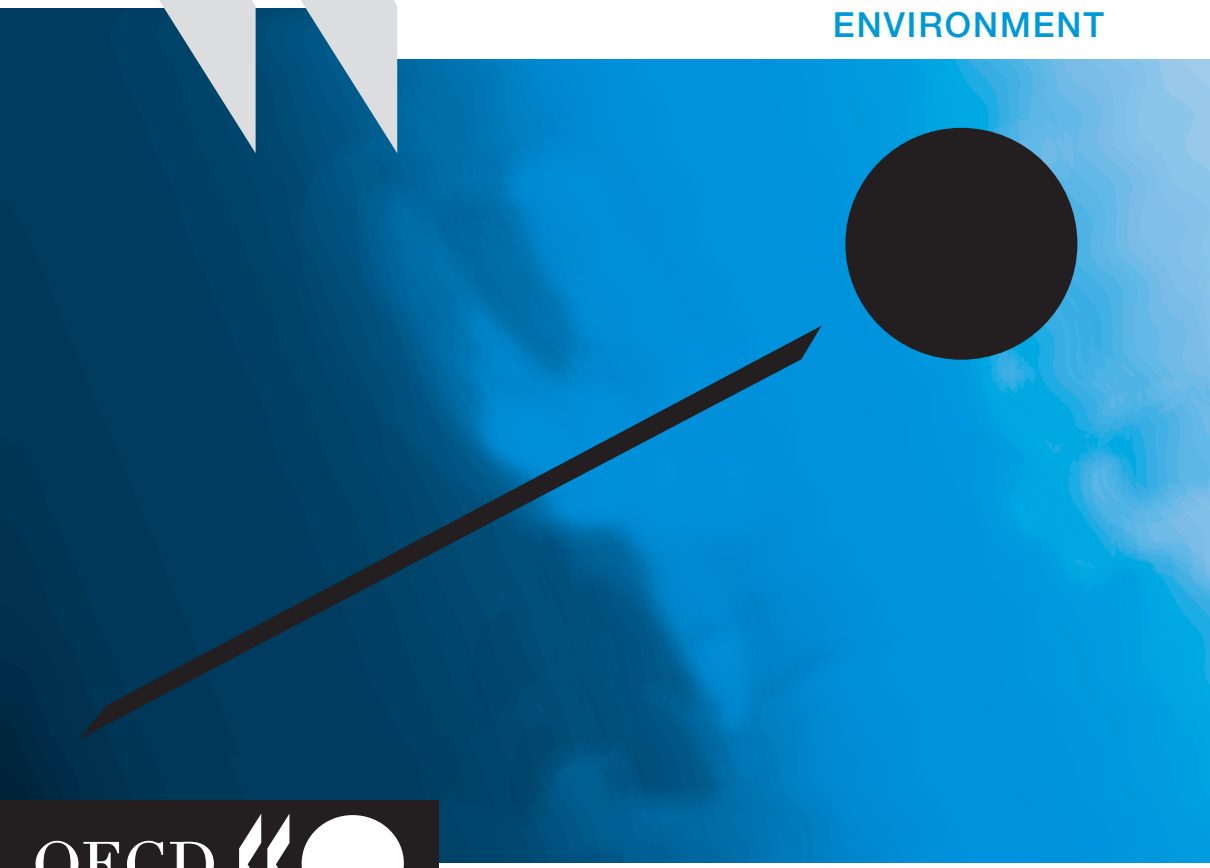
Environmental Performance Reviews

WATER

ENVIRONMENT



OECD

Environmental Performance Reviews

WATER

Performance and Challenges in OECD Countries

OECD

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996), Korea (12th December 1996) and the Slovak Republic (14th December 2000). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

FOREWORD

The OECD is an organisation with a special interest in the *environmental effects of economic policies and the economic effects of environmental policies*. In the area of *water resource management*, this interest is reflected in a focus on the cost-effectiveness of water management policies, the efficiency of water resource allocation and the impact on water resources of sectoral and other economic policies (e.g. concerning agriculture or spatial planning). In recent years, the OECD has evaluated the use of economic instruments for, inter alia, water management, as well as water pricing for domestic, industrial and agricultural uses.

The *OECD environmental performance reviews* have documented the progress made by individual member countries in terms of their national objectives and international commitments. This paper draws on the water management chapters of 42 reviews carried out to date to identify common achievements and remaining challenges for OECD countries in terms of further reducing the pollution burden and protecting human health and aquatic ecosystems. Conclusions are drawn relating to: i) better integrating water and other policies for sustainable development; ii) getting water prices right; and iii) new challenges for water-related public health.

This report was prepared at the request of the OECD Working Party on Environmental Performance (WPEP) as background documentation to the meeting of the Third World Water Forum (Kyoto, March 2003). This report has been written by Eduard Goldberg and Henri Smets, under the supervision of Christian Avérous and with the technical assistance of Maria João Santos, Frédérique Zegel, Sylvie Dénaux and Nadine Rocher. The report has benefited from comments by a number of experts and officials of OECD member countries. It is published under the authority of the Secretary-General of the OECD.

OUTLINE

FIGURES AND TABLES

Cut-off date
This report is based on information and data available up to 31 December 2002.

EXECUTIVE SUMMARY

During the 1990s water, which is supporting life, was increasingly considered an economic as well as a social and environmental good. The water sector has significant economic weight and requires good governance.

There is *wide diversity among OECD member countries* in terms of their water needs and available water resources. While most are industrialised countries, a minority are still in the process of development, with lower availability of water supply and sanitation. Water resources in eight member countries are already subject to high or medium-high stress; in a further eight water availability is becoming a constraint on development and significant investments are needed to marshal adequate supplies. Some other member countries, though relatively water-rich on a national scale, have extensive arid or semi-arid regions where the nature of development is necessarily shaped by water scarcity. A few countries have low population density and abundant water resources. In an international context, integration of upstream and downstream interests of transboundary water bodies is receiving increasing attention as these are a potential source of discord.

In the past few decades *OECD countries have made large efforts* to clean up effluent discharges, and to protect and restore water resources. Good progress has been made, though the diversity among member countries with respect to economic and social development, institutional structures and culture accounts for considerable differences in the environmental results achieved to date. In view of the objectives adopted in the OECD Environmental Strategy and at Johannesburg, many OECD countries will have to take significant steps to improve sanitation and restore aquatic systems.

The OECD has led a programme of environmental performance reviews; since 1992, 42 reviews have been issued covering all member countries and a few countries which are not OECD members. On the basis of these reviews, it is clear that all member countries have achieved notable success in at least some of the following areas:

- access to *drinking water for all*;
- improved water supply and sanitation for *low-income* groups;
- large *reductions in point discharges* from industry and urban areas;
- *clean-up* of the worst polluted waters;
- establishment of a comprehensive *framework* of water management laws, policies, programmes and institutions;
- a good degree of *integration* of quantity and quality management;
- progress towards the *whole-basin* approach;
- wider implementation of *integrated permitting*;
- improvement in the *enforcement* of regulations and permit conditions;
- good *capacity* to effectively implement policies and measures; and
- growing momentum in the reform of water *pricing regimes*.

Nevertheless, the considerable water management efforts of recent decades have *not been enough to safeguard and restore receiving water quality and aquatic ecosystems*. Much progress remains to be made on many issues, such as:

- achievement of *ambient water quality objectives*;
- better protection of *aquatic ecosystems*;
- improved *cost-effectiveness* of water management policies and activities;
- reduction of *subsidies* which increase water problems (e.g. overabstraction, pollution);
- more consistent application of the *polluter pays principle* and the *user pays principle*;
- *implementation* of the laws, regulations and policies that have been adopted;
- renewed attention to *human health* aspects of water management;
- control of *diffuse sources and depositions* of nutrients, heavy metals and persistent organic pollutants;

- contamination of *groundwater* aquifers by nitrates, pesticides and other persistent chemicals;
- completion, restoration and upgrading of *waste water treatment infrastructure*;
- better integration of water management into *sectoral and land use policies*;
- protection against *floods and droughts*;
- greater *public participation* in the formulation of water management policies and programmes;
- more effective measures to ensure that water is *affordable to all*.

One of the main challenges for making the *use of water resources sustainable* is improving the integration of environmental factors in sectoral policies. Water quantity and quality problems caused by agriculture, in particular, raise questions about the sustainability of some of the current practices in this sector in a number of countries. For example, in dry regions of several OECD countries the *scarcity of water has become a limiting factor on development*, which can be exacerbated by droughts. A change in production processes will often be required, which is mostly beyond the direct reach and responsibility of water managers. Stakeholders must therefore take responsibility for the environmental effects of their actions. Policy instruments should be aimed at encouraging environmentally responsible behaviour, for example through greater application of social and economic instruments, including the reform of subsidies or taxes that have harmful environmental effects. Unless investments in the water sector are made in due time, countries risk being confronted with a crisis situation whose effects will grow with climate change.

Another challenge concerns the *supply of safe drinking water and sanitation at reasonable cost to all*. A few OECD countries have yet to connect a part of their population to water supplies. In others the need to upgrade ageing networks and installations appears to be emerging at the same time as new demands for more, and higher, standards for drinking water purification. The need to remove nitrates and pesticides from water supplies is becoming more frequent as a result of pollution of water supplies. Concern about the poor quality of some drinking water supplies and the greater vulnerability of children or the elderly to infections by viruses and parasites is creating demand for more advanced purification. Thus an increase in water prices will be required. Considerable water infrastructure expenditure will also be required at a time

when central government subsidies are being reduced. Growing contributions from the private sector through public private partnership (PPP) can be expected.

The need to *get water prices right* is a third challenge. Both concern about the sustainability of current water management practices and the rising cost of water are focusing attention on the need to: i) allocate water resources efficiently, ii) operate water services cost-effectively and iii) ensure that water is available to all. Pricing systems must and can be structured so that every person has access to clean water for drinking, cooking and washing. They should also encourage water conservation. Metering should be developed, and flat rates and subsidies for operating costs should be abolished. Furthermore, subsidies for infrastructure capital costs should be progressively reduced without creating public health problems or employment problems. Water is no longer a minor expenditure item for many households, and signals that the public's willingness to pay is being stretched are becoming more evident. Authorities must therefore build (through public education, consultation campaigns and meaningful public participation practices) a broad stakeholder consensus on the justification for higher water prices, while establishing social measures to reduce the impacts of such price increases on the poor.

1

BACKGROUND

Over the past few decades *OECD countries have expended considerable efforts in the water sector. In particular, they have made large investments in cleaning up effluent discharges and protecting and restoring water resources*. Good progress has been made, though the wide diversity among OECD members in terms of economic and social development accounts for substantial differences in the environmental results achieved to date. The Environmental Performance Reviews* of all member countries carried out since 1992 have documented progress made by individual countries, in terms of their national objectives and international commitments, towards the goal of sustainable development. This report evaluates the performance of OECD countries in achieving national and international objectives related to fresh water adopted over the last ten years. For this purpose, the report is structured on the basis of the OECD Environmental Strategy for the First Decade of the 21st Century, adopted by OECD Ministers of the Environment in 2001. Account is also taken of the declarations of the Second World Water Forum (The Hague, 2000), the International Conference on Freshwater (Bonn, 2001) and the World Summit on Sustainable Development (Johannesburg, 2002).

Both water and population are unevenly distributed over the globe; OECD countries, like other countries or regions, are experiencing *differing degrees of water stress*. Not all water uses put equal stress on water resources. However, it is generally considered that when the ratio of water withdrawal to annual water availability is less than 10%, water stress is low. A ratio in the range of 10 to 20% indicates that water availability is becoming a constraint on development and that significant investments are needed to provide adequate supplies. When the ratio is over 20%, both supply and demand will need to be managed and conflicts among competing uses will need to be resolved. Eight

* A list of reviews completed as of February 2003 is provided in the Annex.

OECD countries already withdraw more than 20% of the water resources available to them, and a further eight withdraw between 10 and 20% (Figure 1). Some other member countries, while relatively water-rich on a national scale, have extensive arid or semi-arid regions where the nature of development is necessarily shaped by water scarcity; in numerous aquifers in these regions, and decades after the problem was identified, groundwater abstraction still exceeds natural recharge, resulting in a progressive lowering of groundwater tables. Long-term natural variations in rainfall can also cause droughts lasting several years. In addition to human needs, the water requirements of ecosystems must be taken into account.

It is now accepted that water is a key to sustainable development and should be protected strictly. It is also acknowledged that "water is an economic and a social good, and should be allocated first to satisfy basic human needs. Many people regard access to drinking water and sanitation to be a human right." (Bonn, 2001)[*] In 2002 the right to water was formally recognised as a human right by the Committee on Economic, Social and Cultural Rights.[**]

As water has an economic value and should therefore be recognised as an economic good, it should also be considered a social good and an environmental good with multiple functions in aquatic ecosystems. Water is a sine qua non for sustainable development. While it is accepted that everyone should have access to clean water in order to satisfy basic needs such as drinking, cooking and washing, this does not translate into provision of free water to all. There remains a need to allocate water resources efficiently and equitably, to operate water services cost-effectively, and to ensure proper financing of all water services.

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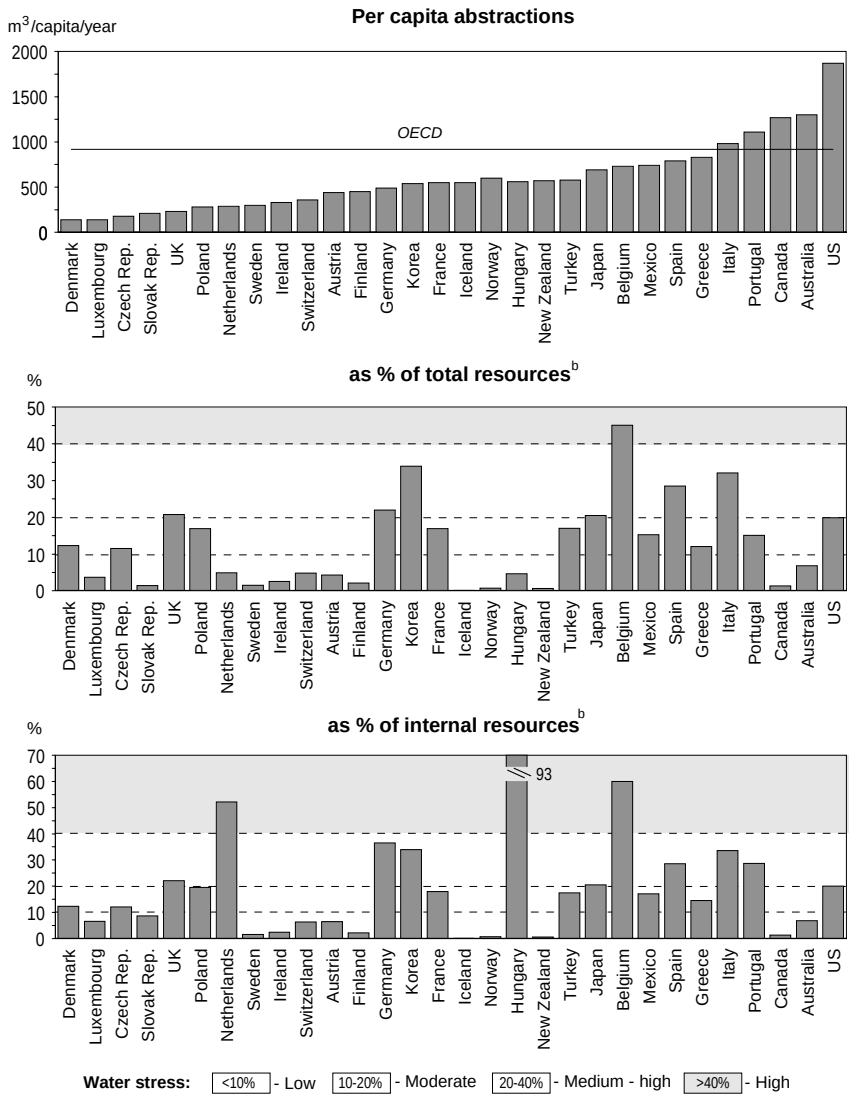
[*] Extract from Recommendations of the International Conference on Freshwater (Bonn, 2001). According to the Dublin Statement on Water and Sustainable Development (1992), "Water has an economic value in all its competing uses and should be recognised as an economic good. Within this principle, it is vital to recognise first the basic right of all human beings to have access to clean water and sanitation at an affordable price." According to the EU Water Framework Directive, water is "not a commercial product like any other."

[**] See General Comment N°15 (November 2002). The Committee on Economic, Social and Cultural Rights is following up the implementation of the International Covenant on Economic, Social and Cultural Rights (ratified by 145 States, including 28 OECD member countries).

Figure 1. **Gross freshwater abstractions**,[a] latest year available



a) Time-averaged. National figures may conceal subnational or occasional water resource problems.
b) Internal resources = precipitation - evapotranspiration;
total resources = internal resouces + transboundary inflows.
Source: OECD.

In OECD countries, the "*water sector*" (i.e. all activities concerning the supply, purification and distribution of water for domestic, industrial and agricultural use, the treatment and disposal of effluents, and the protection of water resources and aquatic systems) has a *significant economic weight* which is likely to increase.[*] In the OECD countries as a whole the expenditure of the water sector exceeds USD 250 billion per year, taking into account all direct expenditure related to water for domestic, industrial and agricultural use.[**] In the area of pollution abatement and control (PAC), investment and operating expenditure related to water (i.e. sewerage and waste water treatment) ranges between 0.3 and 1% of GDP (Figure 2 and Table 1). Most such expenditure is public expenditure, with private expenditure mostly limited to that part of industry and households treating their own waste water. Water supply and irrigation expenditure are of the same order of magnitude as PAC expenditure.

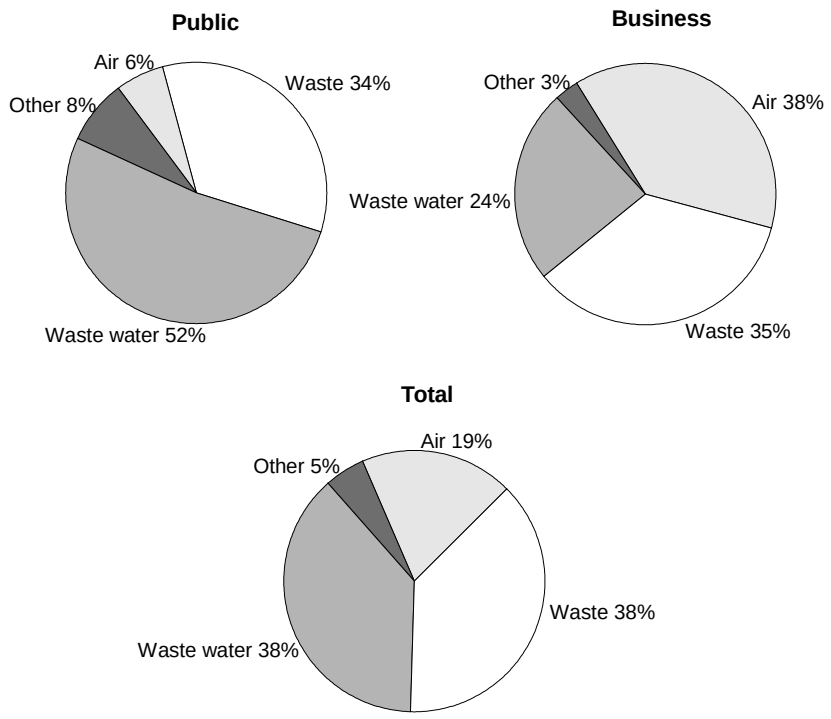
The discussion below of OECD countries' performance with respect to water objectives is broken down into five sections:

- water: a vital good;
- water: its economic dimension;
- water: its social dimension;
- water: its environmental dimension;
- water governance.

[*] The protection of oceans, all kinds of seas (including enclosed and semi-enclosed seas) and coastal areas is not discussed in this report, which focuses on freshwater. It should nevertheless be pointed out that land based sources of pollution contribute significantly to marine pollution, especially in the Baltic Sea and North Sea.

[**] Use of water as a resource including waste water treatment, but not including water amenities and waterways.

Figure 2. **Pollution abatement and control expenditure**, OECD countries



Source: OECD.

Table 1. **Investment and current expenditure on waste water pollution abatement and control**, selected countries, late 1990s

		Total[a]			Public sector[b]				Business sector		
		Year	per capita	‰ GDP	Year	per capita	‰ GDP	Investment ‰ GDP	Year	Per capita	‰ GDP
Mexico	*	..	..	..	2000	1.8	0.2	0.1	..	..	..
US		1994	161.8	6.0	1994	105.0	3.9	1.8	1999	23.4	0.7
Japan		..	..	..	1999	84.1	3.3	..	..	..	..
Korea		2000	116.3	6.6	2000	80.8	4.6	3.6	2000	35.5	2.0
Australia		..	..	..	2000	36.7	1.4	0.6	..	..	..
Austria	*	2000	202.8	7.5	2000	117.2	4.3	1.9	2000	47.2	1.4
Belgium		2000	111.4	4.3	2000	74.3	2.8	1.9	2000	29.6	1.1
Denmark		..	..	..	2000	123.0	4.3	1.6	..	..	..
Finland		1999	81.8	3.6	2000	58.4	2.4	1.1	1999	30.6	1.3
France		2000	177.9	7.5	2000	100.7	4.2	2.3	2000	23.3	1.0
Germany	*	1999	195.4	8.3	1999	168.7	7.2	3.6	2000	28.0	1.1
Greece		..	..	..	1999	14.3	1.0	0.9	..	..	..
Iceland		..	..	..	2000	17.2	0.6	0.5	..	..	..
Ireland		1998	73.6	3.1	1998	58.7	2.5	1.7	1998	14.9	0.6
Italy	*	..	..	..	1996	3.2	0.2	0.0	1997	6.3	0.3
Luxembourg		..	..	..	1997	96.8	2.7	1.6	..	..	..
Netherlands		1998	144.3	5.9	1998	113.5	4.7	2.0	1998	26.6	1.1
Norway	*	..	..	..	2000	81.2	2.8	1.3	..	..	..
Poland	*	2000	62.7	6.8	2000	42.0	4.5	3.7	2000	20.3	2.2
Portugal		1998	58.5	3.7	2000	40.0	2.3	1.7	2000	14.9	0.9
Slovak Rep.		..	..	..	1994	38.3	4.9	3.6	..	..	..
Spain		..	..	..	1999	46.4	2.5	2.0	..	..	..
Sweden	*	..	..	..	..	..	..	..	..	..	..
Switzerland	*	..	..	..	1999	131.6	4.8	2.6	..	..	..
Turkey		1997	10.5	1.7	1997	8.7	1.4	1.2	1997	1.8	0.3
UK		2000	17.7	0.7	2000	4.7	0.2	0.0	2000	13.0	0.5

a) Public and business sectors and specialised producers of environmental services (not households).
b) Including public specialised producers of environmental services.
* See technical notes for country notes and comments -- Per capita: in USD per person at current purchasing power parities -- ‰ GDP: per 1 000 units of GDP.

Source: OECD.

2

PERFORMANCE IN THE MANAGEMENT OF WATER OBJECTIVES

According to the OECD Environmental Strategy for the First Decade of the 21st Century, the major challenges in the area of freshwater are:

a) "to protect, restore and prevent deterioration of all bodies of surface water and groundwater to ensure the achievement of water quality objectives in OECD countries;
b) to manage the use of freshwater resources and associated watersheds so as:
- to maintain adequate supply of freshwater of suitable quality for human use; and
- to support aquatic and other ecosystems."

During recent decades, great progress has been made in *reducing point discharges* of pollutants from *industry* and from *urban areas* to surface waters. In over half the OECD countries problems related to oxygen-demanding substances and bacterial water quality are now largely under control. Upgrading of municipal waste water treatment plants to secondary level is in advanced stages, and planning and implementation of programmes for tertiary treatment (mainly removal of nutrients) are increasingly carried out where required. About ten countries are still completing sewerage networks or installation of the first generation of municipal waste water treatment plants. Larger industrial enterprises in a number of member countries are now equipped with modern technology to remove most oxygen-demanding substances, heavy metals and persistent toxic contaminants from effluent. Progress has also been made by some countries in controlling smaller industrial discharges. Still, continuing reliance on end-of-pipe technology means that the underlying causes of many discharges remain.

This progress has been facilitated by the adoption of modern water legislation at national level and of new international instruments concerned with water management such as the UN/ECE Convention on Protection and Use of Transboundary Watercourses and numerous EU Directives (e.g. drinking water, nitrates, waste water treatment, water framework).

2.1 Water: a vital good

The UN Millennium Declaration adopted by Heads of State in 2000 set the objective of halving the proportion of people in the world who do not have access to safe drinking water by 2015. In Johannesburg, the World Summit for Sustainable Development in 2002 adopted the same objective as well as the objective of halving the proportion of people who do not have access to basic sanitation.

Within the OECD, the OECD Environmental Strategy for the First Decade of the 21st Century adopted by Ministers of the Environment in 2001 contains the more ambitious goal of national action to "ensure access *for all* to safe drinking water and adequate sanitation."

OECD countries have greatly improved water supply and sanitation over the last decade (Figure 3 and Table 2), but gaps remain to be filled, bearing in mind that achieving 100% coverage is neither technically nor economically desirable, nor is it environmentally necessary. In particular, the share of the population connected to secondary and tertiary waste water treatment systems needs to be increased in many member countries. In a few countries much improvement is also needed regarding water supply in rural areas.

With few exceptions, *drinking water supplied to the main centres in OECD countries is bacteriologically safe,* though quality monitoring of smaller drinking water supplies is not always extensive or frequent enough to guarantee safe water at all times. A few member countries have yet to connect a part of their population to safe water supplies. In several countries it is increasingly difficult to find good quality drinking water sources, and at times mandatory health standards of distributed waters are not met due to nitrate or pesticide contamination of source areas.

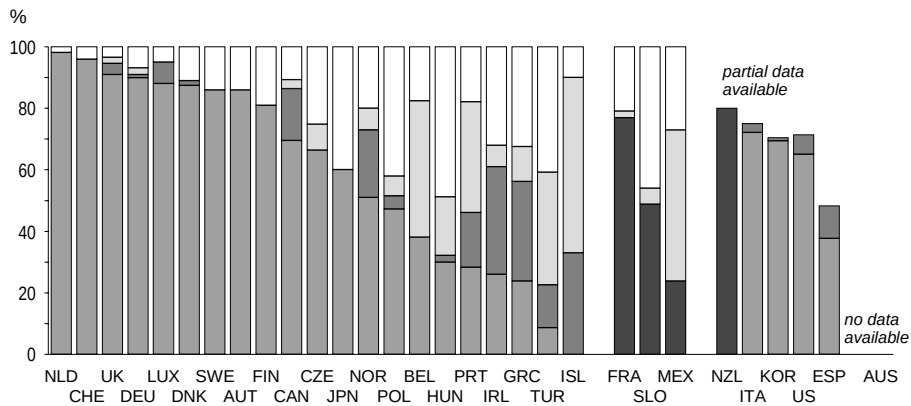
Despite over a century of effort, member countries face some *new challenges in providing safe public water supplies*. Concern about the greater vulnerability of children, the elderly and those with weakened immune systems to infection by viruses and parasites (e.g. *Giardia, Cryptosporidium*), which are often highly resistant to the usual chlorine disinfection techniques, is creating a demand for more advanced microbiological purification. The need to treat water for nitrates and pesticides is becoming more frequent. Lead water pipes in older buildings are one reason allowed water lead levels are exceeded in some areas. An emerging health concern is the effect of disinfectants and disinfection by-products on finished drinking water. Another concern is the effect of greater chlorination as a preventive measure in case of sabotage of water networks.

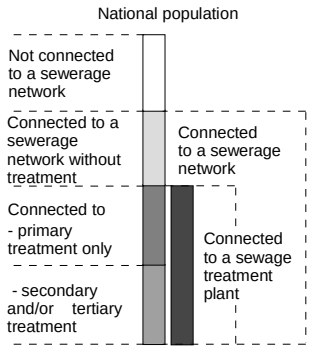
Also of concern is the growing *expenditure associated with the tightening of drinking water standards* (e.g. for lead levels) and the growing number of substances to be measured, which particularly affects operators of smaller purification plants. In addition, ageing pipe networks often require either expensive maintenance or equally expensive upgrading when water losses exceed the economically optimum level. In some member countries consideration is being given to providing water of different quality for direct consumption and for toilet or garden use. However, in many cases the cost of doubling supply networks would be prohibitive. Other countries have encouraged greater use of rain water for domestic use (gardening) or even made it mandatory to collect rain water. In some countries water for gardening is sold at a higher price.

The construction of municipal sewage treatment plants, which began in earnest more than 30 years ago, has been wholly or almost completed in many member countries; in some others new treatment capacity is still being installed at a great pace and existing plants are upgraded. Nevertheless, due to varying settlement patterns, economic and environmental conditions, starting dates, and the rates at which work has been carried out, *there are considerable differences in the share of the population connected to municipal treatment installations among OECD countries* (Figure 3). Much improvement is still needed in terms of levels of sewage treatment. For some countries this will involve secondary treatment, and for most it will mean nutrient removal in sensitive areas.

Quality control of the *operational standards of sewage treatment plants* is exemplary in several member countries, with consistently high rates of pollutant removal being achieved and the results a matter of public record. But this is not the case everywhere, particularly regarding smaller units. Formal quality assurance programmes, with reporting of operational performance, would improve the efficacy of both municipal and privately operated systems.

Figure 3. **Sewerage and sewage treatment connection rates**, latest year available





Source: OECD.

Table 2. **Access to safe drinking water and to basic sanitation**

		Access to safe drinking water[a]	Population connected to public water supply[b]		Population connected to public sewerage				Population not connected to public sewerage	
		(%)	Year	(%)	Year	With treatment (%)	Without treatment (%)	Total (%)	Total not connected (%)	Of which independent/non-public sewerage (%)
Canada		*100*	1996	*92*	1999	*86.4*	*2.9*	*89.3*	*10.6*	..
Mexico		*87*	2001	*65*	1999	*23.8*	*49.2*	*73.0*	*27.0*	..
US	*	*100*	..	..	1996	*71.4*	..	..	..	..
Japan	*	*100*	1999	*96*	1999	*60.0*	-	*60.0*	*40.0*	*7.0*
Korea		*100*	2001	*88*	2001	*73.2*	..	..	..	..
Australia		*100*	..	..	..	..	..	..	..	..
New Zealand		*100*	..	..	1999	*80.0*	..	..	..	..
Austria		*100*	1997	*87*	2001	*86.0*	-	*86.0*	*14.0*	*14.0*
Belgium		*100*	1997	*98*	1998	*38.1*	*44.4*	*82.4*	*17.6*	..
Czech Rep.		*86*	2001	*87*	2000	*66.4*	*8.4*	*74.8*	*25.2*	..
Denmark		*100*	1996	*90*	1998	*89.0*	-	*89.0*	*10.9*	*10.9*
Finland	*	*100*	1997	*87*	2001	*81.0*	-	*81.0*	*19.0*	*19.0*
France	*	*100*	1998	*99*	1998	*76.9*	*2.2*	*79.1*	*20.9*	*10.0*
Germany		*100*	1998	*99*	1998	*91.0*	*2.2*	*93.2*	*6.8*	*4.7*
Greece	*	*100*	1996	*86*	1997	*56.2*	*11.3*	*67.5*	*32.5*	..
Hungary		*97*	2000	*98*	2000	*32.2*	*19.0*	*51.2*	*48.8*	*17.1*
Iceland		*100*	2001	*95*	2001	*33.0*	*57.0*	*90.0*	*10.0*	*6.0*
Ireland		*100*	1994	*80*	1997	*61.0*	*7.0*	*68.0*	*32.0*	..
Italy		*100*	1987	*98*	1995	*75.0*	..	..	..	..
Luxembourg		*100*	1997	*99*	1999	*95.0*	-	*95.0*	*5.0*	*5.0*
Netherlands		*100*	2001	*100*	2000	*98.1*	-	*98.1*	*1.9*	..
Norway		*100*	2001	*89*	2000	*73.0*	*7.0*	*80.0*	*20.0*	*20.0*
Poland	*	*89*	2000	*89*	2001	*54.7*	*6.5*	*61.2*	*42.0*	..
Portugal		*100*	1996	*83*	1998	*46.1*	*36.0*	*82.1*	*17.9*	*4.7*
Slovak Rep.		..	..	..	1998	*48.8*	*5.2*	*54.0*	*46.0*	..
Spain		*100*	1996	*>90*	1995	*48.3*	..	..	..	..
Sweden		*100*	1997	*86*	2000	*86.0*	-	*86.0*	*14.0*	*13.0*
Switzerland		*100*	1995	*100*	2000	*96.0*	-	*96.0*	*4.0*	..
Turkey	*	*83*	1998	*55*	1998	*22.6*	*36.6*	*59.2*	..	..
UK	*	*100*	1996	*99*	2000	*94.6*	*2.0*	*96.6*	*3.4*	..

a) WHO data. May conceal local water quality problems.
b) Piped water inside the dwelling.
* See technical notes for country notes and comments.
Source: WHO; OECD.

In many OECD countries the *proportion of the population connected* to a community sewerage and sewage treatment system is approaching its economic maximum. Several countries have done well in providing small treatment systems for isolated settlements. Further progress can be achieved through the application of appropriate technology. To meet receiving water quality objectives in densely populated areas, it is becoming necessary to better treat urban stormwater and wet-weather overflows of sewage and to distribute the costs of such treatment between water users and tax payers.

2.2 Water: its economic dimension

The OECD Environmental Strategy includes, as a national action: "establish policies aimed at recovering the full costs of water services provision and the external costs associated with water use, and provide incentives to use water resources efficiently (demand side management), taking the social impacts of such policies into account."

It is further stated that "OECD countries will need to remove or reform subsidies and other policies that encourage unsustainable use of natural resources, and ensure the internalisation of the full external costs of natural resource use through market and other policy instruments, and reflecting the user pays principle and the polluter pays principle."

Trends

Overall water use in OECD countries is increasing, and most of this water is used for agriculture. *Trends in water use* vary among member countries and, within countries, among sectors. In long-industrialised countries the share of *industrial use* has been decreasing over the last 30 years, reflecting the decline of water-intensive heavy industry (e.g. mining, steel) and the introduction of cleaner technology; however, water use has increased in the energy sector. Few data are available on *water use efficiency* in industry, notably according to branch. In many cases normal renewal of industrial production equipment will in itself spread cleaner technologies and decrease water consumption. Nevertheless, *water losses in industry* as a whole are estimated at 30 to 40%: the general view is that water savings of 15 to 30% could be made, often merely by improving current practices and thus requiring little investment.

W*ater supply* for domestic use has been increasing, partly because the number of households is growing. This trend would be expected to continue under a "business-as-usual" scenario, though in some countries a weak rise in domestic demand is currently compensated by a larger reduction of water losses from pipe networks and water savings from new sanitary equipment. In some countries household use is diminishing, while in others withdrawals are still increasing. Water losses in *municipal networks* are estimated to average around 30% in most member countries, often exceeding the economically optimum level (on average between 10 and 20%, depending on the nature of individual systems). With greater water conservation efforts by both industrial and municipal users, the need for expensive and environmentally intrusive supply-side solutions such as dams and reservoirs could be avoided or postponed. *Water use in agriculture* has not increased significantly since 1980; the total increase has exceeded 5% in seven countries.

Financing water investment

In many OECD countries investment in the water sector, which includes water supply, water sanitation, provision of irrigation water, river basin management and water pollution abatement, represents over 0.5% of GDP. For the 30 member countries, total investment in the water sector exceeds USD 150 billion per year. Expenditure on water pollution abatement and control (Table 1) tends to be higher in densely populated, long developed countries. The relative shares of the investment and operating components within total pollution abatement and control expenditure also vary from one country to another. Countries whose sewerage systems were completed long ago now face considerable investment costs for the renewal of pipe networks. Those that recently completed an expansion of waste water treatment capacity are experiencing a shift in expenditure towards operating costs. Some countries must still complete their sewerage networks and, at the same time, build new waste water treatment stations.

Most member countries now face *growing expenditure for water supply and waste water infrastructure*: for example, replacement of lead water supply pipes; improvement of water purification techniques to kill bacteria and viruses or to remove nitrates; renewal of old sewerage networks; upgrading of first generation waste water treatment stations; and provision of secondary and tertiary treatment to remove phosphorus and nitrogen. *To minimise this expected expenditure*, innovative technical solutions should be sought and use of

appropriate charging systems should be expanded in order to reduce demand, as well as for financing purposes. Where sewerage service costs have risen, this has led to increased self-treatment and effluent re-use by industry. Whenever possible, industry is now using cleaner technologies and reducing its waste generation. Further efforts by industry to develop integrated pollution prevention and control technology are under way. The problem of treatment and safe disposal of increasing quantities of *sewage sludge* has been solved in a limited number of countries, but still raises difficult issues of public acceptability in other countries. However, progress regarding irrigation water is very slow, with most countries charging only a token fee if any.

Increased cost and reduced availability of public subsidies has led to the need to increase water prices paid by users, i.e. to move towards fuller implementation of the user pays principle. There is growing acceptance of the need for full cost recovery in the provision of household, industrial and agricultural water services. The spread of full cost recovery principles has been accompanied by reductions in total subsidies and in cross-subsidies for water between household and industrial user groups.

Demand side management

Tariff structures for water supply and waste water treatment have a role in increasing the *cost-effectiveness* of resource use. The cost of delivering clean water to urban areas greatly depends on the proximity of raw water sources, the degree of purification needed and the settlement density of the area being served. The cost of providing sewerage and treating waste water also depends on settlement density, as well as on the characteristics of the influent and the required quality of the effluent. It is therefore only to be expected that water prices, sewerage and waste water treatment charges would vary widely among and within countries (Table 3).

However, water and sewage price variations also reflect a host of other factors, often historical ones.

Member countries have created *resource charges* (for pollution and/or withdrawal) and *service delivery fees* characterised by widely varying principles, structures and levels. For example:

- *Pollution charges* for discharging effluent to natural waters were first used over 30 years ago in a few member countries; now they exist in more than a dozen. They can be based on volume only or also on the effluent's pollution content; in the latter case a variable number of parameters is taken into account (most often oxygen demand and suspended solids, but increasingly also nutrients, heavy metals and persistent chemicals). Sometimes charges are levied only on the proportion of the discharge exceeding a certain threshold. In some countries unit rates vary with the capacity of the receiving environment to assimilate the effluent; in others they vary with the size of the enterprise and the type of activity. In some cases the level of charges is related to the cost of measures to prevent pollution of surface waters. Sometimes revenue from these charges is substantial (compared to the country's water management expenditure) (Table 4);
- *Abstraction charges* for ground or surface waters (or both) exist in many member countries. They are typically based on the maximum withdrawal rate permitted by an abstraction licence or on the actual volume withdrawn. In some countries they are based on the source (ground or surface) or the availability of water in place or time (i.e. seasonal); they can also be based on the type of user (agricultural or industrial users often benefit from exemptions). Some countries levy administrative license fees; where these are based on the abstraction volume set out in a permit, they in effect become abstraction charges. In most cases abstraction charges were created to raise revenue for administration and management costs, so that their level is generally low (Table 4);
- *Service fees* for domestic and industrial water services in member countries now frequently cover the full operational and maintenance cost of operating water facilities and may include all or part of capital costs.

In the case of water supply, both progressive and regressive pricing systems can be found, as well as cross-subsidies between industrial and domestic users. Differences in delivery costs greatly affect price levels. Both volumetric charges and flat rates (based, for instance, on property values) exist. Waste water treatment fees are sometimes calculated as a fixed proportion of the water supply bill (even where the latter is not volume-based); they may also vary with the volume of water actually supplied (Table 5).

Table 3. **Prices of water supply in major cities**, late 1990s

			Current exchange rates (USD/m^3)	Current PPPs[a] (USD/m^3)				Current exchange rates (USD/m^3)	Current PPPs[a] (USD/m^3)
Canada	Ottawa		0.34	0.43	Austria	Vienna		1.48	1.35
	Toronto		0.31	0.39		Salzburg		1.43	1.30
	Winnipeg		0.73	0.92		Linz		1.12	1.01
	Vancouver		0.35	0.45	Belgium	Brussels		1.51	1.45
	London		0.72	0.92		Antwerp		0.88	0.84
	Edmonton		0.90	1.14		Liège		1.48	1.42
US	Washington	*	0.80	0.80	Czech Rep.	Praha		0.45	1.06
	New York		0.43	0.43		Brno		0.37	0.88
	Los Angeles		0.58	0.58		Ostrava		0.44	1.05
	Orlando	*	0.29	0.29	Denmark	Copenhagen		1.68	1.32
	Miami		0.36	0.36		Aarhus		1.26	0.98
	Indianapolis		0.88	0.88		Odense		1.32	1.03
	Detroit		0.35	0.35	Finland	Helsinki		0.76	0.66
Japan	Tokyo		0.92	0.74		Tampere		0.86	0.75
	Osaka		0.68	0.54		Vaasa	*	1.32	1.03
	Sapporo		1.13	0.90		Turku		1.19	1.04
	Yokohama		0.74	0.59		Espoo		1.35	1.17
	Nagoya		0.72	0.58	France	Paris		0.87	0.76
Korea	(national average)	*	0.36	0.46		Banlieue Paris		1.46	1.28
	Seoul		0.18	0.38		Bordeaux		1.16	1.02
	Daegu		0.19	0.41		Lille		1.06	0.93
	Daeieon		0.18	0.37		Lyon		1.45	1.27
	Inchon		0.14	0.29	Germany	(national average)	*	1.70	1.47
	Pusan		0.22	0.46		Berlin		1.94	1.70
Australia	Sydney		0.73	0.89		Düsseldorf		1.92	1.68
	Brisbane		0.68	0.82		Gelsenkirchen		1.47	1.29
	Melbourne		0.59	0.72		Hamburg		1.74	1.53
	Canberra		0.63	0.76		München		1.35	1.19
	Perth		0.64	0.78		Stuttgart		1.46	1.28
New Zealand	Wellington		0.63	0.80	Greece	Athens		0.86	1.05
	Auckland		0.46	0.58		Thessaloniki		0.55	0.68
	North Shore City		0.59	0.75		Chanea		1.02	1.25
						Patras		0.77	0.94

Table 3. **Prices of water supply in major cities**, late 1990s (cont.)

			Current exchange rates (USD/m³)	Current PPPs[a] (USD/m³)				Current exchange rates (USD/m³)	Current PPPs[a] (USD/m³)
Hungary	Budapest		0.32	0.71	Portugal	Lisbon		0.97	1.39
	Debrecen		0.37	0.83		Coimbra		0.72	1.04
	Pecs		0.61	1.35		Porto		1.02	1.46
	Miskolc		0.44	0.98	Spain	Madrid		0.81	0.94
Iceland	Reykjavik	*	0.61	0.53		Barcelona		0.78	0.91
	Hafnarfjorour	*	0.51	0.44		Bilbao		0.41	0.48
Ireland	Dublin		0.00	0.00		Seville		0.57	0.67
	Cork		0.00	0.00	Sweden	Stockholm		0.76	0.62
Italy	Rome		0.28	0.29		Goteborg		0.59	0.48
	Bologna		0.61	0.64		Malmo		0.54	0.44
	Milan		0.13	0.13	Switzerland	Berne		1.33	0.97
	Naples		0.57	0.59		Geneva		2.14	1.56
	Turin		0.28	0.29		Zurich		1.88	1.37
Luxembourg	Luxembourg		1.60	1.40	Turkey	Ankara	*	0.18	0.37
Netherlands	Amsterdam		1.02	0.99		Canakkale	*	0.20	0.37
	The Hague		1.91	1.85		Eskisehir	*	0.19	0.40
	Utrecht		0.94	0.92	UK	London	*	0.62	0.57
Norway	Oslo	*	0.47	0.39		Bristol	*	0.57	0.52
	Bergen	*	1.30	1.07		Manchester	*	0.55	0.51
	Trondheim	*	0.80	0.65		Newcastle	*	0.76	0.69
						Cardiff	*	0.56	0.52

a) Purchasing power parities.

* See technical notes for country notes and comments.

Source: IWSA/AIDE.

Table 4. **Pollution and abstraction charges**, OECD countries, 2000

	Charge base		Use of revenue	
	Abstraction	Pollution[a]	Abstraction	Pollution
Australia	various license fees; volume of use charges	various licence fees, by volume	administrative costs	env. administrative costs
Austria	no charge	no charge	-[b]	-
Belgium	groundwater charge, by actual use	charges in some cases	environment	waste water treatment
Canada	actual use	charge for industrial effluents	municipality	province taxation
Czech Rep.	different between types of uses, source, location; no charge on drinking water	pollution content	river basin agencies	environment, including waste water treatment
Denmark	tax on drinking water	tax on waste water	general taxation	General taxation
Finland	no charge	no charge	-	-
France	capacity/actual use by source, location	charge per pollutant varies according to user, regional variations	river basin agencies	water pollution abatement
Germany	by source, location	definition of pollution units for each pollutant	Lander budget	water pollution abatement
Greece	no charge	no charge	-	-
Hungary	actual use, by type	no charge	water fund, environment	-
Iceland	no charge	no charge	-	-
Ireland	no charge	no charge	-	-
Italy	actual use, by type of use, source, location	no charge	water fund	-
Japan	no charge	no charge	-	-
Korea	no charge	15 specified types of pollution (e.g. BOD, COD, SS)	-	environment
Luxembourg	no charge	no charge	-	-
Mexico	actual use, by type, source, location, exemption for agricultural use	receiving body, location, volume and pollution content; discount if improved treatment	general taxation	general taxation

Table 4. **Pollution and abstraction charges**, OECD countries, 2000 (cont.)

	Charge base		Use of revenue	
	Abstraction	Pollution[a]	Abstraction	Pollution
Netherlands	actual use, no differentiation between domestic and industrial use	BOD, COD and heavy metals; p.e.; for largest polluters, quality and quantity metered	environment (provinces); general taxation (state)	water pollution abatement
N. Zealand	no charge	no charge	-	-
Norway	no charge	no charge	-	-
Poland	differentiated by source, location	by pollutants, industrial sector and receiving body	environmental fund	environmental fund
Portugal	charge in the law	charge in the law	not collected	not collected
Slovak Rep.	abstraction fee	pollution charge	environment	water pollution abatement
Spain	capacity, variation of water rights hierarchy, location	pollution parameters and unit tariffs	river basin agencies administrative costs and environment	water management, including construction of waste water treatment plants
Sweden	no charge	no charge	-	-
Switzerland	no charge	no charge	-	-
Turkey	communal tax on groundwater	no charge	communal expense	-
UK	by source, loss factor, seasonal	environmental impact of effluent volume and toxicity	environment, administration	environment, administration
US	no charge	no charge	-	-

a) Pollution charge for release to aquatic environment (not for waste water treatment or administrative costs).
b) Key to symbols: - = not applicable.
Source: OECD.

Table 5. **Service charges for water supply, sewerage and sewage treatment**, OECD countries

	Charge base		Charges cover	
	Supply	Sewerage + treatment	Supply	Sewerage + treatment
Australia	H, F and A: fixed (based on meter size or property value) + volume-based	H: water usage FR/AM; F: water usage, pollution load	full-cost	full-cost
Austria	H, F: fixed + volume-based	H, F : fixed (property) or volume	full-cost	full-cost
Belgium	F: fixed (meter rental) + volume-based	H: water usage FR/AM	full-cost	full-cost
Canada	F: volume-based, decreasing blocks	H: water usage FR/AM; F: water usage, pollution load FR/AM		
Czech Rep.	F: price regulation: based on cost	price regulation	operating + part of invest. expend.+ profit	operating + part of invest. expend.+ profit
Denmark	H: volume-based; F: connection + fixed (various bases) + volume-based	H: water usage FR; F: water usage, excess pollution load AM	full-cost	full-cost
Finland	F: connection + fixed (meter and property size)	H: water usage FR/AM; F: water usage, excess pollution load AM	full-cost	full-cost
France	F: connection + fixed + volume decreasing blocks	H: water usage; F: water usage	full-cost	full-cost
Germany	F: fixed + volume-based	H: water usage; F: water usage, pollution load FR/AM	full-cost	full-cost
Greece	F: connection + volume-based			
Hungary	F: volume-based; H: AM	H: water usage		
Iceland	F: fixed (meter fee) + volume; H: FR	-		
Ireland	F: volume-based; H: zero	H: zero		
Italy	F: fixed (meter fee) + volume-based (rising blocks)	H: water usage (80% of volume of drinking water supplied)		
Japan	F: fixed (pipe size) + volume			
Korea	F: fixed (pipe size) + volume	volume-based	70-80 % of full-cost	50-60% of full-cost
Luxembourg	H: volume-based	H: FR (not included in water bill)	operating cost only	-
Mexico	F: fixed + volume, majority of increasing block tariffs		part of oper. cost	part of oper. cost
Netherlands	H: connection + volume-based F: connection + fixed (size of meter) + volume-based	H: FR, based on number of persons in household; F: according to specific pollution criteria	full-cost	full-cost

Table 5. **Service charges for water supply, sewerage and sewage treatment**, OECD countries (cont.)

	Charge base		Charges cover	
	Supply	Sewerage + treatment	Supply	Sewerage + treatment
New Zealand	H: mostly by property value or uniform annual charges; one-quarter is metered F: by volume when metered	H: mostly by property value or uniform annual charges; F: in proportion to the strength and quantity of the waste		
Norway	F: connection + fixed charge	H: water usage FR; F: water usage, excess pollution load FR/AM	full-cost	
Poland	H: fixed + volume-based charge; F: volume-based charge	volume-based		
Portugal	F: fixed (meter size) + volume (increasing blocks)	H: water usage FR; F: water usage FR		
Slovak Rep.	H: volume-based charge F: contract	H: water usage AM F: contract	oper. cost	oper. cost
Spain	H: volume-based; F: diversity of structures, increasingly two-block structure; A: rate per irrigated land area/volume	H: water usage AM F: water usage AM		full-cost
Sweden	H: fixed + volume-based; F: fixed + volume-based	H: water usage FR/AM; F: water usage, excess pollution load AM	almost full-cost	almost full-cost
Switzerland	H: fixed + volume-based	H: water usage FR/AM; F: water usage FR/AM		
Turkey	H: fixed + volume-based	H: volume-based		
UK	F: connection + fixed + volume-based H: fixed + FR/AM	H: water usage FR/AM; F: water usage, pollution load FR/AM	full-cost	full-cost
US	H: mostly FR; F: connection fees, diversity of block structures, more increasing block rates; A: area served	H: water usage FR/AM F: water usage, pollution load FR/AM	full-cost	

Notes: Key to symbols: - = not applicable; A = agriculture; H = households; F= firms; FR= flat rate; AM= actual measurement; FR/AM = both FR and AM occur; full-cost = total revenues required to cover operating expenditure, plus depreciation, plus a return on capital employed.
Source: OECD: "The Price of Water" 1999.

As the above description of pricing structures demonstrates, *domestic and industrial users* do not bear the *full economic and environmental costs* of providing water supply, sewerage and sewage treatment services since: i) central or local governments make large contributions to the required capital investment (subsidies); ii) there is implicit cross-subsidisation among user groups; and iii) the environment is not, or is only partially, valued. Nevertheless, even if from very different starting points and at differing rates, water prices almost everywhere are beginning to better reflect economic costs (investment, operation and maintenance) and, where abstraction and pollution charges are levied, some environmental costs as well. Metering of domestic users in individual dwellings is becoming more common. Tariff structures increasingly have a fixed and a volume-based component. In many member countries progressive tariffs are used to better protect the water resource or for social reasons.

Policy makers are interested in economic instruments partly because they believe that, under certain circumstances, economic instruments will be better suited than regulations to encouraging cost-effective actions. With few exceptions, however, water pollution and abstraction *charges have been used in close association with permitting systems* and, in practice, it is difficult to distinguish the incentive effects of these two types of instrument. Whatever their incentive value, pollution charges have generally been useful in financing operational and maintenance expenditure and for part of infrastructure investments. Regulations and pollution charges are generally regarded as mutually reinforcing when applied in combination.

Ensuring that *water services are delivered - and seen to be delivered - as efficiently as possible* is therefore a significant challenge for the immediate future. A trend towards consolidation of services through the grouping of several municipalities or greater private sector involvement (in the form of public-private partnership) is gaining momentum. Other features of the changes currently taking place in the water industry are the introduction of competition, greater transparency and effective accountability mechanisms, and customer participation. In recent years a few member countries have created specific bodies to collect and disseminate water price information or to better control water pricing practices of water utilities.

Even when different administrations co-operate effectively, it often *remains difficult to find the most cost-effective solutions*. For this purpose, it is necessary to consider a wide range of options and instruments and assess their

usefulness in a particular context. Further progress in reducing point discharges (the responsibility of water management authorities) and in diffuse discharges from agriculture (a concern of the agricultural authorities) will entail expensive measures (e.g. nitrogen removal from sewage, manure storage enclosure), increasing the desirability of choosing those measures which are the most cost-effective overall. Yet there have been relatively few attempts to integrate approaches to such problems. The challenge is to find new solutions, possibly by using voluntary approaches (e.g. in industry, agriculture) or by creating a trading regime for pollution permits within a river basin, or by better integrating agricultural set-aside measures and creating riparian buffer zones to capture nutrients.

2.3 Water: its social dimension

According to the OECD Environmental Strategy, one challenge is to "address the various links between environmental and social conditions and trends, and the social impacts of environmental policies, in order to enhance human health, environmental equity, employment, access to information, public participation in decision-making, access to justice in environmental matters and environmental education, thus contributing to enhancing the quality of life."

Furthermore, member countries should take into account the "social impacts" of full cost recovery policies and the OECD should "analyse social issues regarding access to freshwater resources, and the design of water management policies and cost recovery systems."

More generally, countries should:

- "ensure equitable access to natural resources and environmental services;
- monitor and reduce disparities in exposure to environmental threats (across households, social groups and communities);
- address actual and potential effects of environmental policies on employment and income distribution;
- assess and address the social implications of environmental policies, in particular the removal of environmentally harmful subsidies."

Work within this new area started in the OECD in 1999 and is now carried out in the framework of the second cycle of Environmental Performance Reviews as well as in special programmes concerned with social issues. Data collected so far show that all member countries provide some form of income support whose purpose is to help poor people afford water supply and sanitation. At the same time, most member countries have introduced measures (Table 6) to make water more affordable to the population at large and to selected groups of people (e.g. large families, pensioners, poor people). These measures include reducing the VAT or waste water tax, use of progressive social tariffs, providing targeted assistance for water to poor people (free first block, grants, forgiveness of arrears), avoiding water disconnection and abolishing annual fixed fees.

The impact of water policies intended to benefit the poor on the price of water paid by most consumers is negligible in most OECD countries, as the aid provided is relatively small and poverty is relatively limited. More weight is given to social considerations in water pricing in less developed member countries, where water sold at real cost would represent a larger fraction of household budgets and where income inequality is greater. In particular, the price of water sold by private water vendors to users not connected to public networks can be very high.

As the user pays and polluter pays principles are increasingly applied, the true cost of water services is becoming clearer on water bills and *consumers' willingness to pay is becoming an issue*. Water bills would increase even if water-related expenditure remained the same. However, expenditure is likely to increase in most member countries because of the need to meet existing and future (higher) drinking water standards, refurbish or replace pipe networks which are often inadequately maintained, upgrade sewage treatment standards, separate sewage from stormwater networks, and treat urban stormwater and wet-weather sewage overflows. While the situation will vary from one city to another, the resulting price increases are often perceived by local political decision makers as an additional burden on water consumers even if there is also a burden on tax payers.

Table 6. **Measures to make drinking water more affordable**

	Large subsidies[a]	Reduced VAT[b]	Reduced WWT[c]	Progressive tariff[d]	Social tariff[e]	Targeted assistance[f]	No dis-connection[g]	Free block[h]	Un-metered[i]	No fixed fee[j]	Income support[k]
Australia				Yes	Yes				Yes		Yes
Austria							Yes			Yes	Yes
Belgium		Yes	Yes	Yes	Yes	Yes	Yes	Yes			Yes
Canada	Yes								Yes		Yes
Czech Rep.	Yes	Yes								Yes	Yes
Denmark									Yes		Yes
Finland						Yes					Yes
France		Yes		Yes/No[l]		Yes	Yes				Yes
Germany		Yes					Yes				Yes
Greece	Yes			Yes	Yes						Yes
Hungary	Yes									Yes	Yes
Iceland							Yes		Yes		Yes
Ireland	Yes						Yes	Yes	Yes	Yes	Yes
Italy	Yes	Yes		Yes							Yes
Japan		Yes	Yes	Yes							Yes
Korea				Yes			Yes			Yes/No[l]	Yes
Luxembourg				Yes	Yes						Yes
Mexico	Yes			Yes	Yes	Yes	Yes		Yes		Yes
Netherlands		Yes	Yes								Yes
N. Zealand									Yes		Yes
Norway							Yes		Yes		Yes
Poland	Yes									Yes	Yes
Portugal	Yes	Yes		Yes	Yes						Yes
Slovak Rep.	Yes										Yes
Spain	Yes	Yes		Yes	Yes						Yes
Sweden							Yes				Yes
Switzerland	Yes	Yes					Yes				Yes
Turkey	Yes			Yes							Yes
UK		Yes			Yes	Yes	Yes		Yes		Yes
US				Yes/No[l]	Yes						Yes

a) Subsidies for water supply and/or sanitation over 30% of service cost.
b) VAT on water below normal rate.
c) Reduced waste water tax or other water charges for the poor (in many cases the WWT for households is flat rate and indirectly linked to property size or value; see Table 5).
d) Progressive water tariff in general use.
e) Social water tariff (reduced price for certain groups of users).
f) Targeted assistance, i.e. grants or forgiveness of arrears for water provided to poor people.
g) No disconnection of water supply of poor people with arrears for water or for municipal tax.
h) Provision of a first block at zero price for poor people or all people.
i) Provision of water to individual dwellings is unmetered in most cases (flat rate tariff for households).
j) Only proportional fee.
k) Income support for poor people.
l) Yes/No: used but not in most cases.

Source: Academy of Water: "Solidarity for Drinking Water" 2002.

2.4 Water: its environmental dimension

Preserving aquatic ecosystems

According to the OECD Environmental Strategy, "maintaining the integrity of ecosystems through the efficient and appropriate management of natural resources is a key objective for OECD member countries for the next decade. The currently unsustainable use of many renewable resources is of particular concern."

Concerning freshwater, countries should "achieve agreed water quality targets and adopt additional targets necessary to ensure the ecological value of in-situ water resources and the ecological functions they provide." The purpose is to "significantly reduce threats to ecosystems and their species from habitat loss and fragmentation, changes in land use patterns, pollution, introduction of invasive species, and overexploitation or extinction of wild species, etc."

During the 1990s, more member countries recognised water as a major component of life-support systems and increased their emphasis on protection of aquatic fauna and flora. Some established objectives for water management related to biological diversity, particularly as a result of the EU Water Framework Directive.* They also took measures to prevent accidental pollution, which has been responsible for massive fish kills in a number of cases.

Laws to set minimum flows and/or levels in rivers and lakes, and to protect wild and scenic rivers for conservation purposes, have been effective in some countries. However, in many cases full advantage has not been taken of such legislation and some river beds are still dry during part of the year because of excessive water abstraction.

Member countries have made varying degrees of progress in adopting "soft" hydraulic engineering practices to aid channel maintenance and the control of bank erosion, reintroducing a near-natural morphology and rendering

* Directive 2000/60/EC of 23rd October 2000 establishing a framework for Community action in the field of water policy, O.J.E.C., L327 (22/12/2000). Gradual implementation during the period 2000-15.

watercourses suitable as habitats for fish and other aquatic biota. They are moving away from canalisation of rivers and are providing more space in which water bodies can expand, while restoring ecological buffer zones and enhancing any recreational uses.

Increased attention is being paid to river sediments, bank protection and interaction with underground water. The potential for better integration of water management objectives and spatial (physical) planning rules and practices is far from exhausted; for example much more account could be taken in land use planning of the ecological functions of water bodies. The role of upstream ecosystems and forests, wetlands and marshes needs to be emphasised, due to their disappearance and to their function of regulating water flows.

Protection of water resources and preservation of water quality

Many member countries have cleaned up the conspicuously polluted waters that aroused great public concern in the 1970s. Large organisational and financial efforts over several decades were required to construct infrastructure capable of treating the many thousands of municipal and industrial point discharges. Industrial discharges of heavy metals and persistent chemicals have been reduced by 70 to 90% or more in most cases. Results are still being improved through the application of more stringent effluent limits, better process control at treatment plants, more effective enforcement, more widespread application of the polluter pays principle, and gradual adoption of cleaner production technologies. In urbanised areas, however, pollution caused by urban stormwater run off, largely from point sources, remains a challenge.

Despite two decades or more of major efforts to reduce end-of-pipe discharges, a number of OECD countries cannot yet claim to satisfactorily meet the *baseline quality standard for inland waters* (e.g. suitability for fishing and swimming). While dissolved oxygen content in larger rivers is satisfactory most of the year and bacterial contamination has also been greatly reduced, for several other parameters it is not possible to discern widespread and general trends of improvement in water quality. Nitrate concentrations appear to have stabilised locally, probably as a result of nitrogen removal from sewage effluents or less overfertilisation in agriculture, but in many rivers this trend still cannot be detected (Figure 4). Success in cleaning up the most polluted waters has sometimes been achieved, but with a failure to protect the few remaining pristine waters, so that a country's waters all tend to be of average quality.

Experience in many member countries has been that cleaning up point discharges is not adequate in itself to restore receiving waters to their former good health.

In estuaries and coastal areas, there has been an increase in *diffuse pollution loads* emanating from various sources such as agriculture, traffic, erosion from earthworks, or deposition of heavy metals and persistent organic pollutants. In sensitive areas, acidifying (NO_x) and eutrophying (phosphates and nitrates) substances are the main cause of concern. The quality of *coastal waters* in many countries is still affected by outflows of pollutants from rivers, estuaries and coastal waste water outfalls. Except in the case of the North Sea and Baltic Sea, clear objectives have generally not been established for reducing pollutant discharges in sea water.

Most OECD countries have also found it very difficult to protect *groundwater quality*. Available information suggests that in many places the trend is towards a worsening of groundwater quality. Elevated nitrate and pesticide levels are recorded in many agricultural areas, with quality standards exceeded regularly where agriculture is particularly intensive. Problems with groundwater quality add to the cost of purifying drinking water and, in the worst cases, render water unfit to drink. Land use controls, as well as better management of pollution related to animal husbandry, can be used more rigorously to better protect water source areas. Problems related to groundwater salinisation also exists, due to over-abstraction and low recharge rates. Most member countries need to find more effective ways to protect the quality of their groundwater.

In most member countries a combination of technology-based, nationally uniform effluent limits and receiving water standards has been used to clean up end-of-pipe discharges. Often the emphasis has been on the former, notably in the case of toxic chemicals. However, as effluent is treated to a progressively higher level, marginal clean-up costs per pollution unit rise and nationally uniform effluent limits become increasingly inefficient (in that the assimilative capacity of receiving waters is not the same everywhere). Thus, while these *command-and-control instruments* have proven effective in reducing point discharges to date, they appear less well suited to the next stage of pollution control since i) further reductions in point discharges are more likely to be achieved through application of cleaner technology (which is more difficult to regulate); and ii) diffuse pollution sources have become the main problem.

The need for a new approach, combined with the demand by society that water management policies be *efficient economically as well as environmentally*, has led many member countries to examine potential reforms of their environmental regulatory framework in order to: i) gain greater economic and environmental efficiency; and ii) give greater weight to protecting aquatic ecosystems. Governments are therefore looking for a wider mix of instruments than those applied thus far.

In regard to improving *cost-effectiveness*, there is a range of issues to consider such as the economic benefit/cost aspects of the standard- and objective-setting process, efficient allocation of water resources among users, and efficient water use by households, industry and agriculture. To address these issues, member countries are exploring a range of initiatives including reducing or abolishing production subsidies with detrimental environmental effects and introducing abstraction or pollution charges or even tradable abstraction permits.

To better protect aquatic ecosystems, there is a trend away from a uniform national approach to water management towards *"place-based" approaches.* These approaches put more emphasis on the biological quality of receiving waters and on the objectives set for their use at particular locations. Improved definition of ambient biological water standards (sometimes including a water body's bottom and banks) is a first step. However, a more proactive approach involving a wide range of stakeholders is likely to be needed to achieve the desired results. Some member countries have had good experiences with so-called *river contracts* in which central and local governments, private enterprise and NGOs commit themselves to a set of co-ordinated actions to clean up parts or all of a river by an agreed date.

Other policy instruments likely to contribute to further reductions of polluting discharges are Pollutant Release and Transfer Registers (PRTRs), the EU Eco-Management and Audit Scheme (EMAS) and voluntary agreements. These instruments may be considered partly regulatory and partly social, in that they rely on progressive incorporation of environmental concerns in the attitudes and behaviour of industrial decision-makers and related stakeholders.

Figure 4. **Water quality of selected rivers***

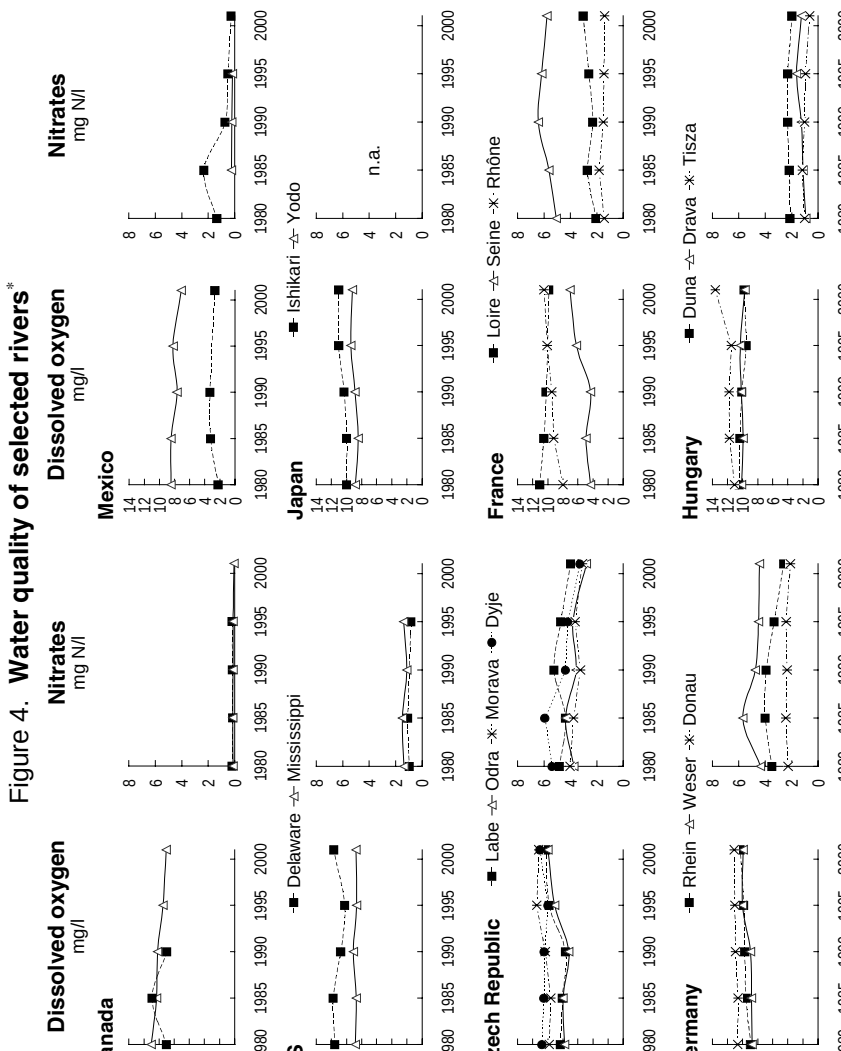
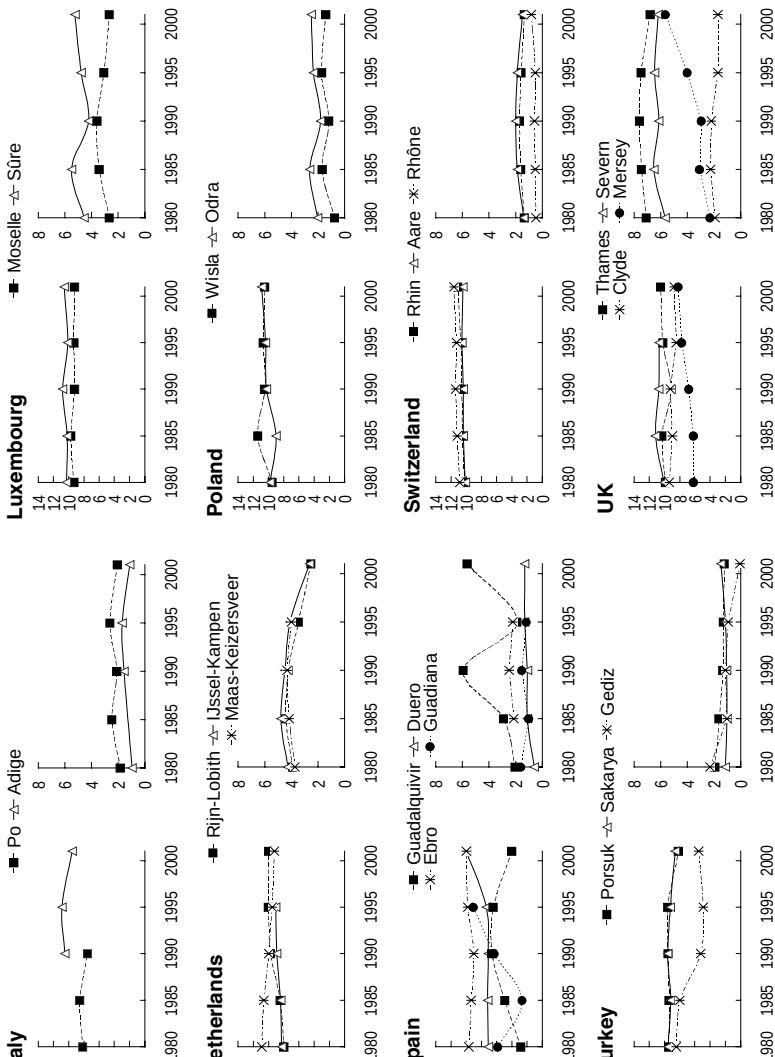


Figure 4. **Water quality of selected rivers*** (cont.)



* See technical notes for country notes and comments.

Source: OECD.

Climatic variations

According to the OECD Environmental Strategy, countries should "develop appropriate strategies to manage watersheds ecologically to prevent extreme flood and drought risk."

Floods

Most OECD countries face at least seasonal or local *water quantity problems*, such as seasonal droughts, shrinking groundwater reserves or falling groundwater tables. Furthermore, there is a risk that climate change will affect rainfall distribution and evaporation, with *increased frequency of extreme weather episodes*, including floods, droughts, high winds and seawater rises.

Many member countries are threatened by major floods, with severe economic and social impacts. While intense rainfall is a natural occurrence, the magnitude and velocity of the ensuing large water flows are affected by human actions, as is the vulnerability of human settlements to flooding and erosion. In recent years catastrophe plans have been implemented in the Rhine basin, in Central Europe, and in France and in other member countries where the population has suddenly experienced major flooding and economic losses equivalent to a few percent of GDP.

Flood damage has increased despite protection measures such as construction of dams and levees. Additional measures will be required along rivers to protect dikes. Development in flood plains results in increased damage when protection measures fail because of poor maintenance or insufficient infrastructure strength. Common factors exacerbating this problem are fragmentation of responsibilities and lack of integration of flood protection, land use planning and flood damage compensation policies. Even where coherent policies are in place, land use and building height restrictions in flood plains are not always respected and compensation payments may even permit property owners to return to the status quo ante that led to the damage in the first place. A more proactive land use policy across an entire watershed (including "green corridors" along rivers and streams, reinstatement of flood control plains, better control of deforestation, and preservation of wetlands),

combined with enforcement of zoning provisions can reverse the trend in the long term. It may even be necessary for potential flood victims to assume a greater share of the risk through higher flood insurance premiums or reduced compensation for flood damage.

Droughts

Recent assessments indicate that current patterns of water use are unsustainable in many countries. An increasing incidence of local and regional droughts would only lead to more water crises. This effect would be felt most strongly in regions where water stress is already relatively high. Several member countries, or regions in member countries, fall into this category (Figure 1); severe droughts increasingly affect parts of Australia, Greece, Spain, Mexico and the United States. If weather patterns become more extreme with climate change, many member countries will have to modify their water use practices in order to respond to the greater variability in climatic conditions.

2.5 Water governance

Integrated water resource development and management

According to the OECD Environmental Strategy, member countries should "apply the ecosystem approach to the management of freshwater resources and associated watersheds, based on integrated river basin management, and develop and apply legal frameworks supported by appropriate policy instruments to ensure the sustainable use of freshwater resources, including measures to enhance their efficient use."

The 1990s saw further evolution towards a *more integrated approach to water management*. This trend included water quantity and quality management at watershed or river basin level, greater consideration of interactions between urban and rural activities and water quality, and greater recognition of the need for rivers and lakes (and their beds and banks) to support aquatic life, as well as to meet human health and recreation criteria. Modern water management needs to take account of ecological, economic and social functions throughout an entire basin. Thus there is renewed interest in

river basin and other "place-based" approaches. Some countries have long had river basin agencies, and many are now creating them. Other countries, while not making the river basin approach a fundamental institutional feature, are improving integration by creating ad-hoc entities for protection of specific water bodies, with representation by all stakeholders.

To meet growing concerns about water quality, many OECD countries thoroughly reviewed their water laws between the mid-1960s and mid-1980s and again more recently. As implementation of the associated regulations and permit conditions had not always been rigorous, some member countries revised their *enforcement* systems in the early 1990s. Improvements included formal enforcement strategies tying frequency of inspections to permit holders' track records, better communication with permit holders, and an emphasis on helping permit holders improve compliance. Feedback from the enforcement process is also used to improve formulation of discharge permits to make them more easily enforceable. In several countries efforts to improve enforcement go hand in hand with integration of water, air and waste permitting systems; in others these improvements are far from being implemented.

Significant progress has been made in terms of the legislation and institutions required to achieve integrated management. However, practice is not always in accordance with the spirit of the legislation adopted. In some member countries *institutional capacity at subnational level* (both in terms of expertise and revenue-raising capability) may be insufficient to allow adequate implementation of integrated water management policies.

The development of integrated water management implies that most member countries will be obliged to make considerable investments. Having drawn up *national action plans, they must develop investment programmes* with clear targets and a schedule of expenses to protect aquatic ecosystems, protect against floods, improve river quality and complete construction of adequate water infrastructure. In member countries with strong municipal governments, supply and sanitation problems are probably tackled more effectively locally than through national action plans. This is true even if the country as a whole faces making considerable investments to maintain and upgrade ageing water systems.

Public participation

The OECD Environmental Strategy specifies that with regard to information, participation and access to justice in environmental matters there is a need to:

- "take measures to ensure and facilitate access to information, public participation in decision-making and access to justice in environmental matters, for citizens as well as for non-governmental organisations" and
- "provide the conditions to facilitate an enhanced role and active participation of local communities and local governments in environmental policy making and implementation."

There is wide diversity in the ways OECD countries have made provision for, and are setting up, avenues for public access to information and participation. While the principle of public involvement is accepted in all member countries, its implementation is not always effective in practice. Stakeholder participation requires time and is often costly; nevertheless, many member countries have experienced its benefits when project designs have been improved and have met with greater public acceptance. If public participation is to mean more than just the opportunity to object and oppose, NGOs and other stakeholders will need to be well informed and to be invited to become involved before irreversible decisions are made. As further environmental improvement will increasingly depend on changing the behaviour of large numbers of actors (e.g. households, farmers), different forms of stakeholder participation will need to be developed, such as through contracts and environmental agreements. Adoption of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters is a sign that public participation is receiving greater support.

Water for sustainable food production, agriculture and rural development

The OECD Environmental Strategy contains the challenge to "progressively decrease the negative environmental effects and increase the positive effects of agricultural production so that ecosystem functions can be maintained or restored."

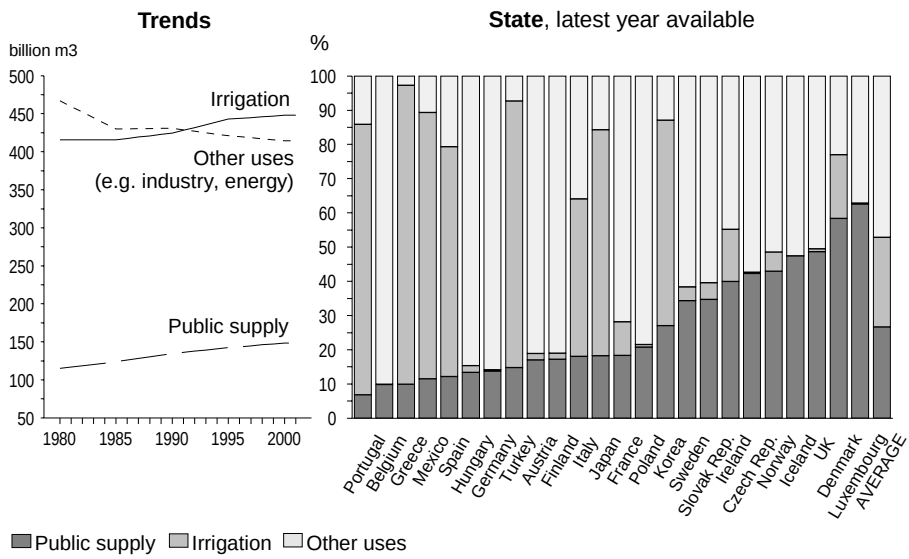
National actions include to "set time-bound targets to increase the efficiency of water use and irrigation systems in areas experiencing moderate or high water stress; set time-bound targets to reduce nitrate leaching and run off of nutrient loads from agriculture into water, lower the risk of soil erosion and reduce health and environmental risks from the use of pesticides; promote the internalisation of environmental externalities in agriculture, make the transition towards full cost resource pricing, including environmental and social costs."

The *predominance of agricultural water use as a proportion of total water use* is common to many member countries. In eight countries irrigation now accounts for more than 45% of total withdrawals (Figure 5 and Table 7). While little change has occurred in irrigation's share of total water use since 1980, there are countries in which it has increased by over 5%. In a few dry regions of several member countries *water scarcity has become a limiting factor on development*. The need to allocate water to highest-value uses is greatest in arid and semi-arid regions. Even where competition for offstream uses is less strong, growing demand for various instream uses and growing demand to maintain groundwater table levels (e.g. for recreational purposes and to preserve wetlands and other ecosystems) will promote greater efficiency of agricultural water use. The solution to many water management problems, in terms of quantity as well as quality, is strongly linked to use of water in agriculture, where it is recognised as a finite economic resource with significant social and environmental implications.

Given the important role of agriculture in rural development and in the social protection of rural populations, it is imperative that *agricultural practices become more sustainable*. Certain current practices (e.g. overapplication of

fertilisers and agricultural chemicals, soil compaction, low irrigation efficiency, lack of drainage) lead to serious water quality and quantity problems, such as high nitrate levels and presence of pesticides in groundwater, eutrophication of lakes and reservoirs, soil salinisation, falling of groundwater tables and low flows in rivers. Examples of the positive environmental effects of agriculture can also be noted, such as paddy irrigation in Asian monsoon areas, which encourages groundwater recharge and provides storage for flood waters.

Figure 5. **Freshwater abstractions by major uses**



Source: OECD.

Table 7. **Freshwater abstractions by major uses**, latest year available

		Intensity of freshwater use				Public supply	Irrigation		
		Abstractions as % of available resources		Abstractions Per capita		Abstractions Per capita	Abstractions per area of irrigated land	Irrigated areas as share of cultivated land	
		(%) Latest year available	Absolute change since 1980	m^3/cap./yr Latest year available	(%) Change since 1980	m^3/cap./day Latest year available	m^3/ha/day Latest year available	(%) 2000	Absolute Change since 1980
Canada	*	*1.3*	-	1 270	*-16*	..	..	*1.6*	0.3
Mexico	*	*15.3*	3.4	740	*-8*	0.233	23.7	*23.8*	3.5
US	*	*19.9*	-1.0	1 870	*-18*	..	..	*12.5*	1.7
Japan	*	*20.5*	0.2	690	*-5*	0.341	59.2	*54.7*	-
Korea	*	*33.9*	10.0	540	*17*	0.399	35.1	*59.9*	0.4
Australia	*	*6.8*	3.7	1 300	*76*	..	20.7	*4.7*	1.3
New Zealand	*	*0.6*	0.2	570	*50*	..	..	*8.7*	3.5
Austria	*	*4.2*	0.3	440	-	0.205	46.2	*0.3*	-
Belgium	*	*45.1*	..	730	..	0.196	0.3	*4.2*	2.5
Czech Rep.		*11.5*	-11.2	180	*-49*	0.208	0.8	*0.7*	..
Denmark	*	*12.3*	-7.4	140	*-42*	0.227	0.8	*19.5*	4.8
Finland	*	*2.1*	-1.2	450	*-42*	0.214	1.7	*2.9*	0.4
France	*	*16.9*	0.7	550	*-4*	0.273	4.2	*11.2*	6.6
Germany	*	*21.9*	-0.9	490	*-9*	0.186	0.9	*4.0*	0.4
Greece	*	*12.1*	5.1	830	*60*	0.225	14.0	*37.6*	13.2
Hungary	*	*4.7*	0.7	560	*24*	0.204	1.4	*4.4*	1.9
Iceland	*	*0.1*	-	550	*17*	0.711	-	-	-
Ireland	*	*2.6*	0.2	330	*6*	..	..	-	-
Italy	*	*32.1*	-	980	*-2*	0.481	26.3	*24.9*	5.6
Luxembourg	*	*3.7*	..	140	..	0.239	..	..	..
Netherlands	*	*4.9*	-5.3	290	*-55*	0.219	0.4	*59.9*	1.5
Norway	*	*0.7*	..	550	..	0.466	..	*14.4*	5.3
Poland	*	*16.9*	-5.5	280	*-30*	0.157	2.3	*0.7*	-
Portugal	*	*15.1*	0.8	1 110	*4*	0.207	37.0	*24.0*	4.0
Slovak Rep.		*1.4*	-1.4	210	*-53*	0.201	0.8	*11.6*	..
Spain	*	*28.6*	-7.4	790	*-25*	0.263	16.0	*20.1*	5.3
Sweden	*	*1.5*	-0.8	300	*-39*	0.285	2.5	*4.2*	1.9
Switzerland	*	*4.8*	-	360	*-12*	0.405	..	*5.7*	-
Turkey	*	*17.0*	10.1	580	*61*	0.236	18.9	*16.9*	7.4
UK	*	*20.7*	-2.0	230	*-15*	0.377	2.7	*1.8*	-
OECD	*	*11.6*	0.2	920	*-12*	0.375	23.0	*12.0*	2.3

* See technical notes for country notes and comments.

Source: Food and Agriculture Organization; OECD.

To reduce the pressure of agriculture on receiving water quality, most OECD countries have embarked on *agri-environmental programmes* that combine various approaches involving, inter alia, technology, awareness raising, community participation, cost sharing and regulation to reduce inputs of fertilisers and farm chemicals and to minimise leaching of residues to natural waters. Some of these programmes have been quite successful (e.g. in reducing fertiliser and pesticide use), but they are often cumbersome to administer and difficult to enforce and only partially meet their objectives. In other cases, nutrient loading has been reduced but without any direct effect on groundwater quality owing to the accumulated load already present in the soil. The high cost of some measures to reduce nutrient loads is another obstacle to progress. Good results could be obtained at little economic cost by cutting agricultural production subsidies, but social costs might have to be considered. Innovative approaches can nevertheless be reported, such as a water supply utility paying farmers to reduce fertiliser and/or pesticide use in some areas rather than having to invest in purification equipment or to seek other water resources at some distance.

The role of the pricing regime for agricultural water is being considered as a mechanism to improve efficiency of water use without necessarily introducing a financial burden. Such a regime would improve the efficiency with which water is recognised as an economic good; attribute a value to the environment; remove exemptions from resource charges payable by other user groups, as well as other hidden or explicit subsidies of capital and operational costs; and provide an incentive for users to conserve water. In general, public authorities finance water works and irrigation projects from the general budget, particularly in countries with large irrigated areas. Among various user groups, agricultural water users currently pay the smallest share of the real cost of providing water. This practice should be discontinued progressively, bearing in mind the social consequences of more expensive water for irrigation. Several member countries have already made significant progress in the difficult reform process, and others are considering such changes. New pricing structures, with social support measures possibly associated, are key features of these reforms. In other countries few measures are taken against nitrate or pesticide pollution or overabstraction from agriculture, and the only measures being taken are funded by industry or households.

Progress has also been made by *giving water users a greater role in resource management*. For example, in some countries responsibility (including financial responsibility) for management or sometimes even ownership of community irrigation systems is being or has been transferred from public bodies to user associations.

Severe droughts in many parts of the OECD in the 1990s, as well as growing awareness of the effects of water-related subsidies on water use and aquatic systems, have reawakened interest in some member countries in the role that *tradable water rights* and *water markets* could play in allowing, at national level, water use to move towards higher-value applications. Depending on local circumstances and water rights allocation, more water exchanges than is currently the case could take place in the agricultural sector or both in this sector and among urban users. Some limited systems are already in operation within a few countries, but in many cases establishing markets will depend on creating suitable water rights regimes and water conveyance systems that can meter and control the flow of water among users.

International issues

Transboundary waters

The OECD Environmental Strategy requires that member countries "ensure co-operation for the environmentally sound management and efficient use of transboundary water resources to reduce flood risks and to minimise potential conflicts from the use or pollution of transboundary water resources."

Over the last 30 years, OECD countries have made considerable progress in resolving *transboundary waters* issues. Bilateral, regional or multilateral agreements have now been reached for most such waters, and more effective new agreements have replaced earlier ones. Monitoring of some of the most contaminated transboundary waters in member countries shows declining pollution levels. Member countries have implemented the OECD General Principles related to transfrontier water pollution and integrated water management adopted in the 1970s. They have agreed on and are implementing numerous bilateral or multilateral plans and strategies (e.g. for the Great Lakes, Lake Geneva, the Rhine, the Danube). They have used financial transfers to reduce chlorine pollution loads to the Rhine. Quantified discharge/emission

reduction targets for a large number of pollutants have been set for various rivers and for inputs to the North Sea and Baltic Sea. Several large basins (e.g. Rhine, Danube) are now managed in the framework of international agreements, with a basin committee and a permanent secretariat; in some instances these committees meet with representatives of the public. Some international agreements include emergency preparedness plans and flood prevention plans. Victims of pollution may also resort to private legal action in transboundary cases: an example is that of users of the Rhine who, following an out-of-court settlement, were compensated by a Swiss firm for water pollution caused by a fire. Multilateral conventions have been adopted, for instance: the 1992 UN/ECE Helsinki Convention sets general rules for transfrontier waters in Europe.

Due to the importance of water in economic development, international disputes over water use can arise as a result of water diversion. Methods to avoid disagreement, such as prior information and notification, have been used where a river's regime has been changed (Euphrates) or bilateral agreements have been negotiated between member countries.* In the case of transboundary water pollution, major difficulties can be avoided when common standards are agreed (e.g. within the European Union) and when water management is undertaken at basin level. On the other hand, solving transboundary pollution problems between countries with different levels of development may require innovative approaches in line with the principle of common but differentiated responsibility. There may be financial transfers between countries to overcome differences in environmental protection priorities (e.g. the Tijuana waste water treatment plant on the US/Mexico border, waste water discharges to the Baltic Sea).

* Recent agreements include:
- 1994 Agreement on the Protection of the Scheldt
- 1994 Agreement on the Protection of the Meuse
- 1994 Convention on Co-operation for the Protection and Sustainable Use of the Danube River
- 1996 Convention on the International Commission for the Protection of the Oder River against Pollution
- 1997 Convention on the Law of the Non-navigational Uses of International Watercourses
- 1998 Convention on Co-operation for Protection and Sustainable Use of Portuguese-Spanish River Basins
- 1999 Convention on the Protection of the Rhine
- 1999 UN/ECE Protocol on Water and Health.

A decision of the International Court of Justice concerning the waters of the Danube at the Hungary/Slovakia border has brought official recognition of Principle 21 of Stockholm* as a principle of customary law in matters of both damage and use of water resources. However, the issue of *equitable apportionment* of waters between riparian states of a given river is still not settled, though progress in this area was achieved by Belgium and the Netherlands concerning the Meuse river and by US and Mexico on the Rio Grande/Bravo and the Colorado River. In many cases there is reluctance to substantially modify a transboundary river's national flow regime, not only when an upstream country needs more water, but also when land use changes affect flow rates or aggravate flooding. Similarly, international transfers of water for drinking purposes may sometimes stimulate objections even if abstraction does not cause any environmental damage to the country of origin.

International aid

Concerning international co-operation, the OECD Environmental Strategy asks member countries to "provide support for capacity building and technology transfer to assist developing countries in managing and developing their freshwater resources in a sustainable manner, and in ensuring safe drinking water and adequate sanitation."

A significant portion of development assistance goes to water supply and sanitation and to water resource management. As a whole, about 8% of *official development assistance* provided by OECD/DAC countries to developing countries concerns water supply and sanitation projects (USD 3.1 billion per year plus USD 1.5 billion per year in the form of concessional loans). As a whole, ODA represents a relatively small fraction of current investment in water supply and sanitation in less developed countries (USD 20 billion-30 billion per year). Water service companies and NGOs also

* Principle 21 of Stockholm, identical to Principle 2 of the 1992 Rio Declaration on Environment and Development, specifies that "States have the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and have the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States."

participate in technology transfers to developing countries. Consequently, the level of access to water and access to sanitation has risen considerably over the last ten years. There is also international funding of irrigation works for agricultural purposes and of hydropower plants.

3

CONCLUSIONS

Similar water management objectives have been part of the water management aims of most OECD countries for the last few decades. Thus the *progress achieved to date is the result of many years of effort*.

There is wide diversity among member countries in terms of their water needs and available water resources, population density, economic development, institutional structures and culture. It is difficult to make general statements about overall progress in OECD countries, but the experience of the OECD programme of Environmental Performance Reviews shows that *all member countries have achieved notable successes* in at least some of the following areas (Table 8):

- access to *drinking water for all*;
- improved water supply and sanitation for *low-income groups*;
- large *reductions in point discharges* from industry and urban areas;
- *clean-up* of the worst polluted waters;
- establishment of a comprehensive *framework* of water management laws, policies, programmes and institutions;
- a good degree of *integration* of quantity and quality management;
- progress towards the *whole-basin* approach;
- wider implementation of *integrated permitting*;
- improvement in the *enforcement* of regulations and permit conditions;
- good *capacity* to effectively implement policies and measures; and
- growing momentum in the reform of water *pricing regimes*.

Table 8. **Performance of OECD countries**

Programme area/objectives	Achievements	Further progress to be made
WATER: A VITAL GOOD		
Drinking water	Most water supply systems deliver bacteriologically safe drinking water.	Human health aspects (nitrates, pesticides, lead) need greater attention. Some countries have yet to connect part of their population.
Sewerage and waste water treatment	Progress in installing treatment capacity. Generally high operational standards.	Still much to do in connection with treatment plants or increasing level of treatment.
WATER: AN ECONOMIC GOOD		
Application of polluter pays and user pays principles	Recent progress towards more consistent application of PPP and UPP.	Prices very rarely reflect full economic and environmental costs. Water sanitation is heavily subsidised.
Trends in water use	Industrial water use efficiency increasing.	Water losses can be reduced at little cost. Demand management policies still little developed; public supply still increasing in many countries.
WATER: A SOCIAL GOOD		
Make water affordable to all	Social support and a few targeted measures.	Improve targeted measures
WATER: AN ENVIRONMENTAL GOOD		
Preserve aquatic ecosystems	Better awareness of need to protect ecosystems. New legislation.	Continue efforts to restore aquatic ecosystems.
Protect water quality	Large reduction of BOD/COD, bacteria, heavy metals and persistent chemicals from municipal and industrial sources. Improved enforcement.	Basic water quality standards not yet adequately met. Failure to prevent diffuse pollution. Greater removal of nutrients required in sensitive areas. Water infrastructure in some countries not yet completed. Groundwater quality a problem in areas with intensive agriculture.
Floods and droughts	Awareness of problems caused by floods and droughts.	Develop strategies to mitigate effects of floods and droughts.

Table 8. **Performance of OECD countries** (cont.)

WATER GOVERNANCE		
Integrated water resource development, management		
Create and operate water resource assessment services	Main objective achieved by all member countries.	Usable, policy-relevant information not always available, esp. on groundwater.
Institutional structures and legal instruments	Creation of a modern legal and institutional framework. Increasing use of river basin approach.	Implementation, finding innovative approaches.
Integration	More integrated permitting. Progress with integrating water quantity and quality, surface and groundwater.	Insufficient progress with integrating environmental and sectoral policies.
Public participation	Public participation is a legal requirement.	Improve effectiveness of public participation.
Water for sustainable food production, rural development		
Agricultural water use	Some progress with rehabilitation of inefficient irrigation systems. Some reforms of pricing systems have begun.	Most work on improving water use efficiency remains to be done; agricultural water use often heavily subsidised.
Agri-environmental programmes	Some progress in reducing fertiliser and pesticide use.	Agricultural pollution fluxes to water remain unsustainable in many places.
International issues		
Resolving transboundary water issues	Agreement or agreed processes for most transboundary waters.	Implementation, esp. apportionment issues.
Increasing aid for water	Water is a major aspect of environmental aid.	Increase in environmental aid.

Source: OECD.

Nevertheless, the considerable water management efforts of recent decades have *not been enough to safeguard and restore* receiving *water quality and aquatic ecosystems*. Much progress remains to be made on other issues, such as:

- achievement of *ambient water quality objectives;*
- better protection of *aquatic ecosystems;*
- improved *cost-effectiveness* of water management policies and activities;

- reduction of *subsidies* which increase water problems (e.g. overabstraction, pollution);
- more consistent application of the *polluter pays principle* and the *user pays principle*;
- *implementation* of the laws, regulations and policies that have been adopted;
- renewed attention to *human health* aspects of water management;
- control of *diffuse sources and depositions* of nutrients, heavy metals and persistent organic pollutants;
- contamination of *groundwater* aquifers by nitrates, pesticides and other persistent chemicals;
- completion, restoration and upgrading of *waste water treatment infrastructure*;
- better integration of water management into *sectoral and land use policies*;
- protection against *floods and droughts*;
- greater *public participation* in the formulation of water management policies and programmes;
- more effective measures to ensure that water is *affordable to all*.

3.1 Better integration of water management into other policies for sustainable development

A number of assessment studies on freshwater resources carried out at global level have concluded that *current use of water is unsustainable* and have called for urgent action to prevent further deterioration of the situation. To what extent does this conclusion also apply to the group of OECD countries?

The evidence presented in the 42 Environmental Performance Reviews conducted by the OECD suggests that strong economic development pressures can compromise the sustainable use and conservation of water resources on a *local scale* where these pressures affect sensitive environments. For example:

- a long-term declining trend in the level of groundwater tables is continuing as a result of overpumping, especially in some dry regions;

- in some areas where there is intensive cropping or animal husbandry, trends of increasing nitrate (and sometimes pesticide) concentrations in groundwater have yet to be reversed;
- in some sensitive areas, deposition of acidifying substances such as NO_x from airborne pollution fluxes still exceeds the maximum sustainable load and contributes to eutrophication of water bodies;
- irrigation and dryland salinity in some dry regions are constraints on water and land management.

In such areas there are questions about the *sustainability of certain patterns of production* (e.g. in agriculture, transport) *and of consumption* (e.g. transport use, water consumption for gardens and golf courses in densely settled dry regions).

As the current water management policies of member countries were mostly formulated over a decade ago, they often do not fully incorporate the concept of sustainability. While considerable improvements in the state of member countries' water resources were achieved using current policy instruments, these instruments were not designed with sustainability in mind. It is therefore vital to evaluate current policies and instruments and decide whether they *adequately address the issues of sustainability* now being confronted in water management, including how well they consider the water needs of the environment.

Integration of *upstream and downstream interests of transboundary water bodies* is receiving increasing attention. Over the last 30 years OECD countries have made considerable progress in resolving transboundary waters issues: bilateral, regional or multilateral agreements have now been reached in the case of most such waters. While the issue of equitable apportionment of waters between riparian states has been settled in principle in international legal instruments, its application to specific areas may be a source of problems, especially in case of water scarcity or where existing water rights have to be reduced.

Preventing unsustainable use of water resources, insofar as such use stems from lack of integration of environmental factors into sectoral policies, will increasingly require changes to production and consumption processes. Effecting such changes is beyond the direct reach and responsibility of water managers; it demands that *stakeholders take responsibility for the*

environmental effects of their actions. Policy instruments should therefore be aimed at encouraging environmentally responsible behaviour, for example through greater application of social and economic instruments, including the reform of subsidies or taxes with harmful environmental effects. The evolution of underground water pollution is a very useful indicator of the results of this policy.

3.2 New challenges for water-related public health concerns

The great majority of consumers in OECD countries are confident that the water flowing from their taps is safe to drink, but *the public is little aware of the difficulties* water utilities increasingly encounter in supplying safe water at reasonable cost. Apart from the few countries that have yet to connect a part of their population to safe water supplies, most member countries face several new challenges in this field. Concern over the greater vulnerability of children or the elderly to viral and parasitic infections is creating a demand for more advanced microbiological purification. The need to remove nitrates and pesticides from water supplies is becoming more frequent. Lead water pipes in older buildings can cause limits on lead water levels to be exceeded in places. Despite investments made over the last decade, considerable additional water expenditure will be required to meet health objectives.

3.3 Getting the prices right while keeping water affordable

In a number of member countries the *need to upgrade ageing networks* and installations appears to be emerging at the same time as new *demands for more, and higher, standards* for drinking water purification and waste water treatment. Expenditure will rise in line with both the tightening of drinking water standards and the proliferation of the number of substances to be included in these standards, a problem that particularly affects operators of smaller purification plants. Considerable water infrastructure expenditure will thus be required at a time when central government subsidies are becoming less and less available. Domestic water bills, which have already risen significantly in recent years, are likely to rise even further, with water slowly becoming a significant part of household expenditure, especially when water prices reflect water costs.

It is now recognised that the considerable water management efforts of recent decades have not been sufficient to safeguard and restore receiving water quality and aquatic ecosystems. This recognition is focusing attention on the fact that, in terms of both quantity and quality, water resources have not been given a high enough value. Consequently, the concept of *water as an economic good* is becoming more widely accepted in OECD countries, as increased emphasis is placed on the need to allocate water resources efficiently and to operate water services cost-effectively. This is not to deny that *every person should have access to clean water for drinking, cooking and washing, as pricing systems can be structured to achieve both efficiency and equity objectives.*

Some OECD countries have already made considerable progress in *reforming water pricing regimes* for public supplies, for sewerage and sewage treatment, and even (to a lesser degree) for agriculture. Where such services are still subsidised, the first priority should be to reduce and ultimately abolish subsidies for operating costs (including preferential electricity tariffs for water pumping). As a long-term goal, all subsidies for infrastructure capital costs should also be removed, though this will initially be difficult in countries where there are still acute public health concerns or where local financing capacity is limited. To encourage water conservation, awareness raising campaigns should be launched and flat rates should be abolished unless they can be justified. Water metering should be introduced in new dwellings, and in all cases where efficiency gains can be made. Water bills should clearly indicate what consumers are paying for and should be sent to all users.

Water is no longer a minor expenditure item for many households, and signals that the public's willingness to pay is being stretched are becoming more frequent. Through public education, consultation campaigns and meaningful public participation practices, authorities need to build a broad stakeholder consensus on the justification for higher water prices. Such consensus can be reached if appropriate social measures are taken to limit the financial impact of water price increases on the household budgets of the most vulnerable groups of the population. Measures to this effect have already been taken by a number of member countries and other such measures are contemplated.

3.4 Challenges

The major policy directions and challenges for the coming years are:

- implementing *appropriate charges* for households, industry and agriculture, in line with the user pays and polluter pays principles, in order to promote water conservation, preserve aquatic ecosystems, reduce water pollution from point and diffuse sources, cover entirely the operational and maintenance costs of water supply and waste water services, finance necessary investments in water supply and waste water treatment infrastructure;
- better *recovering the costs* of water services;
- creating special mechanisms to make sure that water services are *available and accessible to the poor*;
- eliminating *cross-subsidies* between user groups (e.g. households, industry, agriculture) while making appropriate use of cross-subsidies within user groups;
- designing and introducing lower-cost innovative *waste water treatment* techniques;
- introducing *cleaner production methods*, e.g. through integrated permitting that stresses pollution prevention and greater use of voluntary agreements with specific industry branches to meet specified reductions in pollutant discharges;
- adopting and *implementing whole-basin approaches* to water quantity and quality management, and ensuring that these are integrated with sectoral and land use policies by means of institutional and market-based approaches.

TECHNICAL NOTES (TABLES AND FIGURES)

Country codes used are as follows:

CAN	Canada	DNK	Denmark	NLD	Netherlands
MEX	Mexico	FIN	Finland	NOR	Norway
US	United States	FRA	France	POL	Poland
JPN	Japan	DEU	Germany	PRT	Portugal
KOR	Korea	GRC	Greece	SLO	Slovak Republic
AUS	Australia	HUN	Hungary	ESP	Spain
NZL	New Zealand	ISL	Iceland	SWE	Sweden
AUT	Austria	IRL	Ireland	CHE	Switzerland
BEL	Belgium	ITA	Italy	TUR	Turkey
CZE	Czech Republic	LUX	Luxembourg	UK	United Kingdom

Signs:

..	not available
-	nil or negligible
USD	US dollar

Table 1 – Investment and current expenditure on waste water pollution abatement and control

Pollution abatement and control (PAC) activities are defined as purposeful activities aimed directly at the prevention, reduction and elimination of pollution or any other degradation of the environment resulting from the production process or from the use of goods and services. PAC expenditure reported here refers to the sum of investments and internal current expenditure for waste water management. Excludes expenditure linked to mobilisation of natural resource (e.g. water supply).

Data before 1994 have not been considered.

Country notes (*):

MEX Public sector: Federal government, capital city government, and two public enterprises are included.

AUT Public sector investment column: 1999 data.

DEU Investments: end-of-pipe investments only.

ITA Business sector investments: end-of-pipe only. Only covers enterprises with 20 employees or more.

NOR Public sector: public specialised producers of environmental services (municipal Departments) only.
POL Total and public sector: includes investments by specialised producers of environmental services.
SWE Business sector: enterprises with 20 employees or more within NACE 10-41.
CHE Public sector 1999: preliminary data.

Source: OECD.

Table 2 – Access to safe drinking water and to basic sanitation

Access to safe water supply: proportion of the population using any of the following types of water supply drinking: piped water, a public tap, a borehole with pump, a protected well, a protected spring or rainwater.
Population connected to public sewerage country notes (∗):
US Excludes rural areas served by on-site disposal systems.
JPN Population connected: data refer to population served.
FIN Independent sewerage: data refer to 1995.
FRA Independent sewerage: data refer to 1995, reported as % of dwellings.
GRC In 1993 a new waste water plant in Athens city became operational; data include connections still under construction.
POL Without treatment and total not connected: data refer to 1999.
TUR Data result from an inventory covering municipalities with an urban population over 3 000 inhabitants, assuming that the sewerage system and treatment facilities serve the whole population of the municipalities.
UK Data refer to financial year (April to March).

Source: WHO; OECD.

Table 3 – Prices of water supply in major cities

Water Prices: prices calculated on the basis of a family of four (two adults and two children) living in a house with garden rather than an apartment. Where there are water meters, the price is based on annual consumption of 200 m^3. Where supply is normally unmeasured, the average price has been used (Norway and UK). VAT is not included. Waste water treatment cost, water pollution and abstraction charges and taxes are not included.
Data refer to 1998, unless otherwise specified.
Country notes (∗):
US Washington and Orlando: 1996 data.
KOR National data: 1996.
FIN Vaasa: 1996 data.
DEU National data: refer to 1997 and are provisional.
ISL 1996 data.
NOR Unmeasured data: refer to the average price.
TUR 1995 data.
UK Unmeasured data: refer to the average price.

Source: IWSA/AIDE.

Table 7 – Freshwater abstractions by major uses

Abstractions: accounts for total water withdrawal without deducting water that is reintroduced into the natural environment after use.
Abstractions as % of available resources: data refer to total abstraction divided by total renewable resources, except for total, where the internal resource estimates were used to avoid double counting.
Renewable water resources: net result of precipitation minus evapotranspiration (internal) plus inflow (total). This definition ignores differences in storage capacity, and represents the maximum quantity of freshwater available on average.
Inflow: water flows from neighbouring countries. Includes underground flows.
Freshwater abstractions data: refers to 2001 or latest available year.
Cultivated land: refers to arable and permanent crop land. Luxembourg cultivated land is included in Belgium.
Irrigated areas: refers to areas equipped to provide water to the crops, including areas equipped for full and partial control irrigation, spate irrigation areas, and equipped wetland or inland valley bottoms. Luxembourg irrigated areas are included in Belgium. Japan and Korea: includes rice irrigation only.
Abstractions country notes (∗):

CAN Latest year available: 1996. Change since 1980: refers to 1981.
MEX Latest year available: 2000 data based on partial totals excluding electrical cooling. Change since 1980: based on totals excluding agricultural uses other than irrigation.
US Latest year available: 1995.
JPN Latest year available: 1999, irrigation 1997.
KOR Latest year available: 1997. Abstraction for public supply: data refer to domestic supply. Irrigation: includes other agricultural uses.
AUS Latest year available: 1997. Change since 1980: refers to 1977 data adjusted for an average climatic year. In Australia the intensity of use of water resources varies widely among regions; one-third of the country is arid, one-third semi-arid, and the high rainfall areas in the north are far from the densely populated areas in the south.
NZL Latest year available: 1993 estimates. Change since 1980: refers to a composite total based on data for various years. Partial totals excluding industrial and electrical cooling.
AUT Latest year available: 1997. Change since 1980: 1980 refers to electrical cooling from surface water only. Irrigation: groundwater only.
BEL Latest year available: 1999.
DNK Latest year available: 1998 data referring to groundwater only (major part of total freshwater abstractions, e.g. 95-99% for 1995). Change since 1980: refers to 1977.
FIN Latest year available: 1999. Irrigation: country estimates.
FRA Latest year available: 1999. Change since 1980: refers to 1981. Irrigation: includes other agricultural uses but irrigation is the main use.
DEU Latest year available: 1998. Change since 1980: ratios for total Germany compared to ratios for western Germany (1979 data). Excludes agricultural uses other than irrigation.
GRC Latest year available: 1997 including, for public water supply, data from 42 out of 75 great water distribution enterprises. Partial totals exclude agricultural uses besides irrigation.
HUN Latest year available: 2000.
ISL Abstractions for public supply: includes the domestic use of geothermal water.

IRL Latest year available: 1994 including 1980 data for electrical cooling. Irrigation: includes other agricultural uses.
ITA Latest year available: 1998. 1980: including 1973 estimates for industrial cooling. Excludes agricultural uses other than irrigation.
LUX Latest year available: 1999.
NLD Latest year available: 1996. Change since 1980: refers to 1981. Partial totals excluding all agricultural uses.
NOR Latest year available: 1996.
POL Totals include abstractions for agriculture, which include aquaculture (areas over 10 ha) and irrigation (arable land and forest areas greater than 20 ha); animal production and domestic needs of rural inhabitants are not covered.
PRT Latest year available: 1998. Excludes agricultural uses other than irrigation.
ESP Latest year available: 2000, electrical cooling 1997. Change since 1980: Groundwater 1980 excludes industry. Excludes agricultural uses other than irrigation.
SWE Latest year available: 2000. Change since 1980: 1980 includes data from different years.
CHE Latest year available: 2000. Partial totals excluding all agricultural uses.
TUR Latest year available: 2001, public supply 2000. Change since 1980: 1980 excludes electrical cooling. Totals excluding agricultural uses other than irrigation.
UK Latest year available: 2000. England and Wales only. Partial totals. Data include miscellaneous uses for power generation, but exclude hydroelectric power water use.
OECD Secretariat estimates. Public freshwater supply abstractions exclude New Zealand. Irrigation abstractions exclude New Zealand, Netherlands and Switzerland. 1980: includes W. Germany only.

Source: Food and Agriculture Organisation; OECD.

Figure 2 – Pollution abatement and control expenditure in OECD countries

Pollution abatement and control (PAC) activities are defined as purposeful activities aimed directly at the prevention, reduction and elimination of pollution or any other degradation of the environment resulting from the production process or from the use of goods and services. PAC expenditure reported here refers to the sum of investments and internal current expenditure for waste water management. Excludes expenditure linked to mobilisation of natural resource (e.g. water supply).
Total: the sum of public and business sector and specialised producers of environmental services; based on data for 13 countries representing two-thirds of the OECD GDP.
Public sector: including public specialised producers of environmental services.

Source: OECD.

Figure 3 – Sewerage and sewage treatment connection rates

Primary treatment: physical and mechanical processes which result in decanted effluents and separate sludge (sedimentation, flotation, etc.).
Secondary treatment: biological treatment technologies, i.e. processes which employ anaerobic or aerobic micro-organisms.
Tertiary treatment: advanced treatment technologies, i.e. chemical processes.

Latest available year: refer to 2001 or latest available year.
Country notes:

CAN Secondary usually includes private treatment and waste stabilisation ponds. Tertiary: secondary with phosphorus removal.

US Primary: may include ocean outfalls and some biological treatment. Tertiary: includes 2-3% of non-discharge treatment, e.g. lagoons, evaporation ponds. Excludes rural areas served by on-site disposal systems.

JPN Population connected: data refer to population served. Secondary and/or tertiary: may include primary treatment.

FIN Secondary: 50-80% removal of BOD; tertiary: 70-90% removal of BOD.

FRA Data reported as % of dwellings.

GRC In 1993 a new waste water plant in Athens city became operational; data include connections still under construction.

NLD Tertiary: includes dephosphatation and/or disinfection.

SWE Primary: may include removal of sediments. Secondary: chemical or biological treatment. Tertiary: chemical and biological plus complementary treatment.

TUR Data result from an inventory covering only some municipalities, 74% of the whole population.

UK Data refer to financial year (April to March). Primary: removal of gross solids. Secondary: removal of organic material or bacteria under aerobic conditions. Tertiary: removal of suspended solids following secondary treatment.

Source: OECD.

Figure 4 – Water quality of selected rivers

Measurement locations are at the mouth or downstream frontier of rivers.
Data: refer to three-year averages around 1980, 1985, 1990, 1995 and 2001, unless otherwise specified.
Nitrates: total concentrations unless otherwise specified.
Country notes:

CAN Dissolved oxygen: Saskatchewan 2001 one-year average (2001). Nitrates: Saskatchewan $NO_2 + NO_3$. Saskatchewan 2001 one-year average (2000).

MEX Nitrates: Lerma 2001 one-year average (1999).

FRA Data refer to hydrological year (September to August). Seine: station under marine influence. Rhône: since 1987 data refer to another station. Data 2001: one-year average (1999). Nitrates: Loire and Seine dissolved concentrations.

DEU Data 2001: one-year average (1999). Nitrates: dissolved concentrations.

ITA Po: until 1988 data refer to Ponte Polesella (76 km from the mouth); since 1989 data refer to Pontelagoscuro (91 km from the mouth). Dissolved oxygen: Adige 1990 one-year average (1990). Nitrates: Adige 1980 one-year average (1980).

LUX Moselle 1980 and 1985: one-year average (1980 and 1985).

NLD Dissolved oxygen: Rijn-Lobith, Maas-Keizersveer 2001 one-year average (2000). Nitrates: Rijn-Lobith dissolved concentrations. Rijn-Lobith, Ijssel-Kampen 2001: one-year average (1999).

POL Data 1980, 1985 and 2001: one-year average (1980, 1985 and 1999).

ESP Guadalquivir: from 1990 onwards data refer to another station closer to the mouth and farther away from Seville influence. Data 2001: one-year average (1999). Nitrates: dissolved concentrations.
CHE Data 2001: one-year average (1999).
TUR Data 2001: one-year average (1999).
UK Data 2001: one-year average (1999). Nitrates: when the parameter is unmeasurable (quantity too small) the limits of detection values are used when calculating annual averages. Actual averages may therefore be lower.

Source: OECD.

Figure 5 – Freshwater abstractions by major uses

Public supply refers to water supply by waterworks, and may include other uses besides the domestic sector.
Irrigation refers to self supply (abstraction for own final use).
Other uses include industry and electrical cooling (self supply).
Latest available year: refers to 2001 or latest available year.
OECD trends: Secretariat estimates for 27 countries considering England and Wales only. New Zealand, Netherlands and Switzerland are not included.
Country notes: see notes for Table 7 Freshwater abstractions by major uses

Source: OECD.

ANNEX: LIST OF PUBLICATIONS

OECD Environmental Performance Reviews (2nd Cycle)

♦ Germany	(2001)	English, French, German
♦ Iceland	(2001)	English, French
♦ Norway	(2001)	English, French
♦ Portugal	(2001)	English, French
♦ Japan	(2002)	English, French, Japanese
♦ Slovak Republic	(2002)	English, French, Slovak
♦ Italy	(2002)	English, French, Italian
♦ United Kingdom	(2002)	English, French
♦ Poland*	(2003)	English, French, Polish
♦ Netherlands*	(2003)	English, French
♦ Mexico*	(2003)	English, French, Spanish
♦ Austria*	(2003)	English, French, German

OECD Environmental Performance Reviews (1st Cycle)

♦ Germany	(1993)	English, French, German
♦ Iceland	(1993)	English, French
♦ Norway	(1993)	English, French
♦ Portugal	(1993)	English, French
♦ Japan	(1994)	English, French, Japanese
♦ United Kingdom	(1994)	English, French
♦ Italy	(1994)	English, French, Italian
♦ Netherlands	(1995)	English, French

* Forthcoming

♦ Poland*	(1995)	English, French, Russian, Polish
♦ Canada	(1995)	English, French
♦ Austria	(1995)	English, French, German
♦ United States	(1996)	English, French, Spanish
♦ Bulgaria*	(1996)	English, French, Russian, Bulgarian
♦ Sweden	(1996)	English, French
♦ New Zealand	(1996)	English, French
♦ France	(1997)	English, French
♦ Spain	(1997)	English, French, Spanish
♦ Korea	(1997)	English, French, Korean
♦ Finland	(1997)	English, French
♦ Belarus*	(1997)	English, French, Russian
♦ Mexico	(1998)	English, French, Spanish
♦ Australia	(1998)	English, French
♦ Belgium	(1998)	English, French
♦ Switzerland	(1998)	English, French, German
♦ Denmark	(1999)	English, French
♦ Czech Republic	(1999)	English, French, Czech
♦ Turkey	(1999)	English, French, Turkish
♦ Russian Federation*	(1999)	English, French, Russian
♦ Hungary	(2000)	English, French, Hungarian
♦ Greece	(2000)	English, French, Greek
♦ Luxembourg	(2000)	English, French
♦ Ireland	(2000)	English, French

OECD water related publications

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- OECD (1998), *Water Management: Performance and Challenges in OECD Countries*, OECD, Paris.
- OECD (1998), *Sustainable Management of Water in Agriculture: Issues and Policies*, proceedings of Athens workshop, OECD, Paris.
- OECD (1999), *The Price of Water: Trends in OECD Countries*, OECD, Paris.
- OECD (1999), *Household Water Pricing in OECD Countries*, Paris.
- OECD (2000), *Global Trends in Urban Water Supply and Waste Water Financing and Management: Changing Roles for the Public and Private Sectors*, OECD, Paris.

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- OECD (2001), *Environmental Indicators: Towards Sustainable Development*, OECD, Paris.
- OECD (2001), *OECD Environmental Strategy for the First Decade of the 21st Century*, OECD, Paris.
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- OECD (2002), *OECD Environmental Data: Compendium 2002*, OECD, Paris.
- OECD (2003), *Social Issues in the Provision and Pricing of Water Services*, OECD, Paris.
- OECD-World Bank (2002), *Private Sector Participation in Municipal Water Services in Central and Eastern Europe and Central Asia*, proceedings of a conference held 10-11 April 2002, Paris, OECD, and World Bank, Washington, DC.

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