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Assessment of cost recovery through water pricing

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Abbreviations and acronyms

AbwAG	Abwasserabgabengesetz
ACA	Agencia Catalana del Agua
ACT	Australian Capital Territory
APIEME	Association for the Protection of the Evian Catchment Area
ATO	Optimal management units
billion	1 000 million
BMO	Brest Métropole Océane
BWB	Berlin Water Works
C&I	Capital and Investment costs
CAP	Common Agricultural Policy
CF	Cohesion Fund
CIRIEC	International Centre of Research and Information on the Public, Social and Cooperative Economy
CIS	Common Implementation Strategy
CSF	Catchment Sensitive Farming
DANVA	Dansk Vand- og Spildevandsforening
DG Environment	Directorate-General for the Environment
Defra	Department for Environment, Food and Rural Affairs
DVGW	Deutscher Verein des Gas- und Wasserfaches e.V. — Technisch-wissenschaftlicher Verein (German Technical and Scientific Association for Gas and Water)
DWA	Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall (German Association for Water, Wastewater and Waste)
ERC	environmental and resource costs
E&R	environmental and resource (costs)
EA	England & Wales Environment Agency
EBC	European Benchmarking Co-operation
EBRD	European Bank for Reconstruction and Development
EEA	European Environment Agency
EFTA	European Free Trade Association
EIB	European Investment Bank
EMLA	Environmental Management and Law Association
ERBD	European Bank for Reconstruction and Development
ERDF	European Regional Development Fund
EU	European Union
EUREAU	European Federation of National Associations of Water Services
EWC	Estonian Water Company
FCR	full cost recovery
GAECs	good agricultural and environmental conditions
IBNET	International Benchmarking Network for Water and Sanitation Utilities

IBT	increasing block tariffs
IEEP	Institute for European Environmental Policy
IMF	International Monetary Fund
IVM	Institute for Environmental Studies
IWA	International Water Association
MEKA	Market Relief and Cultural Landscape Compensation
Ml	megalitre
MMA	Ministerio de Medio Ambiente (Spanish Ministry of Environment)
NCWCD	Northern Colorado Water Conservation District
NEFCO	Nordic Environment Finance Corporation
NGO	non-governmental organisation
O&M	operational and maintenance (costs)
OFWAT	Water Services Regulation Authority
PDO	protected designation of origin
PES	payment for ecosystem services
PoM	Programmes of Measures
PPP	'polluter pays' principle
PSM	propensity score matching
RBA	river basin authority
RBD	river basin district
RBMP	river basin management plan
RDPE	Rural Development Programme for England
RPA	Rural Payment Agency
SchALVO	The Regulation on Protected Areas and Compensatory Payments
SCR	sustainable cost recovery
SEPA	Scottish Environment Protection Agency
SFP	strategic financial planning
SMEP	Small Municipalities Environment Programme
SORS	Statistical Office of the Republic of Slovenia
SWOT	strengths, weaknesses, opportunities and threats
TC	transaction costs
TEEB	The Economics of Ecosystems and Biodiversity
VEWIN	Vereniging van waterbedriven in Nederland
VKU	Verband kommunaler Unternehmen
WAC	Water Abstraction Charge
WATECO	CIS Working Group 2.6 on Water and Economics
WBRS	Water Budget Rate Scheme
WFD	Water Framework Directive
WICS	Water Industry Commission for Scotland
WSS	water and sanitation services
WTA	willingness to accept
WTP	willingness to pay
WWTP	wastewater treatment plant
ZER	zone de répartition des eaux

Executive summary

I. Setting the scene

The environmental resources situation is shaped by changes in climatic conditions, coupled with pressures exerted by a rapidly growing global population, its increasing demands and the subsequent impacts on the environment. Current practices across the economy sectors are still not sufficiently ambitious in terms of sustainability; they fail to ameliorate the stress conditions of vital resources like water. In recent years, the need has been highlighted for governance and management schemes that allocate resources appropriately among users (including the environment) and that promote the efficient use of such resources.

The very nature of these needs calls for adequate policy responses. One of these policy responses — applied either separately or in combination with other economic or regulatory instruments — is water pricing. The use of such instruments brings additional social and political issues into the already complex equation of sustainable management of water resources.

Calculating a price that reflects the true value of water, and thereby contributing to the long-term sustainable management of water resources, is clearly not a simple task. However, it is critical, for both the effectiveness and the integrity of the proposed water pricing systems. In terms of regulatory principles, Article 9 of the WFD introduces the principle of cost recovery for water services in accordance with the PPP. In addition, Article 9 promotes the internalisation of environmental and resource costs that result from existing uses of water resources and of aquatic ecosystems.

In more detail, Article 9 establishes that:

- water prices must allow for the (adequate) cost recovery of water services, including environmental and resource costs;
- the main water uses (disaggregated for households, industry and agriculture) must adequately contribute to the recovery of costs of water services, proportionally to their contributions to the pressures imposed on aquatic ecosystems in line with the PPP;
- water pricing policies must 'provide adequate incentives for users to use water resources efficiently and thereby contribute to the environmental objectives' of the WFD.

However, the translation of these principles into real water pricing policies applied in EU Member States remains unclear. Furthermore, the approaches and calculation methods for internalising external (environmental and resource) costs into pricing are still the subject of debate. There is a clear need to assess how current pricing (and other economic instruments) applied in EU Member States fare in relation to the requirements of the WFD and the key principles that it promotes for cost recovery, the PPP and incentiveness. There are also questions concerning the extent to which current economic instruments applied to water contribute (if at all) to the achievement of the environmental objectives of the WFD.

In the first river basin management plans (RBMPs), EU Member States reported on current water pricing policies and on the level of cost recovery achieved through existing water pricing. Results from these assessments are difficult to compare among EU Member States, due to differences in assessment methodologies, including aspects such as the definition of water services and the cost elements considered in cost-recovery assessments. EU Member States have also paid limited attention to the role of water pricing in providing incentives for more efficient use of water resources — something also reinforced in the communication *A Blueprint to Safeguard Europe's Water Resources* (COM/2012/0673 final). Despite the mandatory WFD reporting, many questions remain on the current state of water pricing in Europe in terms of cost-recovery levels, the internalisation of environmental and resource costs, and incentiveness or affordability (an issue that has gained importance because of the current economic and financial crisis).

The economics jungle

Prices constitute the most efficient information system; they largely determine decisions taken by producers and consumers. When prices do not reflect the full costs and benefits of production and consumption, the facts about resource scarcity and environmental values aren't made known — and nor are the actual costs of producing or consuming goods and services. Since they have nothing else to hand, however, people must base their decisions on such erroneous information: this results in the overuse of some resources (with a related degradation of the environment), and the underuse of others. So there is a direct causal connection between mispricing and unsustainable development. To trace mispricing, one can look at two well-known failures: market and policy.

A market failure results when the price of goods and services does not reflect either the full costs (such as pollution) or the full benefits (such as improvement of wetlands). A different kind of failure occurs when government interventions distort the market: this engenders a type of policy failure arising from subsidies, taxation policies, price controls or regulations, for instance.

If governments want to promote sustainable development, they have to make sure the prices and incentives are right. This means identifying them, measuring them and assessing their impact.

Taxes, charges, tariffs, etc. are water pricing instruments (or economic instruments) that are commonly applied to correct for market failures, and to ensure that the polluter pays. The revenue from water pricing instruments should help realise environmental and economic policy objectives in a cost-effective way.

Water pricing refers to the processes involved in assigning a price to water, including elements such as utility tariffs. In this report, water pricing means 'monetising the abstraction, use, or pollution of water'.

Prices (in this report for water services) can be charged in many ways.

- Taxes are compulsory, unrequited payments to general government. Taxes are unrequited in the sense that benefits provided by government to taxpayers are not usually in proportion to their payments. For instance, a tax can be raised to compensate for the use of the water system and for cleaning polluted water.

- Water tariffs are prices assigned to water supplied by a public or private utility through a piped network to its customers (see http://www.eea.europa.eu/data-and-maps/indicators/water-prices).

- Water charges are usually made for the (compulsory) payment related to a specific service, e.g. wastewater collection and treatment, but they are also applied to levies on emissions/discharges (air and water pollution charges) and for water supplies. While taxes are usually not earmarked (revenues go to the general budget), charges usually are (with revenues spent on purposes related to the object of the charge).

More specific provisions regarding water pricing are listed in Article 9 of the European Union's Water Framework Directive or WFD (Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy): this introduces the concepts of cost recovery, the 'polluter pays' principle (PPP) and incentive pricing.

But what does this mean?

- Cost recovery is about the amount of money that is being paid for water services. The principle, however, extends not only to the financial costs of the provision of water services, but also to the costs of associated negative environmental effects (environmental costs) as well as forgone opportunities of alternative water uses (resource costs).

- The PPP examines the adequacy of contributions from different water uses, essentially disaggregated into industry, agriculture and households, toward the total cost based on their role in generating these costs, i.e. it addresses the question of who pays for water.

- Incentive pricing relates to how water users pay for their use, and whether the right price signals are transmitted, i.e. how water is being paid for, and how the water price affects water user behaviour.

Although the WFD called for water pricing policies to be in place by 2010, it remains unclear whether the directive has led to effective changes in water pricing policies to support the achievement of the (ecological) objectives of EU water policy.

II. Scope and purpose

To support the policy processes on water, the European Environment Agency (EEA) has produced a series of reports that assess the state of Europe's waters and future challenges. These reports provide different levels of detail on critical environmental aspects such as resource efficiency and water economics, and the status of ecology, hydromorphology, vulnerability and biodiversity. Taken together, the reports contribute to a comprehensive knowledge base that can help policymakers preserve and improve European waters.

To further support policymakers and to help bridge the knowledge gap, this study collates practical knowledge on the current state of water pricing in Europe, with a focus on the concept of cost recovery of water services, including environmental and resource costs. As cost recovery is not the only important measure for the assessment of pricing systems, further assessments were undertaken to explore the issues of incentiveness, affordability and social equity. This study develops a synthesis of the conceptual and theoretical issues, and presents a general review of the evidence provided in the literature, with more detailed assessments of current water pricing for selected EU Member States and accession countries (namely Croatia, England and Wales, France, Germany, the Netherlands, Scotland, Serbia, Slovenia and Spain). Based on the assessment results, the study presents practical recommendations on the development of pricing models and water pricing reporting. It also indicates which alternative economic instruments can complement water pricing, in support of meeting the WFD objectives.

III. General conclusions

The study found a varying degree of cost recovery between EU Member States and between water-use sectors, in line with the more recent assessments of the WFD's first RBMPs carried out by the European Commission. While operation and maintenance costs are recovered from water users in most countries and sectors (excepting some gravity irrigation systems in southern EU Member States), this is generally not the case for investment costs, including drinking water and sewage services. In several EU Member States, uncertainty remains concerning possible hidden subsidies linked to preferential access to financial resources given to water service operators. With regard to environmental and resource costs, existing abstraction and pollution charges (including taxes) are mechanisms that can help internalise these costs. Today, these mechanisms play a financial role, i.e. raising additional financial resources for cost recovery. However, their relative low levels makes it unlikely that they can recover any (fair) share of environmental and resource costs.

Evidence from past studies indicate that current water pricing is inelastic, although demand clearly responds to changes in water pricing. Despite the requirements of the WFD, most of the evidence on price elasticity of water demand is clearly outdated. EU Member States have refrained from producing updated information on the incentiveness of current pricing policies. Generally speaking, the WFD did not result in a change in water pricing policy, EU Member States' efforts being mostly limited to (cost recovery) assessments and to reporting to the European Community. In selected EU Member States, changes in water pricing have been implemented in recent years (the Netherlands and Spain), or will shortly be put into effect (Ireland). But these changes were largely policy responses to the current economic and financial crisis, in some cases actually contradicting the principles promoted by the WFD.

In conclusion, there is a lack of harmonised and operational concepts of cost recovery, and environmental and resource costs including incentiveness.

The rest of this Executive summary presents detailed findings from the study; these are further elaborated and reinforced with tables, figures, etc. across the various sections of the report.

IV. Specific findings

Has cost recovery been achieved?

- It is clear that household water bills vary greatly across countries in Europe. A noteworthy distinction is that bills not establishing a direct link with the actual amount of water consumed or discarded are higher than those for which water pricing reflects both fixed and variable (volumetric) components. This applies to all

countries, with the exception of Germany. In Scotland, and some places in England and Wales, water is charged in relation to the value and size of the property. Not only is this water billing method more expensive for the customer, but it also reduces any incentives for increased household water-use efficiency.

- In the domestic sector, for the selected EU Member States the study reveals a generally high financial rate of cost recovery. It must be stressed that data on cost recovery are not homogenous across and within countries, and information on cost-recovery levels is not always easily accessible. For example, in some countries, cost recovery information is provided at national level, whereas in others, cost-recovery levels are calculated at the river basin district (RBD) or regional level.

- In the case of agriculture, the analysis shows general low levels of cost recovery of irrigation water pricing: these range from 20 % to 80 %, with an average of about 50 % for the studied Mediterranean countries. This is in line with the literature where water supply infrastructures have often been heavily subsidised, indicating that the price paid by irrigators is generally lower than the price required to achieve cost recovery.

- Cost-recovery levels undertaken for six individual water companies that provide water supply only or water supply and wastewater services combined indicate some reporting on environmental costs (charges and taxes) in their financial statements. The information collated stresses that the operation and maintenance costs of domestic water and sanitation services are generally covered. Unfortunately, profit margins for these companies seem to be low. This indicates that water companies cover costs with a profit but have limited extra funds available to handle potential renewals and/or replacements of existing infrastructure.

- Water prices (e.g. tariffs) for the recovery of financial costs in the domestic sector have remained more or less constant in recent years. A financial analysis of revenues and costs for a selection of European water utilities shows that there have not been large increases in costs. Nevertheless, there are examples where considerable EU and national subsidies have been used to meet the need for new infrastructure. This seems to suggest that some water companies are still heavily relying on hidden government subsidies for necessary capital investments.

- The concept of cost recovery as defined in the WFD and its call for the internalisation of environmental and resource costs is difficult to determine, as the costs of water service provision recovered is due to the variability in the way EU Member States define and account for environmental and resource costs (externalities) in practice. Most of the countries examined were considering covering environmental costs by charging water polluters for the purification of their wastewater, for the untreated pollution discharged in surface waters, and for activities (discharges, abstractions, impoundments and engineering) that affect the quality of aquatic ecosystems.

- There are economic instruments like the water levy (*canon del agua*) in Spain which are said to tackle both environmental and resource costs under a single mechanism. The Spanish water levy is an environmental tax designed to protect water resources, with the objective of guaranteeing supply and quality. The charge is calculated as a function of the water used by domestic and industrial users and is designed as an increasing block tariff.

- The interpretation of the water pricing principle according to the WFD is for some countries (Germany, for instance) subject to scrutiny. The main issue identified by the European Commission is that some sectors (e.g. agriculture or abstraction of water for cooling purposes) in some länder are exempted from the water abstraction charge. This led the European Commission to bring infringement proceedings against Germany for non-transposition of Article 9 of the WFD. While Germany is of the opinion that such cost recovery should apply only to the supply of drinking water and the disposal and treatment of wastewater, the European Commission considers that Germany's exclusion of other relevant activities (such as hydropower or agriculture) from the definition of water services hinders the full and correct application of the WFD — and thus of the cost-recovery principle.

- Proposed instruments in France have been designed to take into account environmental and organisational considerations. Environmental factors such as water quality

(costs for treatment, level of treatment) and quantity are considered when setting the price of water and environmental charges.

- In Slovenia, the provisions of the Environmental Protection Act (OJ RS, No 41/04, 17/06, 20/06, 28/06) are the legal embodiment of the WFD's PPP. The introduction of this principle has given rise to a significant source of measures for financing environmental protection policy. The introduction of water pollution-related tax exemption was well received in the area of wastewater collection and treatment. The tax for suitable wastewater collection and treatment is 10 times lower.

- In Scotland and the Netherlands, environmental costs appear to be considered: water polluters have to pay for the purification of their wastewater as well as for activities (discharges, abstractions, impoundments and engineering) that affect water quality. Resource costs in Scotland are considered through the charge on water abstraction. In the Netherlands, resource costs used to be considered in the groundwater tax, but this tax was abolished in 2012.

- The analysis does not reveal any drastic changes in revenues from environmental taxes in the different countries. Therefore, the new requirements under Article 9 of the WFD did not significantly affect the mechanisms put in place for recovering (even partially) environmental and resource costs as indicated by the total revenues collected. This overview, however, might overshadow some more marginal changes resulting from WFD principles that might have affected the rates applied to specific sectors, the removal of exemptions or the adaptation in unitary rates to account for differences in water balances between regions. It is worth noting that the Environment Agency's Environmental Permitting Regulations for Water Quality in England and Wales seem to be the only regulatory change introduced in that period.

What are the barriers to cost-recovery water pricing?

- The process of implementation of cost recovery driven by the WFD has faced numerous different obstacles. When analysing individual EU Member States, it is evident that such obstacles are commonly related to the specific context of the country in question, and a complex array of factors ranging from cultural traits to socio-economic aspects play a part in the mix. One common obstacle to the implementation of cost-recovery water pricing is the lack of metering infrastructure in the domestic sector, which leads to households being short of incentives to use water wisely. In this case, the cost of installation of water meters represents a deterrent — both for the entities responsible for the provision of water services and for their customers. In order to overcome this, it should be ensured that the transition to metering does not imply an imbalance in the financial accounts of service providers, while avoiding the surfacing of affordability issues for low-income groups. Already at this early stage, (i.e. providing the infrastructure necessary for the operation of new water pricing schemes), these conditions pose one of the main obstacles to efficient water pricing: the tension between social objectives and the need for cost recovery.

- There is resistance from stakeholders and users to the rise in water prices. This resistance may in some cases originate from the lack of information, while in others it is due to multiple social issues. Generally, customers (particularly households) have at best limited knowledge about the economic instruments which are set up by water agencies. In Slovenia, this has sparked a debate on whether these initiatives are too ambitious for the country's present context, making reference to the lack of appropriate and reliable data. On the other hand, the general perception that household water demand is inelastic with respect to pricing, and the notion that water is a basic requirement for life (and thus an arbitrary rise in the price of such a basic good is considered socially unjust) both pose uncomfortable political hurdles to the establishment of the cost-recovery principle forwarded by the WFD.

- There are challenges attributable to remarkable differences in water prices across local communities, a phenomenon anticipated in countries where the administration of the water sector is delegated to local and/or regional authorities, but less so when the system is rather centralised. In Slovenia, for example, this disparity in local prices arose from the fact that public utilities had very different price levels at the start of the price control. Some utilities charged prices close to the full cost level, while others were well below this level. Differences in price are often the result of very large differences in local conditions, although different conditions across location are only partly reflected in water prices (e.g. tariffs). The differences in water

supply systems (e.g. in karstic areas, water has to be tapped and transported over long distances from sources that are difficult to access) are not fully reflected in the service charges, because these are determined by the local public utilities and municipalities, often on a political or socio-economic basis. When this great variability in the water prices within a country's boundaries originates from political factors rather than local conditions, compliance to policy requirements at EU level is further complicated.

- Another important hurdle is the counter-effect of certain subsidies on the achievement of cost-recovery objectives. An example of this is the way that the extension of special subsidies initially designed for temporary relief in unusual circumstances (e.g. extreme weather events) impedes the attainment of cost recovery. In Spain, for instance, the price of electricity has in some cases been subsidised to support communities dependent on groundwater resources for their subsistence during periods of extreme drought. While this support is necessary during severe weather periods, it could easily develop into an environmentally harmful subsidy if maintained afterwards for political reasons.

- The low cost-recovery levels reported for the agricultural sector across southern countries are often the result of heavy subsidisation.

- Another variable for the appropriate implementation of water pricing policies that aim to internalise environmental and resource costs is the extent to which compliance with pollution and abstraction charges are enforced. The level of enforcement of existing instruments can be used as a measurement of the political will to achieve the objectives of the WFD.

Do existing water-pricing schemes provide an incentive for more efficient water use?

- The incentive structures of water and sanitation charge schemes are currently being disputed in many countries. Several countries have exhibited changes in consumption levels that closely resemble the desired (level of incentive) effects envisaged by drastic changes in water pricing. But is water consumption really reactive to price changes? In other words, is water demand elastic with respect to price changes? The analysis indicates that price elasticity of water demand might be extremely variable across countries. However, on average, elasticity values seems to be quite low, as coefficients range between – 0.10 and – 0.40 in most of these countries. The cases of Cyprus, Greece and Tunisia suggest that two factors have a major influence on price elasticity: the amount of water used (large consumers are definitely more reactive to price changes than small consumers) and the income levels of consumers.

- Past studies confirm that price responsiveness of demand for residential water is inelastic. However, first, it is statistically significant from zero in all countries, and second, demand is clearly responsive to change in prices (average price elasticity of about – 0.5). Households not facing volumetric water charges consume about a third more water than similar households that do incur such charges. Attitudinal characteristics do not have a statistically significant effect on total water consumption, but do increase the probability of undertaking some water-saving behaviours, as does a volumetric water charge.

- Increasing water prices (e.g. tariffs) to recover costs appears to be a highly effective instrument to manage residential water demand. Demand is inelastic for some urban uses, especially consumptive (households), and elastic for other uses (especially recreational, e.g. gardening and swimming pools). Studies indicate that volumetric variable pricing mechanisms are the best signal for maximising water-use efficiency in urban areas.

- In the agricultural sector, the study shows that in many EU Member States, irrigation water prices are still well below the levels required to achieve financial cost-recovery, not to mention environmental and resource costs. Is irrigation water demand reactive to price changes? Existing studies reveal that technical measures aimed at the modernisation of the irrigation system, followed by the implementation of volumetric pricing, have much higher water-saving potential compared to simple price increases. Farmers paying a flat rate use on average 10 % to 20 % more water than farmers paying a volumetric rate. Flat rates are still common in the EU, thus providing no incentive for efficient water use.

How do water pricing schemes account for social concerns?

- It was found that access to water for people in precarious economic situations is taken into

account in each of the examined EU Member States. Water authorities in some of these countries perform periodical pricing studies that commonly integrate rations comparing the average family income to the expense allocated to the water bill.

- As the means of achieving affordability are not directed by legislation at EU level, access to water services is being tackled in a variety of ways across Europe. For example, in the Netherlands, most municipalities provide the possibility of sewage charge remission for households that cannot afford to pay for this. For low-income households, remission is also possible for the purification, pollution and water system charges. While some national legislations cleary specify the means to achieve affordability, other countries have left this question open. In France, there are no social tariffs and the affordability of water services is handled via separate social policy.

- Support schemes like subsidies and exemptions from water charges and taxes can play an important social and political role in times of crisis. However, when not responsibly managed, they can have large-scale negative impacts on the environment, and actually prevent efficient resource use and allocation. The market distortions created by these mechanisms are detrimental to the effectiveness of water pricing policies geared towards the achievement of cost recovery and the PPP. In order to encounter the distortion effects of support schemes, the design should include a thorough assessment of the indirect impacts these may have on other policies.

V. The way forward

General steps for moving the water pricing agenda forward

In line with the new policy impetus provided by the *EU Blueprint to Safeguard Europe's Water Resources*, steps need to be taken to:

- ensure the application of a common framework for assessing water pricing (including for capturing hidden subsidies and for assessing environmental and resource costs);

- enhance the knowledge base on the price elasticity of water demand for different uses and under different socio-economic, institutional and water management conditions;

- widen the policy debate on cost recovery and incentiveness, by considering alternative economic instruments and accounting for all water management issues including (diffuse) pollution, hydromorphological pressures and the services provided by aquatic ecosystems.

Ways forward for pricing systems reflecting local/ regional circumstances

Drafting a blueprint for an 'optimal' water pricing system that meets the (sometimes conflicting) requirements of the WFD and other social objectives is a challenging task.

Such a system is likely to have the following features:

- a substantial part of the water bill is variable (i.e. a price charged per cubic metre of water used);

- volumetric or increasing block rates are used;

- rates, or rules for calculating them, are determined in a transparent way, preferably by an independent body;

- rates are high enough to enable water service suppliers to invest in (efficient and environmentally sound) improvements, innovation and expansion;

- affordability is addressed by separate, social measures, and not by interventions reducing water price incentives (such as reduced VAT rates);

- regional variations in water scarcity and other relevant conditions are reflected in water prices;

- different water users are treated on an equal footing; differences in water prices are related to differences in water-use characteristics, and not to the sector under which the user is categorised.

Which economic instruments for water management are best suited to the EU context?

The review of water pricing schemes in the selected countries revealed some issues and gaps with respect to recovery of operation and maintenance costs, integration of environmental and resource costs and incentiveness for more efficient use of water resources.

Economic instruments for water management can greatly help address the following issues.

- Among pricing instruments targeting water-use, abstraction charges have often proved ineffective in incentivising for more efficient use of water resources.

- To manage water demand and promote a more efficient use of resources, water tariffs seem to be the most promising option for intervention and innovation among pricing instruments.

- Pollution taxes and fees targeting point-source pollution have so far proven to be effective revenue-raising instruments, useful for internalising environmental and resource costs linked to pollution.

- Abstraction permit trading has been applied in and outside the EU context; it has had uncertain results in Europe.

- Cooperation schemes are useful when competition over water use and consequent benefits exists among water stakeholders. It can take the form of voluntary pricing and trading mechanisms where stakeholders agree on mutually beneficial actions to conserve assets, share benefits, etc.

Proposed options for reporting on environmental and resource costs

- In order to determine whether environmental and resource costs have been included in the costs recovered by drinking water utilities, a definition of environmental and resource costs must first be determined. This has proved difficult at European level. Given that no overall definition is available at the European level, EU Member States must determine how to interpret this aspect of cost-recovery water pricing independently.

- Comparable systems for the reporting of utility costs and revenues are desirable, especially for the inclusion of environmental and resource costs in the costs that are to be recovered. It would be particularly useful to have a system, standardised to a certain degree across EU Member States, that indicates which areas of environmental and resource costs are covered, and the level of coverage.

- Benchmarking initiatives are one promising option. An international reporting system for the recovery of environmental and resource costs can be created by ensuring that the data collected as part of European benchmarking initiatives contain the information needed to get an idea of whether environmental and resource costs are truly being incorporated into the costs recovered by the utilities.

- A report sheet has been developed (see Table 6.2) which collects the necessary data for constructing the indicators and cost positions in order to assess environmental and resource costs integration in cost recovery; it calls for several other data inputs that would facilitate an assessment and estimation of environmental and resources costs.

1 Introduction

1.1 How to read this report

The main objective of this study is to provide practical knowledge on the current status of the implementation of key principles of Article 9 of the WFD, and in particular on the cost-recovery principle.

To achieve this objective, activities follow these steps consecutively.

- **Stage 1: Water pricing theory and the current regulatory and institutional framework for water pricing in the EU.** In this first phase, the authors establish the theoretical basis of water pricing and cost recovery, building on a review of available literature. This helps to define the concepts of cost recovery and incentiveness of water pricing. In addition, they provide an overview of existing water pricing systems in EU Member States and of the current regulatory and institutional framework of water pricing in the EU.

- **Stage 2: Current water pricing schemes in the EU: how do they perform?** The focus is on selected EU Member States (Croatia, England and Wales, France, Germany, the Netherlands, Scotland, Serbia, Slovenia, and Spain) for providing up-to-date and quantitative information on the 'performance' of current water pricing schemes, in terms of their compliance with the key WFD principles highlighted above. Key attention is paid to cost recovery, incentiveness, and to the consideration of social concerns in pricing (affordability issues). Attempts are also made to capture the role the WFD might have as a driver for change in pricing policies in the reviewed EU Member States.

- **Stage 3: Moving the water pricing agenda forward.** The aim of this stage is to explore prospective priorities and needs for further policy action and research in the field of water pricing. Recommendations and suggestions are built on the technical and policy lessons learned through the review of water pricing systems in the selected countries around three themes:

  (i) the way towards a Europe-wide pricing scheme model, accounting for cost recovery of water services;

  (ii) innovative economic instruments (others than the usual water tariffs and environmental taxes/charges) that could be suitable for delivering incentiveness or mobilise additional financial resources for supporting water policy in the EU context;

  (iii) alternative options for reporting current water pricing schemes in Europe.

This study brings together the outcomes of the three stages.

- Chapter 1 sets the theoretical background of cost recovery and incentiveness of water pricing.

- Chapters 2 to 5 describe the state of play of water pricing frameworks and policies (in the context of current water policy and governance) in various EU Member States: the legal basis of water pricing; the mechanisms that explain how water is priced (and by whom); the costs that are recovered; the current application of the PPP; the incentiveness that current water pricing provides in altering consumers' behaviour; and the extent to which social issues are accounted for in water pricing and combined with the cost-recovery principle, allowing for affordable water services to be delivered. These chapters build on the data collected for selected EU Member States using coherent data collection templates and are complemented with available information from the existing literature available for other EU Member States.

- Chapter 6 carries out a preliminary investigation of means to advance water pricing on the EU policy agenda (e.g. in the context of the implementation of the recently adopted EU *Blueprint to Safeguard Europe's Water Resources)*,

providing recommendations and suggestions on a sound water-pricing scheme model, innovative economic instruments for water management, and water pricing reporting.

- Chapter 7 summarises the main conclusions of the study, identifying areas where further investigation would be required to support the understanding and performance of current water pricing in Europe, and to identify possible room for adaptation to respond to the requirements and objectives of the EU WFD.

1.2 Setting the scene: theoretical background of cost recovery and its application in water pricing

Some 12 years after the WFD entered into force, discussion on the implications of its Article 9 provisions on 'cost recovery' and 'adequate incentives' continues. As Unnerstall (2007) noted, the economic working groups of the Common Implementation Strategy (CIS): CIS Working Group 2.6 on Water and Economics (WATECO) and CIS Drafting Group (DG ECO2) have not been able to achieve a harmonisation of standards and methods at European level, leaving considerable room for different implementation approaches by EU Member States. This is reflected in actual EU Member States practice, as is illustrated throughout this report: numerous definitions, systems of water pricing, price/charge levels, and rates of cost recovery coexist.

To a considerable extent, the diverse implementation means of Article 9 may be related to the different interpretations of its key concepts: water services, cost recovery, water pricing, PPP and adequate incentives. The present section will deal with these conceptual issues. Another important factor is the fact that Article 9 calls for other objectives to be met, in addition to cost recovery: an adequate contribution from different water use(r)s, taking account of the PPP, and pricing policies that provide adequate incentives. Moreover, it allows social, environmental and economic effects of the cost recovery, as well as specific regional conditions to be taken into account. Sections 1.3 through 1.5 will deal with the questions of if and how the cost-recovery principle and these other objectives and considerations can be achieved simultaneously.

Water services

While some EU Member States consider only the provision of drinking water and wastewater treatment as 'water services', the European Commission argues for a much broader interpretation of water services: agriculture, industry and household water use — for example the use of surface water for hydropower, cooling and navigation purposes ([1]), and even flood protection ([2]) — are considered water services under the WFD. This broader interpretation may have significant implications. For instance, at present, power plants usually do not have to pay a charge for the 'thermal pollution' caused by their cooling water, and vessels do not have to pay to use inland waterways (except, sometimes, for passing bridges, sluices, etc.) ([3]). In this chapter, we will focus on water services, taking into account water supply, wastewater treatment, and collection in the domestic and industrial sectors, as well as irrigation water supply.

Water pricing

According to the EEA's glossary, water pricing is defined as 'applying a monetary rate or value at which water can be bought or sold'. Arcadis et al. (2012) proposes a broad definition of water pricing, describing it as 'monetising the abstraction, use, or pollution of water'; this broader definition is applied in this study.

Prices for water services can be charged in many ways.

Table 1.1 shows a number of water pricing mechanisms that are commonly used to cover the costs of different water services. It should be noted, however, that there are also several 'hybrid' systems (e.g. a single charge for water use, sewage and wastewater treatment), and that in several EU Member States the costs of certain water services (or parts of these costs, e.g. capital and investment costs) are covered by the general budget rather

([1]) See, for instance, 'Environment: Commission refers Germany to Court over incomplete cost recovery for water services'. Press release, 31 May 2012 (http://europa.eu/rapid/pressReleasesAction.do?reference=IP/12/536&).
([2]) See, for instance, 'Environment: Commission urges Austria to comply with EU law on water services'. Press release, 21 June 2012. http://europa.eu/rapid/pressReleasesAction.do?reference=IP/12/653&.
([3]) The principle that navigation should pay for the use of waterways was also mentioned by Commissioner Siim Kallas at a conference in Brussels on 4 May 2011 (http://www.schuttevaer.nl/nieuws/actueel/nid15672-binnenvaart-gaat-betalen-voor-vaarweg.html).

Table 1.1 Pricing mechanisms for different types of water services ([a])

Water service	Pricing mechanism	Cost types covered ([b])
Water abstraction	Tax or charge	E&R
	Water trading	E&R
Water supply/consumption	Water price/tariff	C&I; O&M
	Tax on water use	E&R
Sewage	Sewage charge	C&I; O&M
Wastewater treatment	Wastewater charge	C&I; O&M
Water pollution	Water pollution charge/tax	E&R
Quantitative water management	Water system charge	C&I; O&M

Note: ([a]) See link to OECD/EEA database for further information on pricing instruments (http://www2.oecd.org/ecoinst/queries/).

([b]) C&I: capital and investment costs; O&M: operational and maintenance costs; E&R: environmental and resource costs.

Source: EEA.

than by specific water-pricing mechanisms. A full overview of pricing instruments in the EU is presented in Annex 1.

The term 'water pricing' suggests that the costs are covered by making the user pay a certain amount per unit of water (consumed or discharged) or for pollution. However, this is not always the case. Prices, charges, and taxes can (partly or wholly) be charged as fixed amounts (e.g. per water connection or household per year), or related to other parameters (e.g. size of household, property value, land area size, capacity of the pump, or connection). Such parameters may to some extent serve as a proxy for the actual amount of water services used, while limiting the transaction costs involved (e.g. the cost of measuring the actual use of the water service).

Cost recovery

Assessing the costs that should be recovered from water users is not a straightforward task. Massarutto (2007) points to three major difficulties.

- The costs to be considered should be only the efficient ones, i.e. those that would be incurred by a service supplier behaving efficiently and paying all inputs at their own marginal cost. However, this does not necessarily occur, owing of a number of market imperfections along the value chain of water services (e.g. lack of competition, transaction costs, the weight of sunk costs ([4]), and externalities).
- Two important components of the cost (depreciation and capital cost) depend very much on accounting practices and on the patterns of allocating ownership of assets and economic risk between operators, users, and public authorities (and between types of uses for multipurpose water systems) ([5]).
- Resource and environmental costs call for complex and site-specific analyses.

Regarding Massarutto's third point, it is worth noting that the EU-funded AQUAMONEY (Economic Assessment of the Environmental and Resource Costs and Benefits of Water Use and Water Services) and EXIOPOL (a new environmental accounting framework using externality data and input-output tools for policy analysis) projects have developed and tested guidelines for the economic valuation of environmental and resource costs and benefits related to water use and water services ([6]). AQUAMONEY looked into values derived from water quality improvements according to the WFD, and EXIOPOL investigated the development of comprehensive estimates of the external costs for Europe for a broad set of water users. Important progress in the valuation of water services (and other ecosystem services) has also been made within the framework of the project entitled 'The Economics of Ecosystems and Biodiversity' (TEEB) ([7]). However, the results of these efforts are not yet widely applied in the practice of accounting for environmental and resource costs in the framework of WFD implementation.

([4]) See https://www.princeton.edu/~achaney/tmve/wiki100k/docs/Sunk_costs.html.
([5]) The risks have a cost that should be covered regardless of who bears the risk burden. There are many situations where costs have dropped, e.g. due to the oversising of waterworks which are paid for by taxpayers in a non-transparent manner.
([6]) See http://www.wise-rtd.info/en/info/development-and-testing-practical-guidelines-assessment-environmental-and-resource-costs-and-9 and http://www.feem-project.net/exiopol.
([7]) See http://www.teebweb.org.

Box 1.1 Focus on environmental and resource costs

How to define environmental and resource costs

According to the WATECO Guidance (2003), the environmental costs 'represent the costs of damage that water uses impose on the environment and ecosystems and those who use the environment', whereas the resource cost 'represents the costs of foregone opportunities which other uses suffer due to the depletion of the resource beyond its natural rate of recharge or recovery'.

However, it was recognised that such definitions were not straightforward and needed further clarification. To this end, the European working group (DG ECO 2) was set up in 2003, and provided more in-depth definitions (DG ECO 2, 2004) as set out below.

- **'Environmental costs** consist of the environmental damage costs of aquatic ecosystem degradation and depletion caused by a particular water use (e.g. water abstraction or the emission of pollutants). ... A distinction can be made between damage costs to the water environment and to those who use the water environment. Interpreted in terms of the concept of total economic value, one could argue that the environmental damage costs refer to non-use values attached to a healthy functioning aquatic ecosystem, while the costs to those who use the water environment refer to the corresponding use values.'

- **'Resource costs** are defined as the opportunity costs of using water as a scarce resource in a particular way (e.g. through abstraction or wastewater discharge) in time and space. They equal the difference between the economic value in terms of net benefits of present or future water use (e.g. allocation of emission or water abstraction permits) and the economic value in terms of net benefits of the best alternative water use (now or in the future). Resource costs only arise if alternative water use generates a higher economic value than present or foreseen future water use (i.e. the difference between net benefits is negative). Resource costs are therefore not necessarily confined to water resource depletion only (in terms of water quantity or water quality). They arise as a result of an inefficient allocation (in economic terms) of water and/or pollution over time and across different water users.'

Normally, environmental and resource costs are partly internalised (i.e. recovered) through environmental taxes and charges (abstraction and pollution charges). To further integrate the assessment of environmental and resource costs and their recovery into the process of selecting measures, three options (Ecologic, 2004) were proposed.

(i) Include environmental and resource costs recovery among the objectives that measures are expected to achieve, along with ecological targets.

(ii) Assess the contribution of measures and instruments to the recovery of environmental and resource costs after they have been selected.

(iii) The recovery of environmental and resource costs could be used to finance the costs of measures: it can be seen as a way of internalising the external costs, as long as the costs can be related to the origin of the environmental damage. In this way, charging polluters would contribute to finance the Programmes of Measures (PoMs) ([a]) and would thus be in line with the PPP.

Estimating environmental and resource costs: some European experiences

Germany

Environmental and resource costs were first estimated in the context of the 2004 reporting on the economic analysis under the WFD. On that occasion, the cost-recovery assessment focused on three exemplary pilot regions (the sub-basin area of Mittelrhein, the sub-catchment area of Lippe, and the administrative district of Leipzig). However, the assessment only took into account the internalised environmental and resource costs, i.e. that proportion of these costs recovered through environmental taxes and charges. This was just a first step towards environmental and resource costs estimation. At the academic level, until 2004,

Box 1.1 Focus on environmental and resource costs (cont.)

existing studies used a mix of approaches and valuation techniques. The favourite approach was the benefit approach, which assesses environmental damage through contingent valuation — willingness to pay (WTP) for environmental improvements and willingness to accept (WTA) compensation for environmental damage. Cost approaches based on the assessment of ecosystem services were less frequent.

This somewhat fragmented exercise and the results can be explained by the relatively little concern reported in Germany with respect to environmental and resource costs. However, it was observed that resource costs may become increasingly relevant in the future due to climate change; in addition, the estimation of environmental and resource costs can be useful in assessing the cost-effectiveness of the PoMs. It was also suggested that the cost of measures be used as a proxy for environmental and resource costs, thereby estimating environmental and resource costs through a cost-based approach. Such an approach would use environmental protection costs as a lower-bound proxy for the external environmental damage cost.

England and Wales

England and Wales have a long tradition of estimating environmental and resource costs. For the years 2002 to 2003, Environmental Resource Management (ERM) (2004) and Pretty (2000) (in DG ECO 2, 2004) estimated the following costs.

- Internal financial costs of current control measures: these are the costs already internalised, which have been incurred recently or in the past on treatment and control measures. For example, for the period 2000 to 2005, water companies planned an investment of GBP 4.5 to 5.5 billion, aimed to address environmental impacts related to pollutant discharges and water abstraction.
- External financial costs of control/abatement measures: a portion of water treatment costs is paid by water companies to treat pollutants coming from other sectors. In 2002 and 2003, the total annual costs borne by water company customers were estimated at about GBP 313 million, of which about GBP 240 million are attributable to external sources such as agriculture.
- External environmental costs: damage costs (or loss of welfare) from current abstraction and discharges (external residual environmental costs).

Note: (a) See http://www.eea.europa.eu/themes/water/water-management/river-basin-management-plans-and-programme-of-measures.

Adequate incentives

Volkery et al. (2011) note that the WFD does not provide further information on what would constitute an 'adequate' incentive. The WFD requires that EU Member States shall 'consider' water pricing, charges or taxes as potentially cost-effective means to reach its objectives when setting up their PoMs, but there is no obligation to implement them.

Generally, it is perceived that water pricing has a limited impact on water use. Although the provision of the resource is often seen and treated as a public good, the consumption of water is far from inelastic. The price elasticity of demand for water differs between users and regions, but is generally low, especially in the short term (see, for instance, Dalhuisen et al. (2003) and OECD (2010b)). Volkery et al. (2011) conclude that allocation and pricing schemes alone will not be able to meet the target of sustainable water use. Nevertheless, substantial changes in water prices can have considerable effects (Boxes 1.1 and 1.2). It seems safe to say that the impact of price incentives on water use will depend on various factors, including sector, region, type of water use, and initial price level and structure. An analysis of these conditions will be needed to determine whether a certain incentive is likely to be 'adequate' in a specific situation.

Box 1.2 Evidence of water pricing schemes providing incentives to reduce household water use

Since 1992, urban water prices in **Denmark** have been based on cost recovery so that prices cover both economic (through user charges) and environmental (through taxes) costs. All urban water users are metered, and water prices are charged according to the volume consumed. Since the policy's introduction, water prices have risen substantially; during the period from 1993 to 2004, the real price of water (including environmental taxes) increased by 54 %. The rise in prices has led to a substantial decrease in urban water demand, from 155 litres to 125 litres per person per day, one of the lowest levels in the OECD (OECD, 2010a and 2011).

In the **Czech Republic**, between 1990 and 2004, the water and wastewater tariff for households increased from 0.8 to 48 CZK/m^3, covering an increasing fraction of the extraction, treatment and distribution costs related to water provision. The reform also increased the fees for the extraction of both surface and ground water, as well as for the discharge of wastewater. The volume of household consumption decreased by 40 %, from 171 litres per capita per day in 1989 to 103 litres in 2002 (IEEP et al., 2012).

1.3 Cost recovery and the 'polluter pays' principle

The 'polluter pays' principle (PPP) was adopted by the OECD in 1972 as an economic principle for allocating the costs of pollution control ([8]). At that time, its main function was to prevent competitive distortions in international trade. In 1975, the use of the PPP was advocated by the European Commission ([9]), and since 1987 (Single European Act), it is also enshrined in the basic EU legislation (e.g. currently in Article 191(2) of the Treaty on the Functioning of the European Union). The PPP is not defined in EU law, which is justified on the grounds that the implementation of this principle across a wide range of policies is rather contextual (De Sadeleer, 2012). As a consequence, the interpretation of the PPP also leaves room for interpretation in the area of water policy. For example, should polluters only pay for those measures that are needed to achieve 'good status' according to the WFD? Or should they also pay for the pollution and ecological damage that still remains once that status is achieved? Moreover, the answer to the question 'Who is the polluter?' is not always clear-cut, especially when it comes to disputes over water quantities and water levels. For instance, should a farmer who voluntarily refrains from drainage receive money from the neighbouring nature protection area that benefits from the higher water level? Or should the farmer who drains his land pay a fee? The answer clearly depends on the initial legal entitlements ([10]).

Article 9 of the WFD links the PPP with the principle of cost recovery, both generally and with respect to the required 'adequate contribution' of the different water uses to cost recovery ([11]). Obviously, in the WFD context, the term 'polluter' must be interpreted in the broad sense, since several types of water use do not cause any pollution *sensu stricto*. The WFD requires those who benefit from water services to cover the cost of providing these services; therefore, the PPP should be extended here so as to include the 'user pays'/'beneficiary pays' principle as well (cf. ACTeon, 2009). Box 1.3 gives an example of how the cost-recovery principle and PPP can be applied in the area of groundwater abstraction.

Ideally, each individual polluter (user, beneficiary) should pay exactly the cost incurred by their use of a particular water service. This ideal, however, cannot be realised for two reasons. First, most of the costs of providing water services are not variable, but fixed (e.g. investments in and maintenance of the infrastructure) ([12]). Somehow,

([8]) Recommendation C(72)128 on Guiding Principles Concerning International Economic Aspects of Environmental Policies.
([9]) Recommendation 75/436/Euratom, ECSC, EEC of 3 March 1975 regarding cost allocation and action by public authorities on environmental matters.
([10]) A famous example in which the victim seems to be paying the polluter is the Payment for Ecosystem Services (PES) scheme initiated by Vittel. This bottled water company is paying farmers (in northern France) to change their farming practices and technology so as to reduce nitrate contamination. See Perrot-Maître, 2006.
([11]) François et al. (2010) argue that in the WFD, the PPP is not used in a very strict sense, because it does not call for cost recovery at the individual household level, for instance.
([12]) Fixed costs are unrelated to the volume of output; variable costs vary (proportionally or otherwise) with the volume of output. Many of the fixed costs in the water sector also have a 'sunk cost' character: the investment decision has been made in the past (usually for a long time period) and cannot be turned back, which means that the related (capital) costs are given and will not be affected by new decisions.

Box 1.3 Cost recovery in groundwater abstraction: the Environmental Improvement Unit Charge in England and Wales

Since 2008, the Environment Agency levies an Environmental Improvement Unit Charge as part of its Abstraction Charges Scheme ([a]). In simple terms, abstractors all pay a charge which is linked to the level of pressure on the environment in their region from abstraction, as the money is used to pay the costs of compensating licence holders for losses incurred due to their licences being varied or revoked to protect the environment (mainly high-value conservation sites). These charges are not currently levied to cover compensation for variations/revocations to meet WFD objectives, as investigations are still under way to determine what changes to abstraction are required under the WFD.

Note: ([a]) See http://www.environment-agency.gov.uk/business/regulation/38809.aspx.

Source: Henry Leveson-Gower, Defra.

a formula has to be found which distributes these fixed costs among the different user categories, and such a code will always have a certain degree of arbitrariness. Second, transaction costs impede the exact quantification of the various services delivered to the individual water user. While individual water metering may be feasible (some EU Member States already have metering rates close to 100 %), measuring the discharge of various pollutants at the level of households, small firms and 'non-point sources' clearly is not. 'Second best' types of water (service) pricing systems will usually be needed.

Water pricing is certainly not the only way to make the polluter (user, beneficiary) pay for the cost recovery of water services. When it comes to environmental and resource costs, regulatory instruments are actually more commonly used to achieve this. Capacity limits for groundwater abstraction, bans and limits on the discharge of certain pollutants (based on best available techniques), and obligations to restore or compensate wetlands degraded by human activities are examples of such regulatory instruments that make the polluters pay by forcing them to invest in pollution prevention and abatement or to neutralise environmental damage. Another example of regulation aiming at cost recovery by making users pay is a 'connection obligation': when an infrastructure for water supply or sewage is built, all dwellings and other buildings in the area can be obliged to connect to this infrastructure, thus preventing overcapacity and ensuring the spread of investment costs over the largest possible number of customers.

In some cases, even subsidies and public spending on water services can be compatible with the principle of cost recovery and the PPP. This is particularly true if the water service caters for the 'public good', i.e. by their nature, the benefits accrue to all firms and households in the jurisdiction. Flood protection (which should be considered to be a water service) is a classic example ([13]). But even public money for investments in water supply, sewage and wastewater treatment infrastructure could be justified under certain conditions. There are two main conditions: (i) that the infrastructure actually covers (close to) 100 % of the territory/population; and (ii) that all user categories contribute financially. The second condition will generally be met if funding comes from the general state budget. The only remaining question is then whether the prevailing tax structure can be considered compatible with the 'adequate contribution' requirement. If the two conditions are not met, it may be preferable to apply a specific tax or charge that makes beneficiaries pay as much as possible in proportion to the benefits they derive from the infrastructure. Such specific schemes inevitably increase transaction costs, as the benefits may be difficult to assess — particularly those which are latent (increase in value of properties).

1.4 Cost recovery and incentives

As we have seen, water pricing is not the only way to achieve cost recovery of water services. But to the extent that water pricing policies are applied, the WFD requires them to provide adequate incentives for users to use water resources efficiently. The WFD does not define 'adequate incentives', but it is clear that a water

([13]) The public health benefits associated with investments in water supply and sanitation also have a 'public good' aspect. See Le Blanc (2007), for instance.

pricing scheme must contain a variable element to provide an incentive. In other words, the price should at least be partly related to the quantity of the water service used. The feasibility of this variabilisation is therefore confined to water services that can be measured: mainly water abstraction, water supply and some large (industrial) point sources of pollution.

Water abstraction

Charges and taxes on water abstraction exist in several countries and mainly apply to groundwater (some EU Member States also have charges on surface water abstraction). They tend to have primarily a financing (rather than an incentive) function and are not normally earmarked; they also tend to have a relatively low rate (typically below or around EUR 0.10 per cubic metre (OECD, 2010a)). Evidence on the effectiveness of groundwater charges and taxes as incentives for water-use efficiency is scarce. The impact of the groundwater tax in the Netherlands (abolished in 2012, this had a rate in 2011 of EUR 0.20 per cubic metre) was reported to be rather small (Ecotec, 2001); this may be partly due to the fact that it provided for some important exemptions (e.g. a de facto exemption for agricultural irrigation).

Water supply

Water tariffs for consumers whose water use is metered are mostly split into a fixed rate and a variable or volumetric rate (per cubic metre). Clearly, the bigger the variable part is, the greater the incentive to economise on water use will be. However, full variabilisation may be unattractive to the water supplier, given the large share of fixed costs in his total production costs.

Even though the demand elasticity for water is low, it is not zero, and there is some evidence that substantial increases in water prices can lead to significant reductions in water consumption (see Box 1.2).

Charges for agricultural water supply are often not levied at a volumetric rate. For instance, per-hectare water charges (flat rate) are widely used for gravity-fed irrigation systems across OECD countries. Flat rate charges per hectare are perhaps the most adverse incentive affecting irrigators' use of surface water, especially where water stress is an issue (OECD, 2010b).

Water pollution

Charges on industrial water pollution, if levied at a sufficiently high rate and adequately monitored and enforced, can be effective incentives for pollution prevention and reduction. The Dutch system of effluent charges has become something like a textbook example in this respect (see, for instance, Bressers and Lulofs, 2002). Price tags for water pollution can also be created by means of tradable emission schemes. Experience with such schemes exists mainly outside the EU, notably in the United States and Australia, where mixed degrees of success are reported (OECD, 2011).

Possible trade-offs between incentives and cost recovery

An effective incentive tax or charge may undermine its own function as a source of revenues. If high water prices reduce water consumption, the supplier's revenues decrease and the cost of water supply may no longer be covered. If the water supplier further increases the prices in response, a vicious cycle may result. In practice, this will usually not happen, given the low price elasticity of water demand and the fact that water prices are only partially variable, as we have seen. Nevertheless, one should be aware of the fact that some users of water services have alternatives available, which may become attractive if the price of the water service becomes too high. They may, for instance, start drilling their own boreholes (legally or illegally), or, in the case of wastewater treatment, they may start building and operating their own private treatment plants. This not only affects the rate of cost recovery for the public (collective) water service investments, but it may also lead to a less efficient use of water resources. Clearly, prices for water services may not only be too low, but also too high to be called 'adequate incentives'.

The WFD requires water pricing policies to provide adequate incentives for users only. However, the principle of cost recovery may imply a lack of incentives for the suppliers of water services to improve their efficiency. If they can be certain that their costs will be covered anyway, they do not need to be concerned about mis-investments or overcapacity ([14]). Once such investments are made, they no longer have an economic interest in restricting demand until the capacity limits of the investment come into sight. Therefore, guaranteed

([14]) Overcapacity is often a major feature in water utilities of Central Europe. But it also happens in many other cities due to the significant decrease in water demand during the last two decades (see http://www.oecd.org/env/outreach/2390612.pdf).

cost recovery has to be complemented by regulation to guide investment decisions and to promote demand management, with a view to efficiently using water resources (OECD, 2009).

Investments in water provision and wastewater treatment are typically made for the (very) long term, and the associated costs have to a large extent a 'sunk cost' character. It is therefore useful to make a distinction between the role of cost-recovery mechanisms in existing and in new situations. In existing situations, where an infrastructure is already in place, the emphasis should be on using it efficiently and ensuring its proper maintenance, repair and improvement (OECD, 2010b). Pricing systems then need to focus on revenue raising; (financial) incentives to reduce demand for the water service will only make sense if the system is operating near the limits of its capacity. In new situations, where decisions must be taken on new investments, cost-recovery mechanisms play a key role in guiding the decision-making, so as to avoid investments that are inefficient from a societal point of view. This relates not only to investments made by the water service suppliers, but also to those made by water users (e.g. irrigation systems in agriculture).

1.5 Cost recovery and affordability of water services

Water pricing and taxing systems often contain specific provisions to ensure that water services are available to low-income households at a reasonable cost. Some examples are provided below.

- Unlimited 'free' water for all: Ireland is the only Member State where this system applies (currently under reconsideration). It transfers the water bill from the water user to the taxpayer and does not provide any incentive to restrict water consumption.

- 'Free' water up to a certain level: this system is used in Belgium (Flanders region), for instance. Each inhabitant is entitled to 15 m^3 of 'free' water per year. Above this level, the water price (which is relatively high, due to the cross-subsidies involved) provides incentives.

- Increasing block tariffs (IBT): this system implies stepwise price increases with increasing consumption. There are many possible versions, e.g. with uniform or variable block widths depending on household size, and combinations with a fixed charge. IBT systems provide a strong incentive for water saving (especially in the 'luxury' part of water consumption, e.g. for private swimming pools and garden watering). They may also benefit the poor, although not necessarily (e.g. not if several households share a tap or meter).

- Reduced VAT rates: this is a common instrument in the EU. Presently, only 10 EU Member States apply the standard VAT rate to all drinking water supplies. Interestingly, among these are some of the EU Member States with the lowest per capita income (such as Bulgaria, Romania and the Baltic states). Clearly, a reduced VAT rate reduces the incentive for water saving. Moreover, it does not differentiate between the poor and the rich. It has no influence on cost recovery, since VAT is a general tax on consumption and is not intended to cover specific water-related costs.

- Specific exemptions for low-income households from paying sewage and wastewater treatment charges. These reduce the cost-recovery rates but do not change incentives.

There is widespread agreement in the literature that keeping water prices at an artificially low level may not be the best way to ensure the affordability of water services to low-income households. It may result in a vicious cycle of underfunded service providers, insufficient investment, collapsing infrastructure and deteriorating services that further reduce the benefits that users receive from them, thereby also reducing their WTP (OECD, 2009). Pricing schemes that imply cross-subsidisation between rich and poor households may reconcile the objectives of cost recovery and affordability, but they need to be carefully designed to ensure that sufficient revenues are generated and that the cross-subsidy is well-targeted (i.e. all poor households and no rich households benefit from it). As the OECD (2009) report shows, this may pose quite a challenge. Ultimately other measures such as direct income support, or assistance from water companies for poor households in reducing their water consumption may be preferable.

What applies to protecting low-income groups also applies to protecting particular sectors. Agriculture often pays less for its water use than households and industry. While there may be good reasons to support agriculture (for instance to keep rural areas vital and to protect landscapes and ecosystems related to certain farming practices), doing so by underpricing water services leads to distortions and inefficiencies. Specific, targeted measures (e.g. in the framework of regional, social, or nature policy)

will do a much better job, while respecting the cost recovery and incentive functions of water pricing.

1.6 Cost recovery and incentiveness of water pricing: key messages

The phrase 'one size fits all' is rarely applicable in the real world, and it is certainly not applicable in the case of water pricing. Striking a balance between the potentially conflicting objectives of cost recovery, 'adequate' incentives and affordability is a delicate art, and the outcome may depend on preferences and considerations that vary in time and space. The diversity will be further enhanced by specific geographic, economic and social conditions.

Water pricing alone cannot realise the three objectives simultaneously (let alone a single, harmonised system of water pricing). The water sector is not immune to the Tinbergen (1952) rule, whereby for each and every policy target there must be at least one policy tool. Therefore, three different purposes cannot be accomplished with one instrument alone. A combination of different instruments is needed to achieve the different requirements of the WFD's Article 9. While water pricing has a role to play in this policy mix, it may well be a modest one. As Massarutto (2007) argues, using prices as a tool for water allocation only makes sense if two conditions are met: short run marginal costs are high and price elasticity of demand for water is high. Both these conditions are the exception rather than the rule in water markets.

Despite this limited allocative role, water prices are important in conveying the message that water is scarce and that one should look for options to use it more efficiently. They also play a useful role in implementing the 'user pays' principle and contributing to cost recovery (including environmental and resource costs). Cost recovery, however, is unlikely to be achieved through water pricing alone. Regulations and public expenditure/investments are also needed ([15]).

From an economic point of view, it might be worth recommending that the emphasis in water (services) policy be shifted from actions targeting the supply side to those targeting the demand side (aimed at reducing water demand directly, for example). Preventing investments in water infrastructure that do not generate net social benefits (taking into account environmental and resource costs) should be a priority, given the longevity of such investments. Once the infrastructure is in place, it represents a 'sunk cost' and the owner will try to operate it at the fullest possible capacity. It will, for example, attract water-intensive activities (e.g. agricultural crops demanding irrigation), and there is little that water pricing can do to reduce inefficiency and welfare loss. Likewise, water service suppliers need incentives to improve their operational efficiency (for instance, by means of benchmarking — see the International Water Association (IWA) (2011)), so as to further limit costs that must be recovered. At the same time, water service suppliers may expect from policymakers a regulatory framework (including water pricing and other instruments) that enables them to finance investments that do improve social welfare, to allow for maintenance, repair and modernisation, and to provide water services in an efficient way.

In the following chapters, we will further investigate the regulatory and institutional framework of water pricing in the EU, the performance of existing water pricing schemes, and possible ways forward to water pricing and cost-recovery systems that would provide for a reasonable compromise between the different water policy objectives, taking into account local and regional circumstances.

([15]) In particular, regulations are very useful tools in setting out the accounting principles defining what should be understood as costs, for instance on an annualised basis.

2 The current institutional and regulatory frameworks of water pricing in the EU

2.1 Definition of water services

According to the first WFD implementation report (European Commission, 2007), there were only 12 EU Member States where the definition of 'water services' was in accordance with the WFD (i.e. the initial transposition analysis had not identified significant non-conformity, or these cases appeared to be minor). Meanwhile, the European Commission has referred Germany to the Court of Justice for its alleged incomplete definition. Similar cases are being investigated in seven other EU Member States (Austria, Belgium (Flanders region), Denmark, Finland, Hungary, the Netherlands and Sweden) ([16]).

The definition of water services varies clearly among countries: the narrow definition of water services is limited to traditional drinking water and sewage services, and the wider definition includes all man-made changes in the hydrological system that serve a given water use (e.g. a dam built for generating hydropower is viewed as a water service provided to the electricity company). This is considered one of the barriers to harmonisation of water pricing across the EU.

Table 2.1 illustrates the diverse definitions of water services found in the countries reviewed, in the context of the present study.

Table 2.1 Comparison of the definitions of water services in various European countries, based on national legislation and literature

Country	Definition of water services
England and Wales	• Not found in national legislation. • However, the Water Environment (WFD) (England and Wales) Regulations indicate the definition given by the WFD: 'All services which provide, for households, public institutions or any economic activity: (a) abstraction, impoundment, storage, treatment and distribution of surface water or groundwater; (b) wastewater collection and treatment facilities which subsequently discharge into surface water'.
Scotland	• Water services are defined in Section 23(4) of the Water Environment and Water Services (Scotland) Act. The definition is the same as in the WFD.
Netherlands	• Water services are not defined in the Water Act. Since the Water Act refers to the WFD, it may be assumed that the definition of the WFD applies. • In policymaking, the Netherlands distinguishes five types of water services: water production and supply; collection and removal of rainwater and wastewater; wastewater treatment; groundwater management; and management of regional water systems.
France	• Article L2224-7 of the General Local Authorities Code states that: (a) all services dealing with all or part of the production by catchment or pumping, the protection of the abstraction area, the treatment, the transportation, the storage and the distribution of water intended for human consumption is a drinking water supply service; (b) all services dealing with all or part of the collection, the transportation, the sewage treatment and the elimination of sludge is a public service of wastewater treatment.

([16]) See: 'Environment: Commission refers Germany to Court over incomplete cost recovery for water services'. Press release, 31 May 2012 (see http://europa.eu/rapid/pressReleasesAction.do?reference=IP/12/536&).

Table 2.1 Comparison of the definitions of water services in various European countries, based on national legislation and literature (cont.)

Country	Definition of water services
Germany	• According to EU standards, 'water services' is a broad term that includes, for example, the water supply used for the cooling of industrial plants and agricultural irrigation. • Germany applies the rules only for drinking water supply as well as for disposal and treatment of wastewater. • Drinking water (according to Trinkwasserverordnung) is all water that is destined for human use, excluding mineral water, medicinal water, water for pools, and water used in drinking water installations that is not considered part of drinking water installation, according to the generally recognised technical standards. • Wastewater (according to Abwasserabgabengesetz): In accordance with this law, wastewater is classified as water that has been modified by domestic, industrial, agricultural, or other usages and runs off together with the unwanted infiltration water (dirty water) as well as rainwater running off and collected from paved or otherwise covered areas(storm water). Also, water coming from waste treatment and deposit plants is defined as dirty water. • Wastewater disposal (according to Wasserhaushaltsgesetz) involves the collection, propagation, treatment, discharge, seepage, of wastewater, for example, as well as the dehydration of sewage sludge. The elimination of sludge from small sewage plants is also part of wastewater disposal.
Slovenia	• According to the Environmental Protection Act, mandatory municipal public utility services in the field of environmental protection (related to water services) are: (a) drinking water supply; (b) discharge and treatment of urban wastewater and run-off rainwater. • Plants and installations necessary for the provision of public utility services referred to in the preceding paragraph shall be considered infrastructure of local importance. • The municipality shall guarantee the provision of public utility services referred to in the first paragraph of Environmental Protection Act in line with regulations governing public utility services. • According to the decree and rules, public services are required to provide a clean water supply to all premises where people are accommodated and/if the water is used for animal care (related to water supply). Public services are required to provide (related to wastewater): (a) draining and purifying wastewaters that are drained in public sewers; (b) adoption of municipal wastewater and sludge from septic tanks; (c) ensuring the performance of the initial measurements and operational monitoring or the estimates; (d) draining and cleaning of draining wastewater that is discharged into the sewer system from public areas or roofs.
Croatia	• According to the Law on financing of water management (Article 2), 'water management' (*vodno gospodarstvo*) covers the activities of water management, detailed activity melioration drainage, irrigation and water services in terms of the Law on waters of the Republic of Croatia.
Serbia	• The law on waters defines integrated water management (Article 24) as the set of measures and activities towards maintenance and improvement of the water regimes, security of necessary water in required quality for different aims and water protection from pollution and other damage. Water management is in the jurisdiction of the Republic of Serbia and is implemented through the relevant ministry and other ministries and institutions of the autonomous provinces, local self-government and public water utilities.

Table 2.1 Comparison of the definitions of water services in various European countries, based on national legislation and literature (cont.)

Country	Definition of water services
Spain	• The definition of water services as stated in the Spanish Water Act is as follows. Services related to water: all activities related to the management of water resources which make possible their use, i.e. abstraction, storage, transport, treatment, distribution of surface or groundwater, as well as the collection and treatment of wastewater to be subsequently discharged into surface water bodies. Also included in this classification are the activities executed for protecting people and goods from floods. • In the sectoral documentation, the integrated water cycle is understood as a sequence of three basic phases which in turn are subcategorised into sub-phases: (a) water supply (collection, regulation, transport, treatment, storage and distribution); (b) water sanitation (sewage, wastewater depuration and treatment, management of sludge and utilisation of biosolids); (c) reutilisation. • The definition of water service used by the Spanish Association of Water Supply and Sanitisation (Asociación Española de Abastecimientos de Agua y Saneamiento (AEAS)) is as follows: (a) The integrated concept of water services consists of the public supply of water for domestic human consumption, the collection of wastewater through sewage networks, its treatment and, in given cases, the regeneration process necessary for reutilisation. (b) The water supply service consists of the permanent provision of potable water to the location of individual use under a specific contract between the service provider and the client. It comprises water abstraction and distribution operations. (c) The sewerage services consist of the operation of the collection networks that collect the wastewater received by the public sanitation systems and transfer it to treatment facilities. (d) The wastewater treatment services involve the purification of sewage waters in the designated treatment facilities to control the quality level of the water returned to the environment. The combination of sewage and wastewater treatment services is referred to as water sanitation.

Sources: EEA based on national data, as follows:

- England and Wales:
  — Water Environment (WFD) (England and Wales) Regulations Scotland: Section 23(4) of the Water Environment and Water Services (Scotland) Act.
- Netherlands:
  — Water services not defined in the national legislation (source used: WFD).
- France:
  — See http://www.legifrance.gouv.fr/affichCodeArticle.do?cidTexte=LEGITEXT000006070633&idArticle=LEGIARTI000006390352&dateTexte=20121015.
- Germany:
  — cp. Institut für Wirtschaft und Umwelt (2012): Die Forderung umfassender Kostendeckung bei allen Wasserdienstleistungen (see http://www.iwu-ev.de/service/wissenswertes/144-die-forderung-umfassender-kostendeckung-bei-allen-wasserdienstleistungen).
  — Umwelt: Europäische Kommission bringt Deutschland vor den Gerichtshof wegen unvollständiger Deckung der Kosten für Wasserdienstleistungen (see http://europa.eu/rapid/pressReleasesAction.do?reference=IP/12/536&format=HTML&aged=0&language=DE&guiLanguage=en).
  — Bundesverband öffentliche Dienstleistungen (2012): EU-Kommission verklagt Deutschland wegen Wasserdienstleistungen (see http://www.bvoed.de/nr.-6812-eu-kommission-verklagt-deutschland-wegen-wasserdienstleistungen.html).
- Slovenia:
  — Environmental Protection Act (Zakon o varstvu okolja), Official Gazette, no. 41/2004, 17/2006, 20/2006, 39/2006-UPB1, 70/2008, 108/2009, 48/2012, 57/2012.
- Croatia:
  — Article 2, The Law on financing of water management ('The People's Newspaper' of the Republic of Croatia, No. 153/09) (see http://narodne-novine.nn.hr/clanci/sluzbeni/2009_12_153_3745.html).
- Serbia:
  — Article 24, The Law on waters ('Official Gazette of Republic of Serbia', No. 30/10) (see http://www.mpt.gov.rs/postavljen/123/893-10.pdf).
- Spain:
  — AEAS (2012) Guía de las tarifas de los servicios de abastecimiento y saneamiento de agua. Madrid: Asociación Española de Abastecimientos de Agua y Saneamiento.
  — AGA (2012). El Ciclo Integral del Agua (see http://www.asoaga.com/ciclo-integral-del-agua).
  — Real Decreto Legislativo 1/2001, de 20 de julio, por el que se aprueba el texto refundido de la Ley de Aguas. Artículo 40 bis, apartado i.

2.2 The current legal framework of water utility ownership

The legal framework of water utility ownership in a country also potentially impacts on the structure and level of water pricing. Whether utilities are operated publicly or as profit-seeking private enterprises can influence how prices are calculated and regulated, given that water utilities are monopolies, by virtue of the huge capital investments needed and the large transportation costs.

Management systems vary considerably across the EU, depending on country-specific characteristics such as national history, legal framework, culture and the accessibility of water resources (Lamothe, as cited in Techneau, 2007). A classification matrix, proposed by Van Dijk and Schouten (as cited in Techneau, 2007), identifies four main types of management on the basis of two strong variables: direct or delegated management and public or private management. The four management types, together with an indication of the countries in which each type is dominant, are illustrated in Table 2.2.

An overall picture of the current situation in Europe shows that 48 % of the population is served by water supply systems under public management, 15 % by public water companies (Germany and the Netherlands), 20 % by delegated private management (mostly France and Spain) and only 1 % by direct private management (England and Wales) (OECD in Techneau, 2007).

In accordance with the literature, the review of water pricing systems in the selected countries revealed that the framework varies across the EU Member States. The fully privatised water service providers in England and Wales are at one end, and the publicly run and managed utilities in Scotland and in some former Yugoslavian states, such as Slovenia, Croatia, and Serbia, are at the other.

Another broad approach applied in Germany, Spain, and France gives municipalities (who have sole responsibility for ensuring the services are provided) the choice between running the system operations themselves or delegating it to a private utility company. In Germany, this option is available for drinking water provision. But sanitation and sewage services are considered to be a fundamental responsibility of the city and must be carried out by public enterprises (outsourcing is allowed for certain tasks) (ATT et al., 2011). In 2008, 36 % of the German drinking water providers were privately run and private providers accounted for 64 % of the delivered water (ATT et al., 2011), stressing privatisation mainly among the largest providers. By comparison, private water companies in France in 2010 supplied drinking water to 66.7 % of total customers, and they provided sewage and wastewater services to 53 % of customers connected to comprehensive water service systems (BIPE, 2012).

Table 2.2 Classification matrix for institutional arrangements for water services, with indications of the countries where each type of management is dominant

	Direct management	Delegated management
Public management	*Direct public management* Under this system, the responsible public entity is entirely in charge of services provision and their management. In the past, this system was by far the most widely adopted institutional arrangement in the EU.	*Delegated public management* A management entity is appointed by the responsible public entity to execute the management tasks. Management entities usually remain the ownership of the public sector, although in the EU in some cases there is the possibility of a minor private shareholding.
	Countries: Denmark,Luxembourg, Sweden, Austria, Finland, Northern Ireland, Ireland	Countries: Portugal, Scotland, Greece, Italy, Germany, Netherlands, Belgium
Private management	*Direct private management* All management tasks, responsibilities and ownership of water utilities are placed in the hands of private operators, while public entities limit their activities to control and regulation. This system is in place in two EU states and it stems from a long tradition of direct private management (e.g. London).	*Delegated private management* The responsible public entity appoints a private company for the management of tasks, on the basis of a time-bound contract in the form of lease or concession contract. In the two countries where this type of management is common, municipalities subcontract their duties to private companies. The ownership of the infrastructure remains in the hand of public authorities.
	Countries: England and Wales	Countries: France, Spain

Source: Van Dijk and Schouten, in Techneau, 2007.

3 Current pricing framework in selected EU Member States

The impacts of factors that affect the structure of water pricing in Europe vary across EU Member States. These may include legal and institutional frameworks, policy initiatives and physical characteristics that influence the form or level of water pricing. The framework and conditions created by these factors across EU Member States can be very different, resulting in the development of differing water pricing systems in the past. The transposition of the WFD might be seen as a driver for standardisation in the application of basic principles such as cost recovery, although discrepancies might still remain between EU Member States owing to diverse legal and institutional frameworks.

Although many exogenous factors determine the costs of providing water services, population dynamics can especially influence the level of water prices, because capital investment makes up the bulk of water provision and sanitation costs. Also, long-term infrastructure decisions based on prognoses of future demand, as well as current capacity needs determine this capital investment. In general, negative population growth resulting in a smaller customer base will result in higher tariffs for those remaining customers, as capital used for previous investment decisions must be amortised by fewer households and businesses. Population dynamics are obviously influenced by a range of factors, and the experiences of the EU Member States analysed in this study vary widely. The Netherlands, for example, is expecting population increases and benefits from a fairly dense population (Statistics Netherlands, 2012), which, other things being equal, generally reduces the infrastructure needed and thus the costs associated with delivering a given amount of drinking water (Höllander et al., 2009). Meanwhile, Germany is expected to see its population declining, especially in the former East, where extensive infrastructure built before reunification was neglected and will now have to be maintained and amortised by fewer paying customers (Höllander et al., 2009).

Water pricing often also differs based on the economic sectors served. Agricultural water use in particular is often subject to pricing schemes that differ from domestic and industrial water uses. In northern European countries characterised by plentiful hydrological regimes, irrigation water is sometimes provided by water utilities or managed on a self-service basis. For example, England and Wales allow for self-service abstraction for irrigation within the abstraction license system. Irrigation abstractors are still required to pay abstraction charges (Arcadis et al., 2012). European countries that use more water for irrigated agriculture include France (48 % of total water use (Conseil d'état, 2012)) and Spain (68 % (World Bank, 2008)), with both countries having comprehensive pricing systems for agricultural water use. More information on irrigation water pricing in Spain is provided in Box 3.1.

Box 3.1 Pricing of irrigation water in Spain

Resource management and the rate structure applied in the Spanish irrigation sector can vary significantly from one river basin to another. River basin authorities may allocate water rights to end users directly or via irrigator communities (*comunidades de regantes*) who then administer the resource to the users (Arcadis et al., 2012).

In its integrated report on Article 5 and Annex III of the WFD published in 2007, the Spanish Ministry of Environment (MMA) recognised the existence of the following modalities of pricing for irrigation water in the country.

- The user pays a yearly amount based on the area of land irrigated, independent of the volume of water used. This fee covers all the costs of the irrigator community. This model is commonly applied by traditional irrigator communities.
- The user pays fixed amounts per unit of land which provide them with irrigation rights. These fees commonly cover maintenance, vigilance, administration and other fixed costs, but no variable costs. The latter are recovered through variable fees which are calculated as a function of the number of hours of irrigation, and in some cases, of the volume of water used.
- The user pays per application, regardless of the volume of water used. This model is applied in some communities which use surface water for irrigation.
- The user pays using a theoretical flow rate during a designated amount of time. This model is applied in the majority of entities managing groundwater.
- The user pays for the volume of water used. This model is only applied in entities using drip irrigation (MMA, 2007).

3.1 Water pricing ([17])

The extent to which environmental and resource costs are integrated into pricing schemes via economic instruments varies by Member State and sometimes by region or RBD (such as in France, where different abstraction and pollution charges are established for individual RBDs).

Private providers in England and Wales can use their own methods to set prices ([18]). A limit for price increases is set by the regulating agency (the Water Services Regulation Authority (OFWAT)) for given five-year intervals. But no other requirements are placed on the calculation of water prices. A draft bill in England, however, calls for OFWAT to lay down specific rules for the calculation of prices, thus requiring utilities to follow a (transparent) methodology approved (ex ante) by the state. Private water service providers in Germany can also set prices according to their own guidelines in order to recover costs. State antitrust offices then oversee the process, but this takes the form of an *ex post* control, following up on queries made by customers who feel they have been overcharged.

Public service providers are generally faced with more comprehensive regulations that dictate price-setting methodologies. In Scotland, the national regulatory authority, the Water Industry Commission for Scotland (WICS) determines what financial resources Scottish Water (the sole water supply company) needs in order to accomplish its mission. And this subsequently lays down the rules for pricing (level and proposed water price increases). In Germany, municipal laws govern the calculation of fees for drinking water provision and wastewater treatment when provided by a public entity. In Croatia, the mayors of municipalities are required to approve water prices before they can be put into effect ([19]). Additionally, Croatian law calls for cost recovery, going so far as to implement a price floor below which utilities cannot offer water services.

([17]) See http://www.eea.europa.eu/data-and-maps/indicators/water-prices.
([18]) Water Industry Act, 1999.
([19]) Law on Waters, Article 207.

Sometimes, the methodology for calculating prices is laid out explicitly in legislation. In the Netherlands, for example, volumetric rates for drinking water are determined according to the Drinking Water Decree and the Drinking Water Regulations. Slovenian water service prices were previously dictated by national legislation. But new rules allow municipal governments, who recently also became owners of water infrastructure assets, to set prices according to guidelines laid down in legislation. Slovenian legislation also includes a price ceiling, as the primary focus of policy formulation in this area is to reduce inflation. A legislated benchmarking system was also considered in 2004, but it was never adopted, as its implementation was considered to be too cumbersome (Filippini et al., 2010).

In Table 3.1, the general water-pricing structure for each of the EU Member States investigated in the context of this study is represented. As the table shows, the most common water-pricing scheme used in the cases analysed are hybrid models combining fixed and variable components (service charges and volumetric rates). However, as mentioned above, the lack of metering infrastructure is often responsible for the prevalence of flat rates.

Table 3.1 Water pricing structures for water and wastewater services in selected European countries

Country	Water pricing structures		
	Drinking water	**Sewage/sanitation**	**Irrigation**
England and Wales	**Households:** fixed + rateable value (if unmetered) or fixed + volumetric **Industry:** fixed + volumetric	**Households:** fixed + rateable value (if unmetered) **or** fixed + volumetric **Industry:** Small users pay volumetric; large users pay fixed + higher volumetric rate	Abstraction charges (fixed + volumetric) apply
Scotland	**Households:** fixed (based on tax bracket) **Industry:** fixed + volumetric (based on size of meter)	**Households:** fixed (based on tax bracket) **Industry:** fixed + volumetric (based on size of meter)	Only abstraction charges apply
Netherlands	**Households:** fixed + volumetric **Industry:** fixed + volumetric	**Households:** fixed (based on size) **Industry:** variable (based on pollution units)	Farmers using piped water are treated as business customers (industry); farmers using groundwater pay a groundwater charge; farmers using surface water pay nothing
France	**Households:** fixed + volumetric **Industry:** volumetric (based on use and provider)	**Households:** fixed + volumetric **Industry:** volumetric (based on number of pollutants)	Several main models (Gleyses, 2004) as shown below. 1) Fixed part depending on the irrigated area + variable part depending on the consumed water volume → tariff structure of 33 % of the irrigation water 2) Fixed part depending on the water debit and variable part depending on the consumed water volume → tariff structure of 8 % of the irrigation water 3) Fixed part depending on the irrigated surface. No variable part → tariff structure of 23 % of the irrigation water 4) No fixed part. Variable part depending on the consumed water volume → tariff structure of 11 % of the irrigation water

Table 3.1 Water pricing structures for water and wastewater services in selected European countries (cont.)

Country	Water pricing structures		
	Drinking water	**Sewage/sanitation**	**Irrigation**
Germany	**Households:** fixed +volumetric **Industry:** fixed +volumetric	**Households:** fixed + volumetric + run-off charge based on land cover. **Industry:** N/A	N/A
Slovenia	**Households:** fixed + volumetric (sometimes solely volumetric) **Industry:** fixed + volumetric	**Households:** fixed + volumetric. **Industry:** fixed + volumetric	No pricing aside from water abstraction charge
Croatia	**Households:** fixed + (sometimes) volumetric **Industry:** N/A	**Households:** (sometimes) fixed + volumetric **Industry:** N/A	N/A
Serbia	**Households:** volumetric **Industry:** volumetric	**Households:** volumetric **Industry:** volumetric	N/A
Spain	**Households:** fixed + volumetric (sometimes block rates) **Industry:** fixed + volumetric (sometimes block rates)	**Households:** fixed + (often) volumetric **Industry:** fixed + (often) volumetric	Several models: (1) based on land area (2) fixed (based on area) + variable (based on hours of irrigation or volume) (3) per application (independent of volume) (4) per flow rate over a period of time (5) volumetric (only for drip irrigation) (Ministerio de Medio Ambiente, 2007)

Note: N/A = information not available.

Sources: EEA based on national data, as follows:

- England and Wales:
  - OFWAT, 2012. Customer charges data 2010–2011 (domestic and industrial sector); Arcadis et al. (2012). The role of water pricing and water allocation in agriculture in delivering sustainable water use in Europe – Final Report. Report for the European Commission, Project number 11589 (irrigation water).
- Scotland:
  - See http://www.sepa.org.uk/about_us/charging_schemes/current_charging_schemes.aspx (domestic water tariffs).
  - See http://www.scottishwater.co.uk/you-and-your-home/your-charges/2012-2013-charges/unmetered-charges (industrial water tariffs, domestic and industrial sanitation tariffs).
  - See http://www.scottishwater.co.uk/you-and-your-home/your-charges/2012-2013-charges/metered-charges (industrial sanitation tariffs).
- Netherlands:
  - VEWIN (2012) Drinkwaterstatistieken 2012. See http://www.vewin.nl/SiteCollectionDocuments/Publicaties/Drinkwaterstatistieken%202012/Vewin%20Drinkwaterstatistieken%202012%20lowres.pdf (domestic and industrial sectors).
- France:
  - Montginoul, M. (2004) La structure de la tarification de l'eau potable et de l'assainissement en France: Eléments de réponse au travers d'une enquête nationale. See http://www.economie.eaufrance.fr/IMG/pdf/StructurePrix_eau_VF.pdf (domestic and industrial water supply).
  - Onema (2012) Observatoire des services publics d'eau et d'assainissement: Panorama des services et de leurs performances. See http://www.onema.fr/IMG/spea2009_201202.pdf (domestic and industrial sanitation tariffs).
  - Gleyses, G. (2004) Les structures tarifaires des réseaux collectifs d'irrigation: Méthodologie et test sur le Bassin Loire-Bretagne. See http://cemadoc.irstea.fr/exl-php/util/documents/accede_document.php (irrigation water).
- Germany:
  - Data for 2010: see https://www.destatis.de/DE/ZahlenFakten/GesamtwirtschaftUmwelt/Umwelt/UmweltstatistischeErhebungen/Wasserwirtschaft/Tabellen/Entgelteerhebung.html (domestic water tariffs).
  - Energie-Abnehmer e. V. (VEA): Pressemitteilung Montag, 6. August 2012 VEA-Wasserpreisvergleich 2012; Hannover (see http://www.vea.de/Seiten/Pressemitteilung.aspx?pressID=136 (industrial water tariffs));
  - See https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/EinkommenKonsumLebensbedingungen/EinkommenEinnahmenAusgaben/Tabellen/Deutschland.html (domestic sanitation tariffs).

- Slovenia:
  - Rules of tariff system for public service on the environmental field (Pravilnik o metodologiji za oblikovanje cen storitev obveznih občinskih gospodarskih javnih služb varstva okolja, Official Gazette no. 63/2009, 87/2012).
  - Filippini, M. et al. (2010): Productivity growth and price regulation of Slovenian water; Zbornik radova Ekonomski fakultet Rijeka, vol. 28, no. 1, pp. 89–112 (see http://amala.rero.ch/record/20112).
  - Filippini, M., Hrovatin, N., Zorić, J. (2006): Cost Efficiency and Regulation of Slovenian Water Distribution Utilities: an Application of Stochastic Frontier Methods (see http://miha.ef.uni-lj.si/_dokumenti/wp/wp_filippini-hrovatin-zoric_zadnja%20verzija.pdf).
  - Statistical Office of the Republic of Slovenia (SORS) (see http://www.stat.si/eng/drz_stat.asp).
  - Websites of various public utilities (see, for instance http://www.vo-ka.si/, http://www.rvk-jp.si/, http://www.komunala-ptuj.si/).
- Croatia:
  - Water companies.
  - Price list documents/Official decision provided by Water management utility of Zagreb (see http://www.vio.hr/default.aspx?id=49; http://www.vio.hr/default.aspx?id=50; http://www.vio.hr/default.aspx?id=45).
  - Price list documents/Official decision provided by Water management utility of Rijeka (see http://www.kdvik-rijeka.hr/default.asp?ru=97).
  - Price list documents/Official decision provided by Water management utility of Split (see http://www.vodovod-st.hr/Servisneinformacije/Cijenavode/tabid/57/Default.aspx).
- Serbia:
  - Water companies.
  - Price list documents/Official decision provided by Water management utility of Belgrade (see http://212.200.75.2/cenovnikk.htm; http://212.200.75.2/download/odluka_o_ceni_04.08.2010_voda.pdf).
  - Price list documents/Official decision provided by Water management utility of Novi Sad (see http://www.podaci.net/_zakon/_RS_LOKAL/propis/Odluka_o_utvrdjivanju/O-ucivuv92v1103.html).
  - Price list documents/Official decision provided by Water management utility of Niš (see http://www.jkpnaissus.co.rs/index.php/usluge).
  - Price list documents/Official decision provided by Water management utility of Sremska Mitrovica (see http://vodovodsm.rs/vodovod/wp-content/uploads/2012/10/CENE-VODE-U-OKRUZENJU-2012.pdf).
  - Price list documents/Official decision provided by Water management utility of Čoka (see http://www.coka.rs/sr/opstina/privreda/jkp/planiranje.php).
  - Price list documents/Official decision provided by Water management utility of Bački Petrovac (see http://www.backipetrovac.rs/vesti/nove-cene-komunalnih-usluga-u-doo-gloakvalis.php).
- Spain:
  - Confederación Hidrográfica del Ebro (2011) Propuesta de Proyecto de Plan Hidrológico de la Cuenca del Ebro. Memoria. Versión 3.7, Zaragoza, junio de 2011 (domestic and industrial water tariffs).
  - Aigües de Barcelona. Factura (see http://www.aiguesdebarcelona.cat/facturaagua) (domestic and industrial sanitation tariffs).
  - Ministerio de Medio Ambiente (2007) Precios y costes de los servicios del agua en España. Informe integrado de recuperación de costes de los servicios de agua en Espana. Articulo 5 y anejo III de la Directiva Marco de Agua (irrigation water).

Table 3.1 suggests that water pricing for the domestic and industrial sector exists in all the countries reviewed. Special water pricing for irrigation water is only applied in southern countries (France and Spain), whereas other countries limited the farmers' financial contributions to a water abstraction charge. The Netherlands is the exception, as farmers who receive irrigated water are treated as business customers, and they pay the same charges as the industrial sector. These differences might depend on differences in water availability across countries: in water-abundant countries such as England and Wales, irrigation water is mainly self-provided. Furthermore, provision costs are normally borne by the farmers themselves. In water-scarce countries, such as Spain and parts of France, irrigation water is normally available to farmers (at least historically) through large-scale infrastructure, which means financial costs are covered through the managing authority, and subsequent water pricing charges are recovered (usually in part) through these costs.

3.2 Abstraction and pollution charges

Economic instruments feature prominently in drinking and wastewater management policy, because they help to internalise external costs that would otherwise be borne by other users and economic sectors. Including these costs is essential for achieving true cost recovery. These instruments include abstraction charges, effluent taxes (or pollution charges), and taxes on irrigated water.

Abstraction charges are in place in some EU Member States. They target households and industry. The agriculture sector often benefits from lower rates (ECOTEC, in ACTeon, 2009), and abstraction charges are nearly ubiquitous in the countries assessed in this study. In most cases, volumetric charging is applied. In the absence of metering systems, fixed charges per hectare are imposed. Exemptions from abstraction charges and taxes are common. Examples of exemption are regions or water bodies with a positive water balance and small water

abstractors charge (ACTeon, 2009). Additionally, water markets can improve the efficiency of water use within an economy and enable a regulator to distribute water rights after setting a cap on abstractions. This structure is already applied in Spain (Tarrech et al., 1999) and is under discussion in France (Strosser and Montginoul, 2001). Other innovative instruments include a policy whereby water-saving investments made by consumers entitle them to a share in the benefits (Scotland), as well as subsidies for electricity use to pump irrigation water during droughts (Spain).

Similarly, pollution taxes and charges are applied in most EU Member States, and are directed at both point and non-point sources. Common instruments regulating point pollution sources include wastewater charges and water effluent charges. In contrast, it was reported that taxes and charges are rarely used to address non-point pollution sources such as nutrients run-off and pesticide use, because they are commonly dealt with by regulatory rather than economic instruments (ACTeon, 2009).

In some cases, such charges are already included in the water tariffs (e.g. Denmark, France and Spain), while in others they are levied separately. They might also be associated with fines for non-compliance when charges are associated with permits and/or thresholds (OECD, 2010a).

Box 3.2 provides a detailed description of the environmental charge schemes that are in place in Germany and France.

3.3 Supporting measures for water tariffs and abstraction and pollution charges

Supporting measures are aimed at allowing and facilitating the implementation of water pricing policies. Variable and volumetric pricing in particular provides an incentive to reduce water use, but volumetric pricing in domestic and agricultural sectors requires efficient metering devices. However, these devices can be complex to install and monitor (EEA, 2012a; Arcadis, 2012).

In the domestic sector, metering devices seem to be in place in many EU Member States; their installation is currently being discussed in many EU Member States (Austria, Belgium, Bulgaria, Estonia, the Netherlands, Spain, Sweden and the United Kingdom) (BioIntelligence Service, 2011).

However, although metering is currently implemented in many countries, a mixed picture emerged from the review of selected EU Member States. In France, single-family homes and apartment buildings constructed after the year 2000 should have an individual water meter. For other cases in the country (e.g. older infrastructure), the installation of a water meter is encouraged, but is not compulsory (Conseil d'Etat, 2010).

A transition to metering is still ongoing in England, Wales and Scotland (for non-domestic users only, as domestic users are not metered in Scotland). For England and Wales in particular the Walker Review (2009) reported that only about 28 % of households were metered at the time the study was carried out. The study also recommended a revision of the policy on household water metering in light of climate change projections, expected population growth and the latest work on catchment assessment management strategies. According to the review, broad metering schemes should be implemented in all those areas where the wider cost-benefit analysis indicates that it would be beneficial ([20]). If these recommendations are fully implemented by the British government and the Welsh Assembly government, it is estimated that about 80 % of households in England and Wales will be metered by 2020. The review also suggests that coordinating water and energy metering might offer benefits, because metering and billing technologies are advancing rapidly in both sectors.

In Slovenia, for example, water consumption is mostly metered per building, not per household. This means that single-family homes are metered individually, while charges for water metered for apartment buildings is evenly distributed among the households, depending on the number of household members. An exception is the coastal area of Slovenia, where individual metering was a condition for a World Bank loan supporting the upgrade of the water supply system in the late 1980s. New apartment buildings have individual metering — not owing to legal obligation, but thanks to market demand.

The agricultural sector, in contrast, offers a different picture. Although metering devices have become more common in many EU river basins (EEA, 2009),

([20]) An agreed methodology for the assessment of costs and benefits of metering should be developed by OFWAT.

Box 3.2 Economic instruments integrated into water pricing in Germany and France

Germany and France have similar economic instruments for managing water quality and quantity through abstraction charges and effluent taxes. However, the two systems are administered slightly differently and at different geographical levels.

In Germany, water abstraction charges are legislated at the *Bundesland*, or regional, level. The water abstraction charge (WAC) was introduced in Germany in the *Bundesland* of Baden-Württemberg in 1986 as a means to finance compensatory payments to farmers whose agricultural practices were constrained within water protection areas. For legal reasons, the funds could not be earmarked, but the importance of abstraction charges for covering the costs of compensatory payments in Baden-Württemberg is undisputed (Möller-Gunland and Lago, 2011). Today, 11 of the 16 German *Bundesländer* have instituted a WAC, with charges potentially varying between regions. Some *Bundesländer* do not charge for surface water abstraction, although all *Bundesländer* with a WAC apply it to groundwater withdrawals. Differences exist between *Bundesländer* in terms of exemptions to the WAC, although all have exemptions for abstractions of small volumes (defined by each state) and users that do not require a permit according to the federal water law.

Meanwhile, effluent charges are laid down in national law. Although revenues are collected by regional administrations, the level of the tax, which substances are covered, and which disposals are exempted can be found in national legislation (*Abwasserabgabengesetz*). The *Bundesländer* have instituted individual laws for the implementation of the charge, but the impact is homogeneous throughout Germany. The effluent charge was designed to incentivise investments in wastewater treatment plants and the development of production processes that reduce water pollution.

In France, the WAC is anchored in the 1964 Water Law, and national caps are set on the charge. As in Germany, the level of the charge is determined at a sub-national level, but in France, water agencies at the river basin level have this responsibility. These water agencies set exemptions from the WAC and also collect the revenues. These revenues are not necessarily tied to any specific expenditure, but environmental taxes such as the WAC are often used for environmental investments in France (Strosser et al., 2009). Although much administrative authority is exercised at the river basin level, the caps set in national legislation constrain the ability of the water agencies to affect water prices through adjustments to the WAC.

French effluent charges are designed to incentivise reduced water pollution in domestic, industrial and agricultural sectors. For households, water agencies charge both for pollution and for the maintenance of the wastewater network within limits delineated in state-level legislations. Agricultural water pollution is either managed as domestic wastewater or through charges added to the price of water services in the case of ranching run-off (pesticide use is taxed differently). Charges for run-off resulting from livestock are uniform throughout France. Non-domestic wastewater services (i.e. in industry) are also subject to a tax set by water agencies at the river basin level, within limits laid down in legislation. The revenues are collected directly by water system operators but then reallocated, like other environmental taxes, by the water agencies.

The economic instruments that can affect water prices covered here vary between Germany and France primarily in terms of administrative level. The water agencies that have set charge levels in France (within legislated limits) are organised around river basins, whereas the German *Bundesländer* are not. The German WAC system shows the greatest level of regional authority, because the legislation is drafted and passed at *Bundesländer* level, and the *Bundesländer* retain full control. Furthermore, the most centralised of the instruments discussed here can also be found in Germany: effluent taxes are determined entirely at the national level and simply implemented by the *Bundesländer*.

non-metered consumption and consequent flat-rates for irrigation water supply are still frequently found in OECD countries — combined, in some cases, with a volumetric component (OECD, 2010b). A major constraint to the large-scale installation of metering devices is the high cost, which would add costs to direct costs imposed on water users.

Besides ensuring the sustainability of water service provision, metering and volumetric pricing also have a positive effect on water consumption. In the United Kingdom, for example, it was observed that after the introduction of metering, domestic water consumption in the 6 summer months declined by 20 % (OECD, 2009). In the

agricultural sector, for example, the Guadalquivir basin districts with binomial tariffs consume on average 10 % to 20 % less than districts with flat-rate pricing, regardless of the level of the flat rate (Rodriguez-Diaz, as cited in EEA, 2009). Another study observed that volumetric rates led to a 25 % to 35 % decrease in water use, as compared to a flat rate (Hernandez and Lamas, as cited in EEA, 2009).

Metering, however, is not the only measure offering support to the implementation of water pricing policies. The analysis of the database of measures produced in the context of the Water Gap project, conducted for the European Commission (ACTeon, 2011) shows that metering is the most common accompanying measure in most EU Member States (Belgium, France, Germany, Italy, Luxembourg, Malta, the Netherlands, Poland, Sweden, the United Kingdom).

But other support measures (presented extensively in Annex 2) include the following.

- Licences and authorisation procedures for water abstraction (Austria, Belgium, Luxembourg, Portugal): a common measure in many EU Member States, which goes hand in hand with abstraction charges.

- Water quotas (France): quotas are primarily a measure to support optimal water allocation, especially in water scarcity situations, but they can also be useful for identifying water users and quantities allowed for each user, thus supporting the design and implementation of pricing policies.

- Monitoring programmes: (Germany and Italy): monitoring programmes can include water resource use and water abstraction, thus providing useful information for the design and implementation of water pricing policies.

- Development of demand forecast models (Germany): although this measure is primarily implemented to support water allocation policies, the information provided by the model might also be used to inform water-pricing policy decisions.

3.4 Price developments

While these factors and policies have had varying impacts on water pricing across the EU Member States, there has been a trend of increasing water service prices in the medium term and recent past across the EU. In England and Wales, average prices for water services increased by 35 % in the period from 1989 to 2006, partially as a result of increased investment to revitalise infrastructure that had previously been systematically neglected (OFWAT, Defra, 2006). Prices have also been steadily increasing in Croatia, Germany and Spain. In fact, by 2009, Spain had experienced an increase of 100 % in drinking water prices compared to the year 2000, mostly resulting from instituting WFD measures (EEA, 2012a). It is important to note that despite these increases, the price level in Spain is still below the European average (AEAS, 2010). Furthermore, the increases recorded for Germany have been at or below the growth rate of the CPI (ATT et al., 2011). And cost recovery has not yet been achieved in some areas of Spain, including the Ebro river basin where 57 % of costs are recovered ([21]).

In Slovenia, rules for the tariff system for public service in the environmental field were applied in 2009, and introduced separate costs for use of public infrastructure and for the service provided. Up to 2012, 45 % of municipalities switched to separate cost means. The government of Slovenia has introduced a decree for the highest price for basic utility services (the last decree dates from 28 August 2011), which effectively froze the prices for water services to their 2009 level twice. A new decree on the price ceilings for basic utility services was passed in 2012, due to enter into force in 2013.

([21]) Demarcacion hidrografica del Ebro, 2008, *Esquema provisional de temas importantes*.

4 Governance

4.1 Governance structure for water service provision

4.1.1 Administrative levels of price-setting mechanisms, revenue collection and reallocation

Governance for water and sanitation services was generally defined by the Global Water Partnership as the 'range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society' (Garcia Quesada, 2011).

As mentioned earlier, the governance framework of a country's water sector (understood here as the administrative levels of policymaking and the legal framework regulating utility ownership) plays a crucial role for the important issues of this report, i.e. water pricing, and cost recovery and internalisation of environmental and resource costs. While in principle similarities exist in the legislation and tenets of water governance, in practice the individual characteristics of each administrative model may combine to yield different results. For example, while a country may establish a decentralised administrative structure for its water sector to provide, inter alia, faster response and adaptation to local conditions and needs, this choice does not necessarily guarrantee that priorities are dependent on the achievement of national and international objectives (e.g. compliance with the WFD) — especially when the effects of the latter may not be welcomed by the local population. In a similar sense, it can be expected that boards of directors in private enterprises will have different interests and drivers than decision-makers in public water service companies. Therefore, attention may be skewed either towards the recovery of costs and the generation of profits, or in favour of socio-political matters discussed earlier in this document.

Administrative levels of policymaking in the water services sector are generally homogeneous among the analysed countries. Most follow a framework in which policy made at national level (including the transposition of the WFD) sets the rules for water service provision in place, followed by local or municipal governments providing services or regulate private utilities. One notable exception to this framework is that of Scotland, where the sole public utility, Scottish Water, operates on a national scale and is overseen by a national body ([22]).

The importance of regional authorities in policymaking (for example, in designing economic instruments) varies across the countries surveyed in this document. Germany exhibits somewhat more independence at the regional level, allowing states to determine how water prices should be calculated in order to consider the issue of cost recovery, while other national governments play a more concrete role. For example, in Slovenia, the government sets the rules for tariff calculation in addition to a price ceiling.

Cases exist where the restructuring of a country's administrative framework for the provision of water services (commonly led by privatisation or changes in the laws governing competences over the water sector) has shown an inextricable influence on the performance and efficiency levels of the sector (e.g. England and Wales). Generally speaking, the performance of the administrative structure of a country's water sector will depend on its specific characteristics including environmental (e.g. abundance/scarcity of water resources) and economic (e.g. funds available for the development of the sector) conditions that determine the perceived value of water resources, how these are managed and the pressures to which they are subjected.

When looking more in detail at the governance of price-setting mechanisms, three main approaches are identified in the literature (Garcia Quesada, 2011), as described below.

([22]) Scottish Government, Water Services etc. Act, 2005.

- Regulatory agency approach: a national independent body is responsible for setting a price cap on the maximum bill increases allowed to provide water.

- Bilateral contract approach: the local authority delegates water provision to a third party by means of a contract, which establishes the conditions for service provision, including the charges imposed on consumers and the level of service they will receive.

- Self-regulatory approach: in some cases, the procedures for setting water prices and customer standards can be defined by the same authorities as those responsible for providing the services (e.g. municipalities). Generally, national regulations establish the minimum requirements for service provision, but the responsible authorities keep wide discretionary powers in the definition of water prices and standard setting.

The same author highlights that, depending on the administrative structures put in place in each countries, some countries adopt only one approach, whereas in other countries, two approaches can coexist:

- in England, Wales and Scotland, prices are exclusively set through the regulatory agency approach;

- in the Netherlands, only the self-regulatory approach is applied;

- in France and Spain, the bilateral contract approach and self-regulatory approach coexist.

An overview of some crucial traits of governance schemes in the studied EU Member States is presented in Table 4.1. These traits can provide insight into the dynamics of each country's administrative system in terms of centralisation of price-setting competences and investment priorities.

Going beyond the countries assessed within this project, it is interesting to explore how the introduction of the WFD might have led to institutional changes and/or adjustments in terms of the legal framework of utility ownership, the administrative management levels and the financing systems for water services. In this respect, two interesting examples are Italy and Estonia, which are characterised by very different adjustment processes, as presented in Box 4.1.

Table 4.1 Basic characteristics of the governance structures of the water supply and sanitation services in various European countries (excluding Croatia and Serbia ([a]))

Country	Authority responsible for price setting	Authority responsible for collection of revenues	Authority responsible for reinvestment of revenues
England and Wales	OFWAT ([b])	Water companies	Water companies
Scotland	Scottish Water	Scottish Water	Scottish Water
Netherlands	Supply services: national government	Supply services: water companies	Supply services: water companies
	Sanitation services Sewage: municipalities	Sanitation services Sewage: municipalities	Sanitation services Sewage: municipalities
	Wastewater treatment: water boards	Wastewater treatment: water boards	Wastewater treatment: water boards
France	Drinking water supply and wastewater treatment: municipality or union of municipalities	Water service (publicly or privately managed) collects all revenues, and transfers one part of them to the municipality, the water agency and the state	Water service Municipality Water agency
Germany	Water supply utility/municipality	Water supply utility	Water supply utility
Slovenia	Municipality	Local public utilities	Local public utilities

Table 4.1 Basic characteristics of the governance structures of the water supply and sanitation services in various European countries (excluding Croatia and Serbia ([a])) (cont.)

Country	Authority responsible for price setting	Authority responsible for collection of revenues	Authority responsible for reinvestment of revenues
Spain	Regional pricing committee and regional administration	Supply services: urban water supply operators (public or private) Sanitation services: municipalities (through public or private service providers) and regional water agencies	Supply services: urban water supply operators (public or private) and regional water agencies Sanitation services: municipalities and regional water agencies

Note: ([a]) Due to lack of information.

([b]) OFWAT sets price limits; prices are set by water companies according to the cost recovery principle and based on the price limits set by OFWAT.

Sources: EEA based on national data, as follows:

- England and Wales:
  — Defra (2006). 'The development of the water industry in England and Wales' (see http://www.ofwat.gov.uk/publications/commissioned/rpt_com_devwatindust270106.pdf and http://www.ofwat.gov.uk/pricereview/setting).
- Scotland:
  — Scottish Water sets prices following principles set by the Ministers and within limits set by the Water Industry Commission for Scotland (WICS) Principles set by the Ministers of Scotland (see http://www.scotland.gov.uk/Resource/Doc/917/0088612.pdf).
  — Limits set by the Water Industry Commission for Scotland (WICS) (see http://www.watercommission.co.uk/view_Price%20Setting_2010-15.aspx).
- Netherlands:
  — Supply services: Drinkwaterwet (Drinking Water Act) (see http://wetten.overheid.nl/BWBR0026338/geldigheidsdatum_24-04-2013).
  — Sewage: Gemeentewet (Municipalities Act) (see http://wetten.overheid.nl/BWBR0005416/geldigheidsdatum_24-04-2013).
  — Wastewater treatment: Waterwet (Water Act) (see http://wetten.overheid.nl/BWBR0025458/geldigheidsdatum_24-04-2013).
- France:
  — BIPE, FP2E (2008) Les services collectifs d'eau et d'assainissement en France: Données économiques, sociales et environnementales (see http://www.documentation.eaufrance.fr/entrepotsOAI/OIEAU/44/224003/224003_doc.pdf).
- Germany:
  — ATT, BDEW, DBVW, DVGW, DWA und VKU (2011): Branchenbild der deutschen Wasserwirtschaft. Wirtschafts- und Verlagsgesellschaft. Bonn.
  — Holländer et al. (2008): Kernaussagen des Gutachtens: Trinkwasser in Deutschland: Welceh Faktoren begründen regionale Unterschiede? Berlin: Verband kommunaler Unternehmen.
- Slovenia:
  — Environmental Protection Act (Zakon o varstvu okolja), Official Gazette, no. 41/2004, 17/2006, 20/2006, 39/2006-UPB1, 70/2008, 108/2009, 48/2012, 57/2012.
  — Rules of tariff system for public service on the environmental field (Pravilnik o metodologiji za oblikovanje cen storitev obveznih občinskih gospodarskih javnih služb varstva okolja, Official Gazette no. 63/2009, 87/2012).
  — Szilagyi, S. et al. (2010) 'Implementation of the Water Framework Directive – an overview of the Hungarian, Croatian, Serbian and Slovenian situation', Environmental Management and Law Association (EMLA) (see http://emla.hu/aa2.10.0/img_upload/f1b7fd0e4cde967799ab3c249bb8f4f4/EU_Water_Framework_Directive_final.pdf).
- Spain:
  — Confederación Hidrográfica del Ebro (2011) Propuesta de Proyecto de Plan Hidrológico de la Cuenca del Ebro. Memoria. Versión 3.7, Zaragoza, junio de 2011; Aigües de Barcelona. Tarifas (see http://www.aiguesdebarcelona.cat/esp/servicio/facturas_tarifas/tarifas.asp).
  — Ruiz Cañete, Dizy Menéndez (2009) The Water Sector in Spain. Working paper CIRIEC No. 2009/04.

Box 4.1 Systems in transition: Italy and Estonia

Italy: the public/private 'dilemma'

In Italy, changes in the type of management for water services partially depend on internal processes and the implementation of the WFD. Historically, municipalities have always been responsible for water services, until the introduction of the Galli Law in 1994. Under the new law, fragmented municipal companies were aggregated into bigger territorial units or 'optimal management units' (ATOs), and these companies had to be structured like corporations with stakeholders where the municipalities decide whether they are public, mixed or private. In practice, many water operators have invested little in conveyance infrastructures, and this has resulted in some of the highest rates of water losses due to leakages in Europe (Hachfeld et al., 2009).

Due to the corporate structure of companies, as well as the introduction of the WFD and the cost-recovery principle, the cost of the services must be covered completely by the water tariff. In addition, a decree established in 2006 stated that this tariff must also include a 7 % return on capital employed, inevitably resulting in a commodification of the resource (Hachfeld et al., 2009; Acqua Bene Comune ([a])).

However, from 1994 to 2008, many ATOs in Italy (64 of 92) opted for public management. Therefore, the Ronchi Law in 2009 required that all water companies be made up of both public and private partners, and that private shareholders control at least 40 % of the total capital (Acqua Bene Comune).

These laws prompted a massive civil society campaign against privatisation of the water services, based on the principle that water is a common good, and cannot be managed for private profit. This mobilisation eventually led in 2011 to an official national referendum aimed at abrogating the articles referring to the 7 % return on invested capital and the compulsory participation of private shareholders for at least 40 % of total capital. A great majority of Italian citizens voted for the referendum, calling for the two articles to be abolished. As a result, nowadays both public and joint public–private entities may handle water services provision. Moreover, the return on invested capital cannot be included in water tariffs, thus discouraging private investments in water services (Acqua Bene Comune). The effect of these new developments on service quality standards and the state of water utilities still remain to be seen, however.

Estonia: innovative approach to water service reform

During the Soviet era, all water and sanitation services in Estonia (with the exception of the capital Tallinn) were owned and managed by the state-owned Eesti Vesi (Estonian Waters). After the Soviet Union disbanded, ownership and responsibility for such services was transferred to the municipalities. In the same period, major shortcomings of the Estonian water sector came to light: poor quality of services, pollution, institutional shortcomings and low productivity, inadequate funding mechanisms. Most notably, the lack of efficient water pricing and effective metering, as well as poor conditions of conveyance infrastructures, resulted in high water consumption.

Water service management at municipality level, however, soon proved problematic: Estonia counts 226 municipalities (33 of them being urban and 193 rural) for 1.3 million inhabitants, and this means that such administrative units are too small and fragmented to attract the required financing to upgrade and rehabilitate the infrastructure, and inter-municipal cooperation was often constrained by competition and suspicion.

To overcome these problems, in 1992 Eesti Vesi requested assistance from the European Bank for Reconstruction and Development (EBRD) to restructure the water sector and finance the necessary investments. The EBRD initiated the Small Municipalities Environment Programme (SMEP), featuring projects in wastewater treatment, sewerage systems, water supply intake and other facilities. The municipal-owned Estonian Water Company was established at the place of Eesti Vesi to manage and coordinate the investment programme for the sector, including loans and donations from several funders (EBRD, the Nordic Environment Finance Corporation (NEFCO), government, municipalities and others), investments in infrastructures and the payback plan. Specifically, the Estonian Water Company (EWC) signed a project contract with EBRD and NEFCO, while the municipalities signed project contracts with EWC (on-lending loans) and EBRD (guarantees of tariff increases). In this way, a previously fragmented situation was restructured to offer the advantages of a single, larger contract that is able to attract the necessary funding, which could not have been captured by single municipalities.

Box 4.1 Systems in transition: Italy and Estonia (cont.)

Water tariffs played a major role in contract agreements. User charges are meant to repay the ERBD loan and municipal funding. The programme involved a 5-year investment period (1995–2000) followed by 10 years for loan repayment thereafter. Therefore, a 15-year tariff increase was planned and included in the contract, based on assumptions of local affordability — the increases were in fact planned in such a way that, at their maximum levels, the total household expenditure for water and sanitation services would not exceed 4 % of family income.

At the time of reporting, loan repayments from the municipalities was on schedule. In addition, several positive outcomes were reported, including the achievement of important environmental objectives: water savings resulting from the installation of new water meters and the rehabilitation of the water supply network; and the solution of high-priority environmental problems (e.g. pollution).

Note: ([a]) See http://www.acquabenecomune.org.

Source: Global Water Partnership Toolbox, Case Study #113 (nd).

4.1.2 Comparing centralised and regional governance schemes

While the complexity of the issues investigated in this study does not allow for generalisations, the detailed description of the governance structures of two selected countries serves to outline, in their specific context, the possible effects discussed above. In Box 4.2 and Box 4.3, the case of Scotland is compared to that of Spain, in order to highlight the distinct characteristics of the countries' administrative structures and their potential impacts on water prices and cost-recovery levels.

As described in Box 4.2, governance of the water sector in Scotland lacks the challenges engendered by the existence of intricate networks of lawmakers, regulators and service providers at a range of spatial levels. Here, the information and communication barriers commonly encountered in countries where competences and decision-making capabilities are dispersed among multiple actors at different administration levels are either not present or negligible in comparison to those found in the decentralised models operating in other countries. Furthermore, the centralised character of the Scottish model inhibits the appearance of remarkable

Box 4.2 Administrative structures in Scotland

The administrative structure of the water sector in Scotland is built upon a centralised system involving four main entities whose roles are clearly defined in a relatively simple configuration. This means that the internal forces and interests that underlie policy strategies and operation of the system are controlled by a limited number of actors. In theory, this should facilitate the vertical transposition of national and international laws and objectives and serve to reduce the levels of bureaucracy.

In an attempt to describe the governance structure of water supply and sanitation services in Scotland, a simplified, structured blueprint can be employed. First, the Scottish Environment Protection Agency (SEPA) is the administrative body responsible for the protection and improvement of surface water and groundwater through regulation, monitoring and planning. Second, as assigned by the Water Environment and Water Services (Scotland) Act 2003, water and sewerage services are provided by Scottish Water, a publicly owned company that also has competences in setting water prices. Finally, to extend WFD principles to Scottish Water customers, the Water Services (Scotland) Act 2005 set up an independent economic regulator, the Water Industry Commission for Scotland (WICS). The WICS is in charge of determining the financial resources required by Scottish Water to deliver all of its public policy objectives, including environmental objectives, and the charges that it can set. Subsequently, the principles according to which charges should operate over every (4-to-5 year) regulatory control period are determined by Scottish ministers.

Box 4.3 Administrative structures in Spain

By comparison, in Spain the decentralised character of the water sector results in a complex structure and processes regarding regulation and operation. This low level of centralisation combined with the existence of various models for the administration and management of the water cycle yield a framework where responsibilities are shared between a number of public and private actors involved at different spatial levels. Thus, the criteria employed to regulate the water sector are shaped by the political strategies of the municipalities, but also by interventions by and interests of higher government levels, river basin authorities, water agencies, utilities, and ultimately, the EU. This, together with tapped water sources and the quality of the services provided, results in a wide range of prices for end users, depending on their location.

According to Spanish water legislation, each one of the 8 116 municipalities of the country has the competence to provide the water services in its area of jurisdiction. In the execution of this responsibility, municipalities may opt either to provide such services on their own, or to integrate public communities called local water entities (*entidad local del agua*) in order to provide water services across a broader area. They may also choose between public, private, or joint models of management for the provision of water and sanitation services. According to Spain's Ministry of Environment, in the year 2007, '42 % of the country's population was provided with water services by public companies, 40 % by private companies, 11% by joint ventures, 6 % directly by local authorities, and 1 % by other means'.

Like water service provision, tariff regulation is a factor that varies according to the municipality and the service. In this matter, the Committee on Prices (an entity dependent on the Autonomous Communities) and the administration of the municipality are commonly in charge of authorising prices for the main water services in a locality. In some cases, it is only one of the two entities who make the decision.

Source: data collection templates.

differences in water prices across local communities, assisting the process of compliance across the country's territory.

The situation in Spain is practically the opposite, where a number of organisations (river basin authorities, autonomous community governments, regional water agencies and regional price committees) take part in the regulation, control and public administration of the full water cycle. The operation of such an elaborate network will generally tend to exhibit obstructed communication and thus suboptimal cooperation levels between the different actors involved. Moreover, the wide range of prices for water resources across the Mediterranean country complicates compliance with European legislation on water pricing and cost recovery.

In terms of water prices, Scotland generally exhibits higher unitary prices than Spain for domestic water supply and sanitation services. In turn, the percentage of household disposable income dedicated to the payment of water and wastewater services appeared significantly higher in Scotland. In analysing the data for the industry sector however, the relationship in prices is inverted for drinking water supply services, where Scotland showed lower unitary prices than Spain. The case of sewage and wastewater treatment prices for the industry sector shows the same trend of domestic sanitation services, being higher in Scotland than in Spain. Overall, cost-recovery levels were found to be higher in Scotland.

4.1.3 Transparency: access to information and public participation

Access to information and public participation of citizens in the context of decision-making processes on water tariffs can be ensured through appropriate accompanying mechanisms. Quesada (2011) includes these mechanisms among the criteria for assessing 'good' governance of the system, and reviews such mechanisms in the six countries presented earlier in Chapter 4 (England, Scotland, France, Italy, the Netherlands and Spain). A summary of these findings is provided in Table 4.2.

The mechanisms put in place to allow citizens' access to information and public participation in the decision-making process are quite different across the selected countries, although some similarities exist between certain countries (e.g. France and Spain). This diversity shows that the legal provisions developed by individual countries are not necessarily determined by the type of management (ownership and delegation) in place in each

Table 4.2 Mechanisms for ensuring access to information on water prices and public participation in the decision-making process, in selected EU Member States

England and Scotland
Access to information
England and Scotland provide more comprehensive information to consumers, thanks to the regular reports published by the Scottish Office of Water Services (OFWAT) and the Scottish water regulator (the Water Industry Commission for Scotland (WICS)). The Information Commissioners are responsible for dealing with consumers' requests for information on tariff and service standard setting.
Public participation
The involvement of consumers in tariff and service standard setting is encouraged. Participation is guaranteed by law: consumers can provide their opinion in consultation processes initiated by OFWAT and WICS and the government. The input of consumers in the decision-making process, however, seems to be limited.
France
Access to information
National legislation exists to ensure information is provided to customers. In France, for example, tariffs have to be published on the city hall, and local public authorities have the obligation to publish an annual water service report that includes elements on water tariffs and on the quality of water services. Because water services are provided at the local level, the mechanisms chosen for communicating this information to consumers and the type and level of detail provided can vary across the country. In the case of delegated management (both public and private), most of the relevant information on water services is contained in a service contract, which is a public document. Moreover, local authorities are required to inform the local council every year of changes in tariffs and service standards. The *Commission d'Accès aux Documents Administratifs* is responsible for dealing with citizens' requests for information on tariff and service standard setting.
Public participation
Participation is guaranteed by law. In medium and large towns, local consultative commissions ensure citizens' participation. Consumers have an advisory role in local consultative committees. However, their contribution is limited to informing about their preferences of service quality standards.
Italy
Access to information
Participation is guaranteed by law, to some extent. According to the national legislation, the ATOs are responsible for collecting and disseminating information to consumers, although there are no specific requirements on the type and degree of information which must be provided. In general, the published information covers water consumption and tariffs, while little is said about investment plans, past activities, etc. The *Commissione per l'accesso ai documenti amministrativi* is responsible for dealing with citizens' requests for information on tariff and service standard setting.
Public participation
The regulatory framework ensures that consumers are consulted when deciding on quality service standards, but the same does not apply with respect to tariff setting. Consumers have an advisory role in local consultative committees, although their contribution is limited to providing information about their preferences on service quality standards.
The Netherlands
Access to information
The Netherlands has a long tradition of information provision to consumers, resulting from the Freedom of Information Act. A large amount of information is provided to consumers. For example, regular information on activities and performances is provided by *Vereniging van waterbedriven in Nederland* (VEWIN), the association of drinking water companies. In addition, local and regional authorities, which are legally responsible for providing water services, are required to provide information on policies and plans. No commission exists for dealing with citizens' requests for information: past disputes in this context were solved, in the past, through arbitration and ordinary judicial courts.
Public participation
Public participation in tariff and service standard setting is not the object of specific legal provision. Public participation is developed on a voluntary basis by water companies who may consult consumers in the process of tariff and service standard setting.

Table 4.2 Mechanisms for ensuring access to information on water prices and public participation in the decision-making process, in selected EU Member States (cont.)

Spain
Access to information
As is the case in France (see above) water services are provided at the local level. Thus, the type of information available to consumers largely depends on local approachs to water services. In the case of delegated management (both public and private), most of the relevant information on water services is contained in the service contract, which is a public document. The degree and type of information varies across the country. Moreover, local authorities are required to inform the local council every year of changes in tariffs and service standards.
In contrast, no entity is responsible for processing citizens' informational demands, nor has specific legal provision been made for facilitating consumers' access to information.
Public participation
Citizens have the right to participate in the meetings of the Regional Price Commission, which ratifies water tariffs where they have member status. These meetings play a decisive role in the decision-making process.
In contrast, when it comes to quality standard setting, no legal provision exists to ensure consumers' participation in the decision-making process.

Source: Garcia Quesada, 2011.

country: England and Scotland, for example, are at the opposite sides of the spectrum (direct private management and delegated public management respectively), but the accompanying mechanisms in place are basically the same (Garcia Quesada, 2011).

The in-depth country review conducted within this project revealed that the experience of transparency and stakeholder inclusion in the water sector across the EU has been mixed. Transparency in how water prices are calculated is important for broad public understanding of why water prices vary as they do and are set as they are. Likewise, an understanding of water pricing will foster stakeholder participation if the opportunities for such participation are present.

Croatian water suppliers are required to publish their price calculations, and similar transparency is legislated in the Dutch Drinking Water Act of 2011. In 2005, an independent consumer organisation, the Consumer Council for Water, was established to represent consumers in the policymaking process in England and Wales. By collecting consumer questions and complaints and engaging in policymaking, this organisation provides a forum for stakeholder involvement. It attempts, among other things, to represent consumer interests in the OFWAT price review administered every five years (Consumer Council for Water, 2012).

On the other hand, evidence shows that knowledge of water pricing is low in some EU states like Germany and France. In Germany, only 3 of 10 people interviewed estimated the costs of their water supply correctly (between EUR 1 and 3 per 1 000 litres). About 27 % estimated the costs to be higher than EUR 3, and 39 % could not state what the cost might be ([23]). Likewise, awareness of the economic instruments being used by water agencies in France to set and tweak water prices is very low. This may contribute to reduced acceptance of new economic instruments ([24]). This lack of knowledge about water prices may indeed call into the question the ability of economic instruments to have incentivising effects on water service use. Additionally, there have been calls in Spain to increase pricing transparency in order to better identify cross-subsidies among different user groups, especially those in the agriculture sector (AEAS, 2012).

4.2 Governance structure for abstraction and pollution charges

As mentioned above water charges are normally levied by the government or water agencies, although there are some exceptions (e.g. municipal authorities in Sweden and Finland) (Hiltunen, Speck et al., as cited in ACTeon, 2009). In many countries,

([23]) Results of the study 'Qualität und Image von Trinkwasser in Deutschland' conducted by Institut für empirische Sozial- und Kommunikationsforschung e.V. (I.E.S.K.) since March 2007, presented by VKU (see http://www.vku.de/wasser/ergebnisse-der-tw-imagestudie.html).

([24]) According to the information portal on the environment in Brittany, 64 % of the French population does not know about the water price (see http://www.bretagne-environnement.org/Eau/L-eau-et-ses-usages/Prix-de-l-eau).
According to the associations France Liberté and 60 millions de consommateurs, water prices suffer from a lack of transparency, reducing acceptance of rising charges or water prices (see http://www.france-libertes.org/Phase-1-Le-prix-du-service-de-l.html#.UJ0H1XIrCCk).

revenues from abstraction charges and taxes are often earmarked for environmental funds and water protection (ACTeon, 2009). In Germany, for example, revenues are reinvested in research and pollution abatement, while in the Seine-Normandy RBD (France) they are earmarked for water agency investment programmes (Speck, 2004). The case of Baden-Württenberg in Germany is particularly interesting, because abstraction charges are part of a mix of policy instruments including compensation programmes for nature and cultural landscape protection, and compensations are funded by abstraction charges revenues. The main features of this policy are presented in Table 4.3.

The review of governance structures for abstraction charges confirms the information found in the literature, as these are generally managed by national authorities (England and Wales, Scotland, Germany and Slovenia) or water agencies (France and Spain); the Netherlands is the only exception, because charges there are managed by the provincial authority. In France, however, although the water agency is in charge of charge setting, collection and reinvestment of revenues, thresholds are set by the state. In most cases, abstraction charges are supported by a licensing or authorisation mechanism, often a licensing or permit system (England and Wales, Scotland, the Netherlands, Slovenia and Spain). The results are summarised in Table 4.4, which also includes a description of the licensing or authorisation mechanisms set up in each country.

In Europe, the governance of pollution charges and taxes is often complex, because different authorities and administrative levels are involved at the same time. In all reviewed countries, legal standards and thresholds are set at the national level (although in Spain, the river basin authorities play a role in this task). In only two cases, namely England and Wales, and Slovenia, the national Environment Agency heads the whole process/mechanism, from the setting of standards and thresholds to the detection of non-compliance. Similarly, in Scotland, the Scottish Environmental Protection Agency (SEPA) is responsible for setting charges and taxes, collecting

Table 4.3 Mix of environmental policy instruments in Baden-Württemberg (Germany)

Water abstraction charge as part of a mix of environmental policy instruments: Baden Württemberg (Germany)		
Description		WACs are part of a mix of policy instruments, including a Regulation on Protected Areas and Compensatory Payments (SchALCO) and a Market Relief and Cultural Landscape Compensation (MEKA). These policies were first introduced in 1988, fundamentally revised in 2010, and applied in 2011, with the aim of optimising the incentives for conservation and protection of water resources and to incentivise investment in water-intensive industries by introducing offsetting options, simplifying the tariff structure and offering legal certainty. The unitary amount to be charged is based on three cost categories, namely surface water, groundwater and water used by the public water supply.
Exemptions		Abstractions below 4 000 m^3/year, abstractors exempted from requiring water abstraction permits, water for cooling of buildings or irrigation purposes, water used for damage aversion or soil, ground water remediation. A total of 90 % maximum reductions for water-intensive industries, if they can prove that the abstraction charge impinges on their competitive position (conditional on water-saving efforts); 75 % maximum of abstraction charges can be offset by investment costs for measures that reduce heat pollution, improve the ecology of waterbodies, or enable the substitution of groundwater with surface water; maximum 75 % reduction for specific industries if environmental management systems are used.
Responsible entity for:	Charge design and tariff level setting	Landtag von Baden-Württemberg (state government).
	Implementation	Water authorities: Ministry of Environment (Supreme Water Authority), Regional Councils (Higher Water Authorities), city and county administrative authorities (Lower Water Authorities).
	Monitoring	Water authorities: Ministry of Environment (Supreme Water Authority), Regional Councils (Higher Water Authorities), city and county administrative authorities (Lower Water Authorities).

Source: Möller-Gulland and Lago, 2011.

and reinvesting revenues and detecting offenses. In other countries, tasks are split among a variety of bodies: national bodies, water boards, water agencies, water service and wastewater companies, river basin authorities and regional authorities. In two cases, two specific bodies (the inspection of environment and transport in the Netherlands, and the water police in France) are in charge of detecting non-compliance cases. The governance structure of pollution taxes and fines in the analysed countries is presented in Table 4.5.

In EU Member States, pollution charges and taxes are implemented and enforced at different levels (national government, regional and local authorities), and can be associated with fines.

Table 4.4 Summary of governance structures for abstraction charges in the reviewed countries

Country	Licensing or authorisation mechanism(s)	Authority responsible for threshold and charge setting	Authority responsible for collection and reinvestment of revenues
England and Wales	WACs are applied to licence holders. To date, licences have been granted on a first come, first served basis, but with the new regulations licensing strategy, licences will be granted depending on the amount of water available after the needs of the environment and existing abstractors have been met. Licences are needed for abstracted quantities > 20 m^3/day	Environment Agency (subject to Parliament's approval)	Environment Agency
Scotland	Abstractions < 10 m^3 per day: general binding rules. Abstractions between 10 and 50 m^3 per day: registration. Abstractions > 50 m^3 per day: licence + annual abstraction charge (surface water only)	Threshold setting: government Charge setting: SEPA	SEPA
Netherlands	Provincial charge (usually linked to registration or permit) (groundwater only)	Province	Province
France	Abstraction charges depend on the abstracted volumes within a year	Threshold setting: state Charge setting: water agencies, in compliance with ceiling charges defined in the legislation	Collection: water agencies (through catchment operators: municipalities, irrigation association, etc.). Reinvestment: water agencies
Germany	Abstraction charge in Baden-Württemberg.	State (applications approved by water offices)	State (water office)
Slovenia	The abstraction charges are applied to the licence holders. To date, the licences have been granted on a first come, first served basis	Environment Agency	Environment Agency
Spain	Concession system. Concessions are granted by the respective river basin authority or regional water agency	River basin authority (Confederaciones Hidrográficas) or regional water agency	Collection: household and industry sectors: river basin authority or regional water agency. Agricultural sector: irrigator communities. Reinvestment: river basin authorities (Confederaciones Hidrográficas) or regional water agency

Sources: EEA based on national data, as follows:

- England and Wales:
  — Arcadis et al., 2012. The role of water pricing and water allocation in agriculture in delivering sustainable water use in Europe – Final Report. Report for the European Commission, Project number 11589; Draft Water Bill (see http://www.official-documents.gov.uk/document/cm83/8375/8375.pdf).
- Scotland:
  — SEPA.
- Netherlands:
  — Infomil, Handboek Water, Provinciale grondwaterheffing (see http://www.infomil.nl/onderwerpen/klimaat-lucht/handboek-water/wetgeving/waterwet/financiele/provinciale).
- France:
  — Conseil d'Etat (2010) L'eau et son droit (see http://www.conseil-etat.fr/media/document/eau_droit_rapport.pdf).
- Germany:
  — Möller-Gulland, J., and Lago, M. (2011): Water Abstraction Charges and Compensation Payments in Baden-Württemberg (Germany). EPI-Water Project Deliverable 3.1.s.
- Slovenia:
  — Environment Agency (see http://www.arso.gov.si/en/online).
  — Statistical Office of the Republic of Slovenia (SORS) (see http://www.stat.si/eng/drz_stat.asp).
  — Ministry of the Agriculture and the Environment (see http://www.mko.gov.si).
  — Operational Programme of Environmental and Transport Infrastructure Development for the Period 2007–2013, The Republic of Slovenia, 2007.
  — Environmental Protection Act (Zakon o varstvu okolja), Official Gazette, no. 41/2004, 17/2006, 20/2006, 39/2006-UPB1, 70/2008, 108/2009, 48/2012, 57/2012.
  — Rules of tariff system for public service on the environmental field (Pravilnik o metodologiji za oblikovanje cen storitev obveznih občinskih gospodarskih javnih služb varstva okolja, Official Gazette no. 63/2009, 87/2012).
  — Szilagyi, S. et al. (2010) 'Implementation of the Water Framework Directive – an overview of the Hungarian, Croatian, Serbian and Slovenian situation', Environmental Management and Law Association (EMLA) (see http://emla.hu/aa2.10.0/img_upload/f1b7fd0e4cde967799ab3c249bb8f4f4/EU_Water_Framework_Directive_final.pdf).
- Spain:
  — Royal Decree 1/2001, of 20 July, by which the revised text of the Water Act is approved.
  — Royal Decree 849/1986, of 11 April, by which the Regulation of the Public Water Domain is approved.

Table 4.5 Summary of governance structures for pollution charges in the reviewed countries

Country	Authority responsible for setting of legal standards and thresholds	Authority responsible for setting of charges and taxes	Authority responsible for collection and reinvestment of revenues	Authority responsible for detection of non-compliance
England and Wales	Environment Agency (submitted for Parliament's approval)	Environment Agency (submitted for Parliament's approval)	Environment Agency	Environment Agency
Scotland	Government	SEPA	SEPA	SEPA
Netherlands	National authorities	State waters: Rijkswaterstaat Other waters: water boards.	State waters: Rijkswaterstaat Other waters: water boards	State waters: Inspection Environment and Transport Other waters: water boards
France	State government	Water agencies, in compliance with ceiling charges defined in the legislation	Collection: water services, wastewater treatment services, etc. Reallocation: water agencies	Water police
Germany	Federal law	The level depends on the harmfulness of the wastewater according to § 3 Abs. 1 AbwAG. The law contains various spots where the Bundesländer are authorised to set detailed regulations. Therefore, the Bundesländer have enacted execution laws	The effluent charge is paid to the Bundesländer. The effluent charge has to be used for water pollution control measures	
Slovenia	Environment Agency	Environment Agency	Environment Agency	Environment Agency
Spain	The national administration and the river basin authorities (Confederaciones Hidrográficas)	Regional authorities and committees	_	River basin authorities

Sources: EEA based on national data, as follows:

- England and Wales:
  — Environment Agency.
- Scotland:
  — SEPA.
- Netherlands:
  — Infomil, Handboek Water, Verontreinigingsheffing (see http://www.infomil.nl/onderwerpen/klimaat-lucht/handboek-water/wetgeving/waterwet/financiele/item-112721);
- France:
  — Conseil d'Etat (2010) L'eau et son droit (see http://www.conseil-etat.fr/media/document/eau_droit_rapport.pdf).
- Germany:
  — Law on Effluent Taxes (2010): Abwasserabgabengesetz in der Fassung der Bekanntmachung vom 18. Januar 2005 (BGBl. I S. 114), das zuletzt durch Artikel 1 des Gesetzes vom 11. August 2010 (BGBl. I S. 1163) geändert worden ist (see http://www.gesetze-im-internet.de/abwag/index.html).
- Slovenia:
  — Environment Agency (see http://www.arso.gov.si/en).
  — Ministry of the Agriculture and the Environment (see http://www.mko.gov.si).
- Spain:
  — Arcadis et al. (2012) 'The role of water pricing and water allocation in agriculture in delivering sustainable water use in Europe'. Case Study Spain — Guadalquivir. Final Report to the European Commission, project number 11589, February 2012, p. 72.

5 How does current water pricing 'perform'? Evidence from selected EU Member States

Following the overview of the institutional, regulatory and administrative frameworks under which water pricing operates in selected EU Member States, the present chapter investigates the quantitative aspects of water pricing in the reviewed countries, with focus on a principle central to the study, that of cost recovery. According to Article 9 of the WFD, cost-recovery objectives must underlie the management schemes of water sectors across the EU. As previously mentioned, the cost of water includes the following: the financial costs (operational and maintenance (O&M) and investment) usually recovered through tariffs for water services, and the environmental and resource costs internalised (at least partially) through abstraction and environmental charges.

This chapter provides an overview of the application of the cost-recovery principle in the selected countries, mobilising information from other EU Member States whenever possible, to present a wider picture at EU level. In the first step, we present the average water tariffs for domestic, industrial and agricultural sectors. Subsequently, we present financial cost-recovery levels in the three sectors, followed by an assessment of the level of integration of environmental and resource costs in existing water pricing systems. At a general level, this assessment revealed that financial cost recovery is achieved in a scattered way across countries and sectors; mechanisms for reflecting and internalising environmental and resource costs still need to be enhanced. A separate section will discuss the barriers to cost recovery identified in the course of this study.

As cost recovery is not the only relevant criterion for the assessment of pricing systems, additional assessments have been carried out to investigate the following: the issue of incentiveness, and the somewhat conflicting objectives of cost recovery on one hand and affordability and social equity objectives on the other.

5.1 Has cost recovery been achieved?

5.1.1 Water tariffs in the selected countries

Tables 5.1 and 5.2 below show the drinking water rates for the household and industry and for sewage and wastewater treatment for the household and industry sectors in the EU Member States being studied.

Table 5.1 Tariff structures and average rates for drinking water in household and industry

	Tariff structure		Average rates (EUR/m³)	
	Households	**Industry**	**Households**	**Industry**
England and Wales	**Unmetered household charges:** • Fixed charge + charge based on the rateable value of the house **Metered household charges:** • Standing charge + volumetric charge per cubic metre (some water companies also apply some trial water charges, such as tariffs differentiated according to season and rising block tariffs)	**Standard charges for water:** • Non-household customers who use less than 50 million litres (megalitres or Ml) of water a year (250 Ml in Wales). Nearly all non-household customers have a water meter • Standing charge + volumetric charge per cubic metre **Large and intermediate users:** • Standing charge + volumetric rate	**Unmetered household charges:** • Fixed charge: 69.6 EUR/year • Charge based on the rateable value of the house: 75.7 cents/EUR **Metered household charges:** • Standing charge: 35.5 EUR/year • Volumetric charge: 132.6 cents/m³ ([a])	**Standard charges for water (example):** • Standing charge — possible ranges as applied by all different companies: — 12 mm meter: between 20.4 and 59.4 EUR/year (m) — 500 mm meter: between 29.6 and 1 213 EUR/year — Volumetric charge: 133.5 cents/m³ ([b])
Scotland	• Fixed rate (depending on Council Tax Band)	• Fixed plus volumetric rate. Rates depend on size of the meter	• Unmetered charges range from GBP 121.44 to GBP 364.32 per year, depending on Council Tax Band ([c]) • Assuming an average consumption of 100 m³ per household, this means EUR 1.51 to EUR 4.52 per cubic metre (unweighted average: EUR 3.02 per cubic metre)	• For large users (meter size > 20 mm), the volumetric rate is GBP 0.7761 (EUR 0.96) per cubic metre ([d])
Netherlands	• Mostly fixed rate per connection plus variable rate per cubic metre (no block tariffs)	• Fixed + variable, or capacity tariff (= fixed amount depending on capacity)	• EUR 1.43 (2010, net of taxes) ([e])	• EUR 1.05 (2010, net of taxes) ([f])
France	• Water tariff depends on the water volume consumed ([g]). For most of the municipalities, there is also a fixed part (all-in price) ([h])	• Water tariff depends on the type of water (drinking water, filtered water, etc.), the provider (public service, a specialised company, the industry by its own, etc.) and the volume	• EUR 1.55 (in 2009) ([i])	
Germany	• Volumetric price and basic fee	• Volumetric price and basic fee	• 1.65 EUR/m³ • 65.60 EUR/year	• Industrial customers using 7 500 m³ to 100 000 m³ per year paid on average 1.735 EUR/m³ in 2012 ([j])

Table 5.1 Tariff structures and average rates for drinking water in household and industry (cont.)

	Tariff structure		Average rates (EUR/m³)	
	Households	**Industry**	**Households**	**Industry**
Slovenia	• Mixed rate: fixed rate per connection plus variable rate per cubic metre • Simple variable rate: variable rate per cubic metre	• Mixed rate: same as household • Simple variable rate: same as household	• Between EUR 0.19 and EUR 1.48	• Between EUR 0.19 and EUR 1.48
Spain	• Varies according to location. The application of progressive tariffs (increasing block tariffs (IBT)) is common in many urban areas of Spain ([k]) • For instance, in the city of Barcelona, water supply services are managed using a hybrid model which encompasses a flat rate (service fee) coupled with increasing block rates	• Similar pricing structure to that of the household sector • Example: City of Barcelona (Aigües de Barcelona)	• Spain: 0.85 EUR/m³ • Catalonia: 1.14 EUR/m³ • Barcelona (province): 1.181 EUR/m³	• Spain: 1.12 EUR/m³ • Catalonia: 1.66 EUR/m³ • Barcelona (province): 1.342 EUR/m³

Note: ([a]) OFWAT, 2012. Customer charges data 2010–2011.

([b]) OFWAT, 2012. Customer charges data 2010–2011.

([c]) See http://www.scottishwater.co.uk/you-and-your-home/your-charges/2012-2013-charges/unmetered-charges. The highest rate (band H) applies to houses with a property value above GBP 212 000 (EUR 260 000).

([d]) See http://www.scottishwater.co.uk/you-and-your-home/your-charges/2012-2013-charges/metered-charges.

([e]) VEWIN (2012), Drinkwaterstatistieken 2012.

([f]) VEWIN (2012), Drinkwaterstatistieken 2012.

([g]) Single-family homes and apartment buildings (constructed after 2000) should have an individual water meter. For other accommodation, the installation of water meter is encouraged, but not obligatory. Conseil d'Etat (2010) L'eau et son droit (see http://www.conseil-etat.fr/media/document/eau_droit_rapport.pdf).

([h]) Montginoul, M. (2004) La structure de la tarification de l'eau potable et de l'assainissement en France: Eléments de réponse au travers d'une enquête nationale (see http://www.economie.eaufrance.fr/IMG/pdf/StructurePrix_eau_VF.pdf).

([i]) Onema (2012) Observatoire des services publics d'eau et d'assainissement: Panorama des services et de leurs performances (see http://www.onema.fr/IMG/spea2009_201202.pdf).

([j]) Energie-Abnehmer e. V. (VEA): Pressemitteilung Montag, 6. August 2012 VEA-Wasserpreisvergleich 2012; Hannover (see http://www.vea.de/Seiten/Pressemitteilung.aspx?pressID=136).

([k]) Confederación Hidrográfica del Ebro (2011) Propuesta de Proyecto de Plan Hidrológico de la Cuenca del Ebro. Memoria. Versión 3.7, Zaragoza, junio de 2011.

Table 5.2 Sewage and wastewater treatment tariff structures and average rates for drinking water in household and industry

	Tariff structure		Average rates (EUR/m³)	
	Households	**Industry**	**Households**	**Industry**
England and Wales	**Unmetered household charges:** • Fixed charge + charge based on the rateable value of the house **Metered household charges:** • Standing charge + volumetric charge per cubic metre	**Large user tariffs for foul sewage:** • A fixed charge + a standard volumetric rate for foul sewage discharged up to the threshold value for the tariff + a lower than standard volumetric rate for foul sewage discharged over the threshold value for the tariff (tariffs include charges for surface water drainage and highways drainage) **Trade effluent charges:** • Charges are based on the Mogden formula = fixed element + variable element based on the actual flow and loads discharged **Infrastructure charges:** • Fixed annual charge	**Unmetered household charges:** • Fixed charge: 42.3 EUR/year • Charge based on the rateable value of the house: 133.5 cents/EUR **Metered household charges:** • Standing charge: 75.3 EUR/year • Volumetric charge: 160.3 cents/m³ ([a])	**Standard charges for wastewater (example):** • standing charge — possible ranges as applied by all different companies: — 12 mm meter: between 14 and 115.9 EUR/year — 500 mm meter: between 59.28 and 16 951.02 EUR/year — Volumetric charge: 153.3 cents/m³ ([b])
Scotland	• Fixed rate (depending on Council Tax Band)	• Fixed and volumetric rate. Rates depend on size of the meter	• Unmetered charges range from GBP 140.94 to GBP 422.82 per year, depending on Council Tax Band ([c]) • Assuming an average consumption of 100 m³ per household, this means EUR 1.75 to EUR 5.25 per cubic metre (unweighted average: EUR 3.50 per cubic metre)	• For large users (meter size > 20 mm (which refers to the diameter of the water pipe)), the volumetric rate is GBP 1.3097 (EUR 1.61) per cubic metre ([d])
Netherlands	• Rates depend on household size (for sewage charge it differs by municipality)	• Purification charge	• EUR 310 per household ([e]) (sewage charge plus purification charge) (given an average household use of 104.5 m³ ([f]), this means EUR 2.97 per cubic metre drinking water)	• EUR 52.05 per pollution unit (2010) (this is the weighted average of the rates charged by all 26 water boards) ([g])
France	• Wastewater treatment tariff depends on the wastewater volume. For most of the municipalities, there is also a fixed part (all-in price) ([h])	• Tariff depends on the volume of wastewater and on its quality (amount of pollutants, etc.)	• EUR 1.54 (in 2009) ([i])	
Germany	• Basic charge, unitary fee and fee for land area		• EUR 2.36 (~ 92 % of municipalities collect a volumetric charge)	

Table 5.2 Sewage and wastewater treatment tariff structures and average rates for drinking water in household and industry (cont.)

	Tariff structure		Average rates (EUR/m³)	
	Households	Industry	Households	Industry
Slovenia	• Mixed rate: fixed rate per connection plus variable rate per cubic metre. • Simple variable rate: variable rate per cubic metre		• Between EUR 0.089 and EUR 2.405	• Between EUR 0.129 and EUR 2.436
Spain	• Sewage charges are not always linked to levels of consumption. However, the tariff structure commonly comprises fixed and variable components, similar to the water supply structure. In the water bill, charges for sewage and wastewater treatment are commonly disaggregated from each other and from supply charges ([j])		• Sanitation (sewage + wastewater treatment) • Spain: 0.56 EUR/m³ • Catalonia: 0.72 EUR/m³	• Sanitation (sewage + wastewater treatment) • Spain: 0.69 EUR/m³ • Catalonia: 0.84 EUR/m³

Note: ([a]) OFWAT, 2012. Customer charges data 2010–2011.

([b]) OFWAT, 2012. Customer charges data 2010–2011.

([c]) See http://www.scottishwater.co.uk/you-and-your-home/your-charges/2012-2013-charges/unmetered-charges.

([d]) See http://www.scottishwater.co.uk/you-and-your-home/your-charges/2012-2013-charges/metered-charges.

([e]) VEWIN (2012), Drinkwaterstatistieken 2012. See http://www.vewin.nl/SiteCollectionDocuments/Publicaties/Drinkwaterstatistieken%202012/Vewin%20Drinkwaterstatistieken%202012%20lowres.pdf.

([f]) VEWIN (2012), Drinkwaterstatistieken 2012.

([g]) VEWIN (2012), Drinkwaterstatistieken 2012.

([h]) Onema (2012) Observatoire des services publics d'eau et d'assainissement: Panorama des services et de leurs performances. http://www.onema.fr/IMG/spea2009_201202.pdf.

([i]) Onema (2012) Observatoire.

([j]) Aigües de Barcelona. Factura. See http://www.aiguesdebarcelona.cat/facturaagua.

The above volumetric water tariffs for supply and wastewater services are not very useful in establishing a direct comparison between the reviewed countries. In this context, it is more useful to establish comparisons between countries using the annual average water bill paid by representative households for a given year.

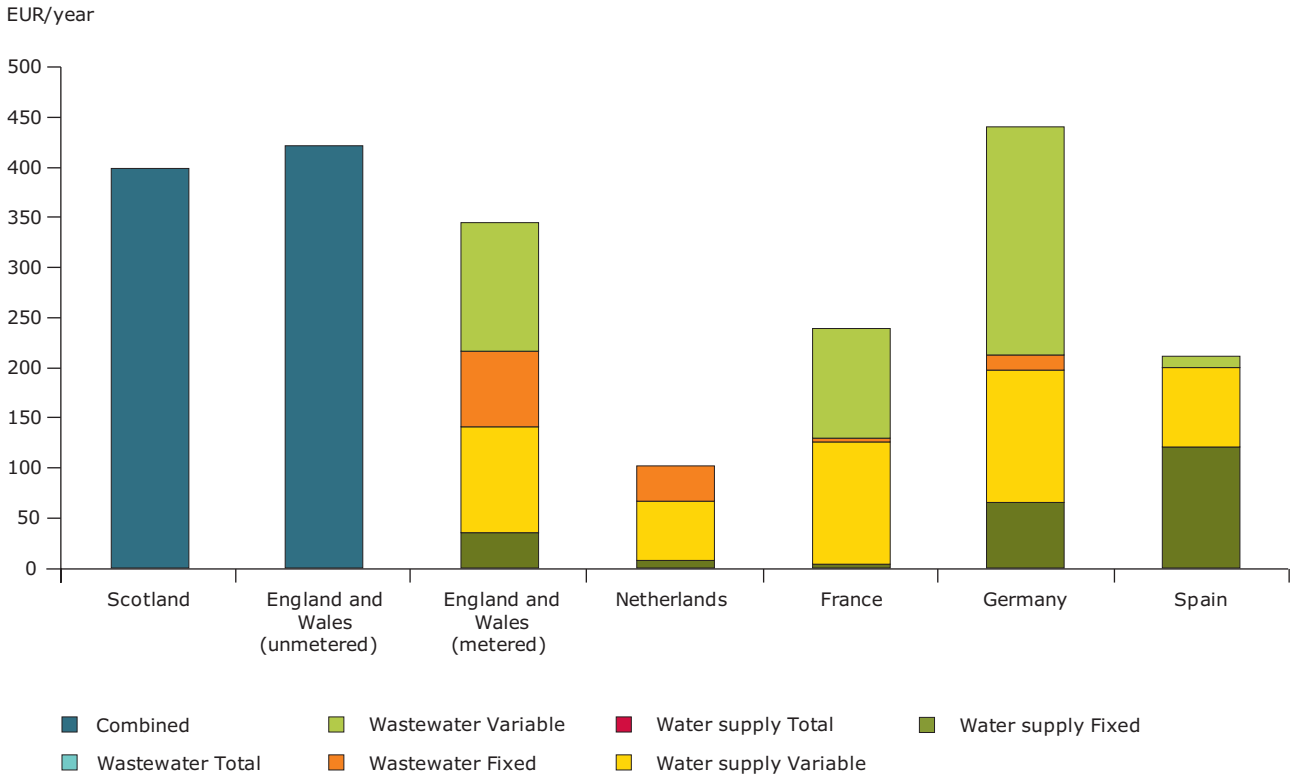
The data collected in the context of this project allow for an understanding of the relative shares of water and wastewater services, as well as volumetric and fixed rates, in the average household yearly expenditures, as shown in Figure 5.1. This original elaboration of water and sanitation service charges is based on an average household of 2 persons with an average water consumption of 80 m³ (per year). Overall, household water bills vary greatly across countries in Europe. While the average household in Germany pays water bills of around 440 EUR/year, a similar household in the Netherlands pays approximately a fourth of this amount (only 102.76 EUR/year). The German water bills even include a household sewer charge for rainwater.

Another noteworthy distinction is that bills which do not establish a direct link with the actual amount of water consumed or discharged are higher than those for which water tariffs reflect both fixed and variable (volumetric) components. This applies to all countries, with the exception of Germany. In Scotland and some places in England and Wales, water is charged in relation to the value and size of the property. This water billing method is not only more expensive for the customer, but also reduces any incentives for increased water-use efficiency by households.

The volumetric aspect of water bills can provide incentives. Nevertheless, there is also a risk that by decreasing the proportion of fixed charges in favour of volumetric billing, water companies will find it difficult to recover costs of water provision and sanitation, as customers become more water-wise with their consumption. This was the case in Germany, where revenues from water tariffs fell considerably in the last decade, when the proportion of the variable component of the bill was increased along with higher water tariffs (Tables 5.1 and 5.2).

Another element for comparison between the assessed EU Member States is whether water tariffs have been used to increase water utilities revenue. (Table 5.3).

Figure 5.1 Annual average water tariffs per household in the surveyed EU Member States (a) (b)



Note: (a) Note that under the Dutch system, the sewer network itself is not covered by the user fees, but rather by local taxes; this should be taken into account in order to understand the low price in comparison with other examples. In the Netherlands, only the WWTP is subject to user fees, not households. See the EEA report on UWWTD from 2005 (http://www.eea.europa.eu/publications/eea_report_2005_2).

(b) The 'Combined' category makes reference to unmetered water bills in some households in England and Wales, and in Scotland where water supply and water sanitation charges are not disaggregated in the water bills.

Sources: EEA based on Tables 5.1 and 5.2.

Table 5.3 Household water and wastewater tariff changes, 2008

		Real average annual rate of change (%)		
	Period	**Water**	**Wastewater**	**Total water and wastewater**
France	2000–2006	0.07	4.29	2.12
Germany	2000–2007	– 0.63		
Netherlands	2000–2007	– 1.33		
Spain	2000–2006	0.74	10.24	3.37
United Kingdom				
England and Wales	2001–2006	2.73	2.98	2.87
Scotland	2004–2007	0.41	0.39	0.41

Source: OECD, 2011.

According to the OECD (2011), water tariffs have not recorded significant increases in recent years. In some countries like Germany and the Netherlands, tariffs for water supply and sanitation services even decreased between 2000 and 2006. In other countries, annual increases were below or in line with inflation (inflation in Europe was 2.0 % to 2.3 % per annum during the period from 2000 to 2007). This seems to suggest that changes in water pricing that would have resulted from the implementation of Article 9 of the WFD did not directly affect water tariffs for households.

In contrast, the water tariff situation for the agriculture sector is more complicated. In most of the reviewed countries, farmers are only charged for water abstraction, and no tariffs on water consumption are applied (England and Wales, some users in the Netherlands, Scotland, and Slovenia). Water tariffs for irrigation water were only found in southern EU Member States (France and Spain), although in the Netherlands, farmers using piped water are also charged as business users. This is not surprising: irrigation is the main source of water for agriculture only in the Mediterranean area (Cyprus, Greece, Spain, Italy and Portugal), whereas in the other EU Member States, agriculture relies mostly on rain-fed agricultural systems (OECD, 2010b).

A clearer picture of how much farmers actually pay for irrigation water in each country is provided in Table 5.4, which summarises existing agriculture water charges (either abstraction charges or water tariffs) in the EU Member States selected for this study. To obtain a wider picture at EU level, this information is complemented by data on irrigation water tariffs from other southern EU Member States, drawn from Arcadis (2012).

5.1.2 Recovery of the water service provision costs (investment and O&M costs)

The aim of this section is to evaluate whether financial costs are fully covered (O&M and capital) through water tariffs or revenues by the water industry. Indeed, investigating water tariff levels only, and comparing them among EU Member States, does not provide a clear picture. There are many different factors that might affect water tariffs (and costs) that do not relate to the strictness of application of the cost-recovery principle. Also, assessing whether the WFD led to changes in cost recovery cannot be achieved using a time-trend analysis of water tariffs. Significant increases in water tariffs might result from an increase in capital costs due to investment needed to meet new regulatory requirements, and show no improvement in cost-recovery levels and the application of the basic principles of Article 9 of the WFD. In the domestic sector, the review conducted in the selected EU Member States revealed generally high financial cost-recovery rates (Figure 5.2).

In England and Wales, France, Germany, the Netherlands and Scotland, cost-recovery levels are close to, or higher than, 100 %. In Slovenia, cost-recovery rates are around 84 %. In Spain, although cost-recovery levels are quite high (84 %), levels for wastewater and sanitation services are still far from recovery (around 44 %). It must be stressed, however, that data on cost recovery are not homogenous across and within countries, and information on cost-recovery levels is not always easily available. For example, in England and Wales, cost-recovery information is provided at national level by OFWAT, whereas in Spain, cost-recovery levels are calculated at RBD or regional level.

This Member State-level assessment was complemented by more detailed assessments of cost-recovery levels for six individual water companies ([25]) that provide water supply only (Vitens and Bristol Water) or water supply and wastewater services combined (Lago et al., 2011). Financial statements for these water companies were investigated for several years to assess changes over time in costs and revenues, and thus cost-recovery rates (revenue/costs). Table 5.5 presents a summary of the data collected and the trends over time of the relative importance of all the different types of expenditures reported by water companies, namely operating expenditures, environmental charges/taxes and capital expenditures.

Table 5.5 helps clarify the different cost categories reported for the water sector. It highlights the fact that some water companies report environmental costs (charges and taxes) in their financial statements and that these are significant in some cases (e.g. around 20 % of total expenditures for Vitens and for the City of Barcelona and around 8 % for Berliner Wasserbetriebe or Berlin Water Works (BWB)). The difference between capital and operating expenditure is also relevant to the scope of this study — as capital investment remained more

([25]) Germany (DE) — Case Study: Berliner Wasserbetriebe (Berlin); Spain (ES) — Case Study Agbar/Aigües de Barcelona (Barcelona); France (FR) — Case Study Brest Métropole Océane (Bretagne); the Netherlands (NL) — Case Study Vitens; the United Kingdom (UK) — Case study: Bristol Water (EN) and Scottish Water (SCO).

Table 5.4 How much do farmers pay for irrigation water? Charges and/or tariffs ([a]) for irrigation water in selected EU Member States ([b])

Country	Water type	Type of charge/tariff	Amount	Year
England and Wales	Water provided	No information	—	—
	Water self-provided	Abstraction charge	Fixed annual charge + 0.0286 EUR/m³	Arcadis, 2012
Scotland	Surface and groundwater	Abstraction charge	0.0033 EUR/m³	2011–2012
Netherlands	Piped water	Water tariff	Fixed charge + 1.05 EUR/m³	2010
	Surface water	No charges		
	Groundwater	Abstraction charge	0.014 EUR/m³ (average, ranging from 0.008 to 0.025 EUR/m³)	2005
France	Water provided	Water tariff, Loire-Bretagne RBD	All-in tariff: 0.09 EUR/m³ Dual tariff (surface + volume): 81 EUR/ha + 0.06 EUR/m³ Dual tariff (discharge + volume): 38 EUR/m³/ha + 0.06 EUR/m³	2003
		Water tariff — Adour-Garonne RBD ([c])	157 EUR/ha + 0.082 EUR/m³	Arcadis, 2012
	Self-provision — surface water	Abstraction charge	In ZER ([d]): between 0.0015 and 0.03 EUR/m³ Outside ZER: between 0.001 and 0.02	2010
	Self-provision — groundwater	Abstraction charge	Between 0.002 and 0.003 EUR/m³	2010
Germany	Water provided	Water tariffs	Information not available	
	Self-provision — surface water	Abstraction charge	0.005 EUR/m³	2011
	Self-provision — groundwater	Abstraction charge	0.025 EUR/m³	2011
Slovenia	Self-provision	Abstraction charge	0.0013 EUR/m³	2012
Spain	Water provided (Guadalquivir RBD)	Water tariff — Volumetric charge	0.026 EUR/m³	2005
		Water fee — flat rate	62.71 EUR/ha	Arcadis, 2012
Cyprus	Water provided	Water tariff	0.15–0.17 EUR/m³	Arcadis, 2012
Greece	Water provided	Volumetric water tariff	0.02–0.7 EUR/m³	Arcadis, 2012
		Water tariff — Flat rate	73–210 EUR/ha	Arcadis, 2012
Italy	Water provided	Volumetric water tariff	0.04–0.25 EUR/m³	Arcadis, 2012
		Water tariff — Flat rate	30–150 EUR/ha	Arcadis, 2012
Portugal	Water provided	Volumetric water tariff	0.002 EUR/m³	Arcadis, 2012
		Water tariff — Flat rate	120 EUR/ha	Arcadis, 2012

Note: ([a]) Existing water tariffs are highlighted.

([b]) The reviewed countries and other southern EU Member States.

([c]) It is worth noting that in France, water tariffs for agricultural users are not set by water agencies, but rather by the service providers directly, making tariffs highly variable within each agency's territory.

([d]) ZER stands for *zone de répartition des eaux*, i.e. an area with inadequate water availability with respect to water needs.

Sources: Arcadis, 2012 and national sources from own data collection, as follows:

- Scotland:
  — See http://www.sepa.org.uk/about_us/charging_schemes/current_charging_schemes.aspx.
- Netherlands:
  — See https://zoek.officielebekendmakingen.nl/kst-30887-7-b1.html?zoekcriteria=%3Fzkt%3DEenvoudig%26vrt%3D30887&resultIndex=6&sorttype=1&sortorder=4.

- France:
  — Gleyses, G. (2004) Les structures tarifaires des réseaux collectifs d'irrigation: Méthodologie et test sur le Bassin Loire-Bretagne (see http://cemadoc.irstea.fr/exl-php/util/documents/accede_document.php).
- Germany:
  — ATT, BDEW, DBVW, DVGW, DWA und VKU (2011): Branchenbild der deutschen Wasserwirtschaft. Wirtschafts- und Verlagsgesellschaft. Bonn.
- Slovenia:
  — Environment Agency — Environmental indicators: irrigation (see http://kazalci.arso.gov.si/?data=indicator&ind_id=463).
  — Statistical Office of the Republic of Slovenia (SORS) (see http://www.stat.si/eng/drz_stat.asp).
  — Target research programme V4-0487 (2010): Assessment of water perspectives on the territory of Slovenia and the possibility of water use in agricultural production (Ocena vodnih perspektiv na območju Slovenije in možnost rabe vode v kmetijski pridelavi), Final Report (University of Ljubljana).)
- Spain:
  — Confederación Hidrográfica del Guadalquivir (2012) Propuesta de Proyecto de Plan Hidrológico de la Demarcación Hidrográfica del Guadalquivir. Anejo Nº9: Recuperación de Costes de los Servicios del Agua. September 2012.

or less constant for all companies for the analysed period, it could be argued that implementation of Article 9 of the WFD did not translate into huge capital investments in order to adapt infrastructure for water services provision.

Furthermore, Figure 5.3 illustrates cost-recovery ratios for domestic water supply and sanitation services for the selected utilities. Cost-recovery ratios illustrate the division between total revenues through tariffs for the analysed utilities divided by the total costs (including operating, capital and environmental costs). For most of the utilities, operating costs most likely include debt service and depreciation of existing loans. The information collated stressed that the operation and maintenance costs of domestic WSS are generally covered. Unfortunately, profit margins for these companies seem to be low (with revenue/cost ratios of around 0.1 and 0.2). This indicates that water companies cover costs with a profit, but have limited extra funds available to cover any potential renewals and replacements of existing infrastructure, a constraint that might impact the implementation of the WFD if additional (large) investments for the drinking water and sewage service sectors are required. In the case of Scottish Water, the revenue/cost ratio is higher than 2. This is because Scottish Water had to increase revenues through tariffs to repay existing loans and debt to the Scottish government.

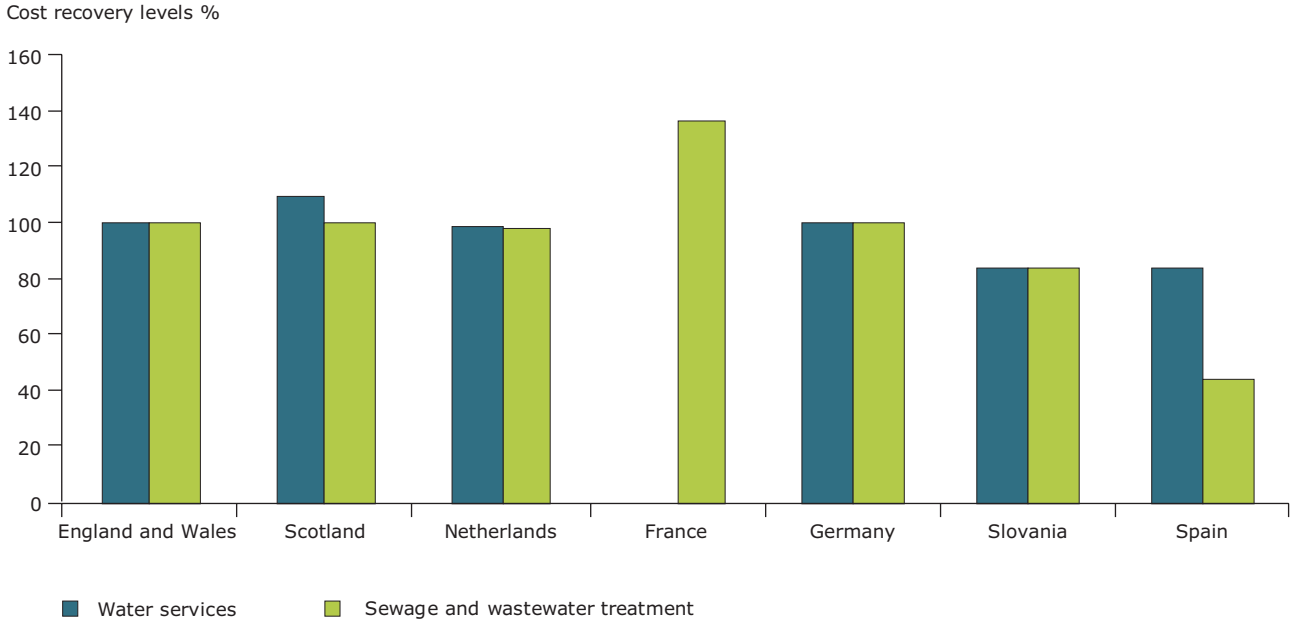
For the purposes of this study, it can be concluded that the balance between revenue and costs for the selected water utilities has not changed over recent years. Significant expenditures in capital investment have not been reported in the analysed time periods. Nevertheless, these capital costs may have appeared prior to the WFD (e.g. to comply with wastewater treatment and drinking water quality directives, in particular). An example is discussed in Box 5.1, where a more in-depth assessment of financial cost recovery for Germany is provided.

When discussing the recovery of financial costs in the domestic sector, it is also important to investigate the sector's sources of financing. The taxes, tariffs and transfers (3Ts) concept developed by the OECD primarily relates to an assessment of the sources of financing of the WSS systems. It has been developed to describe and categorise the three ultimate financial sources of investment for the water sector. As such, the 3Ts method refers to accounting, raising, and balancing finance in the form of tariffs (user fees), taxes (subsidies) and transfers (such as funds from the EU). The strategic financial planning (SFP) process is intended to provide answers on the right balance among the 3Ts, which collectively make up the basis for sustainable cost recovery (SCR). SCR entails securing future cash flows from a combination of the 3Ts and using this revenue stream as the basis for attracting and compensating repayable market-based sources of finance — such as loans, bonds and/or equity — where this is necessary to bridge financing gaps. It is important to note that the OECD's version of SCR is not concerned with cost recovery based on tariffs alone (OECD, 2009). Box 5.2 outlines the revenue categories according to the 3Ts approach.

In line with the 3Ts concept ([26]), Table 5.6 provides an overview of the sources of finance for selected water utilities as a whole, that cover their operations for the

([26]) The subsequent analysis of the practical application of the 3Ts concept to selected water companies in Europe builds on the results of a study previously performed by the authors (Lago et al., 2011) for EUREAU in 2011, titled *Methodological guide on Tariffs, Taxes and Transfers in the European Water Sector*. This report informed EUREAU's contribution to the European Regional Process towards the 6th World Water Forum *(Final Report for the WWF6 TSG7.2 under the priority target to Improve European Drinking Water and Sanitation Services)*.

Figure 5.2 Cost-recovery levels for water and sanitation services in the domestic sector



Sources: EEA based on national data, as follows:

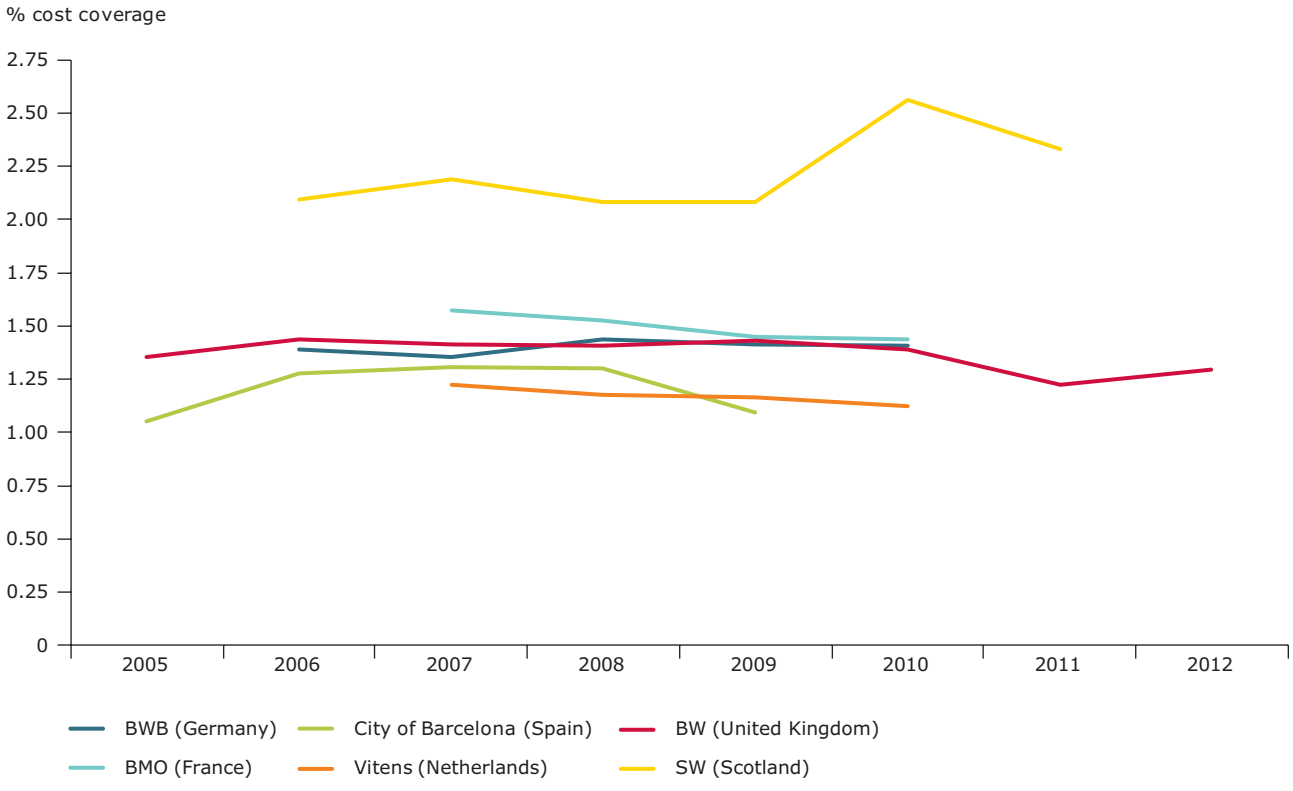
- England and Wales:
  — OFWAT, 2011. 'Financial performance and expenditure of the water companies in England and Wales 2009-10' (see http://www.ofwat.gov.uk/regulating/reporting/rpt_fpe_2009-10.pdf).
- Scotland:
  — See http://www.scottishwater.co.uk/assets/about%20us/files/key%20publications/annual_report_accounts_201112.pdf.
- Netherlands:
  — VEWIN (2010), 'Reflections on performance 2009' (see http://www.vewin.nl/SiteCollectionDocuments/Publicaties/Overige%20Vewin-uitgaven/2010/Reflections%20on%20performance%202009.pdf and http://www.vewin.nl/Drinkwater/Drinkwaterbedrijven/Pages/default.aspx).
- France:
  — Ernst & Young, 2007. 'Etude relative au calcul de la récuperation des coûts des services liés à l'utilisation de l'eau pour les district français en application de la Directive 2000/60/CE 23 octobre 2000 — Mise à jour — Rapport final'. Study undertaken for the Ministry of Ecology, Sustainable development and Sustainable environmental planning. Note: the report provides three estimates of cost-recovery levels for water and sanitation services (the two services are evaluated together), which depends on three estimates of infrastructure update costs: upper level (98 %); median level (83 %) and lower level (72 %). In the graph, the median value was used.
- Germany:
  — Veser, A. (2009): Vorgehensweise zur Ermittlung der Kostendeckung, bei Wasserdienstleistungen in Bayern, Bayerisches Landesamt für Umwelt, Referat 82, veröffentlicht im Tagungsband zur DWA-Landesverbandtagung Bayern und DWABundestagung, am 27. und 28.10.2009 in Augsburg.
- Slovenia:
  — Environment Agency (see http://www.arso.gov.si/en).
  — Statistical Office of the Republic of Slovenia (SORS) (see http://www.stat.si/eng/drz_stat.asp).
  — Ministry of the Agriculture and the Environment (see http://www.mko.gov.si).
- Spain:
  — ACA (2012) Preu de l'aigua a Catalunya 2012. Observatori del preu de l'aigua. Coordination and Strategic Analysis Department, March 2012.
  — ACA (2010) Plan de Gestión del Distrito de Cuenca Fluvial de Catalunya. Capítulo 10: Recuperación de Costes de los Servicios de Agua. Documento aprobado por el Gobierno de la Generalitat de Catalunya el día 23 de noviembre del 2010.
  — AEAS (2010) Tarifas de agua en España 2009. Precio de los servicios de abastecimiento y saneamiento.

Table 5.5 Time changes in reported expenditures (as % of total expenditures) for selected water utilities

		2005	2006	2007	2008	2009	2010	2011	2012
BWB (Germany)	Operating expenditure	–	62 %	61 %	61 %	62 %	62 %	–	–
	Environmental charges and taxes	–	9 %	8 %	8 %	8 %	8 %	–	–
	Capital expenditure	–	30 %	31 %	31 %	30 %	30 %	–	–
BMO (France)	Operating expenditure	–	–	45 %	41 %	43 %	51 %	–	–
	Environmental charges and taxes	–	–	–	–	–	–	–	–
	Capital expenditure	–	–	55 %	59 %	57 %	49 %	–	–
City of Barcelona (Spain)	Operating expenditure	51 %	47 %	54 %	55 %	45 %	–	–	–
	Environmental charges and taxes	26 %	30 %	28 %	28 %	25 %	–	–	–
	Capital expenditure	23 %	23 %	18 %	17 %	29 %	–	–	–
Vitens (Netherlands)	Operating expenditure	–	–	58 %	58 %	57 %	58 %	–	–
	Environmental charges and taxes	–	–	20 %	20 %	20 %	19 %	–	–
	Capital expenditure	–	–	22 %	22 %	23 %	23 %	–	–
BW (United Kingdom)	Operating expenditure	72 %	69 %	69 %	70 %	70 %	71 %	64 %	61 %
	Environmental charges and taxes	–	–	–	–	–	–	–	–
	Capital expenditure	28 %	31 %	31 %	30 %	30 %	29 %	36 %	39 %
SW (Scotland)	Operating expenditure	–	46 %	49 %	47 %	46 %	46 %	45 %	–
	Env. Charges and taxes	–	–	–	–	–	–	–	–
	Capital expenditure	–	54 %	51 %	53 %	54 %	54 %	55 %	–

Source: EEA based on national data.

Figure 5.3 Cost coverage ratios of selected utilities in EU Member States (2005–2010)



Source: EEA based on national data.

Box 5.1 Cost recovery in Germany

In principle, water providers in Germany have the obligation to set aside quasi-rents arising from depreciation in order to have capital available when investment is needed. The centralised water supply and wastewater disposal system in Germany is characterised by a highly sophisticated infrastructure. Therefore, the share of fixed costs arising from investments in new construction, extension and physical capital renewal amounts to approximately 70 % to 80 % (ATT, BDEW, DBVW, DVGW, DWA, and VKU, 2008). This includes fixed costs for operation and maintenance of the facilities. Such a cost structure seems to suggest a split tariff structure that is divided between a base tariff and a volume-dependent tariff. Traditionally, however, a volume-dependent tariff is more commonly found in Germany. Not all *Länder* have a split tariff structure in place; in those *Länder* where it is in place, the base tariff is not weighted to reflect the cost structure. Additionally, a clear decrease in water consumption over the past few years has reignited discussion of a split tariff structure and a stronger weighting of the base price to achieve a higher impact on cost recovery.

In 2010, the BWB, Germany's largest freshwater and sanitation provider, recorded revenues of EUR 1.2 billion and earnings before interest and taxes, of EUR 403.5 million. For BWB, 80 % of the costs are fixed, and the base tariff is being weighted more strongly to take this fact into account. In the long term, the aim is to reflect this cost structure more clearly in the tariff system. In 2010, tariffs were calculated for two years for the first time, among other reasons, to induce stability (BWB, 2011).

Box 5.2 Relevant 3Ts revenue typologies

Users' money or 'tariffs' (revenues from service users):
- operators' revenues from service provision (water and sanitation bills — taxes or charges);
- infrastructure owners' revenue (mainly public; relevant only if reinvested in the water sector).

National taxpayers' money or 'taxes' (subsidies, grants); cash from (non-foreign) public budgets:
- subsidies to local or national water operators; there are a number of potential hidden subsidies: tax rebates, tax holidays, soft loans (i.e. at a subsidised interest rate), transfers from local government housing taxes, donations, debt forgiveness, subsidised services (e.g. electricity) and prices, 'dormant' equity investments, coverage of the operator's financing gap, etc.
- subsidies to infrastructure owners (including soft loans/concessionary conditions for investment.
- Foreign taxpayers' money or 'transfers'; cash in aid from foreign sources:
- official development assistance — ODA (e.g. subsidies from foreign sources, grants, and soft loans);
- budget support from foreign sources (e.g. debt forgiveness);
- philanthropic donations through non-governmental organisations (NGOs), charities and foundations;
- EU subsidies — transfers.

year 2010. Sources of financing are used to cover all cost categories introduced above (operating, capital and environmental costs). Three of the water utilities report that their only source of revenue is through tariffs. In addition, Brest Métropole Océane (BMO) (France) and the metropolitan area of Barcelona (Spain) report sources of revenue from other sources outside their customer base.

Figure 5.4 shows the evolution of the proportion of tariffs, taxes and transfers in the overall budget of the water operators in the metropolitan area of Barcelona. This graph shows the variability of the taxes and transfers components caused by substantial investments during that period, which were funded by grants from different sources. The graph illustrates that much of the needed investment undertaken by BMO and the metropolitan area of Barcelona came from EU, national and regional subsidies or soft loans. Further investigation would be necessary to ascertain the degree of recovery by the company for these capital investments. The company is unlikely to have to repay subsidies, but may have to repay loans.

The analysis shows that the cost of drinking water supply and sanitation has not risen as sharply as might have been predicted in view of the two most pressing financial challenges facing the water industry in Europe at the moment: i) replacing an ageing infrastructure, and ii) adapting to new environmental standards and increased costs as a result of the implementation of the WFD and other environmental legislation.

Table 5.6 Proportion of sources of financing for the selected water utilities ([a])

	BWB (Germany)	BMO (France)	City of Barcelona (Spain)	Vitens (Netherlands)	BW (United Kingdom)
Tariffs	100 %	87 %	46 %	100 %	100 %
Taxes		13 %	20 %		
Transfers			34 %		

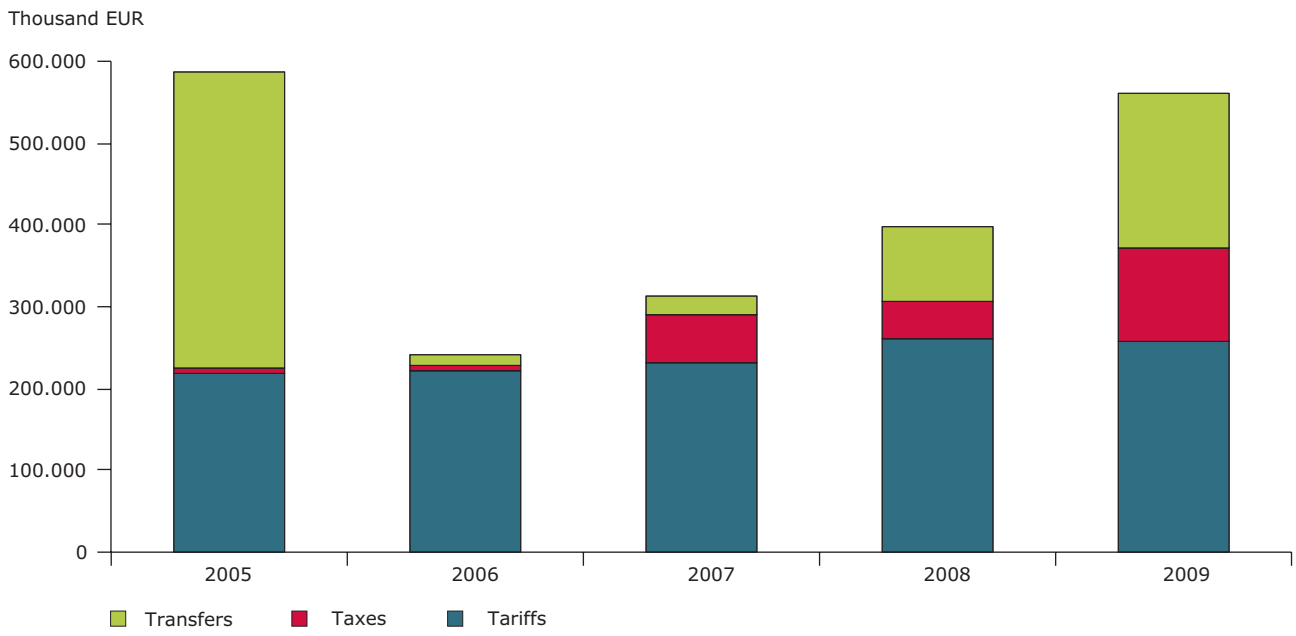
Note: ([a]) The data in Table 5.6 highlight different sources of financing for the selected water utilities as reported in their financial statements for the year 2010. In order to understand these figures, the reader should be aware of some of the limitations regarding data, especially in the analysis of static or very short time-series. This table seems to imply that funds are only at play in certain EU Member States. However, because of the long-term nature of the types of investments that are needed in the water sector, caution is advised in drawing conclusions. The table shows that Barcelona has received subsidies, but only because their loans were reported in 2010. Longer time-series would be needed to identify other heavy transfers received by the other companies.

Source: EEA.

The ultimate question is 'who has been paying — government/EU subsidies or water users?' According to the cost recovery and PPP under the WFD, all costs should be borne by the industry and theoretically passed to customers through an increase in tariffs. The analysis indicates that tariffs have more or less remained constant in recent years. In addition, a financial analysis of revenues and costs for a selection of European water utilities shows that there have not been large increases in costs.

Nevertheless, as is shown in Figure 5.4 for the sources of financing for the city of Barcelona, there are considerable EU and national subsidies that have been used to invest in new infrastructure needs. This seems to suggest that some water companies are still heavily relying on hidden government subsidies for necessary capital investments. It is assumed that other water companies are still relying on the good state of previously installed water infrastructure, which was likely sponsored using heavy subsidies.

Figure 5.4 Source of financing for the water sector in the metropolitan area of Barcelona

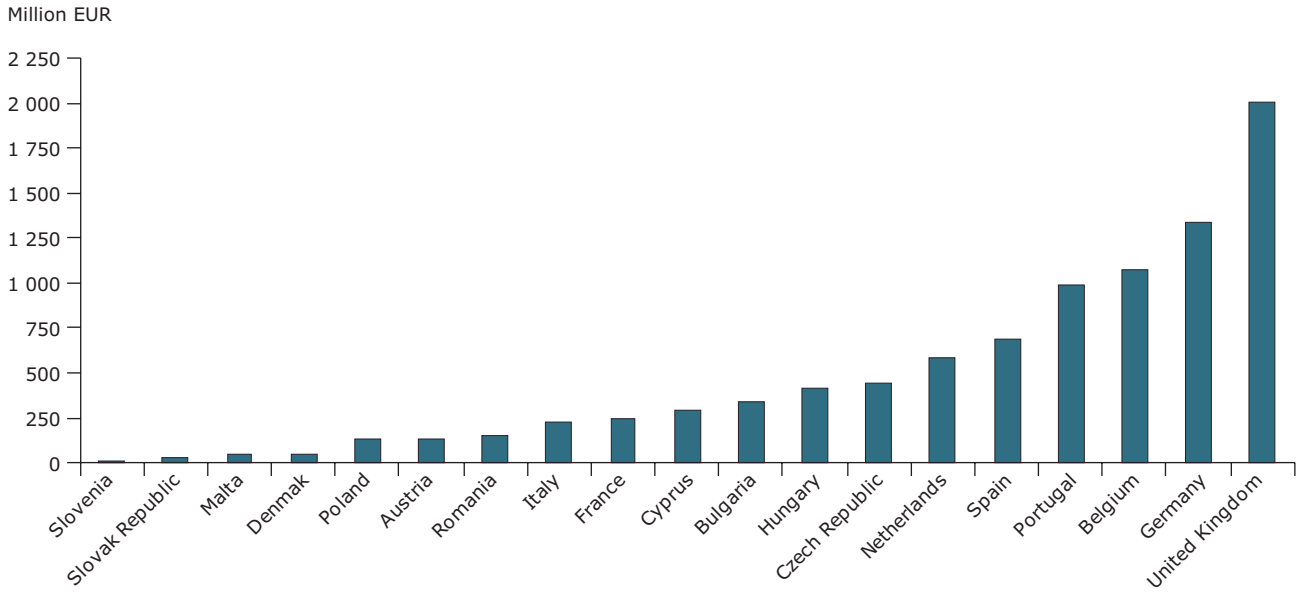


Source: Lago et al., 2011.

For example, Figure 5.5 illustrates an aggregation at country level of individual loans from the European Investment Bank (EIB) ([27]) for water supply and sanitation projects in the EU and the European Free Trade Association (EFTA) countries. A total of EUR 9.1 billion was lent to the water sector by the EIB from 2003 to 2007. Please note that according to EIB borrowing rules, the EIB's lending constitutes on average up to 30 % of the total cost of the water project. Therefore, around 70 % of the remaining costs have to be covered by the water company itself or by EU, national, regional and municipal funds/ subsidies. For example, the construction costs of water supply and wastewater systems are eligible for assistance under the Cohesion Policy from the European Regional Development Fund (ERDF) and the Cohesion Fund, varying from 25 % to 85 % of eligible expenditure. In the period from 2000 to 2006, such support totalled EUR 4.05 billion, with four EU Member States (Greece, Italy, Portugal and Spain) accounting for nearly 90 % of all funding ([28]).

In framing the discussed elements on funds and transfers in relation to cost pricing, this section takes a bottom-up approach from the perspective of selected individual water companies. In this case, the observation could be made that alleged cost water pricing does not normally factor in the value of funds (whether these are subsidies or loans at below the market interest rate). Due to inconsistent reporting by the selected water companies, it is difficult to ascertain if all sources of funding and expenditures are included in their financial accounts. The analysis above warrants this claim. Fundamentally, a more solid agreement on the underlying accounting principles for any cost water pricing scheme is needed. Above all, such financial reporting guidelines need to be clear and transparent. The 3Ts approach advocated by the OECD could perform this role. Nevertheless, clear guidelines in its application by individual water companies are needed. The industry seems to be moving in this direction — see, for example, the

Figure 5.5 EIB individual loans for water supply and sanitation in the EU and EFTA countries (2003–2007)



Source: European Investment Bank, 2008.

([27]) The EIB, in support of EC Regional and Environmental policies, can use EU funds and instruments (subsidies and grants) for leveraging budgetary funds through EIB financing. As a non-profit, policy-driven public bank, interest rates are based on the EIB's borrowing cost, with a small margin to cover administrative expenses and other costs. The EIB lends to public or private utility companies, national or local authorities, or it can directly finance individual projects. It can lend up to 50 % of the investment costs of individual projects, but financing may be combined with EU grants, depending on the scope and definition of the individual project. However, on average, its lending makes up 30 % of the total cost of water projects, split more or less equally between public and private sector borrowers.

([28]) See http://www.publications.parliament.uk/pa/cm201011/cmselect/cmeuleg/428-xiii/42816.htm.

manual developed by the European Federation of National Associations of Water Services (EUREAU) on the practical application of the 3Ts concept that was presented at the latest World Water Forum in Marseilles. However, the question remains: To what extent does the 3Ts concept allow for consistent reporting of the financial and economic (including environmental) costs that would need to be recovered according to the WFD?

In the case of agriculture, cost-recovery rates can only be estimated for those countries in which water tariffs for provided water are applied. In the case of self-provision, in fact, financial costs are covered by the farmers themselves, as water is independently abstracted and conveyed to the sites; farmers only pay an abstraction charge, which is mainly aimed at covering environmental and resource costs and will be discussed in the following section. Financial cost-recovery rates for France, the Netherlands and Spain are summarised in Table 5.7 (from the data collection templates). In addition, to enlarge the focus of the investigation, financial cost-recovery rates in the other southern EU Member States (Cyprus, Greece, Italy and Portugal) are also provided (Arcadis, 2012), since in these countries, agriculture mainly relies on irrigation water.

As for Mediterranean countries, Table 5.7 highlights generally low levels of cost recovery of irrigation water tariffs, ranging from 20 % (lowest in southern Italy) to 80 % (highest in northern Italy), with an average of about 50 %. This is in line with information from the literature: according to the OECD ([29]), water supply infrastructures have often been heavily subsidised, indicating that the price paid by irrigators is generally lower than the price which would be required to achieve cost recovery (Arcadis, 2012). In contrast, with a 99 % cost-recovery level, the Netherlands is an exception to this general picture; however, it must be recognised that farmers using piped water are charged as industrial customers, and this level of cost recovery refers to the provision of water services as a whole, thus including domestic, industrial, and agricultural users.

5.1.3 Pollution taxes and charges

Table 5.8 provides a summary of the characteristics of pollution charges and taxes in the reviewed countries. These charges have been divided in terms of the types of water services that are relevant for the implementation of Article 9 of the WFD (household, agriculture and industry).

Table 5.7 Cost-recovery levels in reviewed countries where irrigation water tariffs are in place, and in other southern EU Member States

Country	Cost-recovery levels	Year
Netherlands	99 % (figure including all sectors, i.e. domestic and business users including farmers)	2010
France	O&M costs: 100 % Investment costs: 15–95 % (Average: 55 %)	Arcadis, 2012
Spain (Guadalquivir RBD)	49.78 %	2005
Cyprus	51 %	Arcadis, 2012
Greece	54 %	Arcadis, 2012
Italy	20–30 % (south) 50–80 % (north) Average: 50 %	Arcadis, 2012

Sources: EEA and national sources from Arcadis (2012) as follows:

- Netherlands:
  — VEWIN (2010), 'Reflections on performance 2009' (see http://www.vewin.nl/SiteCollectionDocuments/Publicaties/Overige%20Vewin-uitgaven/2010/Reflections%20on%20performance%202009.pdf).
- Spain:
  — Confederación Hidrográfica del Guadalquivir (2012) Propuesta de Proyecto de Plan Hidrológico de la Demarcación Hidrográfica del Guadalquivir. Anejo N°9: Recuperación de Costes de los Servicios del Agua. September 2012.

([29]) OECD, 2010. 'Agricultural water pricing: EU and Mexico'; in Arcadis et al., 2012.

The table contains the following information:

i) a brief description of the economic instruments that are employed;

ii) an indication of the average unitary rates (EUR/m^3) in the respective countries;

iii) where available, illustrative information on the total revenue and costs for the authority responsible for the scheme.

In the reviewed countries, pollution charges are linked to different characteristics of the polluter (e.g. sector, processes), the effluents (volume or pollutant concentration) or the recipient type of waterbody (e.g. surface water or groundwater). Average unitary rates in all the reviewed countries differentiate between quantities of pollutants emitted and the level of the economic activity that pollutes the water environment (for example, the three-block eco-tax used in Catalonia to control emissions to water from households differentiates between three levels of emissions). Finally, charges are set in a way that clearly is aimed at recovering the costs of running the regulatory functions of the responsible authorities. For example, in the United Kingdom, the revenue raised by the industrial charges for water quality (EUR 79.2 million), which aim to control the release of industrial emissions to surface waters, barely cover the costs of regulation (EUR 78.8 million).

5.1.4 Internalising environmental and resource costs: what progress has been made since the WFD's adoption?

As described in the initial sections of this report, the concept of cost recovery as defined in the WFD calls for the internalisation of environmental and resource costs. One of the main difficulties in determining whether the costs of water service provision are recovered is attributable to the variability in the way EU Member States define and account for such externalities in practice. Most of the countries examined were found to consider environmental costs by charging water polluters for the purification of their wastewater, for the untreated pollution discharged in surface waters, and for activities (discharges, abstractions, impoundments and engineering) that affect the quality of aquatic ecosystems. Similarly, but seemingly to a lesser extent, resource costs are considered by setting charges on water abstraction and on the construction, operation, and maintenance of water storage facilities.

In this respect, it is important to consider the methodological considerations that have been employed in water price design for the inclusion of the environmental and resource costs principle for water services according to Article 9 of the WFD (see Table 5.8 for pollution charges). This is linked with countries' perceptions of whether efforts made to date in the implementation of Article 9 of the WFD are sufficient to internalise all the costs of water services provision.

There are economic instruments like the water levy (*canon del agua*) in Spain, which are said to tackle both environmental and resource costs under a single mechanism. The Spanish water levy is an environmental tax designed to protect water resources, with the objective of guaranteeing supply and quality. The charge is calculated as a function of the water used by domestic and industrial users and is designed as an increasing block tariff.

In Germany, the cost-recovery principle is formally embedded in the Law on Communal Fees of the *Bundesländer* and has been for many years (cp., for instance, § 10 SächsKAG or § 6 KAG NW). However, the understanding of cost recovery in the WFD differs from the understanding in the Laws on Communal Fees. According to the WFD, cost recovery should not only follow the business costs of water supply and sanitation services, but should also include environmental and resource costs more comprehensively than is currently done by communal fees (Gawel et al., 2011). An approach to environmental and resource costs has been created by the German Association for Water Management, Wastewater and Waste (Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall or DWA) that should allow for a calculation of environmental and resource costs; however, there is as yet no legal obligation to do so. The approach should cover environmental taxes and fees, including compensatory payments, costs for environmental protection and the necessary measures for achieving the environmental goals set forth in the WFD. Costs and benefits of the externalities of water services are not to be covered (e.g. resource costs for water use going beyond the quantity goals of the WFD, external effects of water provision and effluent discharge from sewage plants, biodiversity benefits of reducing water withdrawals and protecting waters, etc.); this is a weakness of the DWA approach (Nickel et al., 2012).

The proposed instruments in France have been designed to take into account environmental and organisational considerations. Environmental factors such as water quality (costs for treatment, level of

Table 5.8 Pollution charges and taxes and average rates

	Water service	Taxes and charges (description)	Average rates (EUR/m³)	Total revenues (R)/ transaction costs (TC) per year
England and Wales	Agriculture	**EP charges for groundwater discharges** Different charges are applied to liquid and solid discharges, and the amount of each charge is based on the quantity of discharge, as follows: 1) Liquid discharges: • application charge, one time only • variation charge, in case the permit incurs variations • subsistence charge, annual 2) Solid discharges: • application charge, one time only • subsistence charge, annual	Examples only for large discharges: 1) Large liquid discharge: • sheep dip volume: > 50 m³/y • application charge: EUR 1 185.6 • variation charge: EUR 654.5 • subsistence charge: 4 742.4 EUR/ year 3) Large solid discharge: • solids > 100 tonnes • application charge: EUR 8 878.2 • variation charge: EUR: 2 963.5 • subsistence charge: 4 741.6 EUR/ year	
	Industry	**EP charges for water quality (a)** 1) Application charges: • the application charge is a fixed charge, although two rates exist — standard and reduced. 2) Subsistence charge (the subsistence charge depends on four factors): • volume: maximum daily volume of discharge permitted • content of discharge: bands detailed in the Environmental Permitting Charging Scheme and Guidance 2012 • receiving water: groundwater, coastal, surface, estuarial • financial factor: fixed multiplier	• Reduced application charge: EUR 154.3 • Standard application charge: EUR 1 092.8 • Annual charge financial factor: 844.6 EUR /year	• R: EUR 79.2 million (2011–2012) • TC: EUR 78.8 million (2011–2012)
	Industry	**EP — Groundwater assessment (b)** • Certain environmental permits (installations — activities related to waste management (e.g. landfills) are periodically subject to reviews to check the quality of groundwater. The initial review corresponds to a first charge and, if necessary, a more detailed review is carried out at an additional charge	• The initial review: EUR 1 211. • Second review (only if necessary): EUR 4 399	

Table 5.8 Pollution charges and taxes and average rates (cont.)

	Water service	Taxes and charges (description)	Average rates (EUR/m³)	Total revenues (R)/ transaction costs (TC) per year
Scotland	Industry, agriculture, and households	**Point-source effluent discharges ([c])** The charge rate is calculated taking the following factors into account. Brackets enclose the values of each factor taken to calculate the unitary rate mentioned below. For the disposal to land charge, different values for the volume factor apply. Furthermore, the 'contents' factor is always 2.0 and the 'receiving waters' factor is 0.5. The other two factors do not apply. • Volume: authorised maximum daily volume that may be discharged [100 m³] (for fish farms, the volume factor relates to the weight of the fish produced) • Content: type and nature of the discharge (factor ranges from 0.3 for cooling water to 14 for certain toxic chemicals) • Receiving waters: groundwater or land (0.5), inland waters (1), coastal and territorial waters (1.5) [inland] • Number of point-source activities • Number of sewer overflows	• EUR 857 per year ([d])	• R: EUR 24.5 million (total for all water environment and water services charges) ([e]) • TC: EUR 26.7 million (total for all water environment and water services expenditure)
	Industry	**Disposal to land charge** • Different values for the volume factor apply. Furthermore, the 'contents' factor is always 2.0 and the 'receiving waters' factor is 0.5. The other two factors do not apply	• EUR 478 per year ([f])	
Netherlands	Households, industry, and agriculture	**Groundwater charge** This is a charge that can be levied by the provinces to cover the costs of preventing and abating the negative impacts of groundwater abstractions and infiltrations, and of investigations relating to groundwater policy. The charge does not have an incentive function	• In most provinces, the rate of the charge is between EUR 0.01 and EUR 0.02 per cubic metre. • Some provinces apply a threshold (e.g. 100 000 m³ per year) to reduce administrative costs	• R: water boards: EUR 52.05 per pollution unit (2010) (this is the weighted average of the rates charged by all 26 water boards) ([g]) • R: state waters: EUR 35.50 per p.u. • TC: water boards: EUR 10 million (2012) ([h]) • TC: state waters: EUR 22 million (2009) ([i])
	Households, industry, and agriculture	**Pollution charge** This charge is levied by water boards and by the state on direct discharges to surface water. The charge rate applied by water boards is the same as the rate of the purification charge	• For discharges to state waters, the rate is presently EUR 35.50 per p.u. (Article 7.6 of the Water Act)	

Table 5.8 Pollution charges and taxes and average rates (cont.)

	Water service	Taxes and charges (description)	Average rates (EUR/m³)	Total revenues (R)/ transaction costs (TC) per year
Netherlands	Households, industry and agriculture	**Water system charge** Levied by water boards to cover the costs of regional water system management (such as water level control and flood protection). The water system charge has four components: 1) a charge for inhabitants; this is a fixed amount per dwelling (regardless of household size), paid by the owner or occupier 2) a charge for building owners: a percentage of the value of the building 3) a charge for owners of (agricultural and other vacant) land (except nature areas): based on acreage 4) a charge for owners of nature areas: based on acreage	1) The average rate in 2010 was EUR 60.21 (ranging from EUR 28.30 to EUR 29.66). 2) Average in 2010: 0.0254 %; range: 0.0123 – 0.0596 %) 3) Average rate per hectare in 2010 EUR 53.50; range: EUR 24.55 – EUR 181) 4) Average rate per hectare in 2010 EUR 2.57; range: EUR 0.95 – EUR 8.04)	
France	Households	**Charge for pollution with domestic origin** The base for calculation of the pollution charge is the water consumption of the household. Charges are defined by the water agencies, taking into account inter alia the particularities of the environment and the specificities of the local water regulation	• The ceiling charge for pollution with domestic origin is 0.5 EUR/m³ • Ceiling charge the modernisation of the wastewater collection network is 0.3 EUR/m³ ([j])	• Charges for pollution (non-domestic and domestic origin pollution): EUR 97.4 million. • Charges for the modernisation of the wastewater network: EUR 32.6 million • Charges for diffuse pollution: EUR 5.3 million • Charges for pollution from breeding activities: EUR 0.47 ([k]) million
	Agriculture	**Charge for pollution from animal husbandry** follows the same rules in the whole French territory. It concerns breeders with more than 90 livestock units (150 livestock units in mountainous areas) and with a density above 1.4 livestock unit per hectare **Charge for pollution with a domestic origin** ([l]) When the farming activity does not incur charges for pollution with a non-domestic origin, charges are the same as charges for pollution with domestic origin **Charge for diffuse pollution** This charge is defined by water agencies and depends on the bought quantity of plant protection products. This charge does not appear in the water price, but in the pesticide price ([m])	• Charges for pollution from animal husbandry are calculated by multiplying the number of livestock units with the all-in price (EUR 3 per livestock unit). The 40 first livestock units are free of charges ([n]) • Ceiling charge for the modernisation of the wastewater collection network is 0.15 EUR/m³ ([o])	

Table 5.8 Pollution charges and taxes and average rates (cont.)

	Water service	Taxes and charges (description)	Average rates (EUR/m³)	Total revenues (R)/ transaction costs (TC) per year
France	Industry	**Charge for pollution with a non-domestic origin** Thresholds and the ceiling charge are defined by the legislation. They depend on the pollutant and the economic activity. Charges for pollution from a non-domestic origin are defined for each unit of pollutant and, eventually, for each activity by the water agencies, taking into account inter alia the particularities of the environment (e.g. risks of infiltration of aquifers) and the specificities of the local water regulation (e.g. measures planning for water management) ([p])		
Germany	Industry	**Effluent tax** Priority pollutants: oxidisable substances, phosphorous, nitrogen, halogen connectors, and the metals quicksilver, cadmium, chrome, nickel, lead, and copper and their associated compounds.	• Per unit of pollution (see 2002 law): EUR 35.79	• R: total revenue for effluent tax (2010): EUR 254 million
Slovenia	Households, agriculture	The basis for calculating of the environmental charges for the urban wastewater treatment units is the sum of the loads that occur during the current calendar year through the discharge of wastewater in the entire area for the prescribed utilities collection and treatment of urban wastewater and rainwater	• 0.0528–0.528 EUR/m³	
	Industry	The basis for calculating the environmental charges of the industrial wastewater is the sum of unit load achieved during the previous calendar year to the discharge of the industrial wastewater through all outlets	• The environmental tax is calculated on the basis of the aggregate units of load data from the operational monitoring reports for the previous year	
Spain	Households	**Three-block eco-tax** with a minimum billing of 6 m³ per user per month	• Block 1 (fewer than 9 m³/month): 0.4339 EUR/m³ • Block 2 (between 10 m³/month and 15 m³/month): 0.4596 EUR/ m³ multiplied by a coefficient of 2 • Block 3 (more than 15 m³/month): 0.4596 EUR/m³ multiplied by a coeffiicient of 5 ([q]) • Barcelona (province): 0.434 EUR/m³	• R: Catalonia: 209 million EUR/ year

Table 5.8 Pollution charges and taxes and average rates (cont.)

	Water service	Taxes and charges (description)	Average rates (EUR/m³)	Total revenues (R)/ transaction costs (TC) per year
Spain	Agriculture	Agricultural water users are exempt of the Canon de l'aigua. This exemption can be revoked in the case of inspection services identifying special contamination due to the use of pesticides, fertilisers or organic material. For livestock farming, the general 'use tax' component of the Canon de l'aigua is disabled and only the specific 'pollution tax' is left active in case inspections identify the incidence of pollution discharges.		
	Industry	**Eco-tax** which is a sum of a general 'use tax' component and a specific 'pollution tax' component	• General 'use tax' component: 0.1314 EUR/m³ (may be modified by locality dependent coefficients) • Specific 'pollution tax' component: under volumetric pricing 0.5152 EUR/m³ under direct measure of water use and pollutant discharge level, a special formula is used to calculate this component • Barcelona (province): 0.716 EUR/m³†	• R: Catalonia: 134 million EUR/yr
	Hydropower	Hydropower — Canon de l'aigua. Can be determined based on: 1) the electricity production regime and the energy produced 2) direct individual measure		

Note: (a) See http://www.environment-agency.gov.uk/business/regulation/38807.aspx.

(b) EA, EP charges scheme and guidance 2012. See http://www.environment-agency.gov.uk/business/regulation/38811.aspx.

(c) The figures in brackets were used to arrive at the single number for the unitary rate mentioned in the Table 5.8, i.e. EUR 857. Since the charge is calculated according to a complicated formula, we had to make assumptions concerning the values of the variables in this formula. In the final report, the amount of EUR 857 is not 'below' but 'to the right' of the description.

(d) See http://www.sepa.org.uk/water/water_regulation/charging_scheme.aspx.

(e) Source: SEPA's Annual Report and Accounts 2011–2012 (see http://www.sepa.org.uk/about_us/publications/annual_reports.aspx).

(f) See http://www.sepa.org.uk/water/water_regulation/charging_scheme.aspx.

(g) VEWIN (2012), 'Drinkwaterstatistieken 2012' (see http://www.vewin.nl/SiteCollectionDocuments/Publicaties/Drinkwaterstatistieken%202012/Vewin%20Drinkwaterstatistieken%202012%20lowres.pdf).

(h) See http://statline.cbs.nl/StatWeb/publication/?VW=T&DM=SLNL&PA=71974ned&LA=NL.

(i) See http://www.infomil.nl/onderwerpen/klimaat-lucht/handboek-water/wetgeving/waterwet/financiele/item-112721.

(j) See http://www.legifrance.gouv.fr/affichCode.do?idSectionTA=LEGISCTA000006195229&cidTexte=LEGITEXT000006074220&dateTexte=20121016.

(k) Prevision for the period 2007 to 2012 in the Adour-Garonne River Basin: EUR 2.8 million. Agence de l'eau Adour-Garonne (2012) Redevance Pollution de l'eau d'origine non domestique: Activités d'élevage. See http://www.eau-adour-garonne.fr/fr/eau-et-activites-economiques/agriculture/les-redevances-percues-par-l-agence-liees-a-l-agriculture.html.

(l) Charge for pollution with domestic origin concerns also economic activities with pollutants emissions under the thresholds defined by the legislation.

(m) See http://www.legifrance.gouv.fr/affichCode.do?idSectionTA=LEGISCTA000006195230&cidTexte=LEGITEXT000006074220&dateTexte=20121016.

(n) Agence de l'eau Adour-Garonne (2012) Redevance Pollution de l'eau d'origine non domestique: Activités d'élevage.

(o) See http://www.legifrance.gouv.fr/affichCode.do?idSectionTA=LEGISCTA000006195229&cidTexte=LEGITEXT000006074220&dateTexte=20121016.

(p) See http://www.legifrance.gouv.fr/affichCode.do?idSectionTA=LEGISCTA000006195228&cidTexte=LEGITEXT000006074220&dateTexte=20121016.

(q) Data for 2012. Source: ACA (2012) Preu de l'aigua a Catalunya 2012. Observatori del preu de l'aigua. Coordination and Strategic Analysis Department, March 2012, p. 12.

Source: EEA.

treatment) and quantity are considered in setting the price of water and environmental charges. The price also has other policy objectives. It depends on organisational issues such as the density of consumers in the territory (dispersed housing, etc.) and the size and type of water service (public or private). Environmental factors (reliefs) may influence the complexity of the water service.

In Slovenia, the provisions of the Environmental Protection Act (OJ RS, No 41/04, 17/06, 20/06, 28/06) are the legal embodiment of the WFD's PPP. The introduction of this principle has given rise to a significant source of measures for financing the environmental protection policy. The introduction of tax exemption for water pollution was a positive experience in the area of wastewater collection and treatment. The tax for suitable wastewater collection and treatment is 10 times lower. The National Environmental Action Programme recognises the following as priority targets as relates to the economic aspects of the environment: the encouragement of an increase in the economic resources for the investments in the environmental protection projects as well as increases in the budget expenditure which would indirectly entail the reduction in pollution; speeding up the introduction of tax relief for investments in the environmental protection projects; and introduction of a deposit and refund system in relation to the system of taxation ([30]).

In the Netherlands and Scotland, environmental costs are considered: water polluters have to pay for the purification of their wastewater as well as for activities (discharges, abstractions, impoundments, engineering) that affect water quality. Resource costs in Scotland are considered through the charge on water abstraction. In the Netherlands, resource costs used to be considered in the groundwater tax, but this tax was abolished in 2012.

It is worth noting that the European Commission still needs to put together an official interpretation of environmental and resource costs; therefore, it is impossible to conclude at this stage if current efforts by EU Member States to comply with the cost-recovery principle will suffice. One of the actions of the 2012 *Blueprint to Safeguard Europe's Water Resources* is that further guidance is needed in this respect. Nevertheless, there are some elements of the cost recovery provision that the European Commission is starting to evaluate.

As introduced in this report, the revenues are mostly earmarked for measures to protect waterbodies. Nevertheless, the German interpretation of the water pricing principle according to the WFD is open to scrutiny. The main issues identified by the European Commission are that some sectors (e.g. agriculture or abstraction of water for cooling purposes) are in some *länder* exempted from the WAC. This has led the European Commission to to bring infringement proceedings against Germany for non-transposition of Article 9 of the WFD. ([31]). The German interpretation is that such cost recovery should apply only to the supply of drinking water and the disposal and treatment of wastewater, while the European Commission considers that Germany's exclusion of other relevant activities (such as hydropower or agriculture) from the definition of water services hinders the full and correct application of the WFD — and thus of the cost-recovery principle.

([30]) See http://kazalci.arso.gov.si/?data=indicator&ind_id=42&lang_id=94.
([31]) See http://europa.eu/rapid/press-release_IP-12-536_en.htm?locale=en.

With exemptions being one of the most controversial issues in the interpretation of Article 9 of the WFD, it is also worthwhile assessing whether EU Member States have progressed over time with internalising environmental and resource costs into existing water pricing schemes. In this respect, how revenues from environmental charges have evolved over the last years is assessed, as this might give some indications on additional efforts made by EU Member States to internalise environmental and resource costs. Table 5.9 illustrates the income from environmental charges from 2005 to 2012 in England and Wales, France, Germany, Scotland and Spain.

Table 5.9 highlights the absence of drastic changes in revenues from environmental taxes in the different countries. Thus, the new requirements of the WFD under Article 9 did not significantly affect the mechanisms put in place for recovering (even partially) environmental and resource costs as indicated by the total revenues collected. This global overview, however, might hide some more marginal changes resulting from the WFD principles that might have affected the rates applied to specific sectors, the removal of exemptions or the adaptation in unitary rates to account for differences in water balances between regions. It is worth noting that the EA's Environmental Permitting Regulations Water Quality in England and Wales seem to be the only regulatory change introduced in that period.

5.2 Identified barriers to cost-recovery water pricing

The process of implementation of cost recovery driven by the WFD has had numerous obstacles of various natures. A study of individual EU Member States reveals that such obstacles are commonly related to the specific context of the country in question, and a complex array of factors ranging from cultural traits to socio-economic aspects play a part in the mix.

As stated before in this report, one common obstacles to the implementation of cost-recovery water pricing is the lack of metering infrastructure

Table 5.9 Selected examples of revenue figures collected from environmental taxes for water services

(EUR)	2005	2006	2007	2008	2009	2010	2011	2012
Germany (all Länder)	339 480	289 140	269 330	254 040	–	–	–	–
– Charge for wastewater discharge	339 480	289 140	269 330	254 040	–	–	–	–
France (all agencies)	1 789 300	1 665 800	1 730 400	1 876 200	1 838 700	1 959 600	2 044 700	2 084 000
Spain (ACA)	326 110	336 967	322 127	347 518	366 420	–	–	–
– Canon de l'aigua	326 110	336 967	322 127	347 518	366 420	–	–	–
United Kingdom (EA)	119 400	114 300	184 500	188 900	200 000	200 600	194 300	196 700
– Abstraction charges	119 400	114 300	123 100	123 700	134 200	134 800	131 600	134 500
– Environmental Permitting Regulations Water Quality	–	–	61 400	65 200	65 800	65 800	62 700	62 200
Scotland (SEPA)	12 728	13 940	16 954	18 867	19 452	19 082	19 459	19 929
– Control of Pollution Act discharge application consents	12 466	13 116	–	–	–	–	–	–
– Groundwater regulations	262	302	–	–	–	–	–	–
– WFD	–	522	16 954	18 867	19 452	19 082	19 459	19 929

Note: ACA = Agencia Catalana del Agua; EA = England & Wales Environment Agency; SEPA = Scottish Environment Protection Agency.

Source: EEA.

in the domestic sector, which leads to households being short of incentives to use water wisely. In this case, the cost of installation of water meters represents a deterrent both for the entities responsible for the provision of water services and for their customers. In order to overcome this, it should be ensured that the transition to metering does not imply an imbalance in the financial accounts of service providers while avoiding the issues of affordability for low-income groups. Already at such an early stage, i.e. that of providing the infrastructure necessary for the operation of new water pricing schemes, these conditions pose one of the main obstacles to efficient water pricing: the tension between social objectives and the need for cost recovery.

A first example of the reported barriers to cost recovery is provided in Box 5.3, for domestic water and sanitation tariffs in England and Wales.

The second barrier identified was resistance from stakeholders and users to the rise in water prices. This resistance may in some cases originate from the lack of information, while in others it is a matter of compound social issues. Generally, customers (particularly in the case of households) have at best limited knowledge about the economic instruments set up by water agencies. In Slovenia, this has sparked a debate on whether these initiatives are too ambitious for the country's present context, making reference to the lack of appropriate and reliable data. On the other hand, the general perception that household water demand is inelastic with respect to pricing (Roca Jusmet, 2004) and the notion that water is a basic requirement for life (and so an arbitrary rise in the price of this basic good is socially unjust) both pose uncomfortable political hurdles to the establishment of the cost-recovery principle forwarded by the WFD.

The lack of information mentioned above may be related in part to the lack of cooperation between water management entities (water agencies, decentralised state services, municipalities, etc.), as identified in France, for example.

It is also worth noting the challenges set by remarkable differences in water prices across local communities, an expectable phenomenon in countries where the administration of the water sector is delegated to local and/or regional authorities, but less so when the system is rather centralised. In Slovenia, for example, this disparity in local prices arose from the fact that public utilities had very different price levels at the start of the price control. Some utilities charged prices close to the cost level, while others were well below the costs. Differences in price are often the result of very large differences in local conditions, although different conditions across locations are only partly reflected in water tariffs. For example, (as can be seen in Figure 5.6) in the karstic areas (south-west, central-east), where water is very scarce, the cost of water itself is much higher than in the regions with abundant and easily accessible groundwater (north-east) and/or plenty of rainfall (mountainous areas in the north and north-west).

However, the differences in water supply systems (e.g. in karstic areas, water must be tapped and transported over long distances from sources that are difficult to access) are not fully reflected in the service charges (Figure 5.7), because these are determined by the local public utilities and municipalities, often on a political or socio-economic basis. When this great variability in water prices within a country's boundaries is due to political factors rather than local conditions, it further complicates compliance to the policy requirements at EU level.

Another important hurdle that was identified is the counter-effect of certain subsidies on the achievement of cost-recovery objectives. An example of this is the way that the extension of special subsidies initially designed as temporary relief in unusual circumstances (e.g. extreme weather events) impedes the attainment of cost recovery. In Spain, for instance, there have been cases where the price of electricity is subsidised to support communities dependant on groundwater resources for their subsistence during periods of extreme drought. While this support is necessary during the severe weather period, it could easily develop into an environmentally harmful subsidy if maintained thereafter for political reasons alone.

Furthermore, as previously mentioned, the low cost-recovery levels reported for the agricultural sector across southern countries are often the result of heavy subsidisation (OECD, as cited in Arcadis, 2012).

Another variable for the appropriate implementation of water pricing policies that aim to internalise environmental and resource costs is to what extent compliance with pollution and abstraction charges is enforced. The level of enforcement of existing instruments can be used as a measurement of the political will to achieve the objectives of the WFD.

For example, the lack of progress made in Spain to monitor and prosecute illegal water abstractions has

Box 5.3 Domestic water and sanitation tariffs in England and Wales

Two independent studies — a review on economic instruments at large in England, Wales, and Scotland, commissioned by Defra (NERA, 2006) and a review of charging for household water and sewage services known as the Walker Review (Walker, 2009), jointly commissioned by Defra and the Welsh Assembly government — investigated issues with domestic water and sanitation tariffs and screened charging policies and cost-recovery mechanisms against Article 9 of the WFD respectively.

The combined findings of the reviews indicate the following.

- Water and sanitation charges schemes in England and Wales do not really encourage efficient water use, in part due to the fact that only around 28 % of households in the two countries are metered, and thus the greater proportion have no incentive to use water wisely. The current alternative used to calculate charges for unmetered households — the rateable value system — creates cross-subsidies that result in higher bills for those who remain unmetered (often low-income groups), thereby falling short in both incentives and equality issues.
- Furthermore, opportunities are lost since metering and volumetric charging could address pressures from abstraction and point-source pollution and reinforce the effectiveness of incentives created by the abstraction and discharge charging schemes.

recently been highlighted in the *Blueprint to Safeguard Europe's Water Resources* as a key problem for achieving the objectives of the WFD in the country. The Guadalquivir river basin authority (RBA), for example, has personnel in charge (*guardería fluvial*) of visiting, metering and controlling water abstraction and correct compliance with requirements set out in the water-use license. Nonetheless, monitoring of abstractions — in particular of groundwater — is weak, and registration of groundwater abstraction rights is still incomplete. Though there are likely tens of thousands of illegal water abstractions across the RBD, the administrative process for fines and/or closure is very complex; it has been successfully applied for only some hundreds of illegal abstractions over the last few years, possibly at a lower ratio than the increase of new illegal abstractions, and is often bottlenecked due to political sensitivity and irrigator lobbying. In addition, access to farms to identify illegal abstractions is often impeded when rangers attempt this without court authorisation. Illegal abstraction is considered a minor infringement and fines have a low impact ([32]).

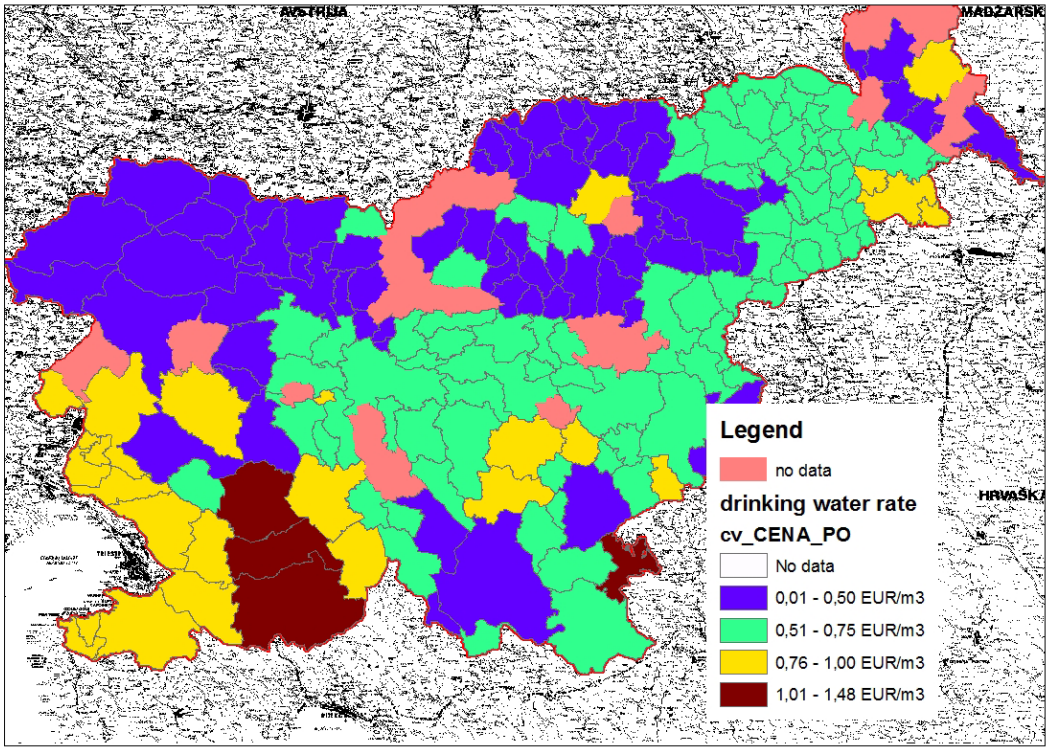
In addition, the French Court of Auditors observes an almost complete failure of preventive legislative measures against polluters. During the last decade, progress has been made in the organisation of the water police. But sanctions are still very low and they have been decreasing: since 2004, 26 % of the controls carried out resulted in an administrative or penal response, but only 1 % led to a sanction. Fines are not dissuasive compared to the economic advantages for the polluter: EUR 1 062 in average for a tort fine and EUR 394 for a contravention ([33]).

Over the period from 1995 to 2012, there were a total of 255 legal cases in the Netherlands on pollution charges, 17 cases on groundwater charges, 50 cases on water system charges and 351 on sewage charges (including predecessor charge types with other names) ([34]). Nevertheless, the total amount of pollution treated by wastewater treatment plants is always higher than the number of pollution units for which a purification charge is paid. This discrepancy (on average about 10 %) can partly be explained by pollution from streets washed away into the sewage system, but there are also cases where the effluent from firms is higher than the amount they pay for the charge ([35]).

In England and Wales, the surplus between expenditures and revenues for both abstraction charges and environmental permits for water quality reported by the EA suggests a high level of enforcement. The same is concluded for Slovenia.

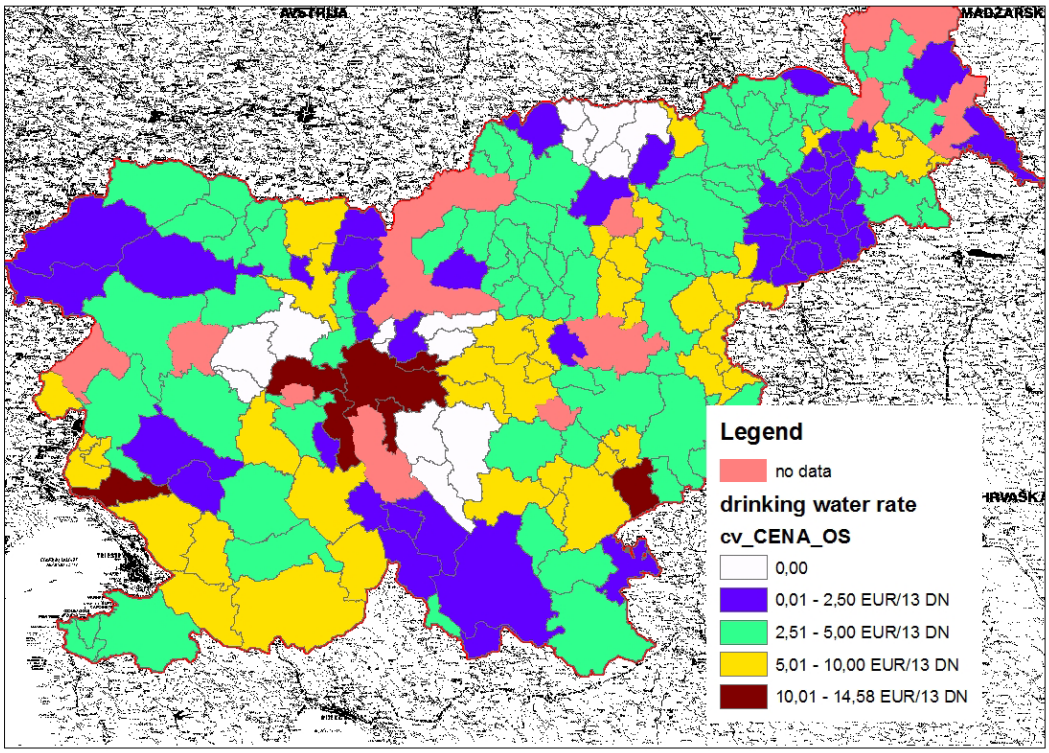
([32]) Arcadis et al. (2012) The role of water pricing and water allocation in agriculture in delivering sustainable water use in Europe. Case Study Spain — Guadalquivir. Final Report to the European Commission, project number 11589, February 2012, p. 72.
([33]) Cour des Comptes (2010) 'Les instruments de la gestion durable de l'eau' (see http://wwf-ue-2008.org/download/38).
([34]) These numbers were found using the charge type names as search terms on the website: see http://www.rechtspraak.nl.
([35]) Hoogheemraadschap Hollands Noorderkwartier (2012), Onderzoek effectiviteit zuiveringsheffing HHNK (see http://www.hhnk.nl/bestuur_en/bestuur/bestuur/rekenkamercommissie).

Figure 5.6 Map of water prices in Slovenia, per cubic metre (2012)



Source: The Surveying and Mapping Authority of the Republic of Slovenia. The layer showing the data was produced by Oikos on the basis of data from water utilities websites and reports of public utilities and concessionaires.

Figure 5.7 Map of water supply service charges in Slovenia, per household per month (2012)



Source: The Surveying and Mapping Authority of the Republic of Slovenia. The layer showing the data was produced by Oikos on the basis of data from water utilities websites and reports of public utilities and concessionaires.

5.3 Do existing water pricing schemes provide an 'incentive' for more efficient water use?

5.3.1 The domestic sector

While the incentive structures of water and sanitation charge schemes are currently being disputed in England, France, Germany and Wales, other countries have seen substantial increases in the water prices in the past, like Hungary in the 1990s and Spain in the last decade. These countries have exhibited changes in consumption levels that closely resemble the desired (level of incentive) effects that could have been envisaged from such drastic changes in water pricing. Nonetheless, isolating the influence of water pricing on the consumption habits of a population and neglecting the effects in the individual context of each country among other changing factors, could be considered unwise.

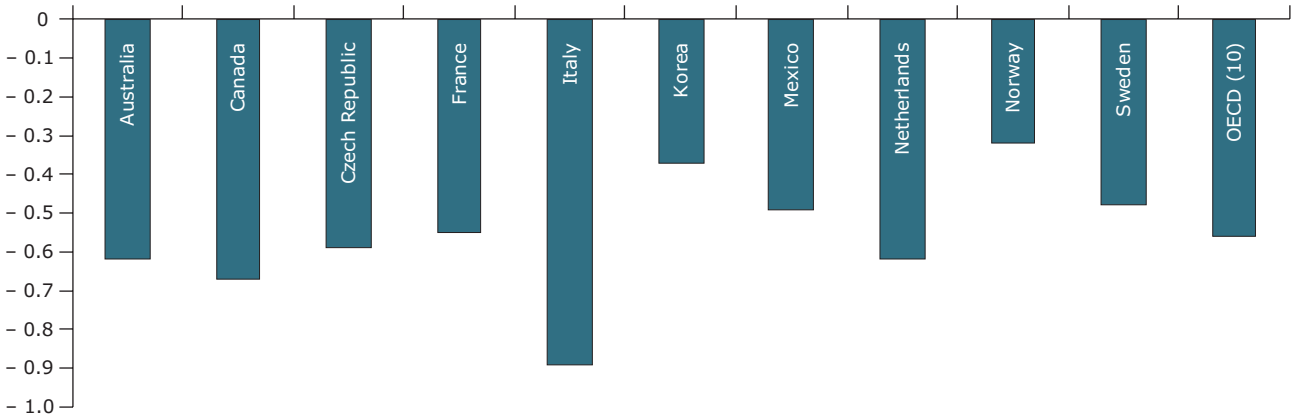
The first question to be answered, in fact, is whether water consumption is actually reactive to price changes, in other words, whether water demand is elastic with respect to price changes. An overview of price elasticity of the demand for urban water is provided in Table 5.10.

Table 5.10 indicates that price elasticity of water demand might be extremely variable from one country to the other. However, on average, elasticity values seem to be quite low, as coefficients range between – 0.10 and – 0.40 in most of these countries. Furthermore, the cases of Cyprus, Greece and Tunisia suggest that two factors have a major influence on price elasticity: the amount of water used (large consumers are definitely more reactive to price changes than small consumers), and the income levels of consumers.

The price elasticity of urban water demand has been the focus of a major volume of economic literature. Probably the most comprehensive review on the topic is that of Grafton et al. (2009) who, through the analysis of OECD survey data from about 1 600 households in 10 countries, studied the determinants of residential water demand. Results of the study show that in every country, price elasticity is negative and statistically significant. Figure 5.8 summarises the price elasticities of urban water demand as found in the study.

According to the analysed data, it was confirmed that price elasticity of demand is inelastic ([36]) although firstly, it is statistically significant from zero in all countries, and secondly, demand is clearly responsive to change in prices (average price elasticity of about – 0.5). The study concludes that households not facing volumetric water charges consume about a third more water than similar households that do incur such charges.

Figure 5.8 Price elasticity of water demand in selected OECD countries



Source: Grafton et al., 2009.

([36]) Please note that as Olmstead and Stavins (2007) point out, 'there is a critical distinction between the technical term 'inelastic demand' and the phrase 'unresponsive to price'. Inelastic demand will decrease by less than one percent (quantity m^3) for every one percent increase in price. In contrast, if demand is truly unresponsive to price, the same quantity of water will be demanded at any price. This may be true in theory for a subsistence quantity of drinking water, but it has not been observed for water demand in general in 50 years of published empirical analysis'.

Table 5.10 Price elasticity of urban water demand in some EU and non-EU countries

Country	Region	Method	Elasticity of demand for water	Notes	Sources
Spain	North-west	Regression (OLS)	– 0.14 to – 0.17	1993–1999	(Martinez-Espiñeira, 2000)
		Marginal price	– 0.34	Beyond a minimum	
			– 0.20	Consumption in summer	
France	Gironde	Regression (OLS)	– 0.17	1975	Point (1993) in (Nauges, 1999)
	Country	Regression (OLS)	– 0.10 to – 0.20*	1975–1980– 1985–	(Boistard, 1993)
			– 0.25 to – 0.35**	1990	
	Country	Regression (OLS)	– 0.12	1989	(Pouquet and Ragot, 1997)
			– 0.32*–0.31**	1995	
	Yerres Basin	Regression (IV)	– 0.31	1995	(Le Coz, 1998)
	Gironde	Regression (IV)	– 0.08	1990 to 1994	(Nauges et al., 1998)
	Moselle	Regression (IV)	– 0.22	1989–1993	(Azomahou, 2000)
		Regression (Panel)	– 0.23	1989–1993	
Greece	Athens	Chronological regression series (macro elasticity)	– 0.4 small consumers	'Consumption Band < 15 m^3'	(Ghini, 2000)
			– 0.8 large consumers	> 60 m^3	
Tunisia		Regression	Lower block: – 0.06 to – 0.15 (country: – 0.08)	'Consumption Bands < 70 m^3'	(Matoussi and baranzini, 1998)
			Higher block: – 0.28 to – 0.91 (country: – 0.58	'Consumption Bands > 70 m^3'	
Cyprus		Water demand model	– 0.79 (for the lowest 10 % of incomes)		(Hajispyrou et al., 2001b)
			– 0.39 (for the highest 10 % of incomes)		

Notes: * in the short term (2 to 3 years), ** in the long term (5 to 10 years); OLS = Ordinary least squares, IV = Instrumental variables.

Source: See http://planbleu.org/en.

Attitudinal characteristics do not have a statistically significant effect on total water consumption but do increase the probability of undertaking some water-saving behaviours, as does a volumetric water charge.

These results are in line with other reviews in the topic. For example, Dalhuisen et al. (2003) present a comprehensive meta-analysis of 64 American econometric studies, estimating a mean price elasticity of – 0.41. Hoffman et al. (2006) conducted a panel data study of urban water demand in Brisbane (Australia), estimating a contemporaneous price elasticity of between – 0.67 and – 0.55. A panel data study by Xayavong et al. (2008) in Perth (Australia) estimated an indoor elasticity of between – 0.70 and – 0.94, and an outdoor elasticity of between – 1.30 and – 1.45. A study by Graham and Scot (1997) estimated the price elasticity of residential water demand in the Australian Capital Territory (ACT) region to be in the range of – 0.15 to – 0.39.

In conclusion, increasing water tariffs to recover costs through water pricing appears to be a highly effective instrument to manage residential water demand (Grafton et al., 2009). Demand is inelastic for some urban uses, especially consumptive (households), and elastic for other uses (especially recreational: gardening, swimming pools, etc.). The literature highlights the fact that volumetric variable

pricing mechanisms are the best signal to maximise water-use efficiency in urban areas.

5.3.2 The agriculture sector

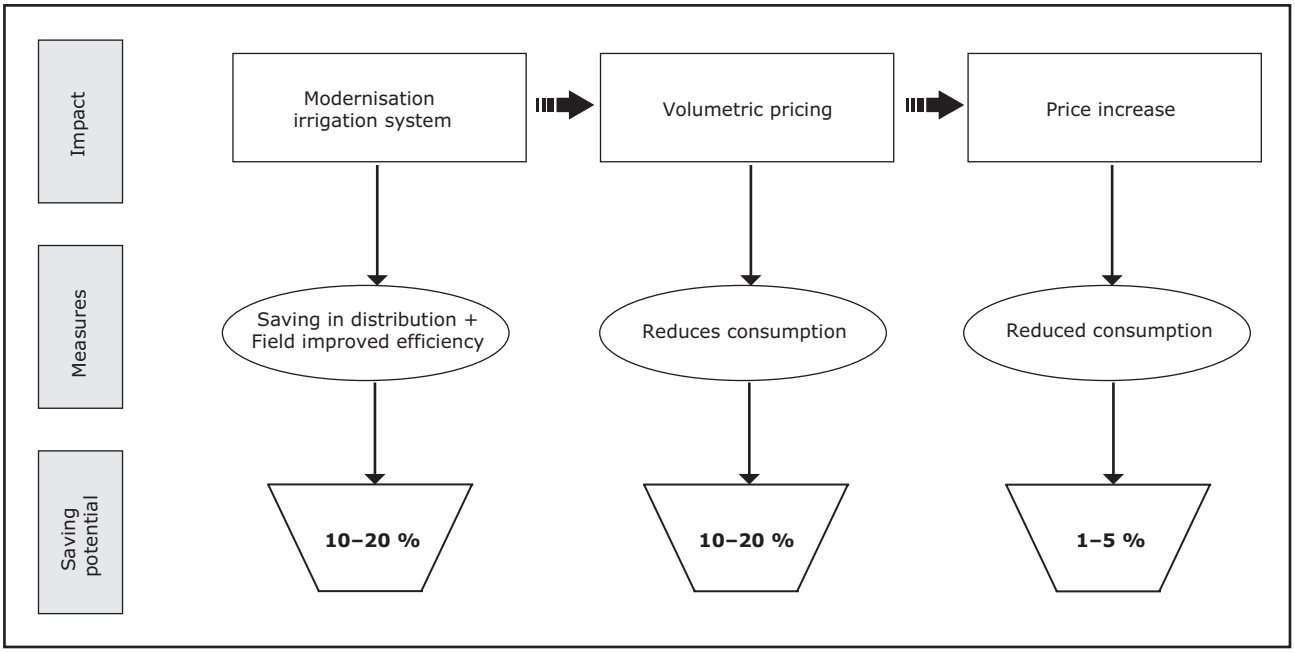
In the case of irrigation water, it is a commonly held view that underpricing is the major cause of waste, and that increasing irrigation water prices will lead to a reduction in the volume of water used in agriculture (see, for example, Wolfehnsohn, Cosgrove and Rijsberman, and WWF), as cited in Molle and Berkoff (2007)). The review presented in Chapter 5, shows that in many EU Member States, irrigation water prices are still well below the levels required to achieve financial cost recovery, not to mention environmental and resource cost. The question to be answered is whether irrigation water demand is actually reactive to price changes and, as a consequence, whether existing price levels provide an incentive for over-consumption.

Existing studies argue that the causal relationship between low prices and waste seems weak, especially in those countries or RBDs with inefficient conveyance infrastructures and/or inefficient tariff structures (i.e. flat tariffs rather than volumetric tariffs). In the Guadalquivir basin, for example, it was shown that technical measures aimed at the modernisation of the irrigation system, followed by the implementation of volumetric pricing, have a much higher water-saving potential than simple flat rate price increases, as shown in Figure 5.9 (Strosser et al., 2007).

The graph highlights firstly that regardless of pricing levels, the structure of the water tariff per se (volumetric pricing versus flat rates) can provide an incentive for a more efficient water use: in this river basin, in fact, farmers paying a flat rate use on average 10 % to 20 % more water than farmers paying a volumetric rate. Flat rates are still quite common in the EU, thus providing no incentive for efficient water use.

In contrast, the question of whether demand for irrigation water is reactive to price changes is complex and more controversial, and authors do not always agree on the matter. According to some studies (Rieu, as cited in OECD, 2010b; de Fraiture and Perry, 2007), elasticity largely depends on price ranges: at low prices, demand is unresponsive to prices, which are hence not the determining factor influencing application techniques or water application technology choices. After a certain threshold, however, demand becomes elastic — but if the price keeps increasing at a certain threshold, it will turn inelastic again, as water quantities used approach the minimum needed for plant growth (Figure 5.10).

Figure 5.9 Measures, impact and saving potential in the Guadalquivir basin



Source: Strosser et al., 2007.

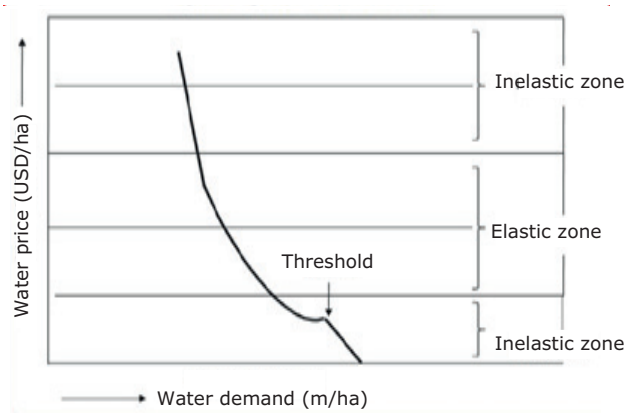
In general, it was observed that the elasticity of demand for irrigation water at current rates is low or negligible (de Fraiture and Perry, 2007). Price ranges, however, are not the only determinant of demand elasticity, as other factor come into play, discussed below.

- Elasticity is generally low when the water bill accounts only for a small share of the total production costs or income (Rieu, as cited in EEA, 2009). A study by Bos and Wolters (as cited in Molle and Merkoff, 2007) reviewed irrigation projects where water charges amounted to less than 10 % of net farm income, and were found to be 'too low to have a significant impact'.

- Elasticity is generally low when alternative crops or irrigation techniques are not available due to technical, social or economical constraints (Rieu, as cited in EEA, 2009). In the Duero region in Spain, for example, where limited crop types are available, it was found that price increases can have an impact on water demand only if farmers' incomes decrease by 25 % to 40 % (Gomez-Limon et al., as cited in EEA, 2009).

- When water efficiency is already high (e.g. high-value crops) there is no possibility of reducing water use, so higher prices will only affect farmers' incomes (Berbel et al., 2007).

Figure 5.10 Agricultural water demand curve



Source: EEA based on de Fraiture and Perry, 2007.

5.3.3 Evidence from the EU Member States' review

A review of the situation in the selected EU Member States highlights that limited adjustments have been carried out in recent years in pricing schemes currently applied in the EU. When rising water prices have coincided with reductions in water-use levels in different sectors, it is unclear whether changes in water prices were the main factor explaining such trends in water use. During this review, it proved difficult to obtain evidence from EU Member States. The evidence collected is succinctly summarised per country below.

England and Wales

Water and sanitation charges schemes for the domestic sector in England and Wales have not been found to provide significant incentives for efficient water use. The principal reason for this is that most households still remain unmetered (Walker, 2009). The same holds true for the case of abstraction charges, especially in the agricultural sector. In general, although the framework for abstraction charges ensures water supply at low administrative cost, it fails to allocate water appropriately and promote efficient use (Cave, 2009). Discharge consents are issued on a first come, first served basis and charges are based on output concentrations rather than actual conditions in the receiving water, failing to ensure that wastewater is treated or released properly (Cave, 2009).

Scotland

Given the existing fixed rate scheme for domestic water use in Scotland, there are no incentives to reduce water consumption which stem from water pricing. Households can opt to have a water meter installed, but this is done at their own expense and thus is financially unattractive for most households ([37]). On the other hand, non-domestic water users do pay a volumetric rate for drinking water and thus have an incentive to reduce their use. The introduction of competition in the water retail sector has allegedly led to improvements in water efficiency. According to the WICS *Annual Report 2010–11* ([38]), awareness among commercial users on the economic benefits of water efficiency has increased and led to involvement in reuse schemes. Regarding the agricultural and industrial sectors, the volumetric component of the

([37]) See http://www.waterbriefing.org/index.php/home/water-issues/item/3648-waterwatch-scotland-calls-for-rethink-on-domestic-water-meters.
([38]) SG/2011/94. See http://www.watercommission.co.uk/UserFiles/Documents/WICS_AnnualReport_26May%20(3).pdf.

abstraction charge provides a minor incentive for both, while the volume and contents factors of the effluent charges provide incentives for the latter.

A further incentive promoting the sustainable management of the public water supply has been introduced through the Water Services (Scotland) Act 2005. Section 29E sets out that where a customer can take action which reduces the costs for Scottish Water, the customer should share in the benefits ([39]).

Netherlands

Price elasticities for water demand by households are known to be low (about – 0.4) (Dalhuisen et al., 2003). The tax on piped water, which amounts to about 10 % of the water price for households, can thus be expected to reduce water consumption by about 4 %; however, there have been no studies producing evidence on the effectiveness of the tax. Water use by industry is not affected by the tax on piped water, since it only applies to the first 300 m^3 per connection. In this case, the water pollution charge has been an effective instrument in reducing industrial water pollution in the past (Bressers et al., 2002). Lastly, there are no known incentives for the reduction of agricultural water use.

France

Even though charges for abstraction and for pollution with domestic origin are included in water bills and are related to the consumed volume of water, consumers are generally uninformed of these charges. Conversely, the observed decrease in domestic water consumption levels in France appears to be more a result of increased environmental awareness of the population than a result of the efficiency of charges (Cour des Comptes, 2010). Despite the increase in water charges during the last decade, these are considered low at farm level, limiting the incentive to change the current agricultural practices. The measures implemented so far have been unsuccessful in influencing the agricultural sector, especially those programmes aiming to reduce pollution levels from agricultural discharges. These have faced numerous difficulties: dead weight effects, slow progress, low extension of concerned areas, lack of monitoring, etc. (Cour des Comptes, 2010). Industrial activities may be concerned either with the charge for pollution with non-domestic origin, or with the charge for pollution with domestic origin. It depends on the amount of pollutants present in the wastewater. Pollution thresholds are too high. Thus, many small industries do not pay charges for pollution of non-domestic origin, but do pay for pollution of domestic origin. The last charge does not depend on the quality of wastewater, and small industries are therefore not incited to reduce their emissions (Cour des Comptes, 2010).

Germany

The combination of basic fees and volumetric fees serves to provide consistent income for the water utilities, the majority of whose costs arise from capital investment, and at the same time provides an incentive to conserve water through the price on marginal consumption. The security of supply and water quality have major significance for water customers and the collected water prices are considered appropriate by the majority of customers (Branchenbild, 2011). Knowledge about the price level is, however, limited: only 3 of 10 people interviewed estimated the costs correctly (between EUR 1 and EUR 3 per 1 000 litres). About 27 % estimated the costs to be higher than EUR 3, and 39 % could not comment ([40]). Based on this low price awareness, the incentive function of water fees and prices may be doubted.

Neumüller (2000) estimates that the introduction of the water abstraction charge (WAC) led to a reduction of specific water use between 1.8 and 3.6 litres per person and day. This corresponds to approximately 14 % to 28 % of the total water savings, which reached 13 litres per person per day (Neumüller, 2000).

Ultimately, the effectiveness of water abstraction charges on private water usage is determined as being low. Low price elasticity for private consumers was identified as a main reason. Especially for very low charges as charged in various *Bundesländer*, no quantifiable impact on water usage is expected; for this purpose, charges would have to be higher. Based on very different water prices and consumption on the national level, price elasticity at the regional level may differ, resulting in varying incentives. For industry, on the other hand, higher price elasticity is assumed, and therefore a higher consumption decline may result also from lower charges (Gawel et al., 2011).

([39]) River Basin Management Plan for Scotland.

([40]) Results of the study 'Qualität und Image von Trinkwasser in Deutschland' conducted by I.E.S.K. — Institut für empirische Sozial- und Kommunikationsforschung e.V. — since March 2007, presented by VKU (see http://www.vku.de/wasser/ergebnisse-der-tw-imagestudie.html).

Due to low charges, the effectiveness of the Charge for Wastewater Discharge (AbwAG) is critically evaluated in the literature with regard to potential dynamic incentives. Jass (1990) showed for the paper industry in Germany that the charges under the Wastewater Ddischarge Law is of less importance for the further reduction of emissions beyond regulatory limits (Jass, 1990).

Slovenia
Some of the communal services have promotional activities on the smart use of water. Most of the households in Slovenia are metered, but in apartment buildings the cost is equally shared among the households regardless of consumption. At the moment there are no incentives to switch to individual household metering in apartment buildings: there are no legal obligations and the cost of water supply is still relatively small despite large regional and local differences. However, it is becoming an important cost for consumers, as is evident in the design of the newer apartment buildings — most (at least from mid 2000s) have individual metering because this is preferred by the buyers. According to the Stat Office there are more than 1 000 water supply systems covering more than 90 % of the inhabitants. Many of these systems (there are no reliable data, but probably about a third) are very small and often unmetered, supplying groups of rural households (up to 50 people) in poorly accessible areas. However, these unmetered households represent only a tiny fraction of the population. Here, the regional variations in price elasticity play a more important role, given the significant variability of water prices across regions.

Spain
While a number of drivers (water metering, increased awareness and access to water-saving devices) could be responsible for the uninterrupted decline in domestic water demand observed in Spain between 2004 and 2009, a correlation with the steady increase in prices appears plausible. The gradual increase in water prices set off by the transposition of the WFD (average household water prices rose from 0.73 EUR/m^3 to 1.42 EUR/m^3 between 2000 and 2009) coincides with the reduction in consumption between 2004 and 2009 (falling from 171 to 149 litres per capita per day).

The principle of cost recovery is said to have a 'heterogeneous impact' in the water-use levels of Spain's agricultural sector. This is explained by describing price elasticity as a variable which is dependent on resource availability and further affected by crop type (referring to crop value). For instance, higher water prices in water-rich areas may result in moderate reductions in the amounts of water used, while the impact of water prices in water-scarce areas is minor. Additionally, since the prices of inputs become less significant as the crop's value increases, the type of crop selected also has a direct effect on the influence of cost-recovery measures.

5.4 How do water pricing schemes account for social concerns?

5.4.1 Affordability of water services

Generally, it was found that in each of the examined EU Member States, the issue of ensuring access to water for those in precarious economic situations is taken into account. Water authorities in some of these countries perform periodical pricing studies which commonly integrate ratios comparing the average family income to the expense allocated to the water bill. An example of this at the regional level is the *Observatori Preu* (price observatory) which is published by the Agència Catalana de l'Aigua (ACA) of the autonomous community of Catalonia (Spain) yearly, and in which the approved tariffs for the year are presented and disaggregated based on different consumption scenarios. Given that the ACA is part of the committee that approves the prices of water services in Catalonia, the integration of this ratio in the observatory document suggests that the impact of the water bill in the average family's budget is taken into account during the approval process.

Since the means of achieving affordability are not dictated by legislation at the EU level, access to water services is ensured in a variety of modes across Europe (e.g. via reductions in service charges, social welfare allowances earmarked for the payment of water services, water charges pegged to the value of the house and special tariffs). In the Netherlands, for example, most municipalities provide the possibility of a sewage charge remission for households that cannot afford to pay it. For low-income households, a remission is also possible for the purification, pollution and water system charges. In Germany, people with no or low income get support from social welfare that usually includes an allowance for the cost for water service (Kraemer et al., 2009). Water charges for households in Scotland are levied according to Council Tax Bands, with rates increasing with the value of the dwelling. In England and Wales, affordability of water services is ensured to low-income metered customers with a high essential use of water by the Government's

national WaterSure tariff. This mechanism caps the bills of these customers in receipt of a qualifying means-tested benefit for the average bill for their company. The additional costs of providing the service to the qualifying households, not entirely covered by the bill, are cross-subsidised by other water customers. The hidden disadvantage of these cross-subsidies is the fact that they actually increase the burden of other low-income groups, since they originate from the rateable value system, which is the scheme applied to unmetered (often low-income) customers (Walker, 2009).

While some national legislations clearly specify the means to achieve affordability (i.e. stating that affordability needs to be taken into account and defining the mechanism to do so), other countries have left this question unaddressed. In France, there are no social tariffs and the affordability of water services is dealt with through separate social policy (Ooisterhuis et al., 2012). According to law ([41]), all persons or households with difficulties due to a precarious situation may benefit from collective support in order to access or maintain the access to drinking water, energy, and telephone services. Similarly, Article 111 of the Spanish Water Act states that the social, environmental and economic consequences of the application of the cost-recovery principle will be taken into account. It also affirms that considerations will be made for those segments of the population affected by special geographic and climatic conditions of the territory they inhabit, as long as the established environmental objectives are not compromised. How exactly this is to be done, however, is not expalined in the article.

Table 5.11 presents the different affordability levels (as a percentage of disposable household income) reported for the selected EU Member States investigated in this study.

5.4.2 Focus on subsidies and exemptions

Subsidies and exemptions are in place in all reviewed countries, and can be distinguished according to their main purpose, as explained below.

- **Subsidies for water operators and infrastructure owners**

  These subsidies refer to funds raised by the EU and national/regional/local governments through the tax base, which are subsequently diverted to the WSS sector. The OECD defines subsidies in this context as 'a fiscal transfer to an organisation, or to specific users or services, in a situation where the provider has a degree of operational autonomy, commercial orientation, and financial transparency — in short, where the service is normally expected to recover its costs, however they are defined' (OECD, 2009, 41). While subsidies or grants are the most visible form of tax funds directed to the WSS sector, 'hidden' forms of subsidies may include tax rebates, soft loans (i.e. at a subsidised interest rate), transfers from local government housing taxes, donations, subsidised services (e.g. electricity) or 'dormant' equity investments. Due to the decentralised nature of WSS service planning, provision, monitoring and governance, this information is frequently hard to track (Trémolet and Rama, 2012). Subsidies can be targeted at local or national water operators and infrastructure owners.

- **Exemptions for activities with limited impact on the water system**

  Exemptions from abstraction and pollution charges exist in most of the reviewed countries, as do target specific activities with a limited environmental impact of abstraction/pollution levels below specific thresholds. For example, in England and Wales, water abstractors using under 20 m^3 per day are not required to have a licence and pay abstraction charges, and the same applies to abstraction for direct use in electricity production in generating stations with a capacity up to 5 MW. Similarly, the German effluent tax does not apply in some particular circumstances (e.g. untreated wastewater that is removed from a waterbody, and subsequently returned to a waterbody in an unpolluted state).

- **Exemptions and subsidies with social equity objectives**

  These types of exemptions and subsidies are normally applied to water and sanitation tariffs, and are aimed at ensuring affordable water services to more vulnerable social groups (for more detail, see Section 5.4.1 on affordability). Among the reviewed EU Member States, four of seven countries have some mechanisms in place to ensure access to water services to all income groups.

([41]) See http://www.legifrance.gouv.fr/affichCodeArticle.do?idArticle=LEGIARTI000006796470&cidTexte=LEGITEXT000006074069.

Table 5.11 Affordability levels of drinking water supply, and sewage and wastewater treatment services in various European countries (percentage of disposable household income)

Country	Affordability for the household sector (% of disposable income)		
	Drinking water supply	Sewage and wastewater	Year
England and Wales	1.09	1.21	2009/2010
Scotland	0.96 ([a])		2010/2011
Netherlands	0.6	~ 1.00	2009; nd
France	0.42	0.38	2009/2010 ([b])
Germany	0.55	0.68	2010
Slovenia	1.4	0.2	n.d.
Spain (Catalonia)	0.52 ([c])		2010

Note: ([a]) Calculations based on the aggregated fees for drinking water and sewage/wastewater.

([b]) Affordability has been stable since 1996. Conseil d'etat (2010) L'eau et son droit. See http://www.conseil-etat.fr/media/document/eau_droit_rapport.pdf.

([c]) Calculations based on the aggregated fees for drinking water and sewage for Catalonia.

Sources: EEA based on national sources, as indicated below.

- England and Wales:
  — OFWAT, 2012. Customer charges data 2010–2011 (see http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-250794).
- Scotland:
  — See http://www.ons.gov.uk/ons/dcp171776_270749.pdf and http://www.gro-scotland.gov.uk/files2/stats/high-level-summary/j11198/j1119818.htm.
  — See http://www.scottishwater.co.uk/assets/about%20us/files/key%20publications/annual_report_accounts_201112.pdf.
- Netherlands:
  — VEWIN (2010), Reflections on performance 2009 (see http://www.vewin.nl/SiteCollectionDocuments/Publicaties/Overige%20Vewin-uitgaven/2010/Reflections%20on%20performance%202009.pdf).
- France:
  — CONSEIL D'ETAT (2010) L'eau et son droit (see http://www.conseil-etat.fr/media/document/eau_droit_rapport.pdf).
- Germany:
  — Data for 2010, calculated for a year (see https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/EinkommenKonsumLebensbedingungen/EinkommenEinnahmenAusgaben/Tabellen/Deutschland.html).
- Slovenia:
  — Statistical Office of the Republic of Slovenia (SORS) (see http://www.stat.si/eng/drz_stat.asp).
  — Websites of various public utilities.
- Spain:
  — ACA (2012) Preu de l'aigua a Catalunya 2012. Observatori del preu de l'aigua. Coordination and Strategic Analysis Department, March 2012.

- **Exemptions and subsidies with environmental improvement objectives**

  This category includes those instruments aimed at promoting good practices with positive environmental outcomes through the provision of a financial incentive, in the form of either tax reductions or grant/compensation payments. In Scotland and Germany, for example, some activities delivering positive outcomes (e.g. environmental services) are awarded a reduction in pollution taxes. In England and Wales, innovative catchment and land use-based grant schemes are in place to protect and enhance the environment, targeting farming activities.

- **Exemptions and subsidies with water efficiency objectives**

  This group of instruments is aimed at promoting water efficiency in different economic sectors, reducing consumption both in times of 'regular' water availability and in water-scarce periods. This category differs from the previous one in that it includes instruments specifically targeting water efficiency and quantity objectives, whereas instruments in the previous category are aimed at achieving a variety of environmental objectives (e.g. diffuse pollution). Although such instruments are known to be in place in southern European

countries, in the review conducted under this project, only one case of actual application was found, namely the MIA/Vamil fiscal scheme ([42]) in the Netherlands, promoting both water efficiency and pollution reduction.

An overview of existing exemptions and subsidies for the reviewed countries is provided in Table 5.12.

While support schemes like subsidies and exemptions from water charges and taxes can play an important social and political role in times of crisis (especially in water-scarce regions), when managed irresponsibly, they can have large-scale negative impacts on the environment, and prevent efficient resource use and allocation. The market distortions created by these mechanisms are detrimental to the effectiveness of water pricing policies geared towards the achievement of cost recovery and the PPP.

In order to counter the distortion effects of support schemes, their design should include a thorough assessment of the indirect impacts these may have on other policies. While this is a complex endeavour, the risks inherent in neglecting possible undesired effects can prove costly in the long term — both in political and economic terms. This is not the case, however, with exemptions and subsidies with environmental objectives and, in particular, with those grant schemes designed to promote sound land-use management and production/ maintenance of ecosystem services at the catchment or territorial scale. These schemes are in fact aimed at tackling several environmental issues (including pollution, erosion and landscape degradation) through an integrated, territory-based approach. As previously mentioned, examples can be found in England, where the Catchment Sensitive Farming (described in detail in Box 5.4) and Environmental Stewardship Programme are in place, and in Wales (Glastir programme). These schemes are particularly interesting because farmers are compensated for the ecosystem services delivered by the use of good land management practices — this reflects characteristics typical of Payment for Ecosystem Services (PES) schemes, although this cannot be properly considered such a scheme, as the payments come from a public source.

The long process of 'greening' the EU Common Agricultural Policy (CAP) is a good example of the level of importance and complexity of conducting such an assessment and policy reformulation.

The proposals recognise the importance of water protection issues as central to adaptation and to the maintenance of competitive and sustainable agriculture. Water is one of six overarching priorities for rural development (Pillar 2) ([43]), and the so-called green payments (Articles 30 to 33) under the direct payments regulation (Pillar 1) ([44]) which would account for 30 % of direct payments, are potentially significant for water protection. A number of opportunities to fund water protection measures are available. The green payments under Pillar 1 would support crop diversification, permanent grassland and ecological focus areas. The rural development regulation enables the funding of a wider range of measures that can support water protection. The requirements for cross-compliance include taking into account the WFD, and increase emphasis on soil management measures, intrinsically linked to water management.

The potential measures could have significant beneficial effects on water protection, depending on their design and funding allocations. The requirements for the green payment measures, however, are not clearly outlined, including, for example, the types of crops covered and rotation requirements under the crop diversification measure or the types of areas, their location and temporal continuity in the ecological focus areas. In some cases, the definitions are not ambitious enough — the Good Agricultural and Environmental Conditions (GAECs) standard ([45]) on buffer strips, for instance, includes no limitations on pesticide use or requirements for width or type of planting. Also, the green payments, for example, no longer include the 'green cover' measure which plays a key role in reducing erosion and nutrient loading to waters.

Improved safeguards are required to ensure that some measures are not used in counterproductive ways by encouraging unsustainable use of water. For example, investments in irrigation are allowed

([42]) See http://www.iepd.iipnetwork.org/policy/fiscal-schemes-environmentally-friendly-investment-mia-and-vamil.
([43]) See COM(2011) 627/3 — Proposal for a Regulation of the European Parliament and the Council on support for rural development by the European Agricultural Fund for Rural Development.
([44]) See COM (2011) 625/3 — Proposal for a Regulation of the European Parliament and the Council establishing rules for direct payments to farmers under support schemes within the framework of the common agricultural policy.
([45]) See http://marswiki.jrc.ec.europa.eu/wikicap/index.php/Good_Agricultural_and_Environmental_Conditions_(GAEC).

Table 5.12 Summary of exemptions and subsidies reported in the reviewed countries

Country	Exemptions for limited pressures (thresholds for consumption and pollution levels)	E/S with social equity objectives	E/S with environmental improvement objectives	E/S with water efficiency objectives
England and Wales	Exemptions from abstraction charges Exemptions from Environmental Permitting charges for water quality	WaterSure scheme Resolve scheme (Yorkshire Water) Assist tariff (Wessex Water)	Catchment sensitive farming (England) Environmental Stewardship (England) Glastir (Wales)	–
Scotland	–	Discounts on water and wastewater charges for low-income households Cross-subsidies among domestic users (variable rates)	Reduction of pollution charges for a number of activities (e.g. environmental services)	–
Netherlands	–	Remission of wastewater tariffs, purification, pollution and water service charges for low-income households	MIA/VAMIL fiscal scheme — subsidies for innovative technologies aimed at water efficiency improvement and water pollution reduction	MIA/Vamil fiscal scheme
France	Exemptions from pollution charges	–	–	–
Germany	Exemptions from abstraction charges Exemptions from effluent tax	–	Subsidies (in the form of exemption from effluent tax) for the construction of sewage treatment plants and connected facilities	–
Slovenia	Exemptions from abstraction and environmental charges/ taxes	–	–	–
Spain ([a])	Discounts on water tax and consumptions tariffs in households with or more people	Solidarity Fund of the Agbar Foundation targeting low-income households (water tariffs). Socially responsible water rate (water tariffs)	–	–

Note: ([a]) Exemptions and subsidies reported here refer to the Barcelona area, and are thus not necessarily representative of the whole country.

Sources: EEA based on national data, as follows:

- England and Wales:
  — EA, Abstraction charges scheme 2012–2013 (see http://www.environment-agency.gov.uk/business/regulation/38809.aspx).
  — EA, EP charges scheme and guidance 2012 (see; http://www.environment-agency.gov.uk/business/topics/water/117481.aspx; http://www.businesslink.gov.uk/bdotg/action/detail?itemId=1083648236&type=RESOURCES; http://www.naturalengland.org.uk/ourwork/farming/csf/cgs/default.aspx; http://www.businesslink.gov.uk/bdotg/action/detail?itemId=1083649292&r.i=1083648236&r.l1=1081597476&r.l2=1082184851&r.l3=1083731942&r.l4=1083637700&r.s=sc&r.t=RESOURCES&type=RESOURCES; http://www.defra.gov.uk/food-farm/land-manage/stewardship).
- Scotland:
  — See http://www.scottishwater.co.uk/you-and-your-home/your-charges/2012-2013-charges/unmetered-charges.
- Netherlands:
  — Remission: Article 26 of the Invorderingswet 1990 (see http://wetten.overheid.nl/BWBR0004770/geldigheidsdatum_24-04-2013#HoofdstukIV_Afdeling3_Artikel26).
  — MIA/VAMIL scheme: Agentschap NL (see http://www.agentschapnl.nl/programmas-regelingen/over-de-regeling-miavamil).

- France:
  — Agence de l'eau Loire-Bretagne (2010) Les redevances dans le bassin Loire-Bretagne: Cas des usages domestiques (see http://www.eau-loire-bretagne.fr/nos_missions/redevances/plqt-poll-dom.pdf).
- Germany:
  — Law on Effluent Taxes (2010): Abwasserabgabengesetz in der Fassung der Bekanntmachung vom 18. Januar 2005 (BGBl. I S. 114), das zuletzt durch Artikel 1 des Gesetzes vom 11. August 2010 (BGBl. I S. 1163) geändert worden ist (see http://www.gesetze-im-internet.de/abwag/index.html).
  — Gawel et al. (2011): Weiterentwicklung von Abwasserabgabe und Wasserentnahmeentgelten zu einer umfassender Wassernutzungsabgabe. Dessau-Roßlau: Umweltbundesamt (Federal Envrionment Agency).
- Slovenia:
  — Environment Agency (see http://www.arso.gov.si/en).
  — Ministry of the Agriculture and the Environment (see http://www.mko.gov.si).
- Spain:
  — Aigües de Barcelona. Bonificaciones (see http://www.aiguesdebarcelona.cat/esp/servicio/facturas_tarifas/bonificaciones.asp).
  — ACA. El cànon social (see http://aca-web.gencat.cat/aca/appmanager/aca/aca?_nfpb=true&_pageLabel=P38400132501315551642515).

when at least 25 % savings are achieved, but it is not specified if the savings need to be returned to the environment or can be used by other sectors or in other places. Obviously, the actual impact of the measure will be dependent on this point. Crop-specific payments for cotton in four countries (Articles 42 to 44 of the Pillar 2 regulation) are problematic: cotton requires significant irrigation, and the measure could hamper adaptation to water scarcity. Once the implementing regulations are proposed, a better assessment can be made to ascertain whether sufficient safeguards have been put in place.

A number of funding provisions may be problematic and limit the ability of the CAP to deliver on environmental objectives, including water protection. The proposal to allow EU Member States to transfer up to 10 % of funding to rural development actions is beneficial, as is the provision that 12 Member States could transfer up to 5 % of rural development funding into Pillar 1. This provision moves funding away from targeted spending, thus reducing options for water management. It is also problematic because the EU Member States involved already have important water difficulties (diffuse pollution or water scarcity) or important areas of extensive agricultural production under risk for intensification.

Moreover, the actual allocation of funding within Pillar 2 may jeopardise funds available for water protection. Currently, the recitals to the proposals (not legally binding) require that EU Member States allocate 25 % of the Pillar 2 funds funding to 'climate change mitigation and adaptation and land management, through the agri-environment-climate, organic farming and payments to areas facing natural or other specific constraints measures'. If this is not retained as a legally binding requirement, the available funding could nominally be significantly less compared to the 2007–2013 period. It is also not clear if this requirement would also include certain climate-relevant measures not related to land management, thus further reducing the budget for water protection measures.

In terms of procedural requirements, the strengths, weaknesses, opportunities, and threats (SWOT) assessment under Pillar 2 requires the consideration of water management as part of union priorities and thus provides potential for improved targeting of spending. The increased emphasis on advice, collaborative action, flexibility and innovation, along with the need to support action at landscape scale, would benefit the delivery of water management by including integrated planning and implementation at a broader scale. Some aspects of the procedural rules require further elaboration and may have negative impacts. The proposal to exempt small farmers from cross-compliance, greening and control obligations, for example, could lead to increased water problems in sensitive areas. The implications of including the WFD in cross-compliance remain unclear, since the requirements would only be settled once 'obligations directly applicable to farmers' are clarified. Thus the basic reference level for compulsory obligations is not yet defined. Moreover, the relationship between the green payments under Pillar 1 and the agri-environment payments under Pillar 2 are not clear, and could lead to double spending. Depending on the final design of the procedural rules, very positive effects could be delivered or measures could fail to provide benefits.

To conclude, there are some positive principles and opportunities contained in the CAP proposals. Nonetheless, a number of critical issues remain unresolved, making it difficult to evaluate the overall contribution of the CAP proposals to water management.

Box 5.4 England: Catchment Sensitive Farming

The Catchment Sensitive Farming (CSF) project is a voluntary initiative delivered jointly by the Department for Environment, Food and Rural Affairs (Defra), the Environment Agency and Natural England. CSF is a land management approach aimed at keeping emissions of agricultural pollutants such as nutrients, sediment and pesticides, to levels that will not harm the ecology and other uses of surface waters, groundwaters and other aquatic habitats. Through free training, information and advice (one-to-one farm visits and group events) and the Capital Grant Scheme, the CSF project aims to promote the adoption of:

- efficient management of fertiliser, manure and pesticide use and adoption of best practices;
- best practice machinery and livestock management, and appropriate cropping and cultivation to improve soil structure and rain infiltration, helping to avoid run-off and erosion;
- protection of watercourses from faecal contamination, sedimentation and pesticides;
- reductions of stock density on land highly connected to water courses or at high risk of soil compaction and erosion/run-off;
- stock management on farms, aimed at avoiding compaction and poaching of land and bankside erosion;
- on-farm separation of clean and dirty water, aimed at improving the efficiency of manure storage and reducing the risk of dirty/contaminated water entering watercourses ([a]).

Natural England is responsible for administrating the scheme, while funding is provided by Defra's Rural Development Programme for England (RDPE). Inspections are carried out by the Rural Payment Agency (RPA) on behalf of Natural England. As part of the CSF project, the CSF Capital Grant Scheme has been offered to land managers in priority catchments in England since 2007 to support the improvement or installation of facilities that would benefit water quality by reducing diffuse pollution from agriculture. It is a competitive scheme based on catchment-level priorities.

Note: ([a]) See http://www.businesslink.gov.uk/bdotg/action/detail?itemId=1083648236&type=RESOURCES.

6 Moving the water pricing agenda ahead

6.1 Ways forward for pricing schemes and models reflecting local/regional circumstances

This section presents some elements for water pricing models that meet the requirements of the WFD, and at the same time, take into account the variety of specific conditions within which water policymakers and regulators throughout the EU have to operate. As we have seen in the preceding chapters, there may be tensions between the main four aspects of a water pricing system (cost recovery, polluter/user pays, incentive provision and affordability), and a compromise will often be needed that simultaneously meets these aspects to a reasonable degree. Moreover, there are several other aspects that determine the extent to which a water pricing model can be expected to be successful.

It has to be flexible enough to make it widely applicable:

- in different geographical conditions,
- in different water infrastructure conditions,
- in different sectors of the economy,
- in different institutional settings,
- in changing circumstances over time.

In addition, the administrative and management costs of the pricing model itself ('transaction costs') should be reasonable.

In the following subsection, these different aspects will briefly be discussed, and it will be assessed to what extent existing systems (as reported in the present report and elsewhere) can be considered as 'good practice' from each point of view. Clearly, this can only be touched upon here, and further elaboration will be required in appropriate forums such as the CIS working groups.

6.1.1 Pricing models and key aspects to be taken into account

Cost recovery and 'polluter/user pays' principle

If cost recovery were the only criterion on which to judge a water pricing scheme, there would be a wide range of options. The OECD (2010a) distinguishes three types of revenue sources for the water industry: the 3Ts. Transfers (especially at an international level) can play an important role, as is for instance witnessed by the large role that the EU's Cohesion Fund plays in the construction of water supply and wastewater treatment infrastructure in several EU Member States. Once the basic infrastructure is in place, tariffs and possibly also taxes will be needed to ensure the cost recovery of its maintenance, improvement and renewal, as well as of the operational costs and the environmental and resource costs.

From a cost-recovery point of view, the rate of the tariffs (and taxes) is the most important factor. Tariff structures are also relevant, but cost recovery is basically possible under different structures. For example, Denmark (where all costs of water supply and sanitation are covered by a volumetric rate) achieves a high level of cost recovery, but the same is true for England, Scotland and Wales, where domestic water tariffs are largely unrelated to the level of water consumption and most households remain unmetered.

The business of supplying water services often has a (quasi-)monopolistic character and therefore price regulations are common. Such regulations take different forms, e.g. (increases in) price levels that are fixed by the government (or an agency acting on the government's behalf), or certain regulatory principles that the water service supplier must follow when setting the prices. Price regulations need to strike a delicate balance between restrictions (to avoid inefficient monopolistic behaviour and high costs for water users) and enabling the water service suppliers to not only recover their operational costs, but also invest in improvement, expansion and innovation.

The latter also requires a form of SFP (see OECD, 2009). An independent authority managing this balancing act in a transparent way (such as OFWAT in England and Wales) may have the advantage of reducing the risk of interests becoming mixed and political considerations prevailing over good business practice.

Cost recovery for environmental and resource costs remains a largely unresolved issue, given the variety in interpretations of the concept (different interpretations of the 'polluter/user pays' principle). It is therefore also impossible to specifically define 'good practice'. A pragmatic approach (taken for instance by the Netherlands ([46])) is to consider the costs made for mitigating measures as the (current) environmental costs. Such costs are by definition recovered if the polluter has to take measures to prevent pollution and pays for these measures himself. Under this 'narrow' interpretation, the damage done by unprevented pollution and the resource costs (opportunity costs of water use) remain unaccounted for, even though systems of pollution and abstraction charges can ensure cost recovery for these costs as well. Such systems, in various forms, already exist in many EU Member States.

Incentives

'What gets measured gets managed': this is also true for water. If water pricing has to provide adequate incentives for efficient use of water resources, metering is indispensable. In this respect, France can be considered a good example. One of the seven principles of water management in France is that water pricing should be conducted according to the measured abstracted and consumed volume, and that each user should have a water meter.

The higher the variable component on the water bill, the stronger the incentive. The best practice from this point of view might therefore be a purely volumetric pricing system, i.e. without any fixed component, as exists in parts of Denmark ([47]). However, if one takes into account the variability in demand elasticity for different types of water use, a more sophisticated system could perform even better in terms of incentive provision. For instance, the 'luxury' part of household water demand (for car washing, garden watering, swimming pools, etc.) may be more price-sensitive than the 'necessity' part (for drinking, showering, toilet flushing and laundry). This means that an increasing block tariff (that also takes into account household size) could be the best model from an incentive point of view. Within the EU, such systems exist in Belgium, Greece, Italy, Portugal and Spain ([48]).

Decreasing block tariffs, which imply the highest prices for the basic and least price-elastic part of water consumption, are rarely if ever applied any more for households. However, a tap water tax that exempts water use above a certain level (such as exists in the Netherlands) has the same effect, and can be considered an inadequate incentive.

Affordability

Water bills typically absorb only a small part of the household budget (typically around 1 % to 2 %, including sewage and wastewater treatment). Nevertheless, there may be genuine concerns about the affordability of water services for the lowest income groups. A variety of systems can be found across Europe that attempt to alleviate the burden of water costs for such users. The water pricing systems in England, Scotland and Wales (where most households don't have a water meter) can be said to contain a 'built-in' affordability element, since they are (for most users) related to house value. In metered situations, IBT and/or a 'free' quotum of water for basic needs (e.g. 15 m^3 per person per year, as in Belgium (Flanders region)) could be an alternative. In any case, such alternatives are preferable to the use of reduced VAT rates, which is still common in many EU Member States. The issue of affordability can also be addressed by means of other instruments that are not directly related to water use. It then becomes part of a more general social policy (like in Denmark and Germany). This has the big advantage that the incentive element of water pricing remains effective for all water users. One could even go a step further and think of social support 'in kind' that helps low-income households to reduce their water consumption (e.g. by providing free or low-cost advice and water-saving equipment).

Flexibility and adaptability

Water pricing systems should be designed so as to take into account the specific conditions and features of the region and sector in which they are applied. This does not necessarily mean that a tailor-made solution has to be developed for each and every situation. It may well be possible to use a basic design that leaves room for regional and sectoral specificity.

([46]) See Rijkswaterstaat, 2008.
([47]) Source: DANVA.
([48]) Source: OECD, 2010a, Table 2.5.

Portugal might provide a good practice example in this respect: it has introduced a system in which some key principles (e.g. a progressive move towards cost recovery, affordability for those in need and transparency) and some tariff features are set by law. The regulator also issues non-binding recommendations and takes on a coaching role to help municipalities define locally adapted solutions. Significant discretion is left to local authorities who approve water service tariffs. In particular, each municipality can determine the tariff levels for each block, and is required to define a social price plan for poor households (OECD, 2010a, Box 2.1).

Climatic conditions vary greatly across the EU and water stress varies geographically and seasonally. A water pricing system should reflect water scarcity in time and place. Equalising water prices between regions may imply a cross-subsidisation and create wrong incentives (e.g. to invest in water-intensive agriculture and industry in drought-prone regions). 'Smart' water meters should enable an even more sophisticated water pricing system that takes the 'real-time' prevailing water scarcity conditions into account. Italy, Greece and Malta are presently the only European countries reported to pursue full, smart, water-metering rollouts ([49]).

The condition of the water infrastructure determines to a large extent the investment and maintenance cost to be covered by the water pricing system. Many utilities are in urgent need of repair, improvements and modernisation of their assets. Such investment may have considerable environmental and resource benefits in terms of pollution reduction and improved water efficiency. Water prices should therefore be sufficiently high to enable the water service suppliers to make these investments. At the same time, they should be discouraged to use their improved financial capacity for investments in projects and infrastructure that might negatively affect environmental conditions.

Article 9 of the WFD requires an adequate contribution to cost recovery from different water use(r)s. There is no *a priori* reason why water pricing systems should be different for households, agriculture and industry. This does not mean that water prices should be uniform, since there are large differences in cost structure (due to economies of scale, among others). However, pricing systems should not discriminate between sectors so as to avoid cross-subsidies and competitive distortions.

A wide variety of institutional settings can be observed in the EU water supply and sanitation industry. The involvement of private and public parties and their specific roles can have significant differences, even within a single Member State. Regulations and established practices add to the mixed picture. Pricing systems and price levels will reflect this variation, since the conditions (e.g. access to finance) under which the actors operate may be equally different. Transparency will be a necessary feature of any pricing system.

Finally, a system of water pricing needs to be flexible in order to deal with future developments. Climate change can, in the long run, change the water resource situation dramatically. New technologies may become available that have implications for the cost structure of the water industry. Demographic developments may enlarge or diminish the basis for cost recovery. The risks and uncertainties inherent in such unpredictable trends should be taken into account when designing a water pricing system.

Transaction costs

Operating a water pricing system comes at a cost. The amount of water that is abstracted or consumed has to be measured, which entails the need for the installation, maintenance and replacement of water (flow) meters. These meters have to be read and the data have to be processed in order to prepare the bills for the water users. 'Smart' water meters may reduce administrative costs, but such meters are themselves more costly than traditional water meters.

There is often a trade-off between these 'transaction costs' and the efficiency gains that a sophisticated water pricing system can bring about (including resource efficiency gains). The cost of installing water meters, for example, is sometimes used as an argument to stick to flat-rate pricing systems. However, the cost-benefit balance may turn out in favour of metering if all costs, including environmental and resource costs, are included in the calculations ([50]). Again, transparency is a precondition when deciding on the best water pricing system.

([49]) Source: http://www.businessgreen.com/bg/news/2104657/europe-ready-tap-smart-water-meter-market.

([50]) As an example, Ofwat (2011) carried out a cost–benefit analysis (CBA) of accelerated water meter penetration in England and Wales. In terms of environmental and resource costs, the CBA did not put a money value on the water resources saved, but it did attach a price tag on carbon emissions (including reduced emissions due to a lower use of heated water). It turned out that, compared to the 'business as usual' scenario (where metering only takes place at the customer's request, or in specific situations) an accelerated and more systematic rollout of water meters (achieving 90% metering by 2029–2030) would deliver the greatest net benefits (net present value: GBP 198 mln).

6.1.2 Key messages

Providing a blueprint for an 'optimal' water pricing system that meets the (sometimes conflicting) requirements of the WFD and other social objectives is a challenging task.

A few features are listed below that such a system would be likely to display:

- a substantial part of the water bill is variable (i.e. a price charged per cubic metre of water used);
- volumetric or increasing block rates are used;
- rates, or rules for calculating them, are determined in a transparent way, preferably by an independent body;
- rates are high enough to enable water service suppliers to invest in (efficient and environmentally sound) improvements, innovation and expansion;
- affordability is addressed by separate, social measures and not by interventions reducing water price incentives (such as reduced VAT rates);
- regional variations in water scarcity and other relevant conditions are reflected in water prices;
- different water users are treated on an equal footing; differences in water prices reflect differences in water-use characteristics and not the sector to which the user belongs.

6.2 Innovative economic instruments for water management, suitable for the EU context

6.2.1 Innovation and reform of existing instruments

The review of water pricing schemes in the selected countries revealed some issues and gaps, with respect to:

- recovery of operation and maintenance costs,
- integration of environmental and resource costs,
- incentiveness for a more efficient use of water resources.

In this light, innovative economic instruments for water management could substantially help overcome these issues. 'Innovation', however, does not necessarily imply the creation of new economic instruments — often, it is about improving or coming up with innovative combinations of existing instruments ([51]).

Some options for innovation and reform of existing instruments, as well as for the introduction of new mechanisms, can be drawn from experiences inside and outside the EU context, collected and analysed in the context of the EPI-Water project ([52]). At present, most of the economic instruments applied in the EU are rather traditional ones, although some notable exceptions exist; most examples of innovative instruments come from outside the EU.

Pricing

Among pricing instruments targeting water use addressed in the course of this project, abstraction charges have often proved ineffective to incentivise a more efficient use of water resources. Nevertheless, no alternative or improved instruments have been tested so far, either within or outside the EU context. A noteworthy exception is the Water Supply Tax in Denmark: although it cannot be defined an innovative instrument in itself, it introduced an innovative payment rule which resulted in a great leakage reduction in the national conveyance system (Box 6.1).

Furthermore, an example of abstraction charge reform comes from Baden-Württemberg, in Germany, where abstraction charges are part of a mix of policy instruments including compensation payments, as discussed earlier in the course of this project.

To manage water demand and promote more efficient use of resources, especially reduced water consumption, water tariffs seem to be the most promising option for intervention and innovation among pricing instruments. Innovation opportunities for water pricing instruments targeting water consumption do not lie in the introduction of brand new instruments, but rather in the design of innovative tariff structures, tailored to the specific characteristics and needs at national/RBD/water

([51]) EPI-Water, 2012. 'WP3 EX-POST case studies — Deliverable no. 3.2: Comparative analysis report'. Most of the information reported in this section is drawn from this report.

([52]) 'Evaluating Economic Instruments for Sustainable Water Management in Europe' (EPI-Water) is a research project conducted under the EU Seventh Framework Programme.

Box 6.1 Water pricing: Water supply tax, Denmark ([a])

Practice example 1

The water supply tax was introduced in 1993 as part of the so-called green tax reform, and it was implemented through a gradual phase-in with successive tax increases per year from 1994 to 1998. At the moment the report was written, the tax rate was 0.67 EUR/m^3, with an additional charge of 25 % (VAT); the final rate was 0.84 EUR/m^3. The tax applies to households and industries (although these can deduct it from their VAT liability). In contrast, it does not apply to the agricultural sector, as irrigation water in Denmark is normally self-abstracted and does not go through the water supply network.

The innovative mechanism introduced with this tax, which resulted in consistent leakage reduction, concerns water supply companies. The tax is in fact imposed on metered water delivered to customers. However, if metered water amounts to less than 90 % of the quantity abstracted by the water supply company, the latter will be subject to the remaining tax; therefore there is high incentive to promptly repair leakages.

Note: ([a]) ECOTEC, 2001. 'Study on the economic and environmental implications of the use of environmental taxes and charges in the European Union and its Member States — Final report'. Study for the European Commission.

utility level, able to achieve multiple objectives such as cost recovery, the provision of incentives for more efficient water use, and the consideration of affordability concerns. An example of such innovation comes from California (Box 6.2), where the failure of traditional tariffs to address multiple objectives led to the design of an innovative tariff structure, namely the Water Budget Rate Scheme (WBRS); this scheme was capable of reconciling not only cost recovery and efficiency objectives but also equity concerns.

Pollution taxes and fees targeting point-source pollution have so far proven to be effective revenue-raising instruments, helping to achieve cost recovery. They are also useful for internalising the environmental and resource costs linked to pollution. However, their contribution to the good ecological status of EU waters is uncertain. To effectively tackle point-source pollution, innovative solutions are better represented by trading mechanisms, which will be discussed in the following section.

Similarly, while taxes and fees aimed at tackling diffuse pollution are effective revenue-raising instruments able to reflect part of the environmental and resource costs, they have failed to achieve their environmental objectives, due to the nature of the pollution sources per se (e.g. nitrates and pesticides from agriculture). In this case, schemes aimed at managing land and

Box 6.2 Water pricing: Water Budget Rate Scheme, California ([a])

Practice example 2

The WBRS is a pricing system able to reconcile sometimes conflicting objectives: (i) efficiency of water use, and thus conservation of scarce water resources; (ii) cost recovery and thus financial stability of water providers, even in periods of low consumption; (iii) equity and fairness; and (iv) funding of conservation and environmental programmeswithout raising taxes on customers.

In short, it is a tiered pricing system similar to increasing block rates, but based on marginal cost pricing, which allows for tailoring the rate structure to each household served, while securing the recovery of fixed operational costs of water utilities at the same time. The rate is compounded by a fixed rate, irrespective of actual water use, and kept at a reasonable level for both the customer and the utility, and has a variable charge depending on consumption, distributed along several increasing tiers. The first and second tiers represent reasonable water-use levels (corresponding to indoor and outdoor water use respectively), and apply to about 75 % of total customers.

Note: ([a]) EPI-Water, 2011. 'WP6 IBE EX-POST Case studies — Water Budget Rate Structure: Experiences from Urban Utilities in California'.

water ecosystems as natural assets and reconciling conflicting uses, such as cooperation mechanisms (e.g. PES schemes), are a promising solution and will be reviewed in the relevant section.

Trading

Under ideal trading schemes, the market mechanism is expected to achieve a sound allocation of water resources to those uses with a higher added value through price mechanisms.

Abstraction permit trading is being increasingly applied within and outside the EU context: water markets are fully established in the Murray Darling Basin (Australia) ([53]), and northern Colorado (United States); in Europe, some forms of water markets have been developed in Spain, albeit with uncertain results. The case studies from Spain and Colorado are illustrated in Boxes 6.3 and 6.4.

As previously mentioned, diffuse pollution could be effectively reduced through the implementation of pollution permit trading schemes. At present, no cases of such schemes have been reported in Europe, but water quality trading schemes do exist in the United States: as an example, the Water Quality Trading Program in Ohio is described in Box 6.5.

Pollution permit trading has proved useful so far in sharing treatment burdens amongst sources, keeping down compliance costs and ensuring that desired pollution limits are respected; in addition, they can facilitate the transition to more stringent pollution limits.

Cooperation

Cooperation schemes can come into play where competition over water use and consequent benefits

Box 6.3 Trading: water markets in Spain ([a])

Practice example 3

Water markets in Spain allow for exchanges of irrigation water among users or water-right holders. The Spanish national water law allows for trading of private water rights and, since 1999, for the exchange of public water rights among holders, who can lease out their concessions temporarily or until maturity. Water trading, however, found very little application until the drought of 2005 to 2008, when water market exchanges supported by the Spanish government became a viable way of alleviating water scarcity conditions in the most intensely hit basins, and increased in frequency (although trading volumes still represent less than 1 % of all annual consumptive uses).

Different forms of water trading have taken place in several basins:
- leasing-out of farmers' water rights for one year (Jucar RBD),
- temporary lease of surface water rights (Segura RBD),
- formal lease contracts (Tagus and Segura RBDs),
- inter-basin exchanges (Tagus and Segura RBDs).

However, the review and evaluation of the Spanish experiences highlighted several issues which need to be addressed to develop efficient markets, including:
- lack of transparency and public information with respect to water management and water uses,
- need for more flexibility in the allocation criteria,
- need for a clearer definition of exchange conditions in the national legislation,
- need for more transparency in the price-setting mechanisms, as sellers often had a dominant position and, as a result, prices were too high.

Some recent changes of the water law in Andalusia are likely to result in better conditions for the creation of water markets.

Nevertheless, in spite of the issues experienced so far, the Spanish experiences have pioneered the implementation of these innovative schemes in the EU, and can pave the way for their diffusion in other European RBDs with water scarcity issues.

Note: ([a]) Garrido, A., Rey, D., Calatrava, J., 2012. 'Water trading in Spain. In de Stefano, L. and Llamas, M.R. Water, Agriculture and the Environment in Spain: can we square the circle?' Taylor and Francis. In press.

([53]) EPI-Water, 2011. 'WP6 IBE EX-POST Case studies — The role of unbundling water rights in Australia's southern connected Murray Darling Basin'.

Box 6.4 Trading: the efficient water market of the Northern Colorado Water Conservancy District, Colorado, United States ([a])

Practice example 4

In Colorado, huge differences in precipitations and water availability exist between the eastern, dry plains and the rugged lands to the west, blessed by abundant rainfalls. To compensate for this imbalance, a complicated water transfer project was designed and put in place between 1938 and 1957. The Northern Colorado Water Conservation District (NCWCD) was established to build the trans-mountain project and to manage diversion works and water allocation.

The efficient water market existing today was developed within the NCWCD as a means to allocate water across the two areas, and it has evolved through institutional and economic change, by design but also by trial and error. State agencies are keeping records of all water rights and their transfers, and the associated administration costs are imposed on the transferor and the transferee, thus becoming part of the transaction costs. Legally, state courts (including Colorado) established in the 19th century that quantified and prioritised water uses (i.e. water licenses) constituted property rights which could be based and sold; recently, several regions in the United States and Canada have shifted toward more flexible rules allowing for water trading.

In short, proposed buyers and sellers make a transfer application to the District Board; beneficial use must be demonstrated, excepting from municipal users. A total of 471 transactions were realised in the last 5 years in Colorado as a whole, with transactions within the NCWCD constituting the majority.

Note: ([a]) EPI-Water, 2011. 'WP6 IBE EX-POST Case studies — The efficient water market of the Northern Colorado Water Conservancy District, Colorado, USA'.

Box 6.5 Trading: Great Miami River Watershed Water Quality Credit Trading Program, Ohio, United States ([a])

Practice example 5

The Water Quality Trading Program is aimed at controlling water pollution in a cost-effective way, and it involves nutrient credit trading between point-source wastewater treatment plants (WWTPs) and non-point sources (agriculture) in the Great Miami Watershed. This trading plan is currently being developed by a watershed-based flood control agency in southern Ohio.

The case for a trading programme was made by announced legislative changes that would have imposed more stringent pollution standards on wastewater treatment plants, which in turn would have required consistent investments in infrastructure updates. On the other hand, there is room for consistent phosphorous reductions from agricultural non-point sources through application of no-till management practices ([b]), acting as credit supply able to meet almost all the demand for additional pollution permits on the side of WWTPs. To date, the programme has involved 10 rounds of agricultural best management practices reverse auction bids, where the local Soil and Water Conservation District calculates the anticipated phosphate and nitrate load reduction from proposed best practices. Contracted best management practices correspond to reductions of 330 tonnes of nitrates and 130 tonnes of phosphates. In addition, annual water quality monitoring is carried out.

Note: ([a]) EPI-Water, 2011. 'WP6 IBE EX-POST Case studies — Great Miami River Watershed Quality Trading Program'.

([b]) See 'A short History of No-till' online.

exists among water stakeholders, and it usually takes the form of voluntary pricing and trading mechanisms where stakeholders agree on mutually beneficial actions to conserve assets, share benefits, etc. In this category, PES schemes have garnered significant attention in academic and policy circles in recent years.

Cooperation mechanisms are capable of managing social conflicts over water resources and land use, by opening up options for mutually beneficial agreements among stakeholders. So far, such schemes have proved effective in tackling water pollution from diffuse sources (e.g. agriculture), and success stories can be found in and outside Europe

(e.g. the New York City Watershed Agricultural Program ([54])). Two outstanding examples of applications of PES schemes in the EU are those developed in France and the United Kingdom (Dorset), described in Boxes 6.6 and 6.7 respectively.

The negative aspect of implementing such mechanisms is the potentially high transaction costs, as reported in the Evian case study.

Risk management schemes

This category of instruments is related to risk bearing, sharing and transfer of decisions concerning water, and it usually involves provisions on the extent to which decision-makers are responsible for economic decisions, also defining the specific institutional setting for risk sharing (e.g. damage compensation funds and drought insurance). This category includes responsibility and liability schemes as well as insurance schemes. In the water management sector, such schemes may cover several sources of risk and uncertainty (e.g. droughts and floods, crop failure and pests, pollution, price volatility).

At present, no examples of such schemes are reported for the EU and, in general, little information is available on their performance. The successful experience of the programmes for Salinity Offsets in Australia ([55]) however, suggests that these schemes might be a promising option to manage risk, and thus they may deserve more attention and research to pinpoint their applicability within the EU context.

6.2.2 How would innovative economic instruments contribute to cost recovery and incentiveness objectives?

Do instruments effectively address cost-recovery purposes?

Water tariffs, in principle, are mainly aimed at achieving cost recovery, and the challenge is to meet both cost recovery and incentiveness objectives at the same time through proper design. In particular, reduced water consumption due to the introduction of volumetric rates, however, might result in a decrease of revenues, thus threatening cost recovery of water service provision. A shift towards innovative tariff structures would help overcome this issue, ensuring cost recovery of water services. In addition, if properly designed, volumetric rates based on consumption thresholds can in principle be effective in incorporating the environmental and resource cost.

In those cases where recovery of provision costs (investment and O&M costs) has been achieved, the integration of environmental and resource costs in the final rates has generally been neglected. This is where trading instruments can come into play, especially when extreme events (water scarcity and drought) and extensive pollution place additional pressures on water resources.

In the case of trading schemes, in particular, the free exchange of water and pollution rights under market rules is likely to result in prices fully reflecting the actual environmental and resource cost of water use (or water pollution). When freedom to agree on prices and adequate price-revealing mechanisms are ensured, water prices are expected to fully reflect the value of available water resources at any given point in time, especially during water-scarce periods, thus also fully reflecting the resource cost of water — it is not a coincidence that water markets in Spain increased during the drought of 2005 to 2008, when exchanges supported by the Spanish government became a viable way of alleviating water scarcity conditions in the most intensely hit basins. In the same way, price creation mechanisms are also likely to result in permit trading reflecting the environmental and resource cost involved in water pollution.

In a less straightforward way, compensation payments under cooperation mechanisms, PES in particular, are able to integrate both the cost of providing the ecosystem services at stake (missed gain linked to the adoption of environmentally friendly practices) and the environmental and resource cost embedded in the conflicting uses of a (scarce) service or resource. In addition, these schemes enhance the economic value of ecosystem services.

Do instruments effectively address incentiveness objectives?

All reviewed instruments have, to different extents, the ability to provide an incentive for a more efficient use of water resources.

As mentioned earlier, water tariffs are no longer intended (and designed) as a pure cost-recovery instrument, but also as a powerful instrument for incentivising efficient water use. The shift towards innovative tariff structure is likely to enhance this aspect.

([54]) EPI-Water, 2011. 'WP6 IBE EX-POST Case studies — New York City Watershed Agricultural Program'.
([55]) EPI-Water, 2011. 'WP6 IBE EX-POST Case studies — Salinity offsets in Australia'.

Box 6.6 Cooperation: financial compensation for environmental services — the case of Evian Natural Mineral Water, France ([a])

Practice example 6

This participatory programme is a promising multi-sectoral water protection policy tackling wastewater collection and treatment, town and council planning, wetland protection, tourism, biodiversity, and agriculture. The programme is an initiative of the Evian company, which in this way can protect the sources of Evian Natural Mineral Water while promoting sustainable development at the same time; other key principles of the programme are the focus on collective projects only and the reliance on strong technical support from scientists. The programme relies on the Association for the Protection of the Evian Catchment Area (APIEME), which brings together local communities from the spring areas as well as from the catchment area at large, the Evian company and national public bodies. The local farmers' association is also formally involved in the implementation of each project under the programme.

In particular, through the 'agricultural economic instrument' the Evian company helps finance projects which maintain a specific land use — dairy farming linked to protected-designation-of-origin (PDO) cheese production — which is presumed to preserve the quality of the Evian Natural Mineral Water. The Evian company is not the only beneficiary of such actions, as local communities also benefit from the maintenance of good water quality. The programme averted a likely shift of agricultural activities in the basin towards intensive agricultural practices (e.g. maise crops) that would have had negative consequences for the water environment.

Although concurrent factors (e.g. a decrease of the number of farms) may have contributed to the success of the scheme, it has definitely helped maintain of the traditional landscape and decrease the use of pesticides.

Note: ([a]) EPI-Water, 2011 'WP3 EX-POST Case studies — Financial compensation for environmental services: the case of Evian Natural Mineral Water'.

Box 6.7 Cooperation: cooperative agreements between water supply companies and farmers in Dorset, United Kingdom ([a])

Practice example 7

Cooperative agreements were developed in Dorset because the local water company (Wessex Water) was facing increasing issues related to nitrates contamination, mainly the result of farming activities. Due to the extent of the problem, relatively inexpensive technical solutions (e.g. blending water from different sources) were no longer viable, so the company could choose to apply expensive treatment technologies or implement a catchment-based approach. Wessex Waters chose to approach the farmers and involve them in cooperation agreements, with the aim of improving water quality by promoting better practices.

The main focus of programme activities is the on-farm advice on best practices, in which catchment officers work closely with farmers, as well as the nitrate-monitoring activities. The programme also involved phased grant payments as an incentive at the beginning of the initiative. Such agreements, targeted to a specific area, are established on a voluntary base between farmers and the company, and are based on self-regulation among the key actors. The company has an important role in the negotiation process and the provision of financial resources.

The programme has been very successful in securing farmers' participation and now covers between 80 % and 100 % of the farmers in the catchment at medium and high risk. Nitrogen levels in the areas covered by the mechanism are now similar to the average national levels, indicating good farming practices and appropriate fertiliser use. Last but not least, this approach to diffuse water pollution implies an annual cost equal to 8 % of the annual treatment costs.

Note: ([a]) EPI-Water, 2011. WP3 EX-POST Case studies — Cooperative agreements between water supply companies and farmers in Dorset'. This economic mechanism was also reported under task 2 of this project (data collection template on England and Wales).

In turn, trading mechanisms are clearly intended to ensure the most efficient allocation of water use (or allowed pollution quantities) among economic uses, simply through the market mechanism. In other words, water resources are allocated to those activities with the highest added value for water used or consumed, especially in scarcity conditions.

The review of existing water markets revealed that these mechanisms are indeed effective in pursuing economic development objectives, especially in water scarcity conditions, fostering agriculture and hydropower generation. Their effectiveness in achieving water efficiency and pursuing quantity-related environmental objectives, however, can be questionable. In some water markets, as for example in the Murray Darling River basin, trading might put into use substantial quantities of water that would have remained in nature in the absence of trading. In many cases, in fact, part of the volumes covered by abstraction licenses are not actually used.

Existing schemes of pollution permit trading, in contrast, have proved effective in keeping pollution level within the desired limits, and at the same time they have the great advantage of promoting the adoption of best practices (e.g. in agriculture); these probably would not have been adopted in the absence of the scheme, and expensive infrastructure updates would have taken their place.

PES schemes implemented in Europe have so far been very effective in pursuing their environmental objectives — although success stories might also have benefited from concurrent factors other than the application of the economic instruments. Nevertheless, these instruments seem to provide a great incentive for resource protection and enhancement.

Besides the role played by compensation payments, the success of the scheme depends on the following elements:

- the ability to manage potential social conflicts over resource use;
- the amount of compensation payments takes on board the environmental and resource cost of clean water availability, as well as the cost of providing such services;
- the decrease of information costs related to best management practices for farmers, in information and training activities, are often part of this programme;
- the improvement of welfare levels of local farmers, thanks to the transition in farm production and practices: in Dorset, for example, farmers remained part of the collaborative scheme even when compensation payments stopped;
- environmental problems are tackled through positive investment on social capital rather than on technical capital (e.g. cost-wise, water treatment is no longer a viable option if compared to cooperation mechanisms);
- local users are empowered in the conservation surrounding a natural and economic asset;
- cooperation agreements are very likely to deliver positive environmental outcomes, reducing uncertainty over conservation of natural capital.

6.2.3 Most promising options for the EU context

Aside from the pros and cons of the proposed instruments and the extent of their contribution to cost recovery and incentiveness objectives, a crucial question to be answered is whether, and how, these instruments are suitable for the EU context, especially in terms of institutional and legal settings.

In the case of reform of water tariff structures, when metered water use and volumetric tariffs are already in place, this adjustment of existing tariffs would require very limited implementation efforts, as management and administration structures, as well as physical infrastructures, are already in place. Higher implementation costs, however, would occur in those countries/RBDs where metering systems are not yet in place.

The creation of water markets in the EU context, in contrast, might present significant challenges, as national legislations and regulations might not meet the required preconditions, such as:

- existence of marketable water rights;
- freedom to agree on prices;
- availability of information, including adequate price-revealing mechanisms;
- suitable structures of water rights;
- conditions for the assessment and regulation of structure and performance of markets.

The challenges encountered in the establishment of water markets in Spain, as well as their not-so-encouraging results, can be mostly traced to the lack of such preconditions. In addition, water resources in the EU are generally public domain assets, and private use rights can only be issued under certain conditions, something that can severly limit trading potential.

Pollution trading schemes can be applied only in exceptional circumstances, where many pollution sources coexist within the same river basin, and exchanges between sources are possible. Also in this case, to create operational pollution trading schemes, some preconditions must be met: well-defined pollution standards in national legislation, and a well-defined institutional focus promoting, overseeing and facilitating the activity.

The absence of pollution trading schemes in the EU suggests that there might be legislative and institutional barriers to be overcome before these instruments can effectively be put in place. For example, in the United States there are legislative provisions allowing and defining water quality trading. Nevertheless, considering the questionable results of traditional instruments (taxes and fees) in controlling pollution, there may very well be a case for exploring opportunities and challenges related to the development of pollution trading schemes in the EU.

In contrast, cooperative agreements, and PES in particular, seem to be a promising option to tackle diffuse pollution and to promote sound water and land-use management in Europe. The advantages of these mechanisms, as well as the positive environmental and social outcomes delivered in the two European case studies, suggest that they have potential for wider application in the EU context.

However, the creation of cooperative schemes in the European context also faces a major challenge due the advanced regulatory and institutional settings. Furthermore, as reported in the case of water markets, the public nature of water resources in the EU, and the constraints placed on private rights might also limit the potential for their implementation. Having said this, institutional and legal constraints were also observed in the Evian and Dorset case studies, but this did not prevent the creation of well-functioning schemes able to fit into the local regulatory and institutional frameworks: this demonstrates that an appropriate programme design can overcome such challenges. The main outcomes of the assessment of innovative economic instruments are summarised in Table 6.1.

6.2.4 Beyond the national level: how can EU financial assistance contribute to cost recovery and water efficiency targets?

Besides the innovative economic instruments reviewed so far, that are to be implemented at the national/RBD/local scale, adjustments in existing EU financing instruments could also contribute to meeting cost recovery and water efficiency targets in EU Member States. Two examples, drawn from the EU Water Scarcity and Drought Gap Analysis project ([56]) are presented below: the allocation mechanisms for the Cohesion and Structural Funds targeting cost recovery and efficiency of water use (e.g. creation of an European water efficiency fund, comparable to the European Energy Efficiency Fund); and the conditionality through CAP (for the agricultural sector) with the introduction of water efficiency targets in direct payments and rural development plans (in line with PES, but through an EU mechanism).

Table 6.1 Synthesis of the assessment of potential innovative economic instruments

Instrument	Advantages	Disadvantages	Contribution to cost-recovery objectives	Contribution to incentiveness objectives	Applicability in EU context
Innovative tariff structures	+++	-	+++	+++	+++
Water trading	++	-	++	++/-	-
Pollution trading	++	?	++	++	+/-
PES	+++	-	+++	+++	++
Offset programmes	Potential	?	?	Potential	?

Source: EEA.

([56]) ACTeon, 2012. 'Water Scarcity and Drought Policy in the EU — Gap Analysis Final Report'. Project funded by the European Commission, DG Environment.

Allocation mechanisms for the Cohesion and Structural Funds targeting cost recovery and efficiency of water use

The rules for the allocation of Structural and Cohesion Funds could be modified by integrating obligations to establish incentive pricing for (relevant) projects in areas with a high water deficit; these rules would complement the existing cost-recovery requirements that are currently applied to projects funded by these EU financing instruments, in accordance with the WFD. Alternatively, the creation of a European water efficiency fund, comparable to the European Energy Efficiency Fund, might be envisaged. At present, financing through Structural and Cohesion Funds already requires the application of the cost-recovery principle, and the inclusions of provisions for incentive pricing would further strengthen the links between the Cohesion Policy and the WFD, promoting projects which give the right price signals to water users.

Conditionality through CAP (for the agricultural sector): introduction of water efficiency targets in direct payments and rural development plans

The introduction of cross-compliance rules under the CAP can help promote crops with low water demand and sustainable water management when crops with high water demands are grown. This option would require a specific ex ante assessment of the impact of the CAP on water demand/water abstraction from agriculture and on the overall water balances/water accounts as input to adapting agriculture product price regimes and mechanisms for supporting agriculture. This policy option would mostly concern southern EU Member States: in these countries, irrigation is widespread and water scarcity problems are more relevant, so the option would target them. While ensuring a water balance in water-scarce areas might impact farmer income and potentially affect job creation, it would ensure sustainable agriculture and therefore longevity of the sector in water-scarce areas. Irrigation, in fact, is mostly concentrated in southern EU Member States, which are also more subject to water scarcity issues, so this policy option would have a clear and effective geographical focus.

6.3 Proposed options for reporting environmental and resource costs to enhance EU-scale comparability and water pricing benchmarking

In order to ensure EU-wide implementation of the cost-recovery principles outlined in the WFD, comparable systems for the reporting of utility costs and revenues are desirable. Especially for the inclusion of environmental and resource costs in the costs that are to be recovered, a system is needed that indicates what areas of environmental and resource costs are covered (e.g. whether the utility manages water protection areas for water provision) and the level of coverage (e.g. how much is spent on WACs, what percentage of water abstraction areas are protected, etc.). It should also be standardised to a certain extent across EU Member States.

Benchmarking initiatives that already exist in many EU Member States are one promising option for such a reporting instrument. In some cases, benchmarking programmes are mandatory, and administered by a government agency tasked with setting limits on price increases (e.g. OFWAT in England and Wales or the Water Industry Commission in Scotland), thereby forcing utilities facing increasing costs to find innovative ways to become more efficient. In other cases, the voluntary and anonymous nature of benchmarking initiatives allows companies to place themselves within the broader industry and recognise where they are relatively strong or weak, thereby encouraging better performance and comparison with industry averages.

An international reporting system for the recovery of environmental and resource costs can be created by ensuring that the data collected as part of European benchmarking initiatives contain the information needed to ascertain whether environmental and resource costs are truly being incorporated into the costs recovered by utilities. In the absence of a centralised European system, this could be conducted at least at national level, if not at regional level. Due to the anonymous nature of voluntary benchmarking systems, utility-level reporting of environmental and resource costs cannot be expected using this instrument.

The distribution of cost-recovery rates among the participating utilities is generally reported in benchmarking assessment reports. Moreover, if all the utilities in a given region (river basin, administrative district, etc.) were to take part in a benchmarking project, then, using the financial data collected in the reporting sheets, a measure of overall cost recovery for the region could be calculated. Initiatives such as the European Benchmarking Co-operation (EBC) ([57]) indicate that the industry is generally open to expanding benchmarking coverage, and integrating the collection of data on environmental and resource

([57]) The EBC is an industry group that offers international benchmarking programmes (see http://www.waterbenchmark.org).

costs in these expanding systems could provide insight into whether environmental and resource costs are being recovered.

This task will focus primarily on determining to what extent existing benchmarking initiatives in the drinking water supply sector collect data that can be used to ascertain whether various aspects of the environmental and resource costs principle under the WFD are included in cost recovery. A similar approach could then be followed for wastewater utilities.

6.3.1 Introduction to European benchmarking initiatives

The drinking water supply benchmarking landscape in Europe is characterised by many different approaches, some of which are incompatible or conflicting. There are systems that focus specifically on certain types of utilities, such as those that operate in very large cities. Others are undertaken at regional level for purposes of regional regulatory oversight (e.g. in Germany), while some regulatory schemes foresee national benchmarking initiatives (e.g. in England/Wales and Denmark).

The benchmarking system for England and Wales is administered by OFWAT, the Water Services Regulation Authority. At the time of privatisation, performance benchmarking using extensive indicator comparisons was considered a plausible way to regulate the industry. OFWAT gathers data from water utilities in England and Wales and, with the cooperation of other industry specialists, uses econometric modelling based on industry average costs to create efficiency bands for each utility that then determine the cap on price increases in the coming years. However, the criteria used for determining the price cap frontier have changed over the years. In 1999, a price cap adjustment for service quality was introduced, indicating that the system is still being refined and improved (Parker, 2005). The introduction of benchmarking in OFWAT's regulation of water utilities marks one of the first instances of performance comparisons on the basis of indicators being used for this purpose.

Since then, many different benchmarking schemes have emerged. The ÜBV (Überbetrieblicher Leistungsvergleich großstädtischer Versorgungsunternehmen) is an initiative focused on utilities in large cities that has been carried out annually for the past 60 years (Nickel et al., 2012) and includes, among others, water providers from Hamburg, Berlin, Dortmund, and Leipzig ([58]). By focusing on large metropolitan areas, a high level of comparability between the users is expected. It operates internationally within the German-speaking world.

The EBC offers benchmarking services for drinking water and wastewater utilities based on the typical two-tiered voluntary benchmarking format that involves a comprehensive comparison based on structural and performance indicators followed by a round of implementation of improvement measures based on the first round's results. The EBC programme is supported by several northern European countries but operates internationally, with utilities from the Americas, the Middle East, and south-east Asia having taken part ([59]) One of the supporting partners is DANVA, the water authority of Denmark, which has also developed its own extensive benchmarking system for domestic use that became mandatory in 2012.

The International Benchmarking Network for Water and Sanitation Utilities (IBNET) attempts to provide a basis for an international benchmarking system, and also publishes data about utility performance, including a database with information from utilities in 85 countries ([60]). Moreover, IBNET provides guidance and facilitates the establishment of other benchmarking systems at various scales. The IBNET toolkit with the reporting sheet used for their comparisons is free to download, but it is not as extensive as that of other benchmarking schemes.

Overall, several other European benchmarking initiatives are ongoing. A full overview of such initiatives could be undertaken in a study focused specifically on benchmarking.

Internationally, the IWA Performance Indicator System is the gold standard of indicator sets. It is used as a basis by the EBC as well as by other regional schemes, including Germany's. Integrating the necessary data for assessing the cost recovery of environmental and resource costs into the reporting sheets used in IWA benchmarking projects or

([58]) See http://www.uebv.de/extern/index.php/mitglieder.
([59]) See http://www.waterbenchmark.org/content/EBC_participants.html.
([60]) See http://www.ib-net.org/production.

other commonly used benchmarking schemes at the European level would be a good way to begin standardising benchmarking reporting for the purposes of overseeing the WFD.

6.3.2 Definitions of environmental and resource costs

In order to determine whether environmental and resource costs have been included in the costs recovered by drinking water utilities, the environmental and resource costs must first be defined. This has proved difficult at the European level. Environmental costs, broadly speaking, include the costs borne by others through environmental media (i.e. through environmental externalities), and resource costs can include resource use beyond sustainable boundaries as well as inefficient resource allocation. Additionally, measures and actions meant to improve the status of water bodies and thereby achieve the environmental objectives set forth in the WFD are often considered part of environmental and resource costs. The following brief discussion should illuminate how the discussion has developed at European level.

The EU WFD introduced the concept of environmental and resource costs in connection with both the PPP as well as cost recovery for water services. Additionally, water prices should provide incentives for the efficient use of the resource, while taking the other aspects of comprehensive water pricing (mentioned above) into consideration. The implementation of Article 9 should contribute to achieving the management goals (good status) for water bodies. At the same time, the WFD demands that the effort required for assessing and incorporating environmental and resource costs in pricing schemes should be justified by the benefits gained through its incorporation (WFD, Appendix III). If possible, the environmental and resource costs should be determined based on information already available.

The CIS has made two attempts at outlining an operable definition of environmental and resource costs. First, the WATECO group provided a guidance document, and another group, DG Eco2, subsequently provided an expanded interpretation. The two groups drew differing conclusions on what should constitute environmental and resource costs.

According to WATECO, environmental costs include the damages incurred by ecosystems and people as a result of water use. Resource costs then occur only when the resource is used beyond its natural regenerative capacity (WATECO, 2003).

DG ECO2, on the other hand, sees resource costs as an issue of misallocation rather than overexploitation. The guidelines produced by this group, however, provide very little practical guidance on how to determine what should actually constitute resource costs and how they should be monitored (Görlach and Interwies, 2004). This may well have to do with the extensive amount of microeconomic data that would be necessary to determine the highest-value uses for water (Nickel et al., 2012), especially in the absence of functioning water markets. It is questionable whether the effort required to collect these data would be justified by their contribution to making water prices more 'ecologically realistic' (DWA, 2011). Therefore, the guidelines developed by WATECO are likely more practical for actual implementation.

Given that an overarching decision on what constitutes environmental and resource costs at the European level has not yet been reached, EU Member States have had to determine how to interpret this aspect of cost recovery through water pricing on their own. In Germany, technical and industry organisations play an important role in setting standards and promoting research, and an approach proposed by the DWA is explained in more detail here.

The first cycle of German reporting under the WFD included information about the environmental and resource costs that were already internalised by various instruments (i.e. through technical requirements, abstraction charges and compensatory payments to farmers). Meanwhile, the DWA working group WI 1.4 'Economic Aspects of the WFD' was hard at work solidifying the methodological basis for calculating environmental and resource costs. The procedure builds mainly upon the following tenets for identifying environmental and resource costs (DWA, 2011).

1. Including environmental and resource costs in cost recovery serves to support an economically minded management principle that serves an informational, incentivising and financing purpose.

2. Environmental and resource costs apply only to resource stress that results from water services and that leads to a failure to meet management goals.

3. Only water-related environmental and resource costs should be considered. Environmental and resource costs that result from water services in other environmental media do not need to be included.

4. Environmental and resource costs should only be included in cost recovery if the management goals for the water body in question are not being met. This is based on the fact that economic requirements of Article 9 should be used to help reach the environmental goals of the WFD.

Within this framework, the costs generated by supplying drinking water can be categorised into business costs that serve to provide the basic service, and environmental and resource costs, which can either be internalised or non-internalised. Thus, the costs described here include capital and operating costs as well as external environmental and resource costs.

The externalities are often internalisedin conjunction with cost-recovery requirements that should ensure consumers are faced with the higher prices, by existing instruments such as WACs or legal mandates to manage water protection areas. Non-internalised costs can be split, based on whether they should or should not be internalised. Those that should be internalised include other external costs of providing water services and costs for additional environmental measures contributing to the achievement of the WFD objectives. Since no such measures were identified for water utilities in German RBMPs and no other external costs have been identified outside this DWA approach, additional costs that need to be internalised have been estimated as negligible (Nickel et al., 2012).

6.3.3 Coverage in current German benchmarking schemes

The DWA approach allows for a general estimation of environmental and resource costs. The approach identifies practical basic requirements for collecting information about environmental and resource costs, so that a lower bound of environmental and resource costs can be constructed. The 'right' definition of environmental and resource costs is not discussed here, but rather the question of how well benchmarking initiatives cover the inclusion of environmental and resource costs in a utility's cost recovery. It is important to note that cost recovery is listed as an indicator itself in most German benchmarking initiatives. The salient question for determining whether these initiatives can provide evidence of the inclusion of environmental and resource costs in cost recovery is dependent on the inclusion of environmental and resource costs in the utilities' expenditures.

The DWA itself highlights that the environmental and resource cost positions will not always correspond with those of the specific utility in question or the benchmarking initiative at hand. Thus, using this approach to calculate environmental and resource costs or even determine whether these have been included in the expenditures used to assess cost recovery may at times be problematic. Annex 3 matches the environmental and resource costs–relevant activities of utilities to the cost positions that are most useful for estimating the amount spent on environmental and resource costs activities and have been surveyed in German benchmarking initiatives. This attribution is based on the IWA indicator set (Hirner und Merkel, 2005) that structures the utilities' costs along the lines of their business areas (technical services and administration, further categorised into water management, extraction, treatment, accounting, etc.), allowing for a clear delineation of costs (Nickel et al., 2012). This set forms the basis of benchmarking initiatives in Germany and can help indicate how well these cost positions overlap with environmental and resource costs. It must be noted that benchmarking projects by necessity only collect explicit data on costs that have already been internalised. It remains to be seen if certain instruments, such as WACs, are high enough to cover the full externality of companies' water abstraction — this is another subject. Since all of the measures and costs that have been identified as generating environmental and resource costs belong to one or more cost positions in the IWA catalogue, any benchmarking project that reports on these cost positions should also be tacitly reporting on the environmental and resource costs included within them. Even if some cost positions in the benchmarking initiatives include costs not associated with environmental and resource costs (such as public service work, additional water treatment and disinfection, or the operating costs of water services), they should include all of the costs that can be attributed to environmental and resource costs within them. It is important to note that all of these indicators do not appear in all German benchmarking projects, but they represent a compilation of the relevant ones found in German initiatives.

This inclusion of non-environmental and resource costs in some of the cost positions renders a calculation of environmental and resource costs

itself more difficult, because additional data would have to be collected from utilities. For example, the indicator 'operating costs of water services' would need to be broken down in order to isolate the components immediately relevant for environmental and resource costs. Additionally, costs for additional water treatment only constitute environmental and resource costs if they are made necessary by anthropogenic sources of water pollution. The type of treatment process alone does not indicate the type or origin of pollutant, as some processes can be used for multiple kinds of pollutants. More detailed information is needed from the utilities on which pollutants are subject to screening, in order to determine to what degree these costs could be considered environmental and resource costs. Moreover, only operating costs of treatment are reported individually; capital costs are reported together with the capital costs for extraction infrastructure, further complicating a direct calculation.

However, a calculation or estimate of total environmental and resource costs is not necessary in order to ascertain whether the total environmental and resource costs identified (using the DWA approach) can be found in the cost positions that are listed in the IWA catalogue and found in most German benchmarking initiatives. Thus, when the indicators on cost recovery are also taken into account, the benchmarking systems developed in Germany to date represent a promising option for reporting on the inclusion of environmental and resource costs in cost-recovery water pricing.

6.3.4 Additional indicators for environmental and resource costs

Annex 3 contains a set of indicators which provide a more comprehensive overview of the activities relevant for environmental and resource costs. They provide the context for the cost positions that represent the environmental and resource costs, such as by reporting the pollutant levels found in water sources used for drinking water, how much of the water extraction area belongs to the utility, and how the type of water resources available influence the level of necessary treatment.

Moreover, they provide a basis for evaluating the performance of the utility in the areas affected by environmental and resource costs. This allows for some assessment of whether environmental and resource costs spending should be increased; for example, if the amount of pipe leakage is abnormally high, increasing pipe maintenance expenditures may help to conserve water and thus protect the resource. Drinking water utilities do not have the same environmental and resource costs function as traditional polluters, so assessing their environmental and resource costs will necessarily focus on sustainability indicators other than direct pollutant emissions, specifically resource protection, quality monitoring and testing, and health indicators (Schramm et al., 2007).

Combined with the cost positions (often reported as indicators), these should allow regulators, politicians, and the general public to see what exactly is being done in the context of environmental and resource costs, even if an exact calculation is difficult or impossible (see Annex 3).

6.3.5 Reporting sheet

In order to create the indicators and cost positions detailed above, comprehensive data collection is required. A reporting sheet to collect data on the cost positions and other fields necessary for calculating the indicators used to assess environmental and resource costs can be found in Table 6.2. This sheet collects the necessary data for constructing the indicators and cost positions that would be needed to assess environmental and resource costs' integration in cost recovery, and calls for several other data inputs that would facilitate an assessment and estimation of environmental and resource costs.

Utility cost data is collected using a matrix that includes cells for capital and operating costs for each business area (technical services and administration, further broken down into water management, extraction, treatment, accounting, etc.) that is not reproduced here.

A section on the utility's assumption of responsibilities is included in order to make clear what tasks within the framework of environmental and resource costs are undertaken by the utility. This is important for expanding the usefulness of benchmarking as a reporting instrument across different Member States that may have completely different regulations governing the responsibilities of drinking water utilities.

Table 6.2 Proposed reporting sheet for assessment of inclusion of environmental and resource cost in cost recovery

Data identifier	Unit
Type of resource	
— Surface water	%
— Groundwater	%
— Bank filtration	%
Water protection areas	#/ha
Extraction areas	#/ha
Percentage of water extracted from nearby (in own service area)	%
Percentage of water delivered externally for any reason	%
Water protection area	ha
Protection area property of utility	ha
Protection area property of the state	ha
Agricultural land in protection areas	ha
Extraction areas with exceptional pollution potential according to DVGW guidelines	ha
Extraction land area subject to cooperation agreements with agriculture	ha
Protection area subject to compulsory compensatory payments to agriculture	ha
Resource usage based on available extraction permits	%
— Average throughout observation year	%
— On highest volume day	%
Service interruptions due to a lack of permits or lack of available water resources	#
Total length of network	km
Total length of service connections	km
Length of network inspected for leaks	km
Length of network having undergone repair in observation year	km
Length of network having undergone renewal in observation year	km
Length of service connections have undergone repair/renewal in observation year	km
10-year average of percentage of network having undergone repair/renewal	%
10-year average of percentage of service connections having undergone repair/renewal	%
Total treated water	m^3/a
Water treated extensively	m^3/a
Water treated conventionally	m^3/a
Water disinfected	m^3/a
Untreated water delivered to customers	m^3/a
Level of nitrates in untreated water	mg/l
Trend of nitrate levels in untreated water	Increasing, decreasing, or no trend
Level of PSM in untreated water	microgram/l
Trend of PSM levels in untreated water	Increasing, decreasing, or no trend
Percentage of water treatment made necessary by anthropogenic pollution	%
Total number of required drinking water analyses	#
Total number of drinking water analyses	#
Are water resources under stress due to wastewater release (is this supported by faecal indicators)?	Yes/No
Are water resources under stress due to other special parameters?	Yes/No
Violations of legal thresholds for chemical/physical parameters	#
— Total duration	Hours
Violations of legal thresholds for microbiological parameters	#
— Total duration	Hours
Compensatory payments to agricultural users in water protection areas	EUR
Water abstraction charges	EUR
Investment in repair and renewal of existing infrastructure	EUR
Capital costs by business service area	EUR; matrix format

Table 6.2 Proposed reporting sheet for assessment of inclusion of environmental and resource cost in cost recovery (cont.)

Data identifier	Unit
Operating costs by business service area	EUR; matrix format
Operating costs — water services	EUR; matrix format
— Technical and industry association fees	EUR; matrix format
— Costs for water protection area management	EUR; matrix format
— Costs for preventive resource protection	EUR; matrix format
— Costs for cooperation agreements with agriculture	EUR; matrix format
— Costs for voluntary environmental improvements	EUR; matrix format
Operating costs — extraction	EUR; matrix format
Operating costs — treatment	EUR; matrix format
Operating costs — transport	EUR; matrix format
Operating costs — storage	EUR; matrix format
Operating costs — distribution	EUR; matrix format
Operating costs — metering	EUR; matrix format
Operating costs — quality monitoring, testing	EUR; matrix format
Operating costs — central administration	EUR; matrix format
Total revenues from water services in observation year	EUR
Total expenditures in observation year	EUR
Are the requirements of the legislation on water protection areas known within the utility?	Yes/No
Is extensive testing for water analysis according to the Drinking Water Ordinance available?	Yes/No
Is there a recognised quality management system at the testing facility?	Yes/No
Are immediate reaction protocols to threshold violations known throughout the utility?	Yes/No
Are analysis results documented and kept for 10 years?	Yes/No
Total costs for repair and renewal of network mains in observation year	EUR; matrix format
— Self-implemented	EUR
— Externally implemented (contractors)	EUR
— Booked as direct costs	EUR
— Booked as investment	EUR
Total costs for repair and renewal of service connections	EUR; matrix format
— Self-implemented	EUR
— Externally implemented (contractors)	EUR
— Booked as direct costs	EUR
— Booked as investment	EUR
Total costs for inspection and maintenance of the network	EUR
Costs for public service work and projects	EUR
— Costs for public service work aimed at consumer behaviour and sustainable agricultural practices	EUR
Mains failures (including service connections)	#
Assumption of responsibilities	
Task — Basic planning of water services	Yes/No
Task — Provision of water rights	Yes/No
Task — Monitoring and testing	Yes/No
Task — Treatment	Yes/No
Task — Measurements	Yes/No
Task — Resource protection	Yes/No
Task — Management of land use in water protection area	Yes/No
Task — Voluntary environmental improvements	Yes/No

Source: EEA.

7 Conclusions

The comparative analysis of water pricing schemes and governance structures within the water sectors of selected EU Member States highlighted the current performance of water pricing systems in responding to the requirements of the EU WFD in terms of cost recovery, incentivising efficient use, and the balance between economic and social concerns.

General conclusions follow below.

- Recovery of the operation and maintenance costs of water services is the rule in most EU Member States, with the irrigation sector remaining the exception in EU Member States where this sector is an important water user (e.g. France, Spain and Italy), and for some types of irrigation systems in particular (e.g. large-scale gravity irrigation systems).

- The recovery of investment costs for water supply and sewage services is not yet the rule in all countries. In particular, Spain and Slovenia show cost-recovery rates lower than 100 % for the sewage/wastewater treatment sector (in which more recent investments benefited from European subsidies). Some uncertainties remain about the relative importance of hidden subsidies that might be linked to access to financial resources for support.

- Most EU Member States have environmental charges/taxes on abstraction/pollution that are internalising part of current environmental and resource costs. There is no evidence, however, of the extent to which these environmental and resource costs are being fully covered, as these instruments are primarily financial instruments that generate revenues to support water policy implementation.

- With regard to incentiveness, information gathered (mainly from studies already available) shows that the water tariffs in place are rather inelastic, although demand is clearly responsive to price changes (average price elasticities between – 0.4 and – 0.5 are rather common for households). The survey found, however, that no recent study has investigated the price elasticity of current water tariffs in different EU Member States, with most available data being potentially outdated.

- Translating the Article 9 requirements in terms of incentiveness might not necessarily be limited to the traditional water tariffs and environmental charges and taxes. Indeed, there is an increasing range of economic instruments applied to the water sector that can be considered — and that are part of the solutions(s) EU Member States can propose to increase incentiveness and address cost-recovery issues in specific contexts.

Overall, like the recent EC review of the first WFD RBMP (EC, 2012), the study indicates that there are very few EU Member States that have implemented a transparent recovery of environmental and resource costs. Cost recovery is implemented, to a greater or lesser extent, in households and industry. For agriculture, in many areas, water is charged only to a limited extent. Furthermore, there is no evidence from the information gathered that the adoption of the WFD and of Article 9 led to specific changes in the economic instruments applied to the water sector. No new economic instrument resulting from the WFD has been put in place between 2005 and 2011. And data do not show drastic changes in water tariff and environmental charge/taxation levels that could be explained by a stricter application of Article 9 for increasing cost recovery and the incentiveness of existing instruments.

Indeed, the recent financial and economic crisis may have worked to counteract the objectives of Article 9 (see ACTeon, 2012). In the Netherlands, for example, government decisions have had negative impacts on water financing: two taxes applied to industry (a tax on drinking water and on tap water) have been abolished as a means to increase the price competitiveness of the Dutch industry, thus reducing revenues to the government. In Spain, the economic crisis also impacted the political will to

raise charges for domestic and agricultural users, a politically extremely challenging and difficult objective to achieve. Economic and political drivers for policy change have been affected by the economic crisis, with crashes in the construction and banking sectors impacting the ability of national governments, regions and municipalities to push through improved cost recovery. In Ireland, however, the economic and financial crisis provided the right impetus for moving the WFD Article 9 implementation forward: the conditions of the Irish assistance package from the EU, ECB, and International Monetary Fund (IMF) led to plans to replace the current prohibition on domestic charges with a new public body to oversee water, Irish Water, and ensured new tariff and funding structures were correctly implemented and in line with the WFD principles.

Overall, despite the influence (varying in significance across the countries studied) of European legislation and the growing awareness within the region of the need for cost recovery and incentive pricing, the aim for a harmonised and functional concept of cost recovery to form part of water policy in Europe remains unachieved. The water sector governance structures in the EU Member States analysed in this study show significant differences, and while the distribution of competencies on the setting of water prices and the management of revenues from the provision of water services are not aspects dictated by the WFD, the incentives which drive the decisions that ultimately influence the functioning and performance of a country's water sector are defined by these setups. The discrepancy in the way affordability is considered in the different EU Member States studied and the conditions set upon the concepts of environmental and resource costs when put into practice are further matters that pose a challenge for the successful implementation of the WFD.

The study has stressed a series of issues calling for further research that are out of the scope of the present study.

- A refining of the assessment of cost recovery for (drinking and sewage) water service companies to capture the relative importance of so-called hidden subsidies, in particular those linked to the access to credit (at preferential rates) and the use of subsidies (resulting in lower than total investment/capital costs being integrated into company accounts) is necessary.

- As far as environmental and resource costs are concerned, there is a need to further develop methodologies to define depletion costs and externalities in a site-specific way, recognising the importance of a sound catchment-based approach for capturing these costs and for proposing mechanisms for internalising them in existing or new economic instruments in an optimal manner.

- Updating the knowledge on price elasticity of demand: a review of available evidence stressed that most available reference studies date back 10 or 20 years, but are still being used today to ground our thinking on the potential role economic instruments might have to reduce abstraction and polluted discharges! New case studies with primary data are required to provide fresh and relevant evidence that accounts for the socio-economic, management, and technological changes that have taken place in the last 20 years.

- With hydromorphological pressures and diffuse pollution from agriculture being significant pressures identified in nearly all RBDs in Europe, more research is required on the use of economic instruments to reduce these pressures via local authorities and economic sectors (e.g. private hydropower companies imposing hydromorphological pressures on rivers). For these water management issues, cost recovery (linked to the costs of the programme of measures), incentiveness (which signals to provide to actors), and affordability (how far can these sectors support costs of measures) have not yet been investigated.

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Annex 1 Overview of water pricing instruments in the EU, from the EEA/OECD database

Table A1.1 summarises the available information on water pricing instruments in EU Member States reported in the EEA/OECD database. Underlined entries contain hyperlinks to the relevant documents where available; these links have not been tested by the present authors, and this information is occasionally incomplete and obsolete; more recent information from other EU and national sources has been provided earlier in this report. More details (e.g. on charge rates and revenues) are also available from the EEA/OECD database.

Table A1.1 Water pricing instruments in the EU Member States

	Pricing rules, taxes and charges on water abstraction	Pricing rules, taxes and charges on water supply/ consumption	Pricing rules, taxes and charges on wastewater discharges and treatment	Pricing rules, taxes and charges on other
Belgium	Underground water tax (Walloon Region; abolished in 2010) Groundwater tax (Flanders Region)	–	Wastewater charge (Walloon region) Tax on sewage disposal (Walloon region; abolished in 2011) Waste Water charge (Flanders Region) Water pollution tax (Flanders Region)	Manure tax (Flanders region; abolished in 2007)
Bulgaria	Water-use charge	Water supply and sewage charge	Water supply and sewage charge Water pollution non-compliance fee	Fines for non-compliance with water regulations Fishing charges
Czech Republic	Charge for withdrawal of groundwater (Czech Law nb. 254/2001 Sb., about water management) Fees (on surface water withdrawals) to cover watercourse and river basin administration and to cover public interest expenses (Czech Law nb. 254/2001 Sb., about water management)	–	Fees for the discharge of wastewater into surface and groundwater (Czech Law no. 254/2001 Sb., about water management)	–
Denmark	–	Tax on water quantity (changed by law nr 1384, 28.12.2011) Water charges	Charge on sewage discharge Duty on wastewater	Duty on nitrogen Duty on pesticides Fee on fishing permit

Table A1.1 Water pricing instruments in the EU Member States (cont.)

	Pricing rules, taxes and charges on water abstraction	Pricing rules, taxes and charges on water supply/ consumption	Pricing rules, taxes and charges on wastewater discharges and treatment	Pricing rules, taxes and charges on other
Germany	Water abstraction charge (Bade-Wuerttemberg; groundwater and surface water) Water abstraction charge (Berlin; groundwater) Water abstraction charge (Brandenburg; groundwater and surface water) Water abstraction charge (Bremen; groundwater and surface water) Water abstraction charge (Hamburg; surface water) Water abstraction charge (Lower Saxony; groundwater and surface water) Water abstraction charge (Mecklenburg-Western Pomerania; groundwater and surface water) Water abstraction charge (Saxony; groundwater and surface water) Water abstraction charge (Schleswig-Holstein; groundwater) Water extraction charge	–	Wastewater charge	–
Estonia	Water abstraction charge and non-compliance fee (groundwater and surface water)	Water usage charge	Sewage charge Water pollution charge	
Ireland	–	–	–	–
Greece	–	Charge on irrigation water	Wastewater user charges	–

Table A1.1 Water pricing instruments in the EU Member States (cont.)

	Pricing rules, taxes and charges on water abstraction	Pricing rules, taxes and charges on water supply/ consumption	Pricing rules, taxes and charges on wastewater discharges and treatment	Pricing rules, taxes and charges on other
Spain	Tax on the environmental damage caused by some uses of water from reservoirs (Galicia)	Tax on water (Balearic Islands) (Resolution of the Economy and Treasury Department of the Government of Illes Balears of 30th December 2009 updating the tax rates and quotas of the regional taxes for 2010) Charge on water purification (Castille-La Mancha) (current rates established in Law 16/2010, of 22 December, on the Budget of the Junta de Comunidades de Castilla-La Mancha in 2011) Tax on water (Murcia) (Law 3/2010, of 27 December, established 2011 tax rates)	Fee on wastewater discharges Wastewater users charge Charge on water (Catalonia) Charge on water and water pollution (Galicia) New Law 9/2010, of 4 November, of Water of Galicia, repealing older Law 8/1993) Tax On Water And Water Pollution (Aragón) Tax on water and water pollution (Cantabria)ia) (Law of Cantabria 11/2010, of 23 December, of Fiscal Measures) Tax on water (Navarra) (2011 tax rates established by the Ley Foral 22/2010, de 28 de diciembre, de Presupuestos Generales de Navarra para el año 2011) Charge on water (Andalusia) Charge on water (Asturias) (Law of Asturias 13/2010, of 28 December, of General Budget Measures) Tax on water treatment (Castille-La Mancha) (current rates established in Law 16/2010, of 22 December, on the Budget of the Junta de Comunidades de Castilla-La Mancha in 2011) Tax on water (La Rioja)	–

Table A1.1 Water pricing instruments in the EU Member States (cont.)

	Pricing rules, taxes and charges on water abstraction	Pricing rules, taxes and charges on water supply/ consumption	Pricing rules, taxes and charges on wastewater discharges and treatment	Pricing rules, taxes and charges on other
Spain			Tax on wastewater treatment (Madrid) (tax rates for 2011 established by Orden 2956/2010, of 23 December) Tax on water (Valencia) (2011 tax rates established by the Ley 17/2010, de 30 de diciembre, de Presupuestos de la Generalitat para el ejercicio 2011)	
France	Charge on water abstraction	Charge on water supply Charge on water consumption	Wastewater user charges Water effluent charges	General tax on polluting activities (washing powder with phosphates; phytosanitary products)
Italy	–	Charge on table water bottles Charge on water services	Charge on water services Wastewater user charges	Duty on pesticides
Cyprus	–	–	–	–
Latvia	Water abstraction charge (groundwater and surface water)	Water consumption charge	Sewage charge Water effluent charge Water pollution non-compliance fees	–
Lithuania	Water abstraction charge (groundwater and surface water)	Water supply user charge	Sewage user charge Water pollution charge Water effluent non-complance fee	
Luxembourg	–	–	–	–
Hungary	Charge on water abstraction	–	Wastewater user charges Water load charge Water pollution levy	–
Malta	–	–	Wastewater charges (Water Supply Regulations LN 58/1999) Effluent discharge charges	Swimming pool license fee
The Netherlands	Tax on groundwater extraction	Tax on tap water	Municipal sewerage charge Levy on water pollution	MINAS (tax on surplus nitrogen and phosphate; abolished in 2006) Charge for fishing license
Austria	–	Fee on water use	Wastewater charges	Fee on hunting and fishing

Table A1.1 Water pricing instruments in the EU Member States (cont.)

	Pricing rules, taxes and charges on water abstraction	Pricing rules, taxes and charges on water supply/ consumption	Pricing rules, taxes and charges on wastewater discharges and treatment	Pricing rules, taxes and charges on other
Poland	Charge on water abstraction (groundwater and surface water) (Executive Order of Council of Ministers of 14.10.2008 — in force since 1.01.2009 + Announcement of Minister of Environment on detailed charge rates for 2011 (4.10.2010))	–	Water effluent charges	Fishing permits
Portugal	–	–	–	Fishing permits
Romania	Water abstraction charge (groundwater and surface water)	Water consumption charge	Sewage charge Water effluent charge Water pollution non-compliance fees	Fishing permits
Slovenia	Water abstraction charge (Decree on the water fee, Official Journal of the RS, No. 103/2002, 122/07) Payment for water rights (a.o. for hydroelectric power production) (Water Act, Official Journal of the RS, nr. 57/2008)	Water consumption charge (Rules of tariff system for public service on the environmental field, Official Journal of the RS, nr. 63/2009)	Wastewater collection and treatment charge(Environment Protection Act (ZVO-1). Official Journal of the RS, No. 41/2004; Rules of tariff system for public service on the environmental field, Official Journal of the RS, nr. 63/2009) Wastewater pollution tax (Decree on environmental tax for environmental pollution caused by wastewater discharge, Act on Local Finances, Official Journal of the RS, No. 104/09, 14/10)	–
Slovakia	–	–	Charge for discharging of wastewater	–
Finland	Water level regulation charge	Water user charges	Water protection charge Wastewater user charges	Fishing management fee Fishing license fees
Sweden	–	–	Wastewater user charges	Tax on commercial fertilizers (abolished in 2010) Tax on pesticides
United Kingdom	Abstraction charges	–	–	–

Note: The distinction between charges for water supply and wastewater treatment is not always clear-cut; in many countries there is a single charge for both types of water services.

Source: EEA/OECD database on instruments used in environmental policy (see http://www2.oecd.org/ecoinst/queries/index.htm).

Annex 2 Accompanying mechanisms and measures in the EU

Country	Measure	Description	Implementation	Responsible organisations
Austria	Authorisation procedure for water abstraction	(Austrian Federal Water Act 1959) Landowners do not need an authorization from the water authority if the abstraction is only by hand-operated pumping stations or if the withdrawal is proportional in relation to his own land. In all other cases of use of ground water and interventions in the ground water regime a permit of the water authority is required (§ 10). Water authorities are responsible for compliance checks of water using facilities (§ 130).§ 137 contains penal provisions for those who violate the provisions of the Austrian Federal Water Act.	National	No information
Belgium	Authorisation procedure for water abstraction	Flanders, Belgium: a permit system for water abstraction is in place under the environmental regulation. Farmers that pump up ≥ 500 m³ of groundwater and surface water from navigable water bodies, need to apply for a permit to the relevant authorities. Farmers that use less than 500 m³ only need to notify their water use. Wallonia, Belgium: Though there is very few irrigation in Wallonia, water abstraction for agriculture is included in authorization procedures (as for other uses).	Regional/RBD	No information
	Metering for groundwater abstraction	Flanders, Belgium: compulsory and linked to the permit system.		
France	Metering	Obligatory metering for each water extraction by drilling. Obligatory metering for each water extraction in water deficit areas, and when abstracting more than 10 000 m^3/year outside those zones. Metering is furthermore a condition for the eligibility for CAP subsidies. Obligation to implement meters for 'cold' drinking water in new collective buildings.	National	No information
	Authorisation certificate for irrigation water for large-scale farming systems	Statutory requirement conditioning granting of CAP aid. Content: Obligation to possess an administrative report receipt and irrigation authorisation certificate and presence of means of evaluating volumes. Target: All farmers benefiting from special irrigation aid for cultivation of cereals and oil and protein crops. Inspection methods: Checking of possession of receipt and certificate and presence of appropriate means of measuring volumes drawn off.	No information	No information

Country	Measure	Description	Implementation	Responsible organisations
France	Distribution of water quotas to farmers	In some areas, water quotas are attributed to farmers. This management system has the following characteristics: a) Alloting a water quota for each farming operation (calculated on the basis of the theoretical water needs for the cultivation of corn on three types of soil). B) instituting a calendar for the distribution of this water quota during periods of low water c) developing rules for restictions based on the state of the resource d) setting up a system for monitoring the irrigators' practices	Regional/RBD Municipality/ Water company	
Germany	Water right allocation shall be coupled with ground water monitoring	Climate change adaptation and effects of climate change in Mecklenburg-Vorpommern	Regional/RBD	No information
	Control of groundwater abstraction for agriculture (watering of animals, irrigation) shall be monitored	Climate change adaptation and effects of climate change in Mecklenburg-Vorpommern	Regional/RBD	No information
	Development of demand forecast and water balance for local water utility services	Bavarian Climate Change Adaptation Plan	Regional/RBD	No information
	Collection of data and valuation of the security of water supply considering changed water availability and considering the demographic development	Bavarian Climate Change Adaptation Plan	Regional/RBD	No information
	Compilation of water use, water use registration	Meter measuring, flow rate measurement for cooling, visualisation of water flows, partial flow	No information	No information
	Water metering	Enhanced efforts to introduce compulsory metering programmes are implemented and applied in all water using sectors.	National	No information
Italy	Metering	More efficient measuring of water consumption	Regional/RBD	Regione Sardegna ATO Piacenza — Regione Emilia-Romagna
	Monitoring water resource use	Better data on availability and use	National regional/ RBD Municipality	ATO Ferrara/ Gruppo Hera

Country	Measure	Description	Implementation	Responsible organisations
Luxem-bourg	Metering	The draft law 5695 regulates the metering of the quantity of drinking and wastewater services at a national level.	National	No information
	Authorisation procedure for water abstraction	Authorizations for water abstractions are necessary according to Art. 23 of the national Water Law from 2008. To address non authorized water abstractions in agriculture, measures are in use.	National	No information
Malta	Smart Metering of water	Installation of smart water meters in all households.	National	Malta's Water Services Corporation (WSC)
	Development of a code of good practices for groundwater abstraction	Supply information to all drillers, or applicants to permits, farmersetc on drilling and pumping practices which affects groundwater quality, favour up-coning, etc. BAT. Remark: activities to be linked/coordinated with general public awareness campaigns	National	MRA MRRA, Department of Agriculture, Malta Chamber and Local Councils
	Introduce groundwater abstraction control	Boreholes will be metered. The measure should provide MRA with a reliable source to information.	National	MRA and WSC NGOs and Local
	Develop an awareness campaign for groups of measures	Within the Water Catchment Management Plan, awareness raising activities will be developed for each group of measures. Each activity will focus on: 1. The scope of each measure and the envisaged benefits such social/economic/ environmental) arising from its implementation 2. Best practices related to different activities as defined by several measures in this Programme.	National	All, MTA, Transport Malta, Department of Fisheries, Department for Environmental Health, NGOs, Malta Hotels and Restaurant
Nether-lands	Extensive metering to reduce demand	97 % of water users are metered and a portion of their bill — typically about one half — is based on actual consumption. Consequently average municipal water use is among the lowest in developed countries at only 124 litre/capita/day in 2004.	National regional/ RBD Municipality	Regulator and water company
Poland	Metering	According to Polish regulations, all economic subjects which abstract water under water entitlements in a quantity higher than 100 m per 24 hours are obliged to ensure systematic control over water abstraction.	National regional/ RBD	No information
Portugal	Water Use Licensing (Offences and penalties related with no authoriesd use)	The Water Institute (INAG), as National Water Authority, requires legal licensing for water use, in accordance with article 81 (3a) of the Decree-Law 226-A/2007 of 31 May. Therefore water abstraction for irrigation purposes without prior authorization is a serious administrative offence.	National regional/ RBD	No information
Sweden	Metering programme	Metering of water usage for control, and possible enforcement	National	No information

Country	Measure	Description	Implementation	Responsible organisations
England and Wales	Water metering of domestic properties	In the UK most households are not metered. In England and Wales, the levels of household water metering in 2008-2009 are on average 35 %. At present, water companies in areas of serious water stress in England are assessing the costs and benefits of near-universal metering, along with other supply-demand measures. Water companies outside areas of serious water stress, and in Wales, have to install a meter on new properties and when a customer asks for this (optant metering), and have the option to install when someone moves home (metering on change of occupancy) or when they can prove a large discretionary use — an unattended watering device or a swimming pool, for example (selective metering).	No information	No information
Northern Ireland	Implementation of metering for commercial and industrial businesses	Metering is a very controversial issue in Northern Ireland and a long way off for use in domestic properties unless householders specifically ask for a meter. The Northern Ireland regulator is first introducing the requirement for all major users — institutions such as schools and hospitals, and large businesses to install meters for water consumption	National	Regulator

Source: ACTeon, 2011. Database developed in the context of the EU project 'Gap Analysis'.

Annex 3 Environmental and resource costs coverage in benchmarking initiatives

Table A3.1 Environmental and resource costs coverage in benchmarking initiatives

Cost position (from German regional benchmarking initiatives)	Unit	Environmental and resource costs — relevant activities or costs based on DWA approach	Definition	Additional comments
Compensatory payments for water quality improvements	EUR	Compensatory payments for water quality improvements (according to § 19 Federal Water Law)	Payments made to farmers in water protection areas as compensation for the restriction of agricultural practices (e.g. fertiliser use)	
Operating costs of water services	EUR	Technical and industry association fees	Costs for special purposes, including membership fees for organisations that contribute to water quality and quantity management	
		Costs for signage in water protection areas	Costs of indicating the extent and allowable uses of water protection areas	
		Measures for preventive water protection	Costs of protecting relevant water resources, including water monitoring	
		Cooperation with agriculture to reduce diffuse pollution	Costs for programmes that fund bank restoration measures, field retirement, etc.	These programmes are additional to the compensatory payments in water protection areas
		Voluntary measures for ecological improvement	Measures undertaken directly by water utility	Encompasses all voluntary ecological improvement of land and water within water protection areas
Water abstraction charge	EUR	Water abstraction charge	Costs for water abstraction charges	
Costs for maintenance and inspection of the network	EUR/km	Measures to reduce water loss	Expenditures for inspections, maintenance and renewal of water transport infrastructure	
Costs of repairs and renewal in the network (direct costs and investments)	EUR for mains and EUR for service connections			
Operating costs for water treatment and disinfection	EUR	Additional technical treatment processes	Processes made necessary by the quality of surface or groundwater bodies	Additional information is necessary to determine what proportion of these costs are ERC

Table A3.1 Environmental and resource costs coverage in benchmarking initiatives (cont.)

Cost position (from German regional benchmarking initiatives)	Unit	Environmental and resource costs — relevant activities or costs based on DWA approach	Definition	Additional comments
Operating costs for quality monitoring, testing	EUR	Additional quality assurance (e.g. monitoring trace elements)	Only testing that goes beyond legal requirements is considered ERC; both untreated and treated water	This can be determined on the basis of the ratio of tests carried out to tests required
Public service work	EUR	Public service work	Public service work that contributes to reduced water demand or reduced water pollution from various sources	Additional information is necessary to determine what proportion of these costs are ERC

Source: Adapted and expanded from Nickel et al. 2012.

Additional indicators for the assessment of environmental and resource costs

The indicators in Table A3.2 that are highlighted in grey have not yet been used in German benchmarking systems — or they have been used previously but were discarded. As the reasons for their removal from benchmarking systems are no longer necessarily relevant, Nickel et al. (2012) have identified them as worthy of consideration for future benchmarking due to their relevance for sustainability assessment)

Table A3.2 Additional indicators for the assessment of environmental and resource costs

Objective		Structural or performance indicator	Unit
Resource protection	Locality of services	Regional water extraction (Structural)	%
		Water imports (Structural)	%
	Water quality	Average nitrate concentration in water sources, including information on 10-year trend (Structural)	mg/l
		Average PSM concentration in water sources, including information on 10-year trend (Structural)	µg/l
		Resource pollution from wastewater disposal, supported by faecal indicators (Structural)	Yes/no
		Resource pollution from special parameters (minimisation ordinance) (Structural)	Yes/no
	Long-term pollution reduction	Operating costs of water services relative to the amount of water provided (Performance)	EUR/m³
		Costs for measures that ensure sufficient quality and quantity of extracted water relative to the amount of water provided (Performance)	EUR/m³
		Proportion of extraction areas in water protection areas (Structural)	%
		Proportion of extraction areas in water protection areas as percentage of requirements according to DVGW guidelines (Structural)	%
		Percentage of extraction area with exceptional pollution potential (Structural)	%
		Percentage of protection areas belonging to the utility (broken down by protection zones I through III) (Structural)	%
		Percentage of extraction area subject to cooperation agreements with agriculture (Structural)	%
		Percentage of extraction area subject to compensatory payments to agriculture (Structural)	%
	Quantitative status	Usage level of available resources as percentage of water availability (on average and high-volume days) (Performance)	%
		Number of service interruptions due to lack of water resources (Performance)	#/year
Drinking water quality	Resource characteristics	Type of resource (surface water, groundwater, etc.) (Structural)	%
		Level of necessary treatment (none, conventional, disinfection, and extensive) (Structural)	%
	Quality monitoring and improvement	Violation of threshold values for substances (percentages microbiological and chemical/physical) (Performance)	%
		Number and duration of allowable threshold violation according to Drinking Water Ordinance (§§ 9&10) (Performance)	# and hours
		Real water losses relative to the network length (Performance)	m³/km* h
		Network inspection and documentation (Performance)	%
		Costs for inspection and maintenance of the network relative to network length (Performance)	EUR/km
		Rate of repair and renewal in the network (including historical average) (Performance)	%
		Rate of repair and renewal of service connections (including historical average) (Performance)	%
		Costs of repairs and renewal in the network (direct costs and investments) (Performance)	EUR/km
		Costs of repairs and renewal of service connections (direct costs and investments) (Performance)	EUR/ service connection
		Mains failures (including service connections) (Performance)	#/100 km/year
	Water quality monitoring (testing)	Relationship between number of tests carried out and number of tests required (broken down by microbiological versus chemical, and by untreated versus treated water) (Performance)	%

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