water investments. The investments required to meet the immediate objectives with regard to wastewater were then believed to be around

135 million Euro, half of which related to the Tallinn area where the greater part of the population and industry is concentrated (ECE, 1996: 32).

In 1997 a National Environmental Strategy document was agreed. It aimed to bring discharges in line with Helcom recommendations before 2000, and established fixed discharge limits for BOD and phosphorous. The nitrogen removal deadline has been postponed to 2010. The priorities were further spelled out in the NEAP (National Environmental Action Programme) prepared for the pan-European collaboration process, which focused on the control of point-source discharges from the major cities. The investment need of the water sector as a whole was estimated at about 30 million Euro per year.

With regard to the UWWTD, Estonia has designated its entire territory as a sensitive area, and has obtained a transitional period for compliance, with a deadline in 2010. A detailed implementation plan has already been elaborated. There are just 19 agglomerations with more than 10 000 inhabitants. The main problem is fulfilment of the requirements for nutrient removal. According to recent estimates, investments of about 325 million Euro are needed to comply with the UWWTD, including for agglomerations down to 2000 inhabitants (Pachel, 2002: 100). This sum is well below the staggering 1.3 billion Euro investment requirement previously stipulated for DG REGIO (Andrews, 2001).

7.3 Institutional context

The Ministry of the Environment, established in 1989, is the main government body responsible for environmental management, including management of water quality. Its predecessor in Soviet times in waste water issues was a state committee on health protection with rather limited responsibilities.

Implementation of national legislation is the responsibility of regional environmental departments at the county level and municipalities. Discharge permits for industry are granted by the counties, while the municipalities are responsible for the provision of sewage treatment. In the absence of regional water boards, it is the counties which establish the charges that should be paid by dischargers.

Enforcement responsibility is vested to the Environmental Inspectorate, which may levy fines or even close enterprises that are in violation. Day-to-day monitoring and inspection, however, are carried out at the regional level. Self-reporting and monitoring has improved.

The Estonian Environmental Fund, established in 1983, has played a supplementary role in financing the extension of sewage treatment coverage. On the basis of revenues from environmental taxes and fines, it has provided loans and subsidies for municipal investments in sewage plants. From 1993–1999 the Fund provided about 20 % of the spending on wastewater investments. Since 1999 the Fund has been transferred to the Ministry of Finance, and renamed the Environmental Investment Centre. It operates under private law, but essentially for the same purposes.

Bilateral environmental assistance from western countries has been offered since 1991. The assistance has been offered in the context of formalised cooperative agreements. Since 2001 and through May 2004 funding for investments was available from the EU via the Pre-Accession Structural Instrument, the ISPA programme. Since accession in 2004, funds have been available from the Cohesion and Structural Funds.

7.4 Policy instruments

The 1994 Water Act replaced the former 1970 Soviet Water Law and introduced a discharge permit system for industries. It also specifies the operation of the economic instruments, e.g. the wastewater pollution levy.

Until 1998 there was no definite method to take into account sensitivity or quality objectives for receiving bodies, leaving scope for negotiation between the polluter and the administration, as well as inconsistency regarding permits in different counties (UNECE, 2001: 44). Water quality objectives will be established only as part of the implementation of EU water directives.

For sewage, the current system of user fees was introduced in 1994. The average user fee for sewage treatment in 2000 was 0.6 Euro/m^3 (UNECE, 2001: 33). Full-cost recovery of wastewater treatment costs is not a requirement.

The wastewater pollution tax in its present form was introduced in 1991, but considerably strengthened and increased after Estonia regained its independence. The discharge parameters subject to the wastewater pollution levy are organic matter, phosphorous, nitrogen, suspended solids, sulphates, monophenols, oil products and pH value. A complex set of coefficients are applied to the standard rate to reduce or increase the charge, depending on the quality of the receiving water body, the degree of compliance, etc. The nominal rates have been increased to 10–20 times the original rates, but the real increase, when account is taken of inflation, is a factor of about 5. Exemptions can be obtained if the revenue is reserved for environmental investments.

7.5 Observations on effectiveness

With 70 % of the population connected to public sewage treatment, Estonia is in a much better situation than many other Member States. The total discharge of BOD into surface waters was reduced by more than 90 % during the 1990s (UNECE, 2001: 31). Discharges of nutrients from point sources were reduced by 62 % from wastewater treatment plants and 86 % from direct industrial sources between 1990 and 1995 (Pachel, 2002: 95). The removal of nitrogen and phosphate, however, is still insufficient to meet UWWTD objectives.

A separate problem is with the rural areas, where wastewater treatment does not exist or has been phased out. In the past the wastewater treatment plants at collective farms also received household wastewater. The treatment units are no longer functioning now that the farms have been privatised.

The wastewater tax has been used mainly to raise money for investments, so its incentive role is not well developed. Financial and distributional concerns have dominated deliberations on increases. Observers point to the absence of staff and capability for economic analysis in the Ministry of Environment.

Monitoring systems and designation of water quality classes remains underdeveloped, and the basic capacity for aquatic analysis could be strengthened.

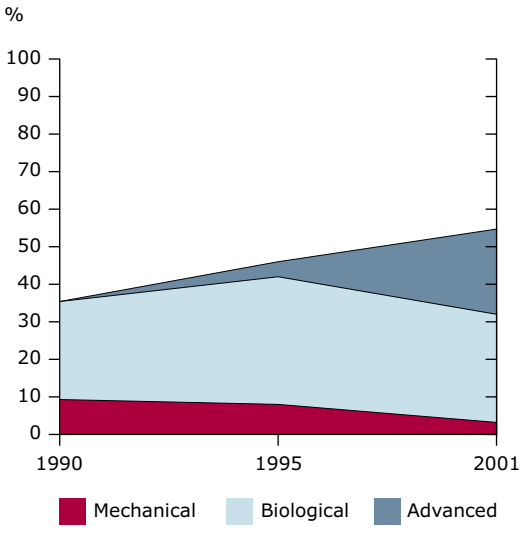
8. Poland

8.1 Water quality situation

Poland is divided into a northern lowland area with two major lake districts and a southern hilly upland area, crossed by flat, long river valleys. It is connected to the Baltic Sea basin and the major drainage goes through the Vistula and Oder rivers. Poland depends on surface waters for its water supply, but high pollution levels and low available water reserves have led to drinking water shortages in a number of areas. The need to improve water quality has been addressed by policy-makers since the early 1970s. Despite significant progress during the 1990s, the overall state of river water quality gives rise to concern, while several beaches continue to be affected by insufficient sewage treatment. The creation of the National Fund, foreign environmental assistance (donors) and the need to comply with the EU's environmental acquis are three main factors which have helped to promote the control of point-source discharges.

About 55 % of households are connected to municipal sewage treatment. At the plants 23 % of the wastewater receives advanced treatment, and 28 % biological treatment. Mechanical treatment has been almost phased out. 3 500 large industries discharge directly to surface waters, and about 1 900 of these have no wastewater treatment plant (Jarosinski, 2002).

Figure 8 Share of population served with public wastewater treatment in Poland 1990–2000



Source: EEA through its European Topic Centre on Water.

Compliance with the UWWTD is an economic and administrative challenge for Poland, which has been granted a 10-year transitional period. The investment needed for the required wastewater treatment plants has been estimated at 3 billion Euro. An additional requirement of 4.5 billion Euro is foreseen for the associated sewer network extension (OECD, 2003: 66).

8.2 Water quality policy objectives

Poland was a signatory of the 1974 Helsinki convention on protection of the Baltic Sea, and agreed to extend its sewage treatment at that time. However, closure of beaches and prohibition of bathing were common during the 1970s and 1980s. The emphasis on industrial expansion resulted in discharges tripling during the 1970s, and in 1981 Poland was responsible for one-third of the total organic discharge to the Baltic Sea, compared with only 11 % of the total water flow into the sea. There was a huge gap between formal policy objectives and the measures provided to meet them.

The 1991 National Environmental Policy document, which was agreed shortly after the demise of the planned economy, provided strategic goals and established a new approach for more efficient water management. This approach was clearly market-oriented and envisioned full-cost water pricing, as a function of water quantity and quality, and the costs of pollution abatement. Increased fees for effluent discharges were therefore proposed. Provision of wastewater treatment was to be increased so that, by 2000, 70 % of wastewater would receive biological or more advanced treatment. Untreated discharges were to be reduced by 50 %.

The 2000 Second National Environmental Policy document revised and updated the strategy. It emphasised the need to increase

effluent charges to a more realistic level so as to meet the targets of the 1991 plan, which had not been achieved. In 2003 a national programme for purification of wastewater was approved by the government.

Not being able to meet the objectives of the 1991 National Environmental Policy, before joining the EU Poland negotiated a transition period of about ten years for compliance with the UWWTD. The transition clause differentiates between industry and various urban areas. Effectively this shifts the compliance deadline for industry to 2006, and for large cities to 2010. Poland has declared the whole of its territory as a sensitive area, to which more restrictive requirements apply.

Of the 509 cities which are required to comply with the UWWTD in 2005, 182 have so far been equipped with at least secondary treatment. However, considerable fractions of Warsaw's left bank domestic and industrial wastewater continues to be discharged with no treatment at all to the Vistula, from which drinking water is extracted.

8.3 Institutional context

The Ministry of Environment is the main government body responsible for environmental management, including management of water quality. However, it shares its competencies on water quality with the Ministry of Infrastructure (Baltic Sea environmental issues).

Implementation of national legislation takes place through the 49 Voivodships, which are regional state authorities. Each Voivodship has an environmental department, which is responsible for issuing permits and setting maximum allowable emission and discharge levels. In relation to wastewater the Voivodship collects environmental levies imposed according to the national rates. This makes the Voivodships Environmental Protection Department the key institution in implementation (Zylicz, 2003).

Inspection is undertaken by units at Voivodship level, which refer directly to the state authorities. The State Inspectorate for Environmental Protection is the national body responsible for enforcement of environmental regulations.

Seven regional water management boards, which were created in 1991, and reorganised from 2001, are responsible for developing programmes for water use, mainly in relation to supply and quantity. The National Fund for Environmental Protection and Water Management, established in 1989, plays the key role in the financing of wastewater treatment. It provides financial assistance in terms of grants and soft loans on the basis of revenues from pollution charges and fines for non-compliance. There are also regional funds at Voivodship level.

The municipalities are responsible for the provision of wastewater treatment capacity, which is funded by subsidies from the various environmental funds and support from foreign donors.

In 1991, western European governments agreed a 'debt-for-environment-swap' and Poland established a separate Ecofund on that basis. Six countries allocated previous debt to the Ecofund, while others decided to offer bilateral environmental assistance. From 2001 and through May 2004 funding was available from the EU through the ISPA programme. Since accession in May 2004 funds have been available from the Cohesion and Structural Funds. However, bilateral financial assistance from foreign donors has remained well below the level of domestic financing through the National Fund, Voivodship funds and others.

8.4 Policy instruments

The 2001 Water Act replaced the former 1974 Water Act and is the framework for a number of decrees that address surface water quality, sewage discharges and emissions guidelines.

Following the 2001 Water Act the Environmental Protection Act was amended with a reform of the previous system of wastewater charges that was initiated during the time of the planned economy and significantly improved and strengthened following the 1989 revolution. The charges are based on BOD/COD, suspended solids, heavy metals and chlorate/sulphate content.

The wastewater charging system was rather complex up to 2001, with different rates for different dischargers. The system favoured municipal sewage plants, which paid a much lower rate than industry. The reform in 2001 introduced a uniform rate, lower than the former standard rate, to

which many exemptions applied. However, revenues declined significantly following the 2001 reform. This is a step backwards compared with the 1990s.

The wastewater charge is collected by the Marshalls of Voivodships, and the revenues are distributed among the National Fund, Voivodship funds, Poviat funds and municipal funds. They provide a basis for financing wastewater control, particularly for the municipalities. An undesired transfer of revenues from industries to municipalities via the funds appears to have been one of the reasons for introducing a uniform rate.

Full-cost water pricing has been partly introduced in many municipalities, but is not implemented in the larger urban areas for reasons of affordability (OECD, 2003: 136). Investments in wastewater treatment plants are covered mainly by the environmental funds and are not included in the pricing structure. Prices of wastewater collection and treatment are estimated at between 0.2 and 1.5 Euro per m^3 for households, averaging 0.8 Euro per m^3. In 1998 households spent 1.4 % of their budget on sewerage and water supply.

8.5 Observations on effectiveness

The total discharge to surface waters of BOD and nutrients from point sources was reduced by about 24 % between the late 1980s and the mid-1990s (Jarosinski, 2002: 157). With only 55 % of the population connected to public sewage treatment there remains a considerable backlog, despite three decades of policy declarations and high levels of investment in the mid-1990s.

As Poland started its transition to a market economy in 1990 it faced a massive deficit in its water pollution control infrastructure. For this and other environmental reasons the National Environmental Fund was created to establish an independent financial basis for clean-up measures, and water pollution taxes were raised to western levels.

However, the municipalities, which were made responsible for provision of sewage treatment, faced very serious financial shortages and in some cases bankruptcy. Although funds were also available from western donors, providing the necessary treatment plant presented a significant administrative and financial challenge. Companies from various donor countries competed for construction contracts, and much assistance was absorbed by consultancy services rather than direct investment. Due to shortage of funds, upgrade of old sewage plants was often given a higher priority than the provision of new infrastructure, e.g. in Warsaw.

9. Comparative analysis

9.1 Introduction

This section compares the effects, effectiveness and cost-effectiveness (as defined in Chapter 2) of the urban wastewater treatment policies in the six countries.

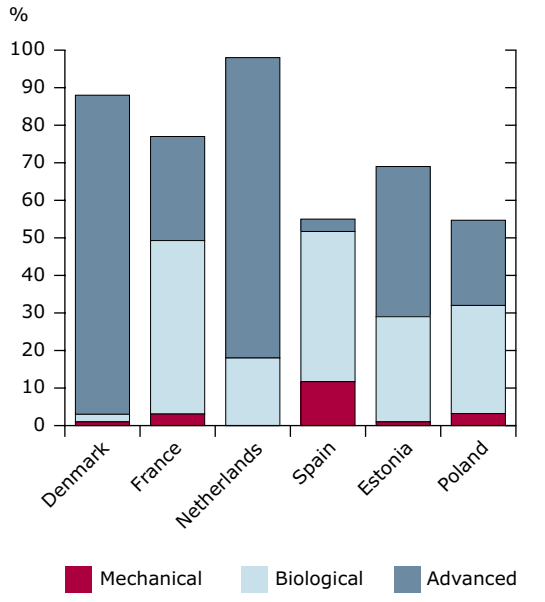
9.2 Effects

a) Wastewater treatment plants

Since 1972 clean water policies have resulted in a gradual increase in the share of the population connected to sewage treatment plants in every one of the six countries studied. The 1991 UWWTD coincided with the national environmental policy plans of the early 1990s and thereby helped to intensify the efforts being made.

Figure 9 provides a comparative overview, and shows that full connection has almost been achieved in Denmark, the Netherlands and France, with Spain and Poland lagging rather far behind and Estonia in between. The figures refer to total coverage with public sewage treatment plants and are not specified according to the detailed UWWTD requirements. Simple mechanical treatment has been phased out in most areas, but advanced treatment, has not been sufficiently extended in France, Netherlands, Poland or Estonia, and remains almost absent in Spain.

Figure 9 Share of population served with public sewage treatment, and type of treatment offered. Latest year available



Sources: EEA, OECD, Eurostat.

b) Discharges to surface waters

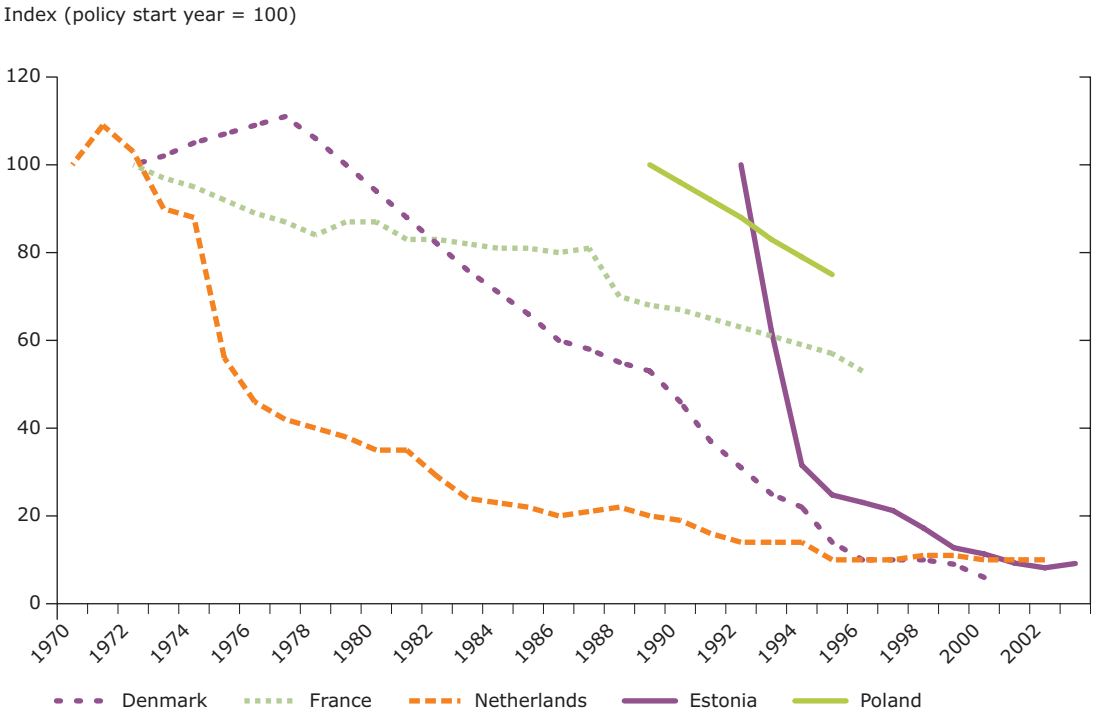
Figure 10 shows how total discharges to surface waters have changed in those Member States where the statistics include both direct and indirect discharges of BOD. The net load concept has been developed by the Dutch Central Bureau of Statistics, which publishes such a figure annually for the Netherlands. For Denmark and France net loads can be calculated on the basis of the statistical sources available.

Changes in net loads for Poland from the late 1980s to the mid-1990s have been calculated in the context of Helcom work. Discharges have been reduced by about 24 % during this period. In Estonia the significant reduction of about 95 % since the early 1990's (also calculated in the context of Helcom) resulted from clean water policies as well as economic restructuring. Reductions in Estonia are impressive and in fact per capita BOD discharge from industry and households combined is currently similar to the level in the Netherlands and Denmark.

The net load on surface waters is a general pressure indicator, which does not contain a spatial dimension. Despite the general decrease, regional differences and undesired local effects can arise. However, the dramatic decline in the net load on surface waters clearly indicates the effect of the improved capacity of sewage treatment and of industrial pre-treatment as regards organic discharges. In terms of effectiveness, the net load indicator reveals the first-order outcome of the policy; organic discharges have been reduced.

Whether there have been improvements in water quality and if so the extent to which they can be attributed to sewage treatment

Figure 10 Net load on surface waters — organic discharges (BOD) from sewage treatment plants, industry and other direct outlets. 1970–2002



Sources: OECD, UNECE, Danish National Environnmental Research Institute and national statistical services.

Note: Absent or incomplete data on industrial discharges in Spain precludes calculation of the development in discharges.

is more difficult to assess. As discussed in the methodology chapter it would be necessary to use a model at catchment level to disentangle the precise impacts of changes in total discharges on water quality. However, such a modelling exercise is beyond the scope of this report.

c) Effects on expenditures

Whether changes in net load on surface waters have been attained in an economically effective way will be analysed in Section 9.4. Here we simply summarise the effects of clean water policies on expenditures.

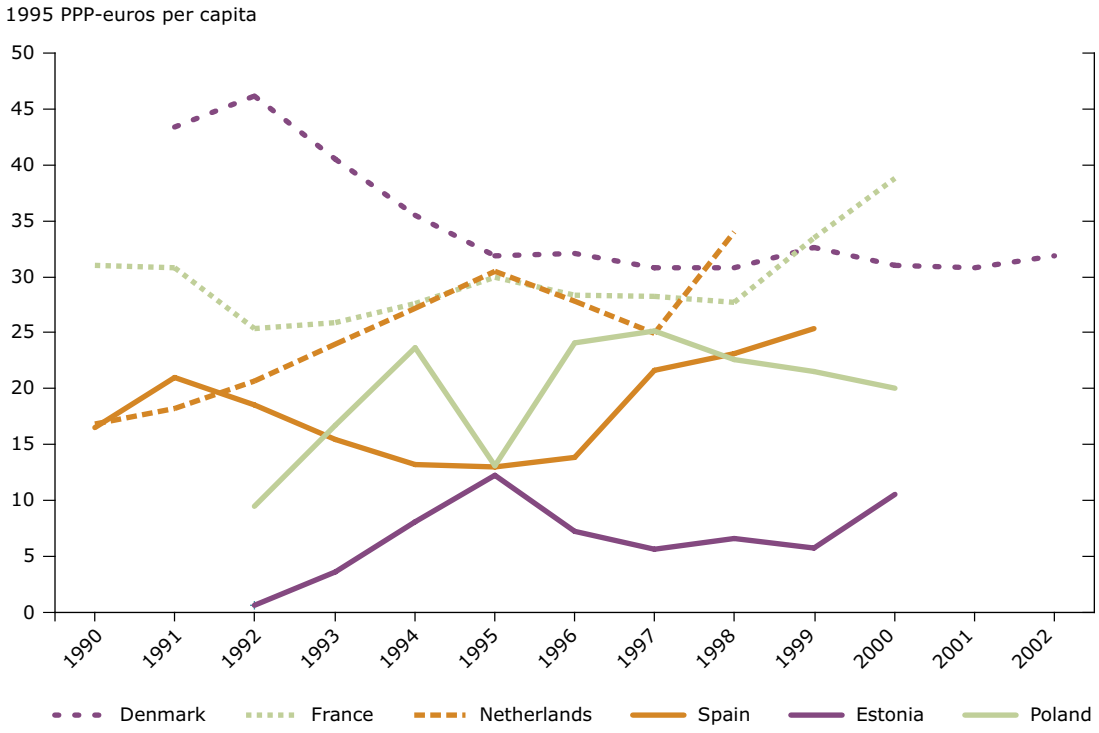
Data for public investment in wastewater management, compiled by national census bureaux according to the common Eurostat SERIEE-methodology, are available for most of the period 1990–2002. Figure 11 provides an overview of investment in water pollution control (incl. both treatment and sewage networks) undertaken in the six Member States. The investments in Spain, Poland and Estonia include subsidies from the EU and foreign donors. To allow comparison between countries, the investments are converted into Euros and corrected for purchasing power parities (PPP). The relative costs of labour and capital differ between countries, so PPP-corrected investments are necessary, as one Euro may buy more sewage treatment in some countries than in others.

Higher levels of investment are apparent in Denmark, the only country which has met the requirements and deadlines of the UWWTD. Investments were already considerable after 1991, as efforts to extend sewage treatment resulting from the Danish 1987 Action Plan for the Aquatic Environment partly preceded the passing of the directive. In France and the Netherlands public investment has increased, resulting in convergence at around 35–40 Euro per capita per year.

Public investment in Spain decreased in the first half of the 1990s and increased only after the 1995 agreement between the government and the regions on the financing of wastewater treatment. Investment is now converging to the level of Denmark, France and the Netherlands. This may indicate an effort to implement the UWWTD, not yet reflected in the statistics on operational sewage treatment plants.

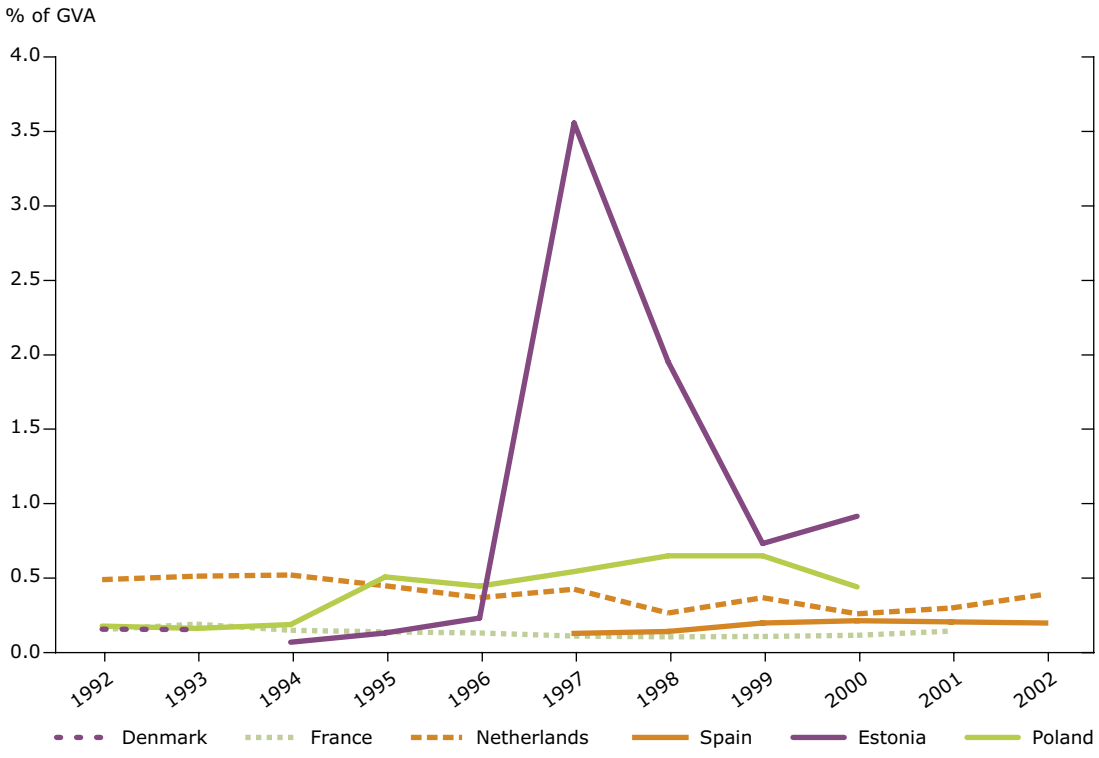
Public investment in Poland was remarkably high before EU membership, investment in

Figure 11 Public investments for sewers and wastewater treatment in Euro per capita 1990–2002. Deflated to constant 1995-prices and corrected for purchasing power parities



Sources: Eurostat, OECD and national statistical services.

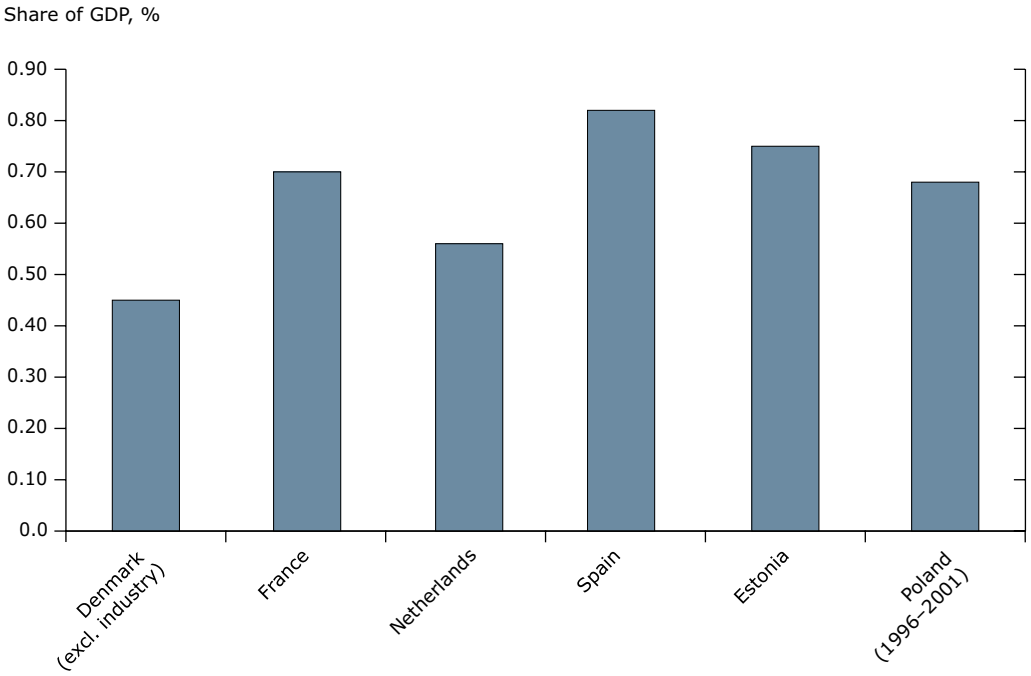
Figure 12 Industrial investments for wastewater treatment 1992–2002. % of industry's gross value added (GVA)



Sources: Eurostat, OECD and national statistical services.

Notes: The high level of investments in Estonia reflects measures in the oil shale industry.
For Denmark, data is only available for 1992 and 1993.

Figure 13 Total expenditures on water pollution control (point sources) since 1992 as a share of gross domestic product. Data covers available years in the 1990s



Sources: Eurostat and national statistical services.

the early 1990s being higher than in Spain. In Poland and Estonia, however, there has been a notable decline since investment peaked in the early and mid-1990s. This may reflect the fact that environmental investment had to give way to other concerns during the transition process.

Data for industrial investment in water management, compiled by national census bureaux according to the common Eurostat SERIEE-methodology, is also available for most of the period 1992–2002. These investments are illustrated in Figure 12 as a percentage of gross value added (GVA) by industry. Unfortunately there is a lack of detailed investment data for Denmark; the figure shows OECD estimates (1999: 60). For the other countries, Poland and Estonia have the highest levels of investment as a share of industry GVA. Industrial investment in water management in the second half of the 1990s as a percentage of industry GVA in both countries was higher than the 0.4 % seen in the Netherlands. Despite foreign assistance and loans, approximately 75–85 % of Polish industry's investments was funded domestically. In Estonia industrial investment in water management peaked in 1997 at a record high of 3.5 % of industry GVA. For France and Spain investment was relatively modest, generally below 0.15 % of industry GVA.

Finally, Figure 13 illustrates total expenditure by the public and private sectors in the field of water pollution control for both investment and operational purposes. This ranges from 0.55 to 0.85 % of GDP, except for Denmark, which is lower as expenditure by industry is not taken into account.. EU subsidies are included in the Spanish figure.

It is notable that the Netherlands generally spends a lower share of GDP for water pollution control than the other countries, despite being close to compliance with the UWWTD. The more detailed analysis below further supports the view that that the Dutch approach has been superior in terms of economic cost-effectiveness.

9.3 Effectiveness

The analysis of effectiveness involves comparisons between the policy measures and the desired objectives, as well as analysis and judgement on the causal mechanisms of implementation. The analysis in this report shows that, despite three decades of European efforts to introduce and set minimum standard requirements for wastewater treatment, disparities between Member States persist. Implementation shortfalls are found in three of the four longer-established Member States reviewed.

Denmark and the Netherlands essentially comply with the UWWTD, although there is still a small deficit for nitrogen removal in the Netherlands. While authorities in Poland and Estonia have until 2010 to meet the standards of the directive, Spain and France have not met the agreed deadlines. In both countries about two thirds of the wastewater treatment plants that discharge in sensitive areas did not provide the required advanced treatment, while one-third in non-sensitive areas did not provide secondary treatment (Commission, 2004). The designation of sensitive areas is a separate issue, and the European Court of Justice recently ruled that France had not fulfilled its obligations under UWWTD in this respect.

In order to understand why expectations for implementation have not been met, even in EU-15 Member States such as Spain and France, it is necessary to consider the influence of institutional responsibilities for water pollution control. It appears that sharing responsibilities between municipalities and water basin authorities, combined with the availability of subsidies, tends to distort implementation.

Objectives for urban wastewater treatment are necessarily implemented by sub-national authorities. While construction of sewage treatment plants is generally the responsibility of municipalities, river catchment authorities are also involved in the planning and financing activities in most countries. The Agence de l'Eau in France and River Basin Authorities (Confederación Hidrografica) in Spain participate in planning and allocate funds from the proceeds of economic instruments (water pollution levies) to the municipalities.

The succesful extension of the coverage of wastewater treatment in Denmark and the Netherlands occurred in a setting where only one authority (either the municipalities or water boards) was made fully responsible. The significance of shared responsibilities can be observed in the Spanish case, where implementation was dependent on finalisation of agreements between the regions and the state. The history underlying the continued shortfall in wastewater treatment in many European urban areas relates to the number of authorities involved in combination with the large investment requirements. Bottlenecks associated with financial support often cause lengthy negotations and provide perverse incentives.

As regards Poland and Estonia, there is some doubt whether it will be possible to meet the UWWTD requirements in the time agreed. Investment needs remain large (Table 1). Current investment is around 5–10 Euro/capita/year cf. fig. 10 (without PPP-adjustment), whereas it appears that implementation by 2010 would require 40–50 euro/capita/year over the next six years.

Table 1 Expenditure and affordability of the UWWT Directive

Country	Population (million)	GDP/capita (Euro) 2002	UWWTD investment expenditure Billion Euro	UWWTD expenditure Euro per capita	UWWTD expenditure as % of a 1-year GDP	UWWTD expenditure as % of annual GDP ([3])
Denmark	5.1	36 026	4.1	804	2.23	0.17
France	61.2	24 850	12.0	197	0.79	0.06
The Netherlands	16.2	27 447	2.9	181	0.66	0.05
Spain	40.2	17 319	10.9	270	1.56	0.12
Estonia	1.4	4 931	0.3	236	4.78	0.80
Poland	38.6	5 213	11.2	292	5.59	0.93

Sources: CEC, 1999; Helcom for Poland and Estonia.

Note: The last column on UWWTD expenditure as % of annual GDP is based on a 13 year implementation period for EU-15 Member States, and a 6 year implementation period for new Member States (2004–2010). The previous column provides the share of GDP if all UWWTD investments theoretically were focused in just one year. The costs have been reported by Member States to the Commission, but the methodology is not entirely consistent across Member States.

([3]) From 1993–2005, but 2005–2010 for Poland and Estonia.

A proper appreciation of the implementation costs of the UWWTD is the key to understanding the implementation difficulties.

Whereas in the EU-15 Member States analysed, the total investment expenditure required for implementation is less than 2 % of one year's GDP, the requirement in the new Member States analysed is around 5 %. Since water pollution control costs as a fraction of GDP are already similar in the new and EU-15 Member States (see Figure 13) it is questionable whether the two new Member States can afford to fully implement the UWWTD without more attention to cost-effectiveness.

Subsidies have been introduced by the EU to soften implementation costs in the less-developed Member States. The role of subsidies is greatest in Spain, where up to 85 % of the costs of construction of sewage treatment plants are supported by EU funds, notably through the Cohesion Fund. Support is also offered to the new Member States, Poland and Estonia, in this case up to 75 % of the costs of the projects under the ISPA fund from 2001 to 2004. Since May 2004 Poland and Estonia have been benefitting from both the Cohesion and Structural Funds.

While subsidies may appear to be a logical solution to the threatening implementation deficit, there is ample reason for caution.

Subsidies may cause distortions, such as over-investments. A further important drawback of the subsidy approach is that cities in non-compliance may profit from delaying action until an opportunity for EU financial support materialises.

Since 1975 the OECD has recommended application of the polluter-pays principle, which basically is a no-subsidy principle. This principle was also adopted in the European Treaty of Rome in 1987. It is in acordance with this principle that the Water Framework Directive recommends the introduction of full-cost pricing for water services in all Member States.

Two economic instruments should therefore be in place in the area of wastewater treatment:

— **user fees** for wastewater discharges for households and industries connected to public sewage treatment plants; these should reflect the full costs of sewerage services (capital and operational);

— **wastewater levies** for entities that discharge directly to surface waters (industries and municipalities); these should vary with the types of pollutants according to the damage caused (external effects).

All six countries in this study have introduced both types of economic instrument, but only three have full-cost user fees for wastewater treatment. There is a legal requirement for full-cost pricing only in the most-established of the Member States: France (since 1959), the Netherlands (since 1971) and Denmark (since 1992). Subsidies, mainly from the EU, continue to play a substantial role in Poland, Spain and Estonia.

EU Structural and Cohesion Funds required the integration of the environmental dimension, including environmental appraisal for large projects, but have not systematically required the polluter-pays principle to be implemented when calculating the investments eligible for EU support. The focus has been on identifying large projects eligible for support. Social concerns are given as a reason for providing support, yet no distinction is made between support to households and to industry. Distributional issues are best mitigated by providing a direct support to those individuals who suffer from inequity, rather than by across-the-board subsidies.

There are distributional concerns which seem to preclude full-cost water pricing in certain Member States. The EU offers subsidies for exactly this reason. However, the subsidies are provided to local authorities and not directly to the most needy citizens (Zylicz, 2003).

Barcelona, for example, has obtained an 85 % EU grant for its newly-opened sewage treatment plant, so that all citizens and industries in this area will benefit not only from cleaner waters in the future, but also from greatly reduced user fees for wastewater discharges.

EU support will continue and increase for less developed Member States if the Commission's proposal for the Cohesion policy activities in the period 2007–2013 is adopted, but Spain has now become too relatively prosperous to benefit to the same extent.

9.4 Cost-effectiveness

Assessing the effectiveness of the implementation of wastewater pollution control policies requires examination of the appropriateness of the investments made. In the absence of a clearcut economic valuation of clean water improvements, a cost-effectiveness analysis is carried out at a more general level as a benchmarking of costs and policy outputs. The question is basically whether the improved sewage treatment capacity has been established in the most cost-effective way.

Improving the quality and reducing the quantity of wastewater discharge at source is normally preferable to constructing sewage treatment plants. Most engineering textbooks mention this, but often fail to go beyond wastewater treatment plant design. A sewage plant is an end-of-pipe solution, and more tailor-made and eco-efficient solutions within the domain of manufacturing can often help to improve both environmental and economic performance. A significant implication of this is that successful eco-efficient approaches in industry will also help to reduce capacity requirements at wastewater treatment plants which, in turn, will reduce the investments required.

Levies and user fees for wastewater discharges therefore have both a financing and an incentive function. The price signal from user fees will encourage dischargers to look for more cost-effective solutions. Where more efficient reductions can be identified, the need for end-of-pipe treatment will be reduced.

From the point of view of the competent authorities, the challenge is to predict the need for capacity accurately, in the light of the possibilities for in-plant measures in industry. Appropriate use and introduction of economic incentives at an early stage can be helpful in this respect. According to economic theory, environmental taxes on emissions will provide incentives to reduce emissions and install cleaner technologies.

Figure 14 provides an overview of wastewater taxes for the final discharges to surface waters, either from industry or from sewage treatment plants. These are not the user fee charges for sewage, but the actual externality payment — the price for direct emissions to surface waters. The tax is important for providing an economic incentive to control discharges and hence to comply with regulations such as UWWTD, but taxes differ considerably in design and rates among the six Member States. The data in Figure 14 relates to BOD only, but except Spain all Member States have tax rates also for N- and P-discharges (simple organic pollution). Comparisons are difficult because there are many exemptions and special conditions.

The highest rate of taxes are found in Poland, the Netherlands and Denmark. Rates are significantly lower in France, Estonia and Spain. The rates of the taxes depend on historical circumstances and developments, as indicated in the country chapters of this report. In the case of Spain the rate of the water pollution control tax is well below that in the other western European countries, as becomes clear when the tax-base of Spanish pollution units is converted into inhabitant equivalents for BOD (Figure 14).

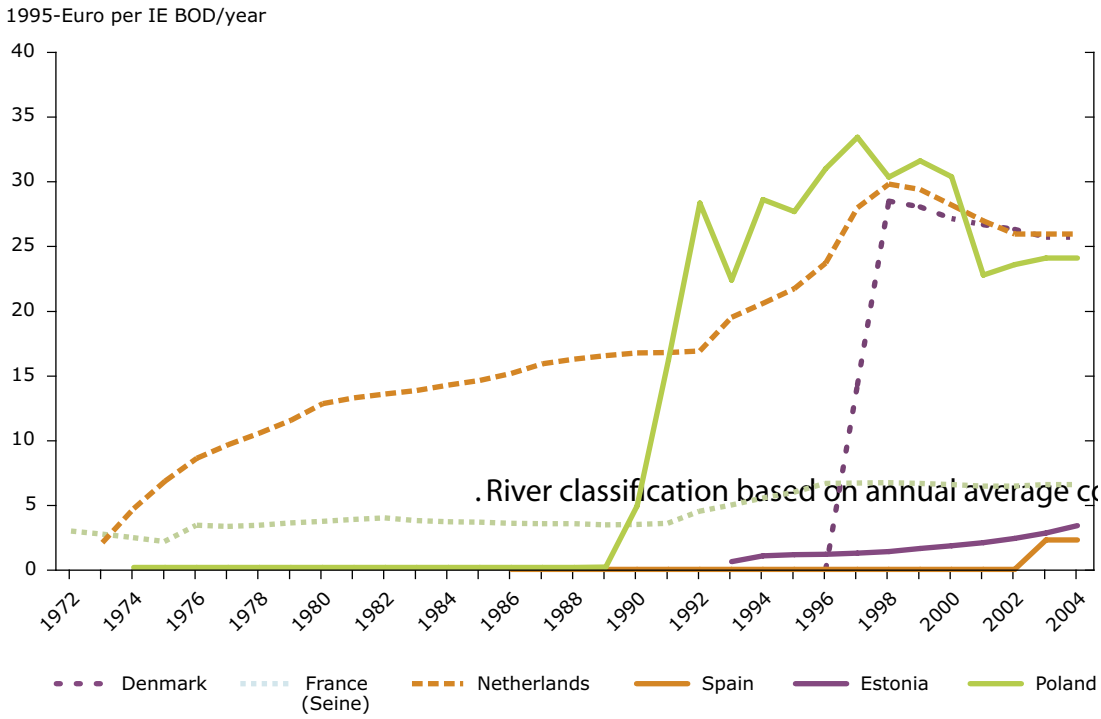
Most countries apply the tax revenues to measures to control water pollution. The exception is Denmark, where the revenue from the wastewater tax has been used to lower income taxes as part of an environmental tax reform.

An understanding of the significance of appropriate economic incentives can be gained by comparing experience in Denmark, France and the Netherlands. The following cost-effectiveness analysis is limited to these three Member States, as the data for Spain, Poland and Estonia do not allow the same level of detail.

Figure 15 provides time-series for gross industrial wastewater discharges comprising both direct discharges and discharges to public sewers. Gross industrial discharges are considered here, because their decline would reflect the extent to which pre-treatment or eco-efficiency measures have been introduced in industry as an alternative to passive end-of-pipe treatment.

The decrease in gross industrial BOD-discharges has been most marked in the Netherlands and compares favourably with developments in France and Denmark. The relatively late Danish reduction af industrial discharges is related to the role of comprehensive planning requirements and the absence of economic incentives until the late 1980s (see Andersen, 1994).

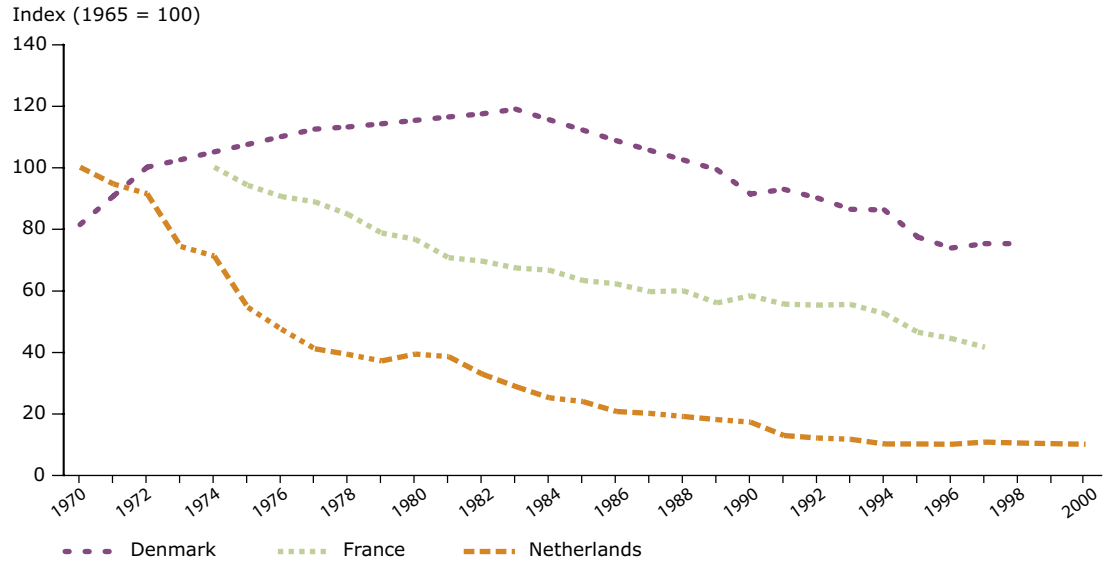
Figure 14 Water pollution control taxes for final emission of one person equivalent BOD to surface water. Standard rates 1972–2004 converted into Euro in 1995-prices, adjusted for Purchasing Power Parities



Sources: Danish National Environmental Research Institute, L'Agence de l'Eau Seine-Normandie, Dutch Ministry of Public Works and Water Management, Ministerio de Medio Ambiente, Polish Ministry of the Environment.

Note:
- Denmark: national wastewater tax for municipalities and industries, the standard rate from which certain exemptions exist.
- France: wastewater levy of Agence de l'Eau Seine-Normandie.
- Netherlands: state wastewater levy for freshwaters
- Spain: the 'canon de control de vertido' with application of a coefficient of 5, converted to inhabitant equivalent.
- Estonia: standard rate of national wastewater tax, without correction for water quality or compliance.
- Poland: the national wastewater tax relating to the main rate for chemical and metallurgical industries.

Figure 15 Gross industrial discharges (organic) before effect of public wastewater treatment



Sources: Danish National Environmental Research Institute, Dutch Central Bureau of Statistics and French National Institute for Statistics and Economic Studies.

Figure 16 provides an estimate of gross discharges from various industrial sectors for 1987 and 1997 for all three countries. Gross discharges from industry are five times higher in Denmark than in the Netherlands. The level in France is twice as high as in the Netherlands. The French economic incentives have been in place since 1970, as in the Netherlands, but the level has been much lower, thereby weakening the effect.

The relatively late introduction of the wastewater tax in Denmark and the cross-subsidisation of industrial discharges to the public system until 1992, whereby the bills were effectively passed on to households, appears to have contributed to the construction of rather comprehensive capacity of public sewage treatment plants.

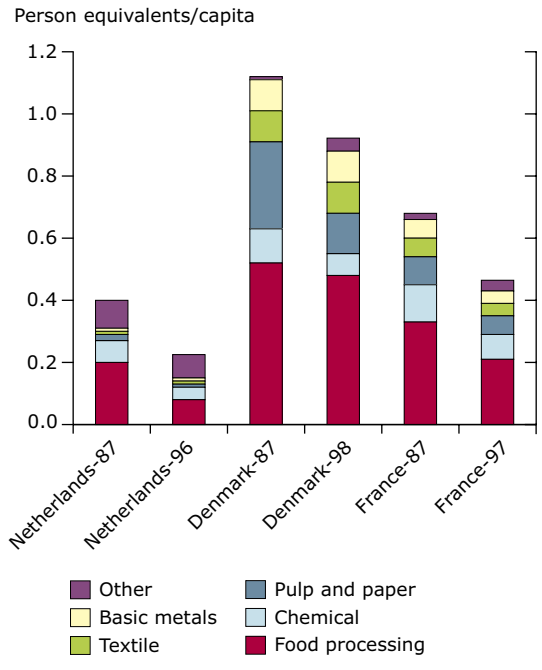
The main reason for the marked decline in gross industrial discharges in the Netherlands is that the levies have been effective in providing incentives to industries to reduce pollution at source, thereby reducing the need for public investment in sewage treatment plants. In Denmark industries were encouraged to send wastewater to the public system, limited attention being given to control at source in the 1970s and 1980s. The cleaner technology programmes initiated in the 1990s came too late to impact capacity extension and costs.

The relationship between increases in levy rates and reductions in discharges in the Netherlands has been documented in statistical analyses (Bressers, 1983; 1988). The significance of the integrated water management system in the Netherlands, with water boards having full responsibility, is further documented in a comparative analysis (Andersen, 1994; 1999).

As a result of the levy system in the Netherlands, less additional public sewage treatment capacity was required (Figure 17). The figures show that the Netherlands has constructed about 40 % less public sewage treatment plant capacity than Denmark.

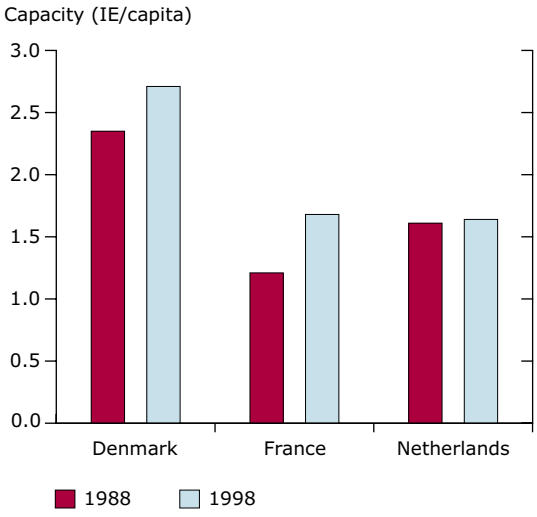
In the Netherlands there is also some pre-treatment by industries, as a result of the economic incentives provided to reduce effluents at source. According to CBS the industrial pre-treatment capacity in the Netherlands is 14 million inhabitant equivalents (IE). In Denmark, a survey among the largest companies conducted by NERI shows a pretreatment capacity of 3.7 million IE. The net difference, when public and industrial sewage treatment capacity is

Figure 16 Industrial sectors: gross discharges (organic) before effect of public wastewater treatment



Sources: Danish National Environmental Research Institute, Dutch Central Bureau of Statistics and French National Institute for Statistics and Economic Studies.

Figure 17 Capacity of public sewage treatment plants. Inhabitant equivalents (IE) per capita connected to WWTP 1988 and 1998



Sources: Danish National Environmental Research Institute, Dutch Central Bureau of Statistics and French National Institute for Statistics and Economic Studies.

counted together, remains about 36 % more sewage treatment plant capacity in Denmark.

Figure 18 provides time-series for public investments in wastewater treatment plants (excluding sewer networks), deflated and PPP-adjusted. As a consequence of the Dutch approach, building and upgrading treatment plants in the 1990s to meet the requirements of the UWWTD appears to have been attained in a cost-effective manner (Figure 18). Since France lags behind in complying with the UWWTD, and has a greater use of private operators, French investment costs are difficult to compare with the Dutch and Danish. In the following we compare the Dutch approach (economic instrument + eco-efficiency) with the Danish approach (public end-of-pipe solutions + no economic instruments).

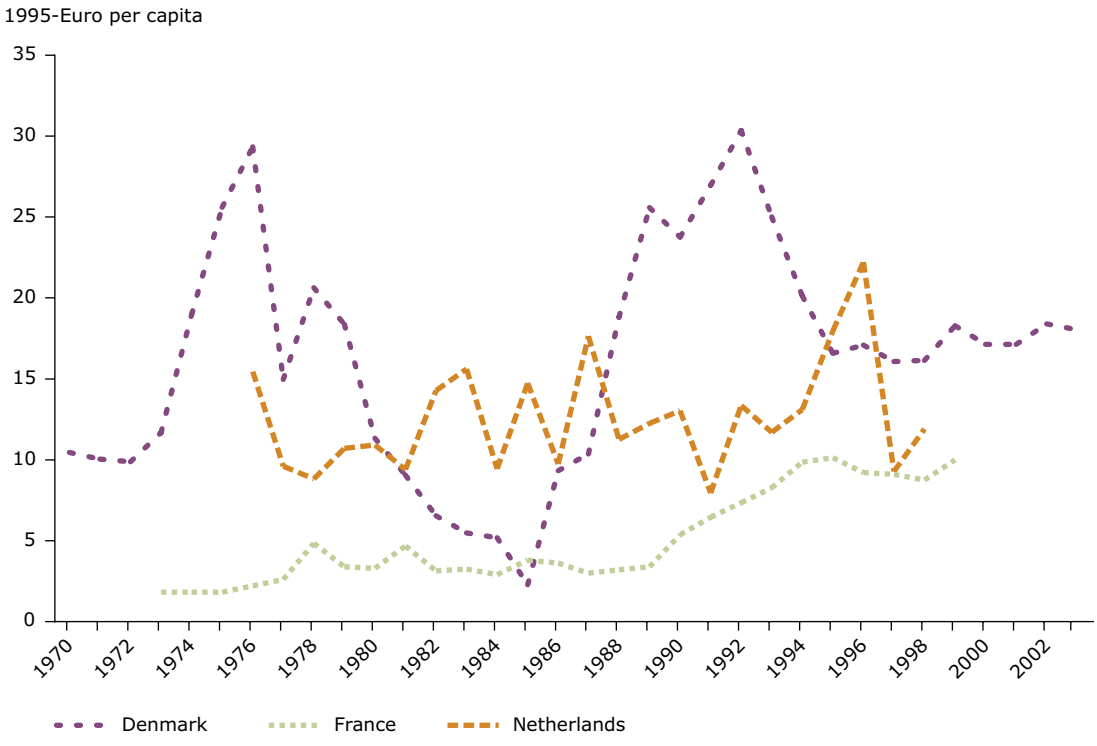
Between 1976 and 1990 Denmark invested 210 Euro/capita in public sewage treatment plants, while the Netherlands invested 129 Euro. During this period the Dutch extended their capacity from coverage of 52 % of the population to 93 %. Denmark extended coverage from 71 % to 85 %.

During the upgrade period 1991–1998 Denmark invested 133 Euro per capita, the Netherlands 88 Euro per capita. Overall, between 1976 and 1998 Denmark invested 343 Euro per capita and the Netherlands 217 Euro per capita.

On basis of the investment costs from 1976–1998 (Figure 18), it is hence possible to observe, that wastewater policy in the Netherlands has been rather cost-effective. In fact, the implementation costs for waste water treatment in the Netherlands became much more modest than foreseen by the Dutch Central Planning Bureau in the early 1970s.

Although differences in plant scale and advanced treatment options may influence the overall figures (as discussed in more detail in Andersen, 1994: 184–186), a basic consistency check on IE capacity unit costs serve to indicate that the main reason for the lower costs in the Netherlands is the lesser capacity. When the deflated investments are assessed against the capacity available in 1998 in both countries, they are found to be at a similar level: 127 Euro per IE capacity unit in Denmark and 132 in the Netherlands (1995 prices). This means that per unit of treatment the Dutch plants were slightly more expensive than the Danish, but as the Dutch approach prevented the need for

Figure 18 Public investments in WWTP (excl. sewer networks). 1972–2002. Prices in PPP-adjusted 1995-Euro



Sources: Danish National Environmental Research Institute, Dutch Central Bureau of Statistics and French National Institute for Statistics and Economic Studies

Table 2 Investments costs per available capacity unit 1998 (PPP-adjusted 1995-Euro)

	Denmark	Netherlands
IE public capacity per inhabitant connected	2.71	1.64
Investments 1976–1998 (EUR/capita)	343	217
EUR/IE capacity unit	127	132

capacity to treat industrial effluent, it appears to have been overall most cost-effective. The greater part of the cost-savings in the Netherlands hence appear to stem from the capacity saved at public sewage plants.

When account is taken of both public and private sewage treatment capacity, there is about 36 % more sewage treatment capacity in Denmark than in the Netherlands. A more detailed study would be required to disentangle the relationships further, but it should also be noted that there are likely to be savings on operational costs as a result of the lesser capacity. The upgrading costs from 1991–1998 being almost 33 % lower in the Netherlands than in Denmark is evidence of the added advantage of the Dutch approach, with less infrastructure needing to be maintained and improved.

The conclusion on cost-effectiveness is that the early and consistent implementation of the polluter-pays principle in the Netherlands has resulted in a high degree of cost-effectiveness. As a result of the incentives provided to dischargers to reduce their effluent at source, less investment in public sewage treatment became necessary. Dutch industry has continued to reduce its discharges, so that in fact some treatment plants suffer shortage of effluent (Bressers and Luloffs, 2004). This paradox underlines that the combined treatment of household and industrial effluent poses a significant challenge to cost-effective planning and design.

The Danish approach is far from unique, but as no other countries are at the same level of compliance as the Netherlands, the comparative analysis is restricted to these two countries. There are good reasons to expect that the Dutch experience would prove superior in cost-effectiveness also in comparison with other Member States, however. In particular countries without full and consistent implementation of the polluter-pays principle in terms of both full-cost pricing and effluent taxes are in fact at risk for making excess investments in the local sewage treatment infrastructure. Neither France, Spain, Poland nor Estonia appear to follow the cost-effective Dutch path.

10. Conclusions

This report has addressed the issue of effectiveness in order to examine the extent to which clean water policies have been implemented and the different approaches of different Member States, as well as to enable benchmarking of effectiveness and cost-effectiveness. The 1991 Urban Waste Water Treatment Directive has played a central role in the assessment as it sets minimum standard requirements for wastewater treatment and discharges, but policies in place since around 1970 have also been considered.

The Commission's 2004 UWWTD Compliance Review found that, despite some progress, several Member States had not met the deadlines and standards required by the directive. This report has analysed the policy background in detail in six Member States: two that largely comply with the directive, two that do not and two that must comply by 2010, as they have only recently joined the EU.

Denmark complies fully with UWWTD and discharges to surface waters have decreased by more than 90 %. However, the Danish approach to implementation appears to have been somewhat costly. Construction of sewage treatment plant capacity and the associated investment have been notably higher per capita than in the comparable case of the Netherlands. Not applying the polluter-pays principle and economic instruments early appears to have led to this result. As Denmark's statistical services do not count private investments, the full cost of the Danish approach is partly clouded by statistical deficiencies.

France has not responded fully to the challenge of the UWWTD, as in sensitive areas 58 % and in non-sensitive areas 37 % of wastewater plants discharge below the required standards. 94 % of the population is served by either public sewage treatment or in rural areas individual treatment, but net discharges to surface waters appear to have been reduced only by about 50 % since the mid-1970s. France does not appear to be reaping the full benefits of its advanced management system with river basin management, full-cost pricing and a water-pollution control levy. French water-pollution levies remain modest by European standards, and the system could be fine-tuned to address the implementation gap, although this also is caused by institutional rigidities and lack of political will in certain municipalities to comply with EU standards.

The Netherlands is close to compliance with the UWWTD. It has not installed sufficient advanced treatment for nitrogen in some large cities, but discharges to surface waters have decreased by more than 90 %. The Dutch approach to implementation appears to have been quite successful with respect to cost-effectiveness. The Netherlands spends a lower share of GDP on water pollution control than the other Member States. Economic instruments have been used to provide incentives to polluters to reduce pollution at source, rather than opting for the more expensive end-of-pipe solution of public sewage treatment. However, due to diffuse sources and impacts from upstream countries many freshwater bodies continue to be of inferior quality, and in view of its high population density the Netherlands will probably in many places have to go beyond the requirements of the UWWTD to achieve water of good ecological quality, as required by the Water Framework Directive.

Spain, despite generous economic support from EU funds (including about 3.8 billion Euro, or half of Spain's investment in sewage treatment, from the Cohesion Fund), has not achieved compliance with the UWWTD. Only 55 % of the population is connected to public sewage treatment plants and advanced treatment remains an exception. The EU subsidy for sewage treatment investments may have resulted in some lack of interest in domestic financing. The Spanish water-pollution levy is very low, with low collection rates, and Spanish industry invests less than 0.15 % of its gross value added annually on water pollution control. As a result many rivers and bathing waters remain highly polluted, but the picture is partly clouded by changing designations with regard to bathing waters.

Estonia, as a new Member State, has until 2010 to comply with UWWTD. With around 70 % connected, a higher proportion of the population is served with sewage treatment

than in Spain, and advanced treatment appears to be applied more widely than in France. As a result of waste water investments, and of industrial decline, discharges to surface waters have been reduced by more than 90 % in just ten years. The Estonian water pollution levy is modest, however, and domestic environmental financing will hardly suffice if UWWTD requirements are to be implemented in time, so there will be substantial reliance on EU support in the future, as there has been on western donors in the past.

Poland has also been allowed until 2010 to comply with the UWWTD for industry and large cities. Despite ambitious policy targets in earlier environmental plans for clean-up and high investment rates in the mid 1990s, only 55 % of the population is connected to sewage treatment plants. As a result discharges to surface waters were reduced by about 24 % during the 1990s. With the environmental funds there is a good financial system in place and the Polish water-pollution levy has been able to secure financing even in the difficult period of transition to a market economy, so investment has been provided, mainly by domestic sources, supplemented by donors. Polish industry has made substantial investment, up to 0.5 % of gross value added annually, on water-pollution control. EU support is now available from the Cohesion and Structural Funds, but new methods of distributing these funds, that promote implementation and cost-effectiveness, could be useful.

The Dutch approach demonstrates that substantial savings in investment costs can be made if advantage is taken of water pollution control levies and the incentives they provide for controlling the sources of pollution. Wastewater treatment plants are only part of the costs imposed by the UWWTD, which also calls for appropriate sewer networks. There is a need for operational expenditure as well as investment.

The efficiency of the incentive approach appears to be reflected in the fact that water pollution control expenditure in the Netherlands, only 0.6 % of GDP, is about 20 % lower than in France (0.8 % of GDP), despite a higher degree of compliance with the UWWTD.

The Dutch-Danish comparison suggests that Member States with low or inadequate water pollution levies (Spain, France and Estonia) or no full-cost pricing of sewerage (Spain, Estonia and Poland), may over-invest in excessive capacity if they do not take account of the potential for reducing discharges from industrial sources. Most of these countries are eligible for considerable EU subsidies (75–85 % of investments), so there is a risk of less efficient use of EU funding if wastewater treatment plant capacity is not optimised. There is also a risk that these countries will incur larger operational costs than necessary, which they will have to meet themselves.

The main reason for delays in implementing the UWWTD is the costs involved, so eco-efficient approaches that minimise investment deserve more attention. Greater emphasis on eco-efficiency, and economic incentives that promote wastewater reduction at source, are likely to be the keys to more timely and cost-effective implementation of the UWWTD in Member States.

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Annex Some options for further work related to the effectiveness of urban wastewater treatment policies

During the review and consultation process for this report, a number of suggestions for further work related to the effectiveness of urban waste water treatment policies were made by experts in the field. Although undertaking such analysis was not possible within the scope of this project with a fixed budget, the EEA found that the suggestions provided potentially useful projects that researchers and organisations may wish to consider if they seek to contribute to the insights on effectiveness of urban waste water treatment policies. Suggestions include the following:

- Undertake detailed analyses of emissions related to urban waste water and of changes in water quality in rivers, lakes, groundwater, inland waters etc. using a large number of water pressure and water quality indicators.

- Mapping changes in the driving forces (agriculture, urban settlements etc) in a certain area (stratum) with where the pollution is impacting (measured at monitoring places) by using the classical stratification statistical technique. This technique can categorise a country or a region (for example Europe) into certain strata such as very urban (high population density, without significant agricultural activities), urban (dominated by urban population, without significant agricultural activities), mixed (urban and agricultural) and rural (mainly with agricultural activities) and link to where the water pollution occurs. This has already been done for France in a pilot study.

- Looking at large scale sea water desalination and brine from desalination and how this can affect water ecosystems.

- Analyse the effects of shared or perhaps unclear division of responsibilities for urban waste water treatment policies between the various levels of public authorities at national, regional and local level.

- Analyse possible counterproductive economic, social and environmental effects of EU subsidies and to which extent such subsidies possibly hinders national investments.

- Analyse competitiveness effects of waste water prevention measures. For example, a factory may reduce pollution by reducing its level of activity and employment. On the other hand, shifting part of the tax burden from labour to for example water pollution would be good for both the environment and for employment (the double dividend).

- Analyse distributional and equity effects of waste water measures. For example water pricing is often difficult to implement because it affects the poorer parts of the population relatively more, unless compensation is made.

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