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## Time to Adapt – Climate Change and the European Water Dimension

### Discussion Paper: Water Supply and Sanitation Services

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#### Introduction

Water management includes a broad range of activities. Here, a differentiation is made between “**water resources management**”, which denotes overarching management at river basin or coastal zone level, and “**water supply and sanitation services**” (WSS), which relates to the activities of the water industry. Although both aspects are closely linked, they will be affected in different ways by climate change, and are therefore dealt with in two separate discussion papers. This paper addresses water supply and sanitation, i.e. the supply of drinking water and the collection and treatment of wastewater, with a focus on services for urban and rural uses (domestic, commercial, industrial connected to collective networks). The papers on water resources management and on other sectors are available at <http://climate-water-adaptation-berlin2007.org/>.

#### Impacts of climate-driven changes in water resources

Water supply and sanitation services will be directly affected by climate change. Changes in rainfall patterns, their seasonality and their spatial distribution will influence the quantity and the quality of water resources, and will impact both on surface waters and groundwater.

The projected increase in intensity and frequency of extreme precipitation events is likely to put sewerage networks under additional pressure. The current hydraulic capacity of parts of the networks will more often be exceeded. More frequent localised flooding and sewer overflows would be the result, which might in turn negatively affect water quality in rivers.

In some parts of Europe, for instance in the Mediterranean region, water supply is likely to be affected. The projected reductions in precipitation and runoff and increase in droughts may lead to a decrease in both the quantity and quality of water available for supply. Furthermore, droughts often entail a deterioration in water quality, for instance as less water is available for the dilution of wastewater effluents. Water supply services will be faced by the challenge to satisfy consumer demand during periods of intensified water shortages. Such limitations in the availability of clean and fresh water could result in conflicts among different users. In a worst-case scenario, the supply of drinking water to the population may be threatened.

In coastal areas, the situation could be further aggravated by rising sea or dropping groundwater levels, which could cause saltwater intrusions into freshwater bodies or coastal aquifers.

Drought periods may entail particular challenges for small decentralised water supply and sanitation networks. Safeguarding water supply in rural areas or small scattered settlements is difficult in some Member States already under current climatic conditions, in particular because these small-scale schemes often lack sufficient financial power and technical expertise. As a consequence of climate-driven changes in water resources, problems for these small-scale structures may be exacerbated.

Furthermore, climate change may lead to apparently contradictory consequences. High intensity rainfall, particularly after a long dry period in which the permeability of soil is decreased, leads to rapid run-off and poor recharge. Thus, there may be a need to manage water shortage and flood at the same time.

## Sector overview

The European water sector supplies water to more than 500 million people. Large quantities of water are abstracted for domestic water supply, agriculture, industry and other uses. Furthermore, the water industry provides sanitation services. Connection to urban wastewater treatment systems has been increasing over time, and has reached more than 90% in some countries.

The need for water supply and treatment capacities in a given region are greatly influenced by land-use planning and demographic developments, as well as production patterns. Generally, water supply and sanitation systems are infrastructure- and capital-intensive.

Institutional set-ups of the water supply and sanitation sector vary greatly within Europe. However, public and private service management systems are faced with the same challenges as regards climate change impacts: protecting the available resources, ensuring their efficient use, and maintaining the current level of services to consumers, whilst protecting public health and the environment and limiting the financial and economic impacts on both the sector and the consumers.

## Adaptation options

Planning water management and design of water supply and sanitation systems used to be based on the assumption that future climatic conditions would be the same as past conditions. Climate change challenges this approach and makes it necessary to take future changes in climate and water conditions into account in today's planning, in order to make the sector resilient to changes. Uncertainties in climate projections and scenarios make this a difficult task. For instance, it might be more difficult to plan for and justify (expensive) new projects when the magnitude, timing, and even the direction of the changes are uncertain.

The strategies developed should be driven by a long-term approach, as climate change will be developing over the decades and centuries to come. Compared to policy cycles with a 10 to 15 years duration, such long-term strategies require more adaptive approaches allowing for "corrections" over time.

Developing an adaptation strategy also requires to set priorities (e.g. first "human basic needs" followed by "aquatic environments survival needs" to the "human being needs"

and "aquatic environments best conditions for life") in order to develop cost-effective measures for implementing the strategy. Such a prioritisation may have wider implications for the economic development of the affected sectors. It therefore needs to be based on transparent criteria and decision-making processes in order to be accepted by those affected. Prioritisation should also reflect the quality of the water available, e.g. clean groundwater should be used for drinking water supply, while water with lower quality could be used for irrigation and cooling purposes.

A particular challenge will be the elaboration of adaptation strategies for small-scale networks (e.g. small scattered settlements, individual farms, etc.) in order to ensure the maintenance of services and to avoid population drain from rural areas affected by drought and water scarcity. Adaptation efforts should be developed which are tailored to the specific needs of these systems.

In order to address the challenges from climate change impacts, adaptation strategies should

- Be based on sound science;
- Seek to influence the abstraction, supply and demand in the long run;
- Be linked to an overarching water protection strategy in order to ensure the availability of sufficient water resources not only today but also in the future;
- Reflect the risk from floods and droughts to water supply and sanitation infrastructure;
- Consider the costs of adaptation and their share among all parties involved.

Different adaptation measures are available:

### *Technically-orientated measures*

Technically-orientated measures are used to ensure a safe drinking water supply of high quality and the disposal of wastewater according to the best available techniques.<sup>1</sup> They are related to the entire infrastructure system, including the modification or extension of infrastructure to collect and distribute water to consumers and to dispose of wastewater. As water quantity strongly influences both the dimensioning of the infrastructure system and the treatment process itself, an appropriate demand management is needed to optimise water supply and wastewater disposal

<sup>1</sup> See IPCC (2001) for recommendations for water resources managers on possible technical adaptation measures.

services. Measures such as rainwater collection and water re-use and recycling, but also improving the efficiency of water use, might play an important role.

However, before major investments in infrastructure are undertaken, all available options for adapting the operation of existing structures to changed targets and boundary conditions should be exploited.

### **Economic measures**

Economic instruments for water demand management can be used to encourage changes in consumer behaviour and the efficient allocation and use of water, and to provide financial resources to cover the costs of providing water, including costs of adaptation (e.g. infrastructure costs).

When setting up economic instruments, the influence of other policies (e.g. specific subsidies) has to be considered. Many of these policies provide incentives to users, thus influencing decisions regarding the use of water, and might counteract the effects of economic instruments.

### **Information measures**

Technical practices and economic instruments alone will not be sufficient in all cases to deal with the projected effects of climate change on water regimes. Stakeholder involvement, public participation and transparency are therefore required to build support for sharing the burden and benefits of the impacts of climate change. Information measures and participative processes are necessary to ensure, on the one hand, a continuous information flow between the various stakeholders in the water and water-related sectors, and, on the other hand, to raise awareness among the general public. Public information and transparent decision-making is essential to generate acceptance for adaptation measures.

### **Regulatory measures**

Regulatory measures focus on the legal and institutional framework organising the water sector and can be used to foster technical, economic or information measures. Further, they can be used to govern the development of other sectors relating to the water supply and sanitation sector.

## **Limits to adaptation for WSS-sector**

As discussed before, there are several mechanisms in the water supply and sanitation sector to adapt to climate change. However, limitations also exist.

Increased demand for water from competing sectors, for instance an expansion of irrigation in agriculture, may limit the adaptive capacity of the water supply and sanitation sector.

Limitations in adaptation capacity might also occur due to financial constraints. Adaptation to climate change might become expensive in some regions, and service providers may not be able to fully cover the costs. Financial constraints are a particular problem in regions or countries where the condition of infrastructure networks is in a bad state and hardly sufficient to cope with current pressure levels. Costs for adaptation may also rise if water is scarce or of low quality, and additional treatment is needed. If high costs and large efforts are needed in order to implement adaptation, this might create concerns regarding the affordability of services and acceptability among consumers, and may thus add a further constraint to adaptation.

A lack in flexibility of policies or regulations might also constrain adaptation efforts. For instance, changing abstraction licences or water rights may be difficult and require extended and time-consuming policy processes, depending on the legal system that is in place in a given country.

Finally, uncertainties in modelling of climate change, hydrology, and demand forecast may also hamper adaptation.

## **Adaptation under the existing EU policy framework**

Adaptation needs to be built into the existing EU policy framework. The current policies provide instruments that may be used for adaptation. In some cases, changes and adjustments of policies and instruments may be necessary.

### **Water Framework Directive**

Europe's water management is currently undergoing significant changes as a result of the implementation of the **EU Water Framework Directive** (WFD).<sup>2</sup> The Directive

<sup>2</sup> Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the

requires integrated river basin management planning, which could also be used as a backbone for an adaptation strategy of the water supply and sanitation sector. This integrated approach requires public involvement, the achievement of ecological objectives (resource protection), and sustainable water use, and fosters approaches that close the water cycle of a region. Special attention has to be paid to current and future drinking water abstraction sources in order to reduce the level of purification treatment required (Art. 7 WFD).

The introduction of water pricing as a central policy is one of the main elements of the WFD and is designed to address problems of water quality and quantity as demand for and stresses on water increase in Europe. According to Article 9 WFD, Member States have to introduce water pricing and cost recovery, having regard to social, environmental, economic effects and to the geographic and climatic conditions of the region or regions affected. This approach allows to recover costs resulting from the adaptation to climate change with some flexibility.

Public participation and stakeholder involvement (Article 14 WFD) allow for informing on and raising awareness for the effects of climate change. It further offers the opportunity to involve stakeholders and the interested public in the development of appropriate and commonly agreed adaptation measures.

All these mechanisms are based on a six-year planing cycle. At the beginning of each cycle a reflection of the previous one is required to make necessary adjustments in the next cycles. This allows for a stepwise adaptation process and to consider new results from climate change projections and adaptation measures in other sectors.

### ***EU Flood Risk Management Directive***

According to the proposed **EU Flood Risk Management Directive** (European Commission, 2006), Member States would first have to carry out a preliminary assessment to identify the river basins and associated coastal areas at risk of flooding. For such zones they would then need to draw up flood risk maps and then make flood risk management plans focused on prevention, protection and

preparedness. When making decisions regarding future water supply and sanitation infrastructure, such maps could help to prevent damage from heavy flooding. On the basis of the need to regularly update these maps, shifts in risks due to climate change can be reflected continuously.

### ***European Technology Platform ETAP***

In order to address the growing need for new technologies and new management systems that can ensure security of supply, the Commission has established a **European Technology Platform** on water supply and sanitation (WSSTP).<sup>3</sup> This Platform should develop – together with the key stakeholders – a strategic vision for the development of sustainable water supply and sanitation technologies, with a medium to long time frame, in order to define a common research agenda and implementation plan. Such innovative technologies as water saving techniques, re-use approaches, clean processes, end-of-pipe treatments, system design, IT-tools for management, monitoring and control systems, flood forecasting techniques, ecological engineering, appropriate technologies, desalination, etc. may help to adapt the water supply and sanitation sector to climate change. In order to make full use of the opportunities of the WSSTP, there may be a need to review the platform and to explicitly include climate change concerns into its research and development agenda.

### ***Policies for funding adaptation***

Several funding mechanisms can be used to pay for adaptation measures (mainly infrastructure) in Europe.

The **Structural** and **Cohesion Funds** are the European Union's main instruments for supporting social and economic restructuring across the EU. They account for over one third of the European Union budget and are used to tackle regional disparities and support regional development through actions including the development of infrastructure. They could assist many of Europe's poorer regions to put in place the water systems necessary to cope with supply and demand problems resulting from climate change in coming decades. Funding for projects in the water supply and sanitation sector may also be provided by the **European Investment Bank** (EIB) and the

Community action in the field of water policy, Official Journal L327, 22/12/2000, pp. 1-73.

<sup>3</sup> See <http://www.wsstp.org/>.

## European Bank for Reconstruction and Development (EBRD).

The European Union **Solidarity Fund**, which has an annual budget of one billion Euro, can be used for immediate actions after a major disaster event such as floods and droughts.

## Conclusions and key issues

Climate change impacts will pose significant threats to the water supply and sanitation sector, and it is necessary to incorporate adaptation efforts in today's planning. Given the considerable uncertainties in climate impact projections, no-regret strategies should be applied that would be beneficial under different possible scenarios.

Besides the climate-driven challenges described above, the water supply and sanitation sector faces several other challenges, which are often driven by more short-term developments. For instance, demographic trends, economic and consumption patterns, land use planning, tourism and industry development also impact on the sector. It is important that both in the assessment and modelling of future conditions and in the development of strategies, all factors influencing the quantity and quality of water resources, including demand patterns and pressures on water resources, are considered (Levina and Adams, 2006).

The water supply and sanitation sector has a high potential to adapt to the effects of climate change. Technical solutions, economic instruments as provided under the WFD, and information measures are central instruments to ensure uninterrupted service even under changed conditions. However, even if a broad set of measures exists, there is a need to ensure that future legal, regulatory and contractual requirements foster the implementation of these measures and guarantee an appropriate repartition of costs among users, providers and polluters. Appropriate finance mechanisms are required to cope with the cost that might occur from adaptation. Therefore it is critical to know the scale and time of investments needed in the regions affected.

Nevertheless, water supply and sanitation will not be able to cope with all impacts from climate change alone. Overarching and cross-sectoral adaptation strategies are needed to balance different interests. It will require paying explicit attention to managing water conflicts and assisting water users and managers to find agreeable solutions for sharing their

common resource.<sup>4</sup> Such an overall strategy has to consider the various tradeoffs among sectors.

## Key questions

1. **Impacts and vulnerability:** What are the most relevant impacts of climate-driven changes of the water cycle on the water supply and water sanitation sector? What will be the combined effects of climate change impacts and other drivers of change, such as demographic trends and other sector developments?
2. **Adaptation options:** Which adaptation options are available to the sector? What repercussions on other sectors are to be expected? How can mid and long-term changes be integrated in planning processes?
3. **Prioritisation:** Which tools and information are needed to prioritise water use in case of conflicts? What criteria can be used?
4. **Policy action:** What could be gained from co-ordinating and implementing adaptation at EU level? How could EU policies support adaptation in the water supply and sanitation sector? How can the EU ensure that climate change issues are being incorporated into existing and future policies and their implementation? Which processes and co-ordination instruments could be employed?
5. **Economic instruments:** How can cost-recovery systems be designed or modified so as to also cover the costs of adaptation?
6. **Research needs:** Which knowledge gaps exist with regard to impacts, vulnerability and adaptation options?

## References

- European Commission 2006: Proposal for a Directive of the European Parliament and of the council on the assessment and management of floods. COM(2006)15 Final of 18/01/2006.
- IPCC, 2001. Climate Change 2001, Impacts, Adaptation and Vulnerability, Section, Hydrology and Water Resources, Report of Working Group II of the Intergovernmental Panel on Climate Change
- Levina E.; Adams, H., OECD, 2006 Domestic policy frameworks for adaptation to climate change in the water sector, Part I: Annex I Countries

<sup>4</sup> <http://www.iucn.org/themes/wani/change/index.html>.