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GLOBAL AND EUROPEAN WATER CHALLENGES IN THE 21st CENTURY

Introduction

Drought in Ethiopia, national conflicts over the Middle East waters, floods along the Yangze river in China, riots over irrigation water in the Punjab, cholera in Peru, subsidence in Mexico City, groundwater pollution in Western Europe, industrial effluents in the Volga and arsenic pollution in the Theiss and Danube river system: in different corners of the world water-related problems take different shapes, mirroring the looming water crisis, which will undoubtedly increase in magnitude during the 21st century.

In Europe, the collapse of the Soviet Union and the disappearance of the "Iron Curtain" lead to dramatic changes in social, economic and political life in all countries of Central and Eastern Europe, not leaving aside the water sector. In regard to water resources management, Europe is still split in a western and central/eastern part, with some problems in common, but even more differing in kind, magnitude and mode and means to alleviate or to overcome those problems.

A Global Perspective

Before concentrating on water related problems in Europe, let us have a look at the global situation. The Second World Water Forum in The Hague in March 2000, the largest freshwater conference ever, showed it very clearly to the world public: Water will be one of the **central issues of the 21st century** of this globe and the life of billions of people will depend on the wise management of this resource. During the Forum, the International Water Management Institute published a study on the world water situation in **2025**. Some of the statements of this study may be quoted here:

- "Nearly one-third of the population of developing countries in 2025, some **2.7 billion** people, will live in regions of **severe water scarcity**.
- They will have to reduce the amount of water used in irrigation and transfer it to the domestic, industrial and environmental sector" (IWMI 2000).
- In **India**, some 460 million people and in **China** more than 500 million people will live in regions that will face **absolute water scarcity**.
- **Groundwater reserves** will be increasingly **depleted** in large areas of the world. In some instances this will threaten the food security of entire nations, such as India. This will certainly lead to major problems in food security and excess to save water.
- **Groundwater contamination** by human interference, e.g. by industrial effluents, agricultural pollution or domestic sewage water intrusion is another world wide problem, which asks for urgent counteractions.
- The world's **primary water supply** will need to increase **by 41%** to meet the needs of all sectors in a sustainable way in 2025. This increase in water demand is largely due to the increase in the **world population**, which is estimated to increase to some 80 million people

every year, at least up to 2015. This means **another India for the world to feed every decade** (Falkenmark 1998)**!**

- Another problem which faces mainly the Developing World is the phenomenon of **urbanisation**: "Safe water and sanitation close to the home for everyone" as demanded by the Mar del Plata Action Plan, seems to remain a dream when acknowledging that in 2025 nearly **4 billion people** will live in urban areas – and the process is most dramatic in countries with relatively few resources (GWP 2000).
- **Seawater intrusion** in coastal aquifers due to overdrafting is another urgent problem in most tropical and subtropical countries alike. This anthropogenic problem accelerates in some areas the already existing natural problem of **poor groundwater quality**, e.g. of high **salinity**. In Tunisia, 26% of surface water, 90% of water pumped from shallow and 80% from deep aquifers have a salinity of more than 1.5 g per litre.

There are many other water related problems, like frequent floods, soil salinisation, acid rain etc. which are encountered world wide.

> **"Every human being, now and in the future, should have enough clean water, appropriate sanitation and enough food and energy at reasonable cost. Providing adequate water to meet these basic needs must be done in a manner that works in harmony with nature."**
>
> *World Water Commission, quoted from GWP 2000*

This is the **global water challenge** and it is well known (theoretically), how to reach this goal, how to solve or least to alleviate the above mentioned problems: " Mobilising the political will to act", "Making water governance effective", "Generating Water Wisdom", "Tackling urgent water priorities", or "Investing for a secure water future" (GWP 2000).

Among the "**urgent water priorities**", which have to be tackled, some should be mentioned here:

- Increasing productivity of water consumed in agriculture,
- More water storage in reservoirs or underground,
- Better water recycling/reuse practices: "Use each drop of water four times!"
- Reduction in water distribution losses in cities as well as in large irrigation systems
- Regulating groundwater extraction
- More waste water treatment, less water pollution etc.

The '**Dublin Principles'** shall be the guidelines, among them the highly debated one: "Water shall be regarded as an **economic good**".

Will we ever meet the "global water challenge" as mentioned above? Why do the problems persist, in spite of so many declarations, so many 'Visions' and 'Frameworks for Actions'? What are the **underlying causes?**

At least for the Developing World, we can identify some reasons why the situation worsens:

- Pauperisation,
- Lack of social structures,
- Lack of education and training,
- Marked oriented production on a global scale ("Globalisation") with missing or at least insufficient enforcement of environmental laws, etc.

(At least the latter point is also true for many countries in the Industrialized World.)

On my opinion, there will be hardly any change to the better during the first decades of the 21st century in this respect, unless the **global economic order** is adjusted. A purely profit-oriented

global society will neither go for “sustainable development”, nor solve the problems of lower income classes nor of the Developing World in general. There is not only the need for a change in water related paradigms, but a general thinking-over, what paradigms we should accept, what goals we should set. There is **no alternative** than to give a larger share of the global profits to the poor and to the Developing World, allowing them a more stable economic, social and environmentally friendly development (Louks 1994).

Water supply problems in Europe

"Our vision is that in two or three decades there will be sufficient, save, clean and healthy water for nature and people living in stable societies in the region".
This statement is the ‘motto’ of the publication "Water for the 21st Century: Vision to Action / **Central and Eastern Europe**", a report edited by the Regional Technical Advisory Committee for Central and Eastern Europe (CECTAC) of the Global Water Partnership.
There is definitely a long way to go to reach this goal: **drinking water supply** and **waste water management** are very unsatisfactory in rural areas of most countries of Central and Eastern Europe (CEE). Part of the rural population rely on **low quality** water resources, such as shallow wells:

- In Poland, more than 50% of rural population relies on water withdrawn by hand from local sources.
- In Latvia, some 350.000 shallow wells supply drinking water for ca. 1 million people living in rural areas. About half of these well are contaminated, either bacteriologically and /or by nitrate.

One reason for the low quality of water in biological terms is the so called “**utility gap”**, which means the percentage of population connected to the water supply minus that of connected to sewerage. This "utility gap" is large in many countries and e.g. in Hungary it is near to 50%. This situation leads to increase pollution of surface and sub-surface waters and health risks.
The situation in **Western Europe** contrasts to certain extent to the situation in the CEE countries. The standard of water supply and sewage treatment is at relatively high level, but by far not yet satisfactorily. It should be kept in mind that the "capital of Europe", the city of Brussels, had its first municipal treatment plant opened just three years ago.

Water pollution is an important topic in western Europe: despite numerous efforts, pollution of soil air and water remain a reality. It is estimated

- 20% of surface water within the European Union countries is seriously threatened by pollution and
- more that 60% of agricultural lands shows alarming loads of agro-chemicals, threatening groundwater and drinking water resources
- (Abandoned) industrial sides are often heavily charged with pollutants.

Particular problems exist in **coastal areas** (e.g. Mediterranean Sea) due to tourism and subsequent sea disposal of wastes and not sufficiently or even untreated waste water.

Therefore, the European Commission started an **anti-pollution programme** in 1996, which included :

- Enforcement of environmental laws and regulations
- Harmonisation of laws and regulations within the European Union and beyond
- Development of the knowledge base required by actors (= legislators, regulators, industry, local authorities, public health bodies, consumer organisations etc).
- Knowledge of the state and evolution of the resources in quantitative and qualitative terms
- Understanding of the nature of pollution within water supply systems
- Understanding of the impact of the pollution on human health and the environment

- Research on socio-economic aspects of the fight against pollution with the purpose of understanding better the system of interaction linking different players and developing new approaches for combating pollution
- Improving waste water treatment quantitatively and qualitatively, addressing also the specific socio-technological and economic constrains on operators in suburban and rural areas.

Prevention of pollution diffusion by:

- "On site" treatment of effluents e.g. pre-treatment before disposal in public sewers
- Treatment in accordance with the specific re-use /re-cycling
- Rehabilitation of contaminated soils, sediments and aquifers
- Implementation of cropping techniques appropriate for preventing or limiting this diffusion of pesticides and fertilisers to nearby aquifers (EU Commission 1996).

In **non-member states** of the European Union, e.g. in the **CEE countries**, the situation is even more alarming. As already mentioned, most of the regions water bodies (surface water and groundwater bodies) receive excessive amounts of untreated or insufficiently treated municipal waste water.

- Pre-treatment of **industrial effluent** is often insufficient for biological treatment processes in treatment plants; industry accounts for a significant part of the discharge of polluting substances into inland waters in the region.
- Both the **agro-food** and pulp and paper industries discharge substantial amounts of oxygen-consuming, nutrient-rich and slowly degradable substances.
- The production of **synthetic chemicals** brings new and more exotic types of production wastes. and waste water treatment installations typically suffer from insufficiency, overloading and poor operation and maintenance (CEETAC 2000).
- **Agricultural activities** contribute substantially to the overall nutrient load in surface and in groundwater. **Eutrophication** of rivers, inland and coastal waters is one of the major problems in many CEE countries, e.g. Latvia. The problems created by agricultural production include ammonia volatilisation, nutrient leaching, discharge of farm wastes such as effluents from animal houses, manure storage and silage heaps.

The **future development** in the CEE region will be strongly affected by the possible **EU integration**. On one hand, the new laws and regulations might contribute to lower pollution rates, but more intensive agricultural production is coupled with higher amounts of mineral fertilisers and pesticides, increasing the risk for surface and groundwater con-tamination. The future will show to what extent the present water loads in pollution will be reduced or not (CEETAC 2000).

Whereas in the EU countries **water quality monitoring** is rather well developed, those systems are at rather low level in most CEE countries. Many international rivers in the CEE countries carry a severe pollution load. The Danube countries are in a better situation since for many years the river system is covered by international conventions including water quality control.

Strategies to Secure Water Supply

Past strategies of water supply development have generally been based on the development of supply by:

- improving abstraction techniques and
- exploitation of new "primary" sources (European Commission 1996).

Needed are strategies for rationalisation of **demand** through

1. **Use of "secondary" sources**, mainly **re-use /recycling** of waste water or drainage water (Prinz 1999a). Europe is somewhat behind in rational use of water, e.g. recycling of water in industry, which is in the US and Japan 2 to 4 times greater than in Europe. Therefore, re-use and recycling of water as well in industry as in agriculture is needed.
2. **Reduction of consumption of water** as well in private as in industry or in irrigation. To encourage the various categories of water users to save water, economic, fiscal and statutory instruments have to be designed and applied. In industry, water can be conserved through finding alternatives to water for cooling, solvent precipitation medium, or by development of better water equipment and management metho-dologies. In agriculture, water can be conserved either by improved irrigation scheduling (better instrumentation, information and control systems) or by using irrigation methods with a higher water efficiency (sprinkler, drip irrigation).
3. **Minimisation of losses**: Within the European Union, the losses in **public supply** and in irrigation networks are about **15-30%** of the total water extracted. Therefore, the strong need exists to minimise those losses by (1) leak detection, (2) leak repair and (3) by leak prevention, e.g. by using material which is less subject to corrosion and mechanical fatigue (European Commission 1996).

The new **Water Framework Directive** of the European Union asks for full **cost recovery charges** for services, such as water supply and wastewater collection and treatment. The enforcement of this directive will speed up the process of rational use of water on one hand, but water pricing might have also negative effects, as it was shown in **Slovakia**:

- Between 1990-1996 the per capita use of water decreased in Slovakia from 200 l per day to 130 l per day. The significant increase in drinking water **prices** was the main cause and it was noticed that in several poorer areas, water use came close to the **hygienic minimum** (80 l per capita per day).

Adequate pricing policies or subsidies should therefore guarantee sufficient clean water supply **to all sectors of the society** (CEETAC 2000).

High prices for drinking water in a number of western European countries brought about the trend to install rainwater collecting systems in new buildings to utilise the rainwater e.g. for flushing toilets, for garden watering etc. Examples of large building being equipped with rainwater harvesting devices are the Millennium Dome near London, the Terminal 2 of Frankfurt/Main Airport, the large DEBIS complex in Berlin, etc.

High prices for wastewater collection resulted at least in some countries in western Europe in an increased **re-use** of water within households but also in the construction of **rainwater infiltration ponds** near homes and official buildings to avoid high wastewater charges.

Privatisation of urban water supply and the wastewater services might play a larger role in future as well in Western as in Eastern Europe, but examples from UK show already a number of negative impacts as well on society as on the environment due to privatisation.

Combating Chronic Water Deficits in Europe

Southern Europe, particularly the coastal regions, faces (1) low annual precipitation, (2) strong seasonal difference in rainfall, (3) significant runoff and (4) a strong and growing seasonal water demand for tourism and/or irrigation (Kayamanidou 2000). For southern Europe, over the period 1996 to 2006, an increase in urban water demand of **20-50%** and of agricultural water demand by **20-30%** was expected (European Commission 1996).

To arrive at a lasting **equilibrium between water supply and demand** will be extremely difficult. To improve the management and exploitation of the resources, some specific actions have to be considered by the European Commission (European Commission 1996):

- Strategies for demand reduction
- Implementation of coherent management and exploitation plans, based on better forecasting of supply and demand. This includes the development of land management scenarios appropriate to a sustainable management of water resources, development of financial and institutional incentives, etc.
- Assessing medium- and long-term environmental impacts of different management options (changes in land use, inter-basin transfers, etc.).

For the development and **diversification** of the supply sources the following actions have to be taken:

1. Exploitation of presently under- or unexploited water resources, e.g.
    - Collecting rain / runoff for use as domestic water of for agriculture (Prinz 1999b)
    - Collecting runoff for artificial recharge of aquifers, taking into account the potential environment impact
    - Exploiting the karstic aquifers found in many of the Mediterranean countries, evaluating the impact of such exploitation on the local and regional hydrological equilibrium.

2. Extended application of the **desalinisation technology** with particular attention being paid to the use of renewable energy technologies (e.g. photovoltaic cells).

In **Eastern Europe** drought is an issue in particular in Slovakia, Hungary, Poland, Rumania and Bulgaria. In **Bulgaria**, almost 120 towns, including large cities, and 120,000 villages have suffered water shortage for many years. Serious droughts were experienced during recent years and in the summer 1994 the water supply to more than 70% of the population of the country including the capital Sofia had to be interrupted. Drought situations in CEE region are quite common especially in the west central Poland, where average precipitation is less than 500 mm (CEETAC 2000).

Future climate change will have strong impact on the hydrologic cycle in whole Europe, especially in areas already characterised by water scarcity. Additionally to impacts on availability of water, extremes and fluctuations may become larger and seasonal distribution of precipitation and / or runoff may alter negatively. Increased **temperatures** will increase the demand of crops as well as of vegetation in regard to water and irrigation will be necessary in areas where it was less needed before.
For the **Danube basin** there are predictions, that rainfall may **decrease** in summer by up to **100 mm/annum**, while it could increase slightly in the winter season (CEETAC 2000). Higher average temperatures will result in higher evaporation rates from reservoirs and additionally stronger winds / storms are expected. As climate change is (to a large extend) caused by anthropogenic actions, e.g. burning of fossil fuels, **counteractions** to reduce the release of relevant trace gases are a necessity.

Floods and excess water problems

Extreme **floods**, which occur e.g. in the Danube region every 10 to 12 years, are not only caused by the coincidence of unusual natural factors, but also influenced by land use changes, narrowing of the river bed e.g. by constructions in the flood plain, etc.
It is therefore extremely important to look for **organisational and institutional structures** for national as well as international **river basin management**. The establishment of **river basin districts** is therefore an essential part of the EU Water Framework Directive. There is no doubt that

water resources management in quality and quantity is possible only within a watershed and therefore this regulation is overdue. The importance of flood protection as one of the major elements of watershed planning is exemplified by the fact, that 85% of all civil protection measures taken by EU member states are concerned with flooding (European Commission 1996).

A good example of international co-operation is the functioning of the '**International Commission for the Protection of the Danube River**'(ICPDR), established officially in 1998. The GDP of the member countries varies between 1,000 and 25,000 US $, but the targets are set for all countries and all members co-operate to reach the objectives: Pollution reduction and restoration of wetlands and aquatic ecosystems (CEETAC 2000).

Specific actions to avoid extreme events like floods and sudden or exceptional pollution, as considered by the European Commission, are (European Commission 1996):

- Improving the capacity to forecast the occurrence (incl. likely amplitude , extent, impact)
- Improving of the knowledge about the causes of "natural" catastrophes
- Establishment of preventive practices (e.g. in the framework of land management)
- Development of management tools to interact rapidly and efficiently
- Development of emergency systems e.g. for supplying water to affected populations.

In **CEE** countries **specific flood problems** are experienced, caused by the break down of drainage channel systems (as consequence of socio-political transformation).

In **Latvia**, out of almost 3.4 million hectares of agricultural land, 80% is **drained** and about 90% of agricultural production of the country is being produced on drained lands.
The total length of sub-surface drains in Latvia makes around 1,6 million km. Due to the collapse of the former collective farms and the establishment of small farms in the range of 8-20 ha, many drainage systems were left without proper attention. In 1997 over 290,000 ha of drainage structures had been transferred to the new landowners but in 1999 still 263,000 ha of land were not used due to the damage of drainage systems (CEETAC 2000).

Serious operational and maintenance problems on agricultural lands were also experienced in the Tisa valley in eastern **Hungary** after the re-distribution of land and the breakdown of the drainage system. In spring 1999 about 450,000ha of agricultural land were inundated for several weeks and several thousand houses were partially or fully destroyed (CEETAC 2000).

Implementation

The principles of Integrated Water Resources Management (IWRM) should be the cornerstones of any implementation strategy in the European water sector.
The IWRM principles focus on :

- **Integration**
  - of water quality and quantity management
  - of groundwater and surface water management
  - of freshwater and coastal zone management
  - of water supply and sanitation planning
  - of upstream and downstream demands in regard to water quantity and quality
  - of physical, economical and social aspects of water resources management
- E**cosystem management** in recognising all values of biodiversity and the integrity of ecosystems
- **Communication** between main actors in water resources management: politicians,

water consumers, water specialists, interest groups ....
- **Capacity building** by training of professional skills, raising public awareness....
- **Public participation** in decision making, based on access to water-related information.

In the 'Transformation Countries' willing to join the European Union, many changes in institutional framework, laws and regulations, financial structures and technical standards have to be implemented parallelly to the principles of IWRM.

Conclusions and summary

"Every human being, now and in the future, should have enough clean water, appropriate sanitation and enough food and energy at reasonable cost... "
This 'vision' will never become true, but we should act in Europe in solidarity with the billions of people in other parts of the world whose 'basic needs' are by far not met, - and we should do it "in harmony with nature."
Water in Europe is a precious, an endangered and often a problem-causing resource.

- Water is in many places in **short supply** and an increasing standard of living is normally paralleled by an increase in water demand. Additional stress will arise from anthropogenic climate change. The application and adjustment of the various means of **supply and demand management** plus improvements in technology are great challenges for the future.
- Water is all over Europe endangered by **pollution** - either by insufficiently or even totally untreated waste water from private households and industry or by agro-chemicals. The pollution problems need in most countries outside the EU even greater attention than inside the EU, namely in CEE countries and beyond. Not only **pollution control** based on information, legislation, enforcement of legislation and peoples' participation challenges us, but the **integrated planning of water quantity and quality**, too.
- Many European countries, not only of the Mediterranean, face **chronic water deficits** and suffer frequently from **droughts**. Strategies for demand reduction include the better land use management, diversification of the water supply sources, rainwater harvesting, artificial recharge of aquifers, exploiting of karstic aquifers and desalinisation. Climate change aggravates the problem. The challenges are manifold; strategic planning, financial assistance for implementation of preventive measures and promotion of innovative technologies are some of the needed measures.
- **Floods and excess water** pose frequently severe problems to the people affected as well as to governments; special problems are encountered in some 'Transformation Countries' due to the breakdown of drainage systems. The need for appropriate preventive measures, e.g. on the sector of land use planning, restoration of wetlands and floodplains, is unquestioned.

Water is largely a shared resource - in several EU Member States over 50% of the supply depends on other countries. A wide variety of actions is involved in its management; their decisions frequently have transnational or even transregional impacts.

The EU Commission has at its disposition various means of influencing water management either directly (through directives, infrastructure funding, etc.) or directly (agricultural, industrial, environmental and regional policy). According to EU sources, "...the initiatives taken in these various areas of intervention had already a considerable influence on the evolution of the markets and on the nature of the demand for technology and services" (EU Commission 1996). This influence will be even stronger in future – and stretch beyond the present borders of the European Union.

The Task Force "Environment - Water", established in 1996, and the "Framework Directive on Water" of the EU Commission ".... contribute towards the development of an European strategy **for sustainable management and rational use of water**, to make European enterprises associated with this area more competitive on internal and world markets and to **refocus scientific and technological cooperation** on priority projects.

Ten years after the fall of the "Iron Curtain", the CEE countries are in the stage of transition and they are confronted with specific problems not encountered in Western Europe. On the another hand, many of the problems of Western Europe like water pollution, flood and drought problems are also pressing problems in Eastern Europe and, of course, in other parts of the world, too.. Reason enough to co-operate, to listen to each other and to practice solidarity, when facing global and European challenges on the water sector in the 21st century.

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