



Seventh “Environment for Europe” Ministerial Conference

**Astana, Kazakhstan
21–23 September 2011**

**Sustainable management of water and
water-related ecosystems**



UNITED NATIONS



Economic and Social Council

Distr.: General
7 July 2011

Original: English

Economic Commission for Europe

Seventh “Environment for Europe” Ministerial Conference

Astana, 21–23 September 2011
Items 3 and 4 of the provisional agenda

Sustainable management of water and water-related ecosystems

Sustainable management of water and greening the economy

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Note by the secretariat and the Organization for Economic Cooperation and Development

Summary

The present document was prepared in accordance with the “Environment for Europe” (EfE) Reform Plan to support the discussions of the Seventh EfE Ministerial Conference under one of the Conference’s two main themes: sustainable management of water and water-related ecosystems. The document follows the agreed questions for discussion in the multi-stakeholder round tables, describing recent trends, challenges and achievements as well as recommendations for the way forward. The different aspects are illustrated by good practices submitted by Governments and other stakeholders.¹ The document does not aim to give a comprehensive overview or assessment; instead it should be read together with the second Assessment of Transboundary Rivers, Lakes and Groundwaters in the United Nations Economic Commission for Europe (UNECE) region, as well as Europe’s Environment Assessment of Assessments report.

The document was developed by the UNECE secretariat of the Convention on the Protection and Use of Transboundary Watercourses and International Lakes, and the Organization for Economic Cooperation and Development secretariat of the Task Force for the Implementation of the Environmental Action Programme for Eastern Europe, Caucasus and Central Asia countries, which was responsible for chapter II. It was prepared through a broad consultative process involving countries as well as partner organizations such as the

¹ All good practices submitted are included in an information document “Collection of good practices” prepared for the Conference (ECE/ASTANA.CONF/2011/INF/3).

United Nations Environment Programme, the Food and Agricultural Organization of the United Nations, the Regional Office for Europe of the World Health Organization, the World Meteorological Organization, the European Environment Agency, the secretariat of the Convention on Wetlands of International Importance and the Global Water Partnership. The document also reflects comments received from UNECE member States and Efe partner organizations.

Contents

	<i>Paragraphs</i>	<i>Page</i>
I. Sustainable management of water and water-related ecosystems	1–49	3
A. Which policies proved to be effective to value and protect water-related ecosystems, including payment for ecosystem services? What are the main obstacles and gaps?	3–16	3
B. What policies proved to be effective in addressing human health issues related to water quality and quantity? What are the main obstacles and gaps?	17–27	7
C. What are the priorities/challenges in adapting management of water and water-related ecosystems to extreme weather events and to climate change?	28–41	10
D. What are the experiences and lessons learned from the cooperation in transboundary basins to improve water quality, manage water quantity and protect ecosystems?	42–49	13
II. Sustainable management of water and greening the economy	50–84	16
A. What policy mixes and practical tools, such as integrated water resources management, pricing, standards and water users associations, can be most effective to improve water efficiency by different water users, especially in agriculture, households and industrial operations?	53–72	16
B. How can we encourage investments to take into account the impacts on water quantity and water quality, energy and resource efficiency and vulnerable populations?	73–84	20

I. Sustainable management of water and water-related ecosystems

1. Water is at the cross roads of economic, social and environmental development. It underpins human health and economic activities, and sustains and is sustained by the proper functioning of ecosystems, which in their turn provide a wealth of valuable services.

2. In the United Nations Economic Commission for Europe (UNECE) region an estimated 120 million people do not have access to safe drinking water and adequate sanitation, which makes them more vulnerable to water-related diseases. Approximately a third of the UNECE population lives in countries suffering from water stress and this percentage is expected to rise significantly due to climate change and other pressures on freshwater resources. Many countries depend on groundwater to meet the demand for drinking water, and are quickly depleting precious aquifers, especially around cities. The needs of irrigation agriculture, too, make excessive demands on the freshwater available. Water pollution remains a significant challenge. These processes are inflicting irreversible damage on the environment and threaten economic activities.

A. Which policies proved to be effective to value and protect water-related ecosystems, including payment for ecosystem services? What are the main obstacles and gaps?

1. The issue and recent trends

3. In most parts of Europe water quality has improved over the past 20 years. This is due to several reasons: there has been better regulation, enforcement and investments in wastewater treatment plants, mainly in the West; in the East, in addition, the economic transition since the early 1990s has helped. Moreover, throughout the region production has become cleaner, resulting in a decrease of pollution from industrial facilities.

4. In the European Union (EU) and in some neighbouring countries new water policies based on the EU Water Framework Directive (WFD) and other related EU directives have been put into place with the aim of reaching a good status for all waters. Increased attention is also being paid to research: knowledge sharing and information dissemination support decisions of Governments in water use and protection.

5. On the other hand, there are numerous remaining pressures from agriculture, untreated or insufficiently treated industrial and domestic wastewater, mining, old chemical burdens, unsafe landfills, tailing ponds and inappropriate land use. Some growing pressure is expected due to increased economic activity, especially in the eastern part of the region, other human pressures and climate change.

6. In parts of Eastern Europe, the Caucasus and Central Asia, the system of regulation and assessment based on the concept of zero risk for determining Maximum Permissible Discharge of pollutant parameters imposes often unrealistic and costly investments and impracticable pollution control requirements. The principles of integrated water resources management (IWRM) are still insufficiently applied: coherent and integrated plans on the protection and management of river basins at national and transboundary levels are often lacking, as well as concrete activities for the protection and sustainable use of water resources and of water ecosystems.

7. Hydromorphology and river continuity have been improved in many European basins through the reconnection of wetlands and flood-plains. However, hydromorphological alterations are still a major challenge. A significant number of surface

water bodies in EU member States face a high risk of not achieving good ecological status by 2015 in accordance with the WFD due to unsustainable modifications by dams, weirs and sluices, straightening and canalization, and the disconnection of flood-plains.

8. Most Western and Eastern European countries adopted water-related policies favourable to the recognition of services of water-related ecosystems (for both water quality and quantity). However, implementation of innovative economic instruments such as PES is not frequent and often relies on local initiatives. The needs of water-related ecosystems are often not taken into account in practice in economic and spatial planning and water governance systems in Central Asia, the Caucasus and Eastern Europe. Some countries experience a continued decline of water-related ecosystems (in particular wetlands) and their services, as well as loss of biodiversity. Ecosystem services are not adequately valued; methodologies for valuation are still not widely used. The low attention paid to ecosystems can lead to severe environmental consequences.

2. The way forward: tackling challenges and building on achievements

9. Water-related ecosystems and their services support water resources management as they capture, filter, store and distribute water. Their protection and sustainable use ensure a reliable water quantity and quality. It is therefore recommended to adopt an ecosystem approach to water management and to respect the principle of environmental flow ensuring the ecosystem's minimum needs for water. This approach requires strengthening wetland/ ecosystem protection and restoration through economic, structural and management measures; increasing investments in river restoration schemes; reconnecting wetlands and flood-plains with rivers; and ensuring river continuity through effectively building and operating fish passes. It is also recommended to promote the extension of Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention) sites, to create transboundary protected areas and to plant new sustainable forest in countries with low forest coverage, including by stimulation of afforestation of former arable land. Finally, establishing integrated ecosystem planning and management (water, forests, wetlands, etc.) and ensuring a better coordination between IWRM plans and other sectoral strategies, plans and programmes, including land use plans, is needed.

Box 1

Ecological restoration in the Syr Darya basin

The Syr Darya is one of the two major rivers of Central Asia that suffered from an important anthropogenic impact, resulting in the Aral Sea disaster. However, it was less influenced by draw-off discharge and clearing of riparian forests for agriculture, and has a lower population density than similarly threatened river systems in Central Asia (the Amu Darya in particular). Thus it provides an opportunity to become a model for sustainable management and socio-economic development of river basins in the region, as well as for species conservation and restoration. Until recently, no protected areas existed in the river valley, in spite of the great biological values at stake. Some years ago, the Karatausskii strict nature reserve (*zapovednik*) and some specially protected zones in the grasslands areas were established. The project "Biodiversity preservation and integrated river basin development in the Syr Darya River Valley of Kazakhstan" aims to provide a basis for integrated river basin management, nature protection and ecosystems restoration. It includes development of protected areas and sustainable land use, working in close cooperation with local communities and non-governmental organizations (NGOs). Intermediate project results already show an important positive impact on the sustainability of water management in the middle reaches of the Syr Darya.

10. It is necessary to strengthen the use of environmental valuation and integrate these environmental or ecosystem values in traditional economic accounting. Innovative tools such as payments for ecosystem services (PES) should be implemented in closer cooperation with other sectors (e.g., forest, wetlands). There are some existing good practices in this regard, such as the city of New York (see box 2 below). The establishment of pilot projects to implement PES in Eastern Europe, the Caucasus and Central Asia is promising.

Box 2

PES scheme in New York City

The Catskill and Delaware watersheds provide 90 per cent of the water consumed by the city of New York. As the quality of water decreased in the 1990s, the United States Environmental Protection Agency required that all surface water be filtered, unless safe water could be provided under natural conditions. It was estimated that building a filtration plant would cost \$6 billion to \$8 billion, and its yearly operation \$300 million to \$500 million. Instead of building a filtration plant, the authorities decided to invest \$1.5 billion over 10 years in a watershed programme to be administered by the Catskill Watershed Corporation, a non-profit organization. The programme is based on improvements in farm and forestry practices in order to reduce water pollution. The PES scheme was initiated with money from the city and the state of New York and the Federal Government. Now the scheme is financed by a tax included in New York water users' bills. Taxpayers' bills increased by 9 per cent instead of doubling.

11. It is necessary to strengthen efforts to improve the quality of water and preserve water-related ecosystems, especially in the eastern part of the region. This requires setting and enforcing discharge permits, including specific limits for selected pollutants discharged from municipal and industrial pollution sources; monitoring legal enforcement measures; investment in sustainable sanitation and wastewater treatment; and appropriate operation and maintenance of water and wastewater treatment plants; as well as pollution reduction/prevention programmes. Particular attention should be paid to groundwater. Long-term target setting and proactive strategies are needed to achieve the objectives related to water quality and ecosystems.

Box 3

Long-term target setting in Finland

Starting in the 1970s Finland introduced four national water protection programmes, specifying quantitative water protection targets for priority sectors. Wide-ranging cooperation with many national and regional stakeholders has been a prerequisite to ensure the commitment of different partners to implement the targets. In addition, river basin management plans for seven regions, prepared through extensive cooperation between all relevant stakeholders, were adopted in 2009. As a result, good water quality status can be maintained or reached by 2015 in over 90% of the lake areas, and in approximately 70% of the total river length. The status of most groundwater resources is expected to be good by 2015, while for coastal waters the target year for good water quality status is 2027.

12. EU legislation such as the WFD and the Urban Wastewater Treatment Directive, as well as UNECE instruments such as the Water Convention, provide a solid framework in this regard; they should be implemented and enforced. To this end, building and strengthening human capacity in relevant national authorities is needed.

13. Many of the pressures on water resource and their quality are due to other sectors, such as agriculture. It is therefore necessary to reform the existing practices of water uses and environmental policies, including the adoption of good agricultural practices, in order to reduce pollution from diffuse sources, unsustainable abstraction and inefficient water use. The ongoing reform of the EU Common Agricultural Policy offers an opportunity to integrate water policy aspects. Also, reuse of treated wastewater can be a valid measure if it is based on existing frameworks, such as the World Health Organization (WHO) guidelines on the safe reuse of wastewater, excreta and greywater in agriculture.

Box 4
Netherlands tax on nutrients

The centrepiece of the current Dutch nutrient pollution policy is a farm-level nutrient accounting system enforced by a tax on annual net balance of nutrients in excess of a levy-free minimum. This is accompanied by a cap on manure application per hectare coupled with a system of manure trading started in 2002. In the Dutch Mineral Accounting System (MINAS) farmers record the amount of nitrogen and phosphorus that comes onto the farm, e.g., through feed, livestock, fodder, manure and chemical fertilizer, and the amount that leaves it in such forms as livestock, forage, manure, grain, milk and eggs. The programme sets a loss standard that represents uncontrollable nutrient loss. The farmer is charged a levy on nitrogen and phosphorus surplus in excess of this loss standard. The farmer must account for the nitrogen and phosphorus content of the inputs and outputs. The MINAS phosphorus tax currently is set at €9 per kilogram of excess phosphate. Excess nitrogen is taxed at a rate of €2.3 per kilogram. The taxes aim to motivate behavioural changes.

14. Despite a certain progress in strengthening the effectiveness of monitoring systems in Eastern Europe, the Caucasus and Central Asia, the need to enhance and modernize monitoring and assessment systems for water and water-related ecosystems remains one of the biggest challenges, especially in Central Asia. This requires adequate financing, human resources, measurable standards/indicators and equipment. Monitoring and assessment should cover both water quality and quantity and be based on both measurements of pollutant loads and water parameters. Ecological monitoring also needs to be introduced or improved. Information should be available to the public.

15. Some progress has been made in preventing industrial accidents and mitigation of their impacts on ecosystems and human health, but accidents are still occurring. It is therefore necessary to prevent and be better prepared for industrial accidents, through improved contingency-planning. This requires, for example, identifying and decontaminating hazardous landfills and obsolete pesticide storage places.

16. Water quality problems should be addressed at the basin level, through the development of river basin management plans involving all relevant actors, with special attention to transboundary cooperation. River basin commissions and other joint bodies should play an important role in this regard; however, they are inexistent in some basins or too weak and with insufficient capacity in other cases. Civil society and NGOs also have an important role to play, for example, in ecosystem restoration. Water users associations (WUAs) can help strengthen the voice of users (e.g., small farmers) in the councils.

B. What policies proved to be effective in addressing human health issues related to water quality and quantity? What are the main obstacles and gaps?

1. The issue and recent trends

17. Progress regarding access to water, and especially sanitation, is varied throughout the UNECE region depending on subregion and social group. Progress has especially been weak regarding access to safe water and adequate sanitation for vulnerable populations and those living in rural and remote areas in Eastern Europe, the Caucasus and Central Asia. Trends in some countries have shown no significant improvements since 1995, and the relevant Millennium Development Goal (MDG) might not be achieved.

18. The situation concerning access to adequate sanitation is particularly serious, with lack of progress or even stagnation and regression in particular in parts of Eastern Europe, the Caucasus and Central Asia. In these regions, pit latrines and open wastewater gutters, as well as an inadequate management of livestock and household waste, lead to drinking water source contamination with bacteria and nitrates. Irrigation canals in Central Asia are often a source of drinking water, but contain a high degree of dissolved salt content and agrochemicals. These problems are often neglected and there is a low awareness among the population about the related health risks.

19. Some progress has been made in reducing the incidence rate of some classic water-related diseases in Eastern Europe, the Caucasus and Central Asia, but the incidence levels of some old diseases are stagnating. According to best estimates by WHO, more than 13,000 children under the age of 14 die every year from water-related diarrhoea in the UNECE region, mostly in its eastern part. More than 170,000 cases of water-related diseases are reported every year, but health systems are often not able to diagnose and survey the emergence of new water-related diseases due to weak surveillance systems.

20. Coherent financial and investment policies to address water supply and sanitation are often lacking, as are resources to sustain infrastructure at the local level and maintain existing centralized systems. Revenues collected by water utilities often do not cover operational costs. Further problems include disruption of water supply, pipe breaks, high levels of unaccounted-for water and poor performance levels. In many countries, more than 30 per cent of water is lost in transfers from supply sources to consumers, such as in open water canals.

21. Special problems relate to the quality and affordability of water services for parts of the population. An increasing number of persons are not able to afford the price of water at full cost recovery, especially if costs charged include collection and treatment of wastewater. Social measures often are ineffective and poorly targeted.

2. The way forward: tackling challenges and building on achievements

22. Problems related to water resources management, water supply and sanitation and health are scattered across different policy sectors and institutions, yet closely linked. This calls for improved integration and cooperation between sectors, such as health, water, forest, agriculture and environment protection, for example through the creation of inter-ministerial coordination mechanisms. Such an approach is promoted by the UNECE/WHO-EURO Protocol on Water and Health. Since the Protocol's entry into force in 2005, there has been a continuous progress regarding its ratification and implementation. However, there are still many challenges to full implementation, mostly related to the still-weak cooperation between sectors and the lack of investments for water supply and sanitation. Especially countries in Central Asia, South-Eastern Europe and the Caucasus facing serious water and health problems should ratify and implement the Protocol, taking

advantage of its approach and of the tools it offers. Better recognition and implementation of the Protocol and its achievements could also be helpful for EU and other developed countries for a coordinated and targeted achievement of long-term water and health-related environmental goals.

23. The recognition of the human right to water and sanitation by the United Nations General Assembly and the Human Rights Council in 2010 are also important steps which countries in the UNECE region should build on.

24. Few public investments more effectively enhance human security or build prosperity than investments in water and sanitation. Financial resources for investments in water supply and, in particular, sustainable sanitation, need to be raised, e.g., through appropriate yet affordable rates and prices for water. Well-structured water tariffs based on the cost recovery principle should be introduced and revenues from water fees and PES should be reinvested in improving water quality. Access to non-commercial investment funds should be improved for rural municipalities and households. Special measures, including both tariff aspects and social measures, should be put into place to ensure affordability and non-discrimination in access to clean water and adequate sanitation and to guarantee access to water to vulnerable groups and rural populations.

25. The most effective means of consistently ensuring the safety of a drinking-water supply is through the use of a comprehensive risk assessment and risk management approach that encompasses all steps in water supply from catchment to consumer. Such Water Safety Plans (WSP) should be established for all water utilities and best practice on their implementation should be promoted and shared. Countries should use these mechanisms and implement international commitments, such as those included in the Parma Declaration and the Youth Declaration of the Fifth Ministerial Conference on Environment and Health (Parma, Italy, 8–10 March 2010).

Box 5

Drinking water protection in the Czech Republic

According to Czech legislation, the water authority identifies zones for protection and wholesomeness of surface and groundwater resources for drinking water abstraction of more than 10,000 cubic metres (m³) per year. The first level of protection is obligatory in close proximity to the abstraction facility. The second level should be stipulated by the water authority, so that the wholesomeness of the water resource is not affected by anthropogenic activities. Standards for the quality of such water resources are set out in legislation.

Nearly 93 per cent of country population is supplied with drinking water from public water supply systems. The requirements for quality and regular control are embedded in Czech legislation, based on EU directives. The legislation does not cover small water resources such as private wells. The use of such resources is up to the responsibility of individuals; however, an information campaign has addressed this challenge, including production and distribution of booklets “The Well as a Source of Drinking Water” and “Own Well: Advantage and Risk”. In addition, the National Institute of Public Health offers a public phone line and e-mail intended to inform interested persons about private wells and the related risks.

26. Plans for development of water supply and sanitation systems should be prepared including both economic and environment aspects in a balanced way, and taking into consideration small-scale systems as a viable alternative to centralized solutions, especially for remote and rural areas. As an example, ecological sanitation treats human excreta as a

valuable resource to be recycled. Capacity-building and awareness-raising on small-scale water supply and small-scale wastewater and sanitation solutions are needed to ensure their safety and proper management.

Box 6

Ecological sanitation in Central Asia

In Kazakhstan, widespread use of street pit latrines has led to significant pollution of groundwater with nitrate and bacteria. Ecological sanitation uses recycled human waste as fertilizer for agriculture. It thereby helps to prevent pollution and to provide access to adequate sanitation for population groups in remote areas. This concept has been implemented in the form of dry toilets in five schools in the villages of Kostanai and South Kazakhstan provinces (oblasts), and dozens of outbuilding dry toilets constructed under the programme “Empowerment and local action”, carried out by Women in Europe for a Common Future. Composting toilets are often used as an alternative to central wastewater treatment plants. Typically, they are chosen to alleviate the need for water to flush toilets, to avoid discharging nutrients and/or potential pathogens into environmentally sensitive areas, or to capture nutrients in human excreta. Experience in Kazakhstan has shown that dry latrines are especially useful for rural schools and in the recovery of destroyed housing after disasters.

27. In some countries there is a lack of awareness and public access to information on water safety and water-related health risks. NGOs play an important role in proposing solutions and setting priorities, in implementation of policies and as key stakeholders, e.g., through awareness-raising, providing training or implementing pilot projects.

Box 7

Investments in wastewater for a low-income small community

Since December 2009, the Global Water Partnership (GWP) Armenia and its partners have been engaged in household wastewater treatment problems. A pilot community was identified that particularly needed wastewater treatment, and funds from the United Nations Development Programme/Global Environment Facility (UNDP/GEF) Small Grants Programme were granted in 2010. The project aims to address agricultural lands degradation and groundwater pollution caused by contamination of community farmlands by municipal wastewater in the Parakar community of the Armavir region of Armenia. The Parakar community’s input in this project is 66 per cent of the total project budget, of which 64.7 per cent is monetary and 35.3 per cent in kind. The community is involved in training sessions on sustainable land management.

This initiative brought an innovative approach into financing: the operating and maintenance company will provide stability and continuity of the plant operation paid by wastewater treatment fees collected from the population, as well as the fees for using the treated wastewater for irrigation purposes.

C. What are the priorities/challenges in adapting management of water and water-related ecosystems to extreme weather events and to climate change?

1. The issue and recent trends

28. Extreme weather events and potential climate change impacts are increasingly affecting the UNECE region, while impacts vary significantly across the region and even within countries. Water is the medium through which most of the climate change impacts occur: increased variability in precipitation, increased frequency and longer duration of floods, and droughts, and especially more frequent and devastating flash flood events; accelerating glacier melting and retreat; and increases in water temperature. These impacts may cause water insecurity. In addition, extreme weather events have significant impacts on water quality, ecosystems and their functioning. For example, during low-water periods the concentration of pollutants in the water often increases. Changes in water availability and water quality have important consequences also for other sectors such as energy (including hydropower), agriculture (irrigation), navigation, tourism and fisheries.

29. Large areas of the region are affected by water scarcity and droughts. These are not an exclusive characteristic of arid areas; in recent years, large-scale water scarcity and drought events have affected even traditionally water-rich regions. For instance, the 2003 drought affected an area extending from Portugal to Romania and Bulgaria. Water scarcity and droughts affect large populations and have consequences for many sectors, particularly agriculture. Central Asia is especially vulnerable to climate change due to glacier melting and existing environmental problems such as the Aral Sea crisis might be exacerbated by climate change.

30. Flooding is, along with storms, the most important natural hazard in Europe in terms of economic losses. In the period 1998–2009, the European Environment Agency (EEA) region alone experienced 213 flood events, with over 1,120 fatalities and €52 billion in losses. The increase in economic losses due to flooding is, among other issues, the result of increased population and wealth in the affected areas.

31. The increase in climate variability and vulnerability is often accompanied by an increase in socio-economic vulnerability to extreme events, indicated, for example, by a decrease in wealth, educational level or health. There are many reasons for this, including lack of sound local and regional land use plans, which may lead to construction in flood-prone areas; poor hazard and risk management policies; and inadequate infrastructure, especially in the eastern part of the region. In addition, specific population groups, such as rural, remote and socio-economically weaker populations, are characterized by a high vulnerability because they cannot easily adapt due to lack of resources. Vulnerability in Eastern Europe, the Caucasus and Central Asia over the next 10 to 20 years is expected to be dominated by socio-economic factors and legacy issues — notably the environmental situation and the poor state of infrastructure — rather than by the changing climate itself.

32. Due to the increase in extreme events and climatic variability, in many regions the cost of achieving current water policy goals, in particular those under the WFD, is expected to grow. Therefore, additional resources are necessary. At the same time, climate change and the need for adaptation is also an opportunity for innovation and new technologies. Economic instruments and strategic financial planning can drive the search for low-cost options (e.g., water efficiency, multi-purpose infrastructures, ecosystem services) and generate additional revenues for water policies, services and infrastructures.

33. The crucial role of effective water management in adaptation, including in a transboundary context, is increasingly being recognized, as well as its role in mitigation. Development of resilience, vulnerability assessments and adaptation strategies is slowly

starting, at least in parts of the region. For example, adaptation strategies have been developed or are in the process of elaboration in Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Latvia, Norway, Portugal, Romania, Spain, the United Kingdom of Great Britain and Northern Ireland and the United States of America.

2. The way forward: tackling challenges and building on achievements

34. Climate change adaptation, but also effective water management in itself, requires reliable hydrological and meteorological data which are often missing. It is important to strengthen the knowledge base and the availability of climate-related information for decision-making, including through the integration of hydrological and meteorological networks. Building reliable hydrological models to predict the magnitude and impacts of hydrological change can help to increase confidence regarding future climate change impacts.

35. In order to increase preparedness for more frequent extreme events, prevention and response capacity to climate variability and to long-term impacts of climate change needs to be improved, with a focus on preventing damages due to extreme events. As a first step, risk maps and vulnerability assessments should be developed, since they help to identify priorities for action. Based on the vulnerability assessments, flood and drought management plans should be elaborated. This is also the approach promoted by the EU Flood Risk Management Directive, which requires the development of preliminary flood risk assessments, followed by flood hazard and risk mapping and flood risk management planning. Regarding droughts, for example, in Spain, a hydrological indicators system has been established coupled with specific drought management plans in each river basin. Disaster risk assessment and preparedness should be mainstreamed in water management and in other sectoral policies. Regarding flood management, support at the international level is provided by the HelpDesk, hosted by the World Meteorological Organization, which aims to provide guidance on flood management policy, strategy, law and institutional development, in response to requests.

36. Uncoordinated sectoral responses can be ineffective or even counterproductive, because a response in one sector can increase the vulnerability of another. Inter alia, agricultural adaptation measures such as increasing irrigation may aggravate climate change impacts on other sectors. Intersectoral cooperation and coordination between institutions is therefore crucial for effective adaptation ensuring coherence and synergies between different adaptation measures. Different plans for coping with extreme events should be integrated, e.g., flood and drought management plans; plans to combat desertification in the framework of land use planning, etc.

37. Local, national and transboundary basin-wide adaptation strategies should be developed in cooperation with other sectors, also considering the importance of land use planning. Several recently developed guidance documents such as the UNECE Water Convention's *Guidance on Water and Adaptation to Climate Change* and *River Basin Management in a Changing Climate — A Guidance Document*, issued by the Water Directors of EU member States, explain how to develop an adaptation strategy. Transboundary cooperation is necessary when designing and implementing adaptation and mitigation strategies to reduce risks of negative impacts caused by uncoordinated/conflicting unilateral measures in neighbouring countries. The programme of pilot projects under the Water Convention aims to support dialogue and cooperation on the development of adaptation strategies in transboundary basins, and is implemented in the framework of the Environment and Security Initiative (ENVSEC).

38. Climate change impacts on water resources are often uncertain, but this should not be a reason not to act. As a priority, win-win, low- and no-regret measures, as well as

flexible investments such as measures aimed at increasing ecosystem resilience (e.g., restoration of flood-plains), which help to reduce requirements for costly climate-proof water infrastructure, should be used. Increasing the efficiency of water use is one win-win option which is beneficial even if no climate change impacts occur. Groundwaters should be adequately preserved. These can act as “natural reservoirs” to be tapped during droughts as a drinking water source.

Box 8**Integrated flood control implemented in transboundary basin**

The project “Making space for water in the Bodrog River Basin”, developed by GWP in Slovakia, Hungary and Ukraine, aimed to mitigate consequences of floods through holistic management of flood risk. The activities considered the maintenance and/or restoration of flood-plains by creating space for water, as well as simultaneous measures to prevent and reduce damage to human health, the environment, cultural heritage and economic activities. The involvement of municipalities, river basin organizations, NGOs, farmers and spatial and urban planning authorities was crucial. Flood-plain restoration also contributed to improved habitat conditions. Early involvement of local stakeholders was critical to ensure consensus, for instance, in the design of sluices. Public involvement also brought additional positive side effects such as the elimination of illegal disposal sites and illegal untreated wastewater releases. Still, it was not easy to get farmers to give up agriculture benefits in favour of flood-plain restoration, even though seasonal or unexpected floods could reduce their profits. Also, urban planners often lacked knowledge on flood risk when making decisions on future urban settlements.

39. Knowledge and experience regarding possible climate change impacts and adequate adaptation measures still need to be improved through training, learning-by-doing, sharing of good practices examples and demonstration projects, such as projects for improved water efficiency in agriculture, safe reuse of wastewater, storm flood management and natural riverbed flood-lands.

40. Extreme events such as floods and droughts may have significant effects on water supply and sanitation systems, entailing risks for human health, through storm water overflow, increased concentration of pollutants in periods of water scarcity, etc. It is therefore necessary to increase resilience to extreme events in water supply/drainage/sanitation systems/facilities and to include the risks of extreme weather events in the water safety plans of municipal and industrial facilities. The *Guidance on Water Supply and Sanitation in Extreme Events* developed under the Protocol on Water and Health, or the guidance, *Vision 2030: The Resilience of Water Supply and Sanitation in the Face of Climate Change*, developed by the United Kingdom Department for International Development and WHO, provide advice in this regard.

41. Selecting adaptation measures is not easy due to their costs, the uncertainty of climate change predictions, their possible social and cultural consequences, etc. Some water supply measures, e.g., desalination, are highly energy-intensive and may even contribute to climate change. Therefore, trade-offs between adaptation and mitigation measures need to be avoided, and synergies should be enhanced. For instance, increasing water use efficiency and reducing water heating can at the same time help to save energy and water.

D. What are the experiences and lessons learned from the cooperation in transboundary basins to improve water quality, manage water quantity and protect ecosystems?

1. The issue and recent trends

42. Over the past 20 years, a comprehensive international legal framework for the management of water and water-related ecosystems has been developed in the pan-European region which includes EU legislation — in particular the WFD — UNECE Conventions and Protocols — in particular the Water Convention and its Protocol on Water and Health — and other international instruments at the global level (the Ramsar Convention, the United Nations Convention to Combat Desertification, the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity, as well as regional conventions and international river basin agreements). These framework agreements have laid the ground for bilateral and multilateral agreements on shared waters.

Box 9

Linking environment and security in the Ferghana Valley

Since 2003, ENVSEC and its partner organizations have catalysed tools for improved transboundary cooperation, and helped to establish transboundary institutions, for example in the Ferghana Valley. In 2005, Kyrgyzstan, Tajikistan and Uzbekistan requested ENVSEC to facilitate an environmental risk assessment in the valley, involving information-sharing, a joint field assessment and a regional stakeholder consultation workshop. Three main environmental issues threatening the health and livelihoods of the population were identified: access to and quality of water resources; access to and degradation of land; and pollution from industry. Based on the information collected, a mapping exercise was also undertaken, whereby hot spots were identified, mapped and prioritized. Several radioactive tailing dams were identified as hot spots of particular concern.

The assessment was a breakthrough, linking together environmental authorities and stakeholders who previously did not cooperate. Although unresolved questions relating to border demarcation and water resources remained, it allowed the parties to agree on a workplan to combat the most critical issues.

43. Progress in transboundary water cooperation is varied in the region. Several transboundary agreements have been concluded recently, such as on the Prut and Danube Rivers between Romania and the Republic of Moldova; on Prespa Lake in South-Eastern Europe; or on the Chu Talas basins in Central Asia. The process in the Drin River Basin is also a positive development for the strengthening of transboundary cooperation in South-Eastern Europe. River basin commissions have been established for many rivers, in particular in the west of the region (for the Danube, Rhine, Elbe, Oder, Scheldt, Meuse and Sava Rivers). In addition, several agreements in Western Europe have been revised, such as the Albufeira Convention between Spain and Portugal. However, many transboundary basins, especially in South-Eastern Europe, Eastern Europe, the Caucasus and Central Asia, still lack a comprehensive legal basis for cooperation. Agreements are still missing in many basins or are outdated and not implemented. Joint bodies responsible for transboundary cooperation are weak, with a limited mandate and little enforcement capacity. Progress often depends on the political relationship between riparian countries and on political willingness.

Box 10

Revision of a transboundary agreement on shared waters: the Albufeira Convention

Spain and Portugal share several basins, including the Miño-Minho, Limia-Lima, Douro-Douro, Tajo-Tejo, and Guadiana River. Bilateral relations concerning water management started with a treaty establishing borders and common uses, the 1864 “Treaty of Limits”. In 1998, the “Agreement on the Cooperation for Protection and Sustainable Use of the Luso-Spanish River Basin Waters” was signed at the Albufeira Summit. The Albufeira Convention defines the cooperation framework for the protection of surface waters and groundwaters of the transboundary rivers and their aquatic and terrestrial ecosystems, and for the sustainable use of water resources of the river basins. It is in full compliance with the EU water policy requirements, and pays special attention to water quality, environmental protection and public health. This agreement was improved in 2008, with the signing of the “Revision Protocol”, in which a criterion for the assessment of the flow regime was included, improving their time allocation, contemplating not only an annual regime, but also a seasonal regime.

2. The way forward: tackling challenges and building on achievements

44. A sound legal framework is essential for stable and reliable cooperation. In many river basins it is necessary to establish, revise or strengthen the legal and institutional frameworks for river basin management and transboundary water cooperation, in particular in Eastern Europe, the Caucasus and Central Asia and in South-Eastern Europe. Transboundary agreements need to be concrete and include institutional arrangements for cooperation, measures for management and protection of water resources and related ecosystems, as well as enforcement. In several basins, new or revised agreements have been negotiated at length and should be ratified without delay. Transboundary groundwaters should be included in the cooperation.

Box 11

Progress on transboundary water management in the Dniester basin

The Dniester River influences the environment, economy and politics of the two riparian countries, Ukraine and the Republic of Moldova. The combination of conflicting water needs, pollution, economic loss and heavy floods puts livelihoods and environment at risk. The need for regional cooperation is evident, but challenging due to deficiencies in the legal and institutional framework.

As a first step, local experts have prepared an assessment that highlighted the need for cooperation between the countries. Two subsequent ENVSEC projects have leveraged financial support and regional engagement throughout the basin, involving numerous national partners and NGOs. Health authorities in the region are working together on joint drinking water quality monitoring. An additional ENVSEC project aims to assess and reduce security risks from climate change, in particular flooding, by improving the adaptive capacity in both countries.

The projects have fostered cross-border dialogue and built national capacity to manage the basin jointly, as well as demonstrated that international organizations can be effective catalysts for regional cooperation and stability. A series of small investments have generated concrete results and sustainable national ownership. A revised agreement which foresees the creation of a river basin commission has been negotiated, but not yet signed.

45. Population growth, rapid urbanization and industrialization, the expansion of navigation, agriculture and tourism, as well as climate change all put pressure on transboundary water resources, including transboundary groundwaters. It is therefore necessary to link transboundary water cooperation to related policies (agriculture, forestry, energy, navigation, tourism, health surveillance, etc.). The new macroregional strategies at EU level (e.g., the EU Strategy for the Danube Region) can play an important role in this. There are successful examples of intersectoral partnerships and multidisciplinary approaches to cooperation in transboundary basins, such as the efforts to link environmental protection and navigation policies for the Rhine and Sava Rivers.

46. Ecosystems often cross political boundaries, and activities in one country or jurisdiction can significantly affect neighbours. Ecosystem processes are disrupted by habitat fragmentation, pollution, reduced river flows and other hydromorphological pressures, threatening biodiversity and sustainable land management. The harmonization of policies across borders and collaboration in the management of shared ecosystems can reduce the threats and bring about multiple benefits. It is therefore necessary to strengthen transboundary cooperation on ecosystems (e.g., wetlands, forests) and water quality, as well as land use, especially in the eastern part of the region.

47. It is recommended to use a broad set of instruments for transboundary water cooperation, including economic instruments based on the ratified international instruments and regional conventions. This includes joint monitoring and assessment, harmonization of methodologies, exchange of information, joint early warning systems, public participation, education and awareness-raising, etc. Payments for benefits (or compensation for costs) can be made in the context of cooperative arrangements. Within a basin, wealthier countries might support investments in poorer ones. Downstream countries could be compensated for creating and operating additional storage capacity by upstream countries or, vice versa, downstream countries could contribute to the costs and operation of upstream infrastructures.

48. Many major river and lake basins are shared by UNECE and non-UNECE countries, e.g., the Amu Darya, shared by Uzbekistan, Kyrgyzstan, Tajikistan and Turkmenistan in the UNECE region with Afghanistan outside of it. Strengthening cooperation with non-UNECE countries sharing waters with UNECE countries (Afghanistan, Iran, China, Mongolia, etc.) would help to improve the management of these basins, reduce uncertainty and improve sustainability. If all riparian countries were Parties to the Water Convention, this would facilitate transboundary cooperation, since the Convention would provide a common framework for cooperation. It is therefore recommended to accelerate the entry into force of the amendments opening the Water Convention and other UNECE Conventions to countries outside the UNECE region.

49. Despite progress, transboundary water management remains difficult, also due to new challenges such as climate change impacts. It is therefore important to promote sharing experience on issues like the implementation of the Water Convention and its Protocol, also beyond the region, the EU WFD, climate change adaptation and public participation in development and realization/implementation of river basin plans, and in monitoring of river basin water quality. The Water Convention, the International Network for Basin Organizations (INBO) or the WFD Common Implementation Strategy provide frameworks for such an exchange of experience.

II. Sustainable management of water and greening the economy

50. Sustainable management of water resources can contribute to greening the economy: it can promote water efficiency and channel water resources where they create most value. It can also contribute to climate change mitigation and adaptation; wastewater can be a source of energy (through heat and sludge). Sustainable water management can also trigger innovations and investments which will benefit both the economy and the environment.

51. The reverse is also true: unsustainable water management can hinder economic development and fuel poverty. It can create shortages, which are detrimental for economic growth, in particular in sectors which depend on secure supply of water of adequate quality (agriculture, selected industries and services such as tourism). It can also have adverse health impacts.

52. This section focuses on (a) trends towards greener water uses (water efficiency, the use of alternative water sources, and ecosystem services) and the policies that can promote them, and (b) the contribution of water investments to a green economy.

A. What policy mixes and practical tools, such as integrated water resources management, pricing, standards and water users associations, can be most effective to improve water efficiency by different water users, especially in agriculture, households and industrial operations?

1. The issue and recent trends

53. Progress towards efficient water uses has been uneven across sectors and subregions.

- Some progress has been achieved in the agriculture sector: alternative technologies (e.g., drip irrigation), crops and farming practices resulted in reduced water losses, more crop per drop and reduced run-offs. Economic instruments (e.g., pricing water, pollution charges) have fuelled this dynamic, together with education and transition support. Environmentally harmful subsidies are a major barrier to further improvements.
- Water consumption per household has decreased in a number of European cities. Outside the EU, various factors impede progress, including inadequate regulatory and incentive frameworks (low tariffs and collection rates), low awareness across a range of stakeholders and lack of financial resources to extend, renew or repair infrastructures. Decaying and oversized infrastructures generate water losses, excessive operation and maintenance costs and breaches of service.
- A number of industries are committed to use water more efficiently and to reduce effluents; point sources of pollution are under control, at least in EU member States. Regulation, tariffs and voluntary agreements help. Multinational enterprises can spread best available techniques and responsible behaviour.

54. UNECE countries have been generally slow to recognize the value of alternative water sources. Desalination is gaining attraction in some developed coastal zones, but less energy-intensive sources, such as rainwater, reused or reclaimed water, are not systematically considered due to inadequate regulatory frameworks and some reluctance from consumers.

55. Ecosystem services are not properly valued, although they contribute to water management and water treatment. There is a trend to turn to technology-driven options to

manage water, which can be detrimental, especially in countries lacking financial, technical and human resources.

56. In addition to sector-specific approaches, IWRM provides a general framework to match supply and demand and to allocate water where it creates more value. IWRM is gaining increasing recognition across the region, in particular through the WFD, which promotes the implementation of its core principles in EU members and neighbouring countries. The Water Convention provides another vehicle to promote IWRM.

57. Implementation of IWRM principles is advancing in EU member States, as river basin organizations and management plans are gradually put in place. However, several EU countries did not meet the 2009 deadline for the development of river basin management plans. In other parts of Europe, implementation of IWRM principles is often impeded by lack of information and capacity and by political considerations (typically, Governments hesitate to make farmers pay the true cost of the water they use).

58. The development of water management plans creates a forum where the different uses of water can be considered in a common framework. Stakeholder consultation is required by the WFD and is acknowledged in the legislation of several non-European countries. For example, the 2006 Water Code of the Russian Federation states that “citizens and social groups have the right to participate in making decisions [that] may have an impact on the use and protection of water bodies”. In the Netherlands, local water management follows the “interest-pay-say” model: those who have an interest in water management should pay for it and have a say on how it is conducted. WUAs can strengthen the role of stakeholders (e.g., small farmers) in key decisions affecting water management; their development can contribute to ownership of policies. However, in many countries, both inter-agency collaboration and public participation require further development.

2. The way forward: tackling challenges and building on achievements

59. Progress in the region can build on success stories, which need to be scaled up, and on supportive institutional tools and frameworks. Environmental impact assessment and strategic environmental assessment should be used to evaluate development plans, investments and land use changes, taking into account climate change, human health and sustainability. Innovative concepts, such as the water footprint, could be more widely used by Governments and water users, once conceptual and methodological ambiguities are clarified.

60. Multilateral environmental agreements (MEAs), such as the Water Convention and related tools, to which most countries in the region adhere, provide mechanisms and incentives to move forward. They are supported by a comprehensive set of guidance materials, handbooks and guidelines aimed at facilitating implementation. Governments in the region can build on such tools to develop water policy frameworks.

61. One priority action is to align incentives across water-related domains, e.g., health, agriculture, energy, recreation and tourism and urban planning, making sure that water policies are not undermined by initiatives in other sectors. By so doing, Governments in the region would build coalitions for water policy reforms. A variety of mechanisms exist which can, for instance, engage farmers in making their practices more water friendly, by deploying less water-consuming irrigation techniques, shifting away from water-intensive crops in arid regions, using less polluting fertilizers in catchment areas, or using reclaimed water where appropriate. The removal of water-harmful subsidies is important in this regard.

62. Another priority is to lower the costs and to generate stable revenues for water management and water-related services. Governments should consider water demand management to reduce the scale and costs of infrastructure development; the education of

citizens and consumers towards water and sustainability can help. Governments could also more systematically use economic instruments (e.g., abstraction charges, pollution charges, water prices, PES) to promote low cost options (e.g., relying on watershed services), provide incentives for water efficiency, allocate water where it is most needed and generate revenues to finance water services.

Box 12

Examples of PES in Central Europe

The World Wildlife Fund (WWF) Danube-Carpathian Programme, as part of a major United Nations Environment Programme/GEF-funded project focusing on ecosystem services in the Lower Danube, is developing a model scheme to encourage river basin administrators to maintain and eventually introduce water management practices, supporting biodiversity and preserving the natural landscape. The model scheme will ensure that land managers are paid as providers of these invaluable services.

Funding opportunities to pay for ecosystem services schemes are seen in tourism activities, green labels for fish production, as well as in the EU Fisheries Operational Programme and in the cost recovery principle of the WFD (for more information, visit http://www.icpdr.org/icpdr-pages/dw1003_p_14.htm).

63. Valuing the benefits that water can provide helps generate new revenues to finance water management and infrastructure. Governments should start by assessing the benefits and identifying the beneficiaries (see table below), and then design financial mechanisms to harness beneficiaries.

Examples of potential benefits and beneficiaries of effective water resources management

<i>Potential benefits</i>	<i>Potential beneficiaries (direct or indirect)</i>
Avoided costs of supplying water from more expensive sources	Water utilities; households; industrial facilities; farmers
Avoided human and economic losses from floods	Households; farmers; industrial facilities; infrastructures; cities
Avoided catastrophic losses from drought	Farmers
Reduced costs of generating electricity thanks to hydropower	Power companies; electricity consumers
Savings in transportation costs from expansion of water-based transport	Water transport companies; producers and consumers of transported goods
Increased opportunities for recreation and revenue from recreation-based tourism	Households; tourism industry
Avoided costs of water treatment thanks to protected water quality	Water utilities; households; industries
Avoided habitat degradation and biodiversity loss	General population
Reduced incidence of water-borne diseases	Households; health system
Increased value of property thanks to improvements in water and riparian ecosystems	Households; landowners

64. Governments and river basin organizations would benefit from developing financially realistic water management plans that take all costs into account (investment, operation and maintenance) and match them with financing means. Experience with low-cost options (typically, based on ecosystems) will be critical across the region. Demonstration projects would be timely and appropriate.

Box 13

Financially realistic planning for achieving the MDGs in the Republic of Moldova

An EU Water Initiative Policy Dialogue on the financing of urban and rural water supply and sanitation in the Republic of Moldova took place in 2006 and 2007 with support from the Organization for Economic Cooperation and Development (OECD), in its capacity of Secretariat of the Task Force for the Implementation of the Environmental Action Programme for Eastern Europe, Caucasus and Central Asia countries.

The initiative assessed annual cash flow needs for different water supply and sanitation (WSS) infrastructure development targets and the available financial resources from user charges, public budgets and official development assistance (ODA) under certain assumptions. It showed that even if user charges reached 5 per cent of household income (with adequate social protection measures), they would only generate about 50 per cent of cash flow needed to maintain and rehabilitate existing infrastructure. Hence, significant public budget and ODA resources are needed to close the financing gap.

Achieving the water-related MDGs by extending services to poor populations in rural areas would further reduce the share of funding that can reasonably be expected from tariffs. Achieving the MDGs would require even larger infusions of public budget and ODA, or decisions to lower service levels in some areas that have coverage (typically in urban areas) so as to free up resources for expansion.

65. Economic instruments are best used in conjunction with other instruments, such as water rights (which may or may not be traded; see different instances in the United States), licences, standards (for water quality or efficiency), and cooperative agreements (e.g., between farmers and utilities in catchment areas). Governments can draw upon substantial international experience in the development of such policy packages.

66. Attention should be given to implementation and compliance enforcement, as progress in the reform of water laws and instruments is hampered by implementation gaps and lax enforcement.

67. An important priority should be to maintain and renew infrastructure that results in water losses from irrigation and urban water supply. When oversized or too costly to operate (as is often the case in countries of the former Soviet Union), replacement may be a cost-effective option.

68. Governments should explore more systematically the availability of alternative water sources (e.g., reused water) for specific uses. Appropriate regulations and incentives are required to mitigate health-related risks (typically, drawing on the WHO Guidelines for the safe use of wastewater and excreta in agriculture and aquaculture), address social concerns and factor in the value of water.

69. The private sector can contribute to increasing the efficiency of water-related services. However, it will generally not directly finance water resource management: any investment made or service provided will have to be repaid. Governments wishing to mobilize private sector capabilities should ensure stable revenue streams from water tariffs, and create an appropriate regulatory framework to avoid rent-seeking behaviours. They can

draw upon international experience, tools and guidelines to set up appropriate regulatory and institutional frameworks (see, for instance, the OECD Guidelines for Performance-based Contracts in WSS, or the OECD Principles for Private Sector Participation in Infrastructures).

70. Governments and river basin authorities should also draw on international cooperation to build and strengthen capacity. IWRM and related policies require complex skills at national and sub-sovereign levels, which are rare, in particular in Eastern Europe, the Caucasus and Central Asia. Appropriate staffing, strengthened institutional memory in cases of political turnover, and capacity development are required.

Box 14

Local capacity-building in Slovakia

Devolution of responsibilities in the Slovakia brought new tasks for local municipalities, including in the water sector, without corresponding human resources. The Slovak Association of Villages and Towns (ZMOS) took the lead and, in 2008, released the Guidance Document “Strategy on IWRM in Municipalities and their River Basins”.

In addition, ZMOS proposed the creation of its own IWRM Competence Centre, to advance the water agenda on the local level and to advise municipalities on water management issues. A guidance document on how to elaborate IWRM plans will be drafted in the 2011–2014 period and disseminated nationwide.

ZMOS is now acknowledged as one of the key players in the field of water resources management by the Cabinet of Slovakia.

71. The same applies to agencies and utilities that manage water-related services in several subregions. Water academies, schools, and vocational training can all play a part, if tailored to existing needs in the countries. Tools developed under the UNECE Strategy for Education for Sustainable Development are relevant in this perspective.

72. Water policy reforms take time and require a long-lasting coordination of a variety of actors and stakeholders. In Eastern Europe, the Caucasus and Central Asia, in the context of the EU Water Initiative, National Policy Dialogues have provided a cost-efficient and effective mechanism to support and substantiate such coordination, with the support of the European Commission and several UNECE member States. Given the high demand and valuable outcomes, they should be developed further and set on a firm and lasting basis. WUAs could play a more prominent role in the process.

B. How can we encourage investments to take into account the impacts on water quantity and water quality, energy and resource efficiency and vulnerable populations?

1. The issue and recent trends

73. Investments are required in the water sector, in particular to extend access to water-related services (especially to vulnerable populations and such public institutions as schools and hospitals in remote areas) and to upgrade existing infrastructure and adapt it to climate change. In a number of cases, investment needs have been reduced by appropriate demand management, more efficient use of water and the search for low-cost options.

74. In addition, it is expected that in 20 years water demand will exceed supply by 40 per cent. Investment in infrastructure and the development of new technologies is required to cover part of this gap.

75. Water-related investments can contribute to a green economy. In Eastern Europe, the Caucasus and Central Asia, greater access to safe water supply can protect the health of populations. Access to improved sanitation also protects health and ecosystems, thus preventing an undue burden being placed on populations and freeing resources for economic development. Inefficient water supply and sanitation systems consume more energy (e.g., to pump, distribute and treat the water).

76. Moreover, watershed services support economic development, as in the case of storing water, protecting assets against floods, or treating water-borne pollution. Positive externalities related to watershed services are often not properly considered in the business models or plans of related economic activities. A number of investments which impact on water quality and availability (urban development, road construction, hydropower equipment) should better reflect this dimension, thus contributing to greening the economy.

77. It is noteworthy that national development banks (e.g., the Russian Development Bank), as well as national eco-funds and regional development funds (e.g., in the Republic of Moldova) help mobilize financial resources for infrastructure, including WSS infrastructure. International finance is very active as well, through the private sector (in the EU) and the international financial institutions (in the Eastern part of the region).

2. The way forward: tackling challenges and building on achievements

78. Investments in several other sectors, such as agriculture, energy, transport and urban planning, have impacts on water. The environmental impact of such investments and of land use changes should be systematically assessed (e.g., the water footprint of product, business, or industry) to make sure they will not deter the availability and quality of water and related services.

79. From within the water sector, water-demand management is the primary option to decouple water use from economic growth. This can essentially be done through economic instruments (e.g., pricing water) and reducing unaccounted for water (essentially leakages). The same instruments contribute to allocating water where it creates most value. Consumers can play a stronger role in reducing water use, and Governments can help, through labels (e.g., WaterSense in the United States), standards, and appropriate signals.

80. Investment in watershed services (wetlands, forests, etc.) should be considered more systematically, as they directly contribute to a green economy and can save costs (and concerns) related to natural infrastructures. Assessing the value of watershed services strengthens the case of such investments. This can give an economic value to upper basin management, wetlands and forest restoration, as they contribute to water storage and flood management. Such a move can involve a transfer of costs from downstream to upstream areas (e.g., Chu Talas Commission and agreement between Kyrgyzstan and Kazakhstan).

Box 15

Benefits of river rehabilitation in Israel

Within the framework of the 2005 National Plan for River Rehabilitation, uniform indicators were developed to present the benefits derived from the rehabilitation of 14 rivers in Israel, with total benefits calculated to be \$1.3 billion. The benefits varied greatly by river. As a result, rehabilitation plans have been initiated and implemented by the National River Administration, the Yarkon and Kishon Authorities, in cooperation with drainage authorities.

81. Investment in water-related infrastructures should be based on the most efficient technologies to limit environmental damages, energy-related costs and health impacts (following WHO recommendations). Incentives can be provided through public budgets for the use of best available techniques, distributed systems, or low-cost options. Technology transfer can be stimulated by appropriate regulatory frameworks (in particular protection of intellectual property) and incentives.

Box 16

Reflecting the value of water in energy prices: feed-in tariffs in Germany

In Germany the Renewable Energy Sources Act grants operators of renewable energy systems priority for feeding their electricity into the grid, at a fixed reimbursement rate, over a given period of time. It also provides incentives for operators of hydropower plants to improve the ecological status of water bodies. For example, new run-of-river power plants will only benefit from feed-in tariffs if they are constructed where a barrage or weir already exist and without cross-construction.

82. National and local authorities should factor water efficiency into public procurement. Water impact assessments could be required for investments in, e.g., hydropower plants or navigation; a focus could be on potential impacts on the hydromorphology of streams (minimum flows, river continuity barriers, etc.), aquatic ecosystems, fish and biodiversity.

83. Allocation mechanisms at the national and regional levels could be reviewed to reflect the economic, social and environmental dimensions of water uses. Similarly, institutions and governance mechanisms need to be adjusted to address coordination, supervision and control of these new business models and mechanisms.

84. In implementing the foregoing, attention should be paid to affordability constraints, so that low-income groups still have access to basic water needs (for drinking, food and hygiene). Targeted instruments are usually more effective than general subsidies or low tariffs. Several countries (Armenia, the Russian Federation, Ukraine) have phased out subsidies that did not discriminate between rich and poor households. They have introduced cross-subsidization through tariffs instead, with effective systems of subsidies targeted to the poor and vulnerable populations groups.