Ministry of the Environment

Danish Support to Improved Water Quality in Central and Eastern Europe

THEMATIC REPORT

1991-2001

DANCEE
Danish Cooperation for Environment in Eastern Europe
Ministry of the Environment

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COWI A/S

Editors
Camilla Hagedorn Trolle (DANCEE)
Morten S. Olsen (DANCEE)

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Valør & Tinge A/S

Abstract
The report describes the Danish support to improve water quality in Central and Eastern Europe during the period 1991-2001. The report describes the results of the support and how this was achieved.

Terms
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CHAPTER 0

RESUMÉ AF DANSK ØSTSTØTTE TIL VANDMILJØ

I april 1991 vedtog Folketinget Lov om tilskud til miljøaktiviteter i østlandene og Miljøstøtteordningen til Østeuropa blev etableret med det formål at:

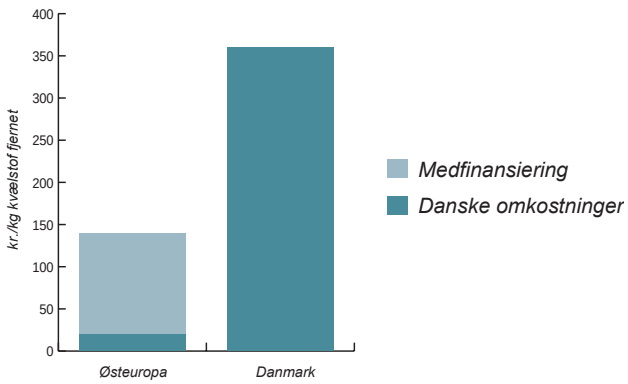
- beskytte miljøet både lokalt og regionalt, herunder den i retning af Danmark grænseoverskridende forurening
- hjælpe EU-ansøgerlande med tilnærmelse af EUs krav
- politiske og økonomiske reformer med miljøbeskyttelse højt på dagsordenen
- fremme dansk teknologi og know-how.

Danmark har i de sidste 10 år støttet og gennemført projekter i 15 Central- og Østeuropæiske lande indenfor luftforurening, vandmiljø, affald, natur og offentlig administration. Den samlede støtte fra Danmark har udgjort ca. DKK 3,3 mia. Inden for vandmiljø er der gennemført 400 projekter til et beløb på DKK 1,4 mia., hvor 80% er gået til investeringsprojekter.

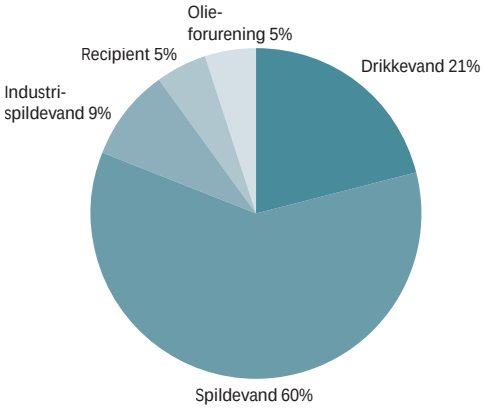
Teknisk assistance projekter er gået til planlægning og identificering af vand- og spildevandsprojekter i østeuropæiske storbyer som St.Petersborg, Kaliningrad, Vilnius, Kiev, Warszawa og Wroclaw. I 35 byer er vandforsyningen blevet forbedret og sammen med en forbedring af grundvandskvaliteten har over 800.000 østeuropæere haft nytte af investeringer i dansk udstyr til vandforsyning.

Indenfor spildevand er der bygget nye eller forbedret eksisterende renseanlæg i 120 byer med en samlet reduktion i udledningen af organisk stof på 60.000 tons/år, kvælstof på 17.000 tons/år og fosfor 2.500 tons/år. Udledningen er således reduceret med hvad der svarer til forureningen fra ca.3-4 mio. mennesker. Reduktion i udledning af kvælstof er af samme størrelsesorden som reduktion i udledning fra danske renseanlæg under den første Vandmiljøplan fra 1987-1995, men til ca. 1/3 af omkostningen i Danmark (360 kr . pr. kg. fjernet kvælstof i vandmiljøplanen sammenholdt med DKK 135 kg. fjernet kvælstof i de støttede projekter). På grund af den store medfinansiering på projekterne har det danske bidrag til kvælstoffjernelsen i Central- og Østeuropa i gennemsnit været DKK 22/kg fjernet kvælstof/år. Støtten til renseanlæg har også medført en reduceret udledning af tungmetaller med over 100 tons/år.

De dansk-støttede projekter har bidraget væsentligt til forbedring af Østersøens tilstand i henhold til den overvågning, der gennemføres af Helsinki kommissionen (HELCOM).



Sammenligning af omkostning ved fjernelse af kvælstof



Fordeling af støttemidler på indsatsområder

Indenfor kloakrenovering og renere teknologi på industrier er gennemført en række projekter, der har demonstreret danske metoder og udstyrs effektivitet i forbindelse med miljøbeskyttelse. 20-30 km kloakledning er blevet renoveret som demonstrationsprojekter for dansk miljøteknologi i CEE. Inden for 10 forskellige industribrancher blev vandforbruget reduceret med op til 90%, udledning af organisk stof og tungmetaller ligeledes reduceret med 90% og kvælstof med 50%. Endelig har de 10 års støtte også indeholdt støtte til bedre overvågning af vandmiljøet samt forbedret kontrol med olieforureningen i Østersøen.

Miljøstøtten har været en væsentlig katalysator for de lande i Central- og Østeuropa, der søger optagelse i EU. Øststøtten har støttet tilpasning af den nationale miljølovgivning i ansøgerlandene til EUs direktiver, en forudsætning for optagelse i EU. En meget vigtig funktion for øststøtten har været at holde gang i optagelsesprocessen ved at stille ekspertise til rådighed, når problemer går i hårdknude. Et eksempel på dette er en definition og forberedelse af de store miljøinvesteringer for at tilfredsstille de internationale bankers krav. For 65 byer er ansøgningen om EU støtte til vandmiljø projekter forberedt med dansk støtte.

Den danske investeringsstøtte til vandområdet på DKK 0,9 mia. har ført til en samlet investering på DKK 5,4 mia. F.eks. har Polen betalt op mod 90% selv af investeringerne i de dansk støttede projekter. Dette tages som et udtryk for at det er lykkedes for den danske miljøstøtte at få sat miljø højt på dagsordenen både nationalt og lokalt. En bred folkelig opbakning bag miljøprojekter er nødvendig hvor begrænsede midler skal prioriteres. Desuden skal mange investeringer finansieres gennem brugerbetaling, og derfor er det vigtigt at sikre både evnen og viljen til at betale vandregningen.

Ca. 150 virksomheder har leveret udstyr og ekspertise til vandmiljøprojekterne. En afledt effekt af miljøstøtten har været at en lang række danske virksomheder i dag har etableret en voksende forretning på det Central- og Østeuropæiske marked. Større aktører både indenfor industri og rådgivere har etableret sig med datterselskaber i et eller flere af de Central- og Østeuropæiske lande. For år 2000 skønnes den samlede omsætning på det Central- og Østeuropæiske marked for danske virksomheder at være i størrelsesordenen DKK 2 mia. Dette niveau er nået indenfor en 10 års periode.

Miljøstyrelsen har udarbejdet en strategi for støtten de næste 5 år, således at a) Danmark fortsat kan påvirke de Central- og Østeuropæiske lande til at investere i miljøforbedringer, b) EU kandidatlandene udvikler sig til en snarlig optagelse i EU og c) dansk udstyr og know-how fortsat har en fremtrædende plads på et kraftigt voksende marked i Central- og Østeuropa.

Alene EU ansøgerlandenes samlede miljøinvesteringer skønnes til DKK 500 mia. de næste 10-15 år. Heraf skal der på vandområdet investeres knapt DKK 120 mia.

CHAPTER 1

SUMMARY

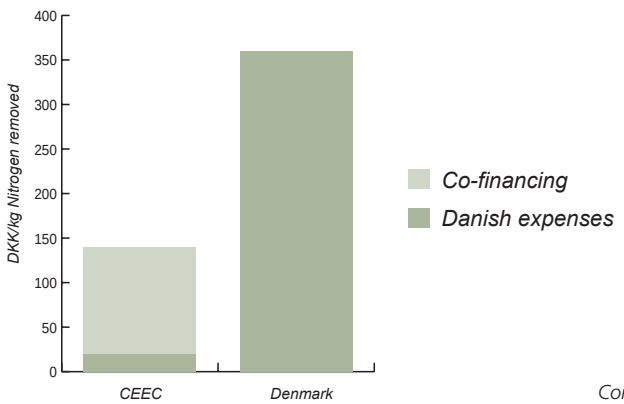
In 1991 the Act on Subsidy for Environmental Activities in Eastern Europe was Adopted by the Danish Parliament with the Overall Objective:

- To protect the environment in CEEC and to limit regional as well as global pollution
- To contribute to the preparation for countries applying for EU membership
- To contribute to political and economic development in an environmental friendly manner
- To promote Danish environmental knowledge and technology

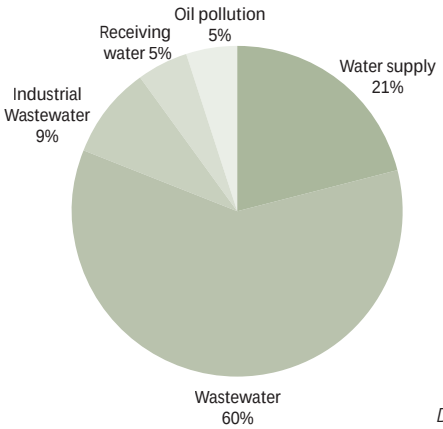
For the last 10 years, Denmark has supported and implemented projects in 15 Central and East European countries within air pollution, water quality, waste, nature and institutional development. The total Danish support amounts to EUR 435 million. Within improvement to water quality, 400 projects have been executed with the Danish support of EUR 184 million, where 80% have been allocated to investment projects.

Technical assistance projects have been allocated to planning and identifying water and wastewater projects in East European cities like St. Petersburg, Kaliningrad, Vilnius, Kiev, Warsaw and Wroclaw. In 35 towns the water supply has been improved and along with improved quality of groundwater more than 800,000 East Europeans have benefited from investments in Danish equipment for water supply.

In 120 towns or cities existing wastewater treatment plants have been rehabilitated or new treatment plants have been constructed with a total reduction in the discharge of organic matter of 60,000 ton/year, nitrogen 17,000 ton/year and phosphorous 2,500 ton/year. This corresonds to the pollution load from 3-4 million persons. The reduction in discharge of nitrogen is at the same level as the reduction in discharge from Danish wastewater treatment plants during the Danish action plan for the aquatic environment 1987 to 1995, but at 1/3 of the cost in Denmark (DKK 360 pr. kg nitrogen removed in the Danish Action Plan for the Water environment compared to DKK 135 for the supported projets). Due to the high degree of co-financing the Danish support to nitrogen removal has on the average been DKK 22 pr. kg. in the CEEC. The support to wastewater treatment plants has also resulted in a reduced discharge of heavy metals by more than 100 ton/year.



Comparing cost of removing nitrogen



Distribution of allocations on action areas

The Danish supported projects have contributed to the improvement of the Baltic Sea according to the monitoring carried out by the Helsinki committee (HELCOM).

Within sewer rehabilitation and cleaner technology at industries, a number of projects have been executed which have demonstrated the efficiency of Danish methods and equipment in relation to environmental protection. 20-30 km sewage pipes have been renovated as demonstration projects for Danish environmental technology in CEE. Within 10 different industrial sectors, the water consumption was reduced up to 90%, the discharge of organic matter and heavy metals was likewise reduced by 90% and nitrogen by 50%. The 10 years, support has also comprised support to improve monitoring of the water environment and improved control with oil spill in the Baltic Sea.

The Danish support has been important in spurring on the countries seeking membership of the EU. The approximation of the individual national environmental legislation in the applicant countries to the EU directives has been supported. The momentum of the approximation process has been continuously supported by providing expertise within technical, financial and institutional matters. One example is the definition and preparation of the large environmental investments to satisfy the demands of the international banks. For 65 towns the application for EU support through the ISPA-programme were supported.

The Danish investment support in the water sector of DKK 0.9 billion has led to a total investment of DKK 5.4 billion For example, Poland has co-financed up to 90% of expenses on Danish supported projects. This is taken as a proof that the Danish environmental support has managed to place the environment high on the agenda on both local and national levels. A popular support for environmental projects are necessarily where limited resources have to be prioritised. Many investments must be financed by the customers over the water bill, and therefore it is important to ensure both the capability and the willingness to pay.

About 150 companies have supplied equipment or expertise to the water quality projects. The result is that a number of Danish companies today have established a growing business on the Central and East European market. The largest companies within industry or/and consultancy have established subsidiaries in one or more of the Central and East European countries. For year 2000 the total turnover on the Central and East European market for Danish companies is estimated to be at a level of EUR 260 million. This level has been reached within a period of 10 years.

The Danish EPA has prepared a strategy for the support the next 5 years to ensure that a) Denmark continuously can support the Central and East European countries in investments of environmental improvements, b) the candidate countries develop towards membership of the EU and c) Danish equipment and know-how is being promoted on a growing market. The EU applying countries are assumed to invest about EUR 65 billion the next 10-15 years. The needed investments in the water sector are estimated at approximately EUR 16 billion.

CHAPTER 2

INTRODUCTION

2.1 Background

Following the fall of the Berlin Wall and the disintegration of the Soviet Union 10 years ago, the Central and Eastern European Countries (CEEC) were left with substantial environmental problems. Denmark was among the first countries supporting environmental improvement in the CEEC and during the last 10 years Denmark has provided support to the environmental sector in the CEEC for about DKK 3.3 billion.

In 1991 the act on subsidies for environmental activities in Eastern Europe was adopted by the Danish Parliament. Later in 1993 a strategy for environmental activities in Eastern Europe was drawn up and has been the basis for environmental assistance to Eastern Europe. The strategy focused on the Baltic Sea Region, EU accession, implementing international conventions, strengthening environmental awareness in the countries and increasing efforts in the newly independent states (NIS countries).

Priority sectors for Danish support to the CEEC until 2001:
- Water pollution
- Air pollution
- Solid and Hazardous waste
- Biological diversity and sustainable forestry
- Institutional strengthening and EU accession.

The Danish support to Central and Eastern Europe (DANCEE) comprises 15 countries.

2.2 Methodology

The report covers more than 400 DANCEE supported projects in the water sector, for which grants have been allocated in the period April 1991-April 2001. The comprehensive overview of the achievements of the DANCEE programme support is based on statistical summary reports submitted to DANCEE, other project reporting and publications available from the Danish EPA.

The report starts by describing the result of 10 years support and its impact on the environment and public health. Then the assistance is described for each action area before focussing on the EU-accession and financing of projects. Finally, the cooperation with the recipient countries are outlined. The review was prepared by COWI, and the opinions reported are those of the review team, and hence they may not fully cover the views of the Danish EPA.

CHAPTER 3

RESULTS OF DANCEE SUPPORT

3.1 Environment and Health Conditions

For Europe in general the pollution of the water environment has been growing with the increase in population, growth in industrial production, and more intensified agriculture. Only in the last two decades has comprehensive treatment of wastewater from urban areas including industries taken place. The development in the CEEC has in many ways been parallel to the development in Western Europe. Still, the dramatic change in the governing system around 1990 left many facilities unattended to due to the lack of funds for maintenance and poorly functioning institutional setup.

The Baltic Sea

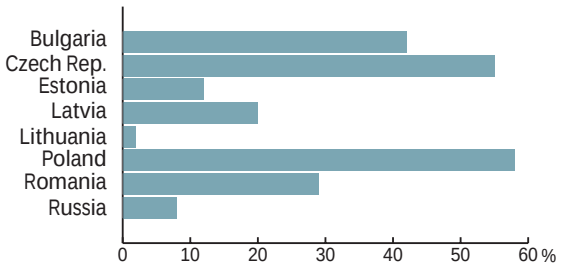
The Baltic Sea is special by being the largest brackish water area in the world, because the many rivers reduce the salinity and a very low level of water exchange, which makes it especially vulnerable to pollution.

Since the 1950s, the pollution of the Baltic Sea has been increasing. The level of nitrogen concentration has increased fourfold during the last hundred years, whereas the concentration of phosphorous has increased 8 times. Besides nutrients, the pollution includes general organic matter and a long range of chemical substances, which are toxic to humans and the environment. According to the investigations prepared by HELCOM the total load of nitrogen on the Baltic Sea is estimated at 1 million tons per year. A major part originate from the CEEC either through direct discharges to the Baltic Sea or through discharges to rivers that runs into the Baltic Sea.

Transport of oil and cargo on the Baltic Sea is increasing dramatically. Therefore, the Baltic Sea bears an increasing risk of ship collisions, which increase the risk of oil spillage. Operational spills during the loading and unloading operations of oil tankers, accidental spills during bunkering, and illegal discharges of oil residue from ships all contribute to the oil contamination and negative consequences to the marine environment. Oil spills from shipping accidents and other discharges of oil residues from ships contribute 10-25% of the total volume of oil pollution in the Baltic Sea. In 1997 the amount of crude oil and oil products handled by Baltic Sea ports had increased to more than 144 million tons. The variation in the amount of fish that can be harvested in the Baltic Sea cannot directly be related to pollution. Natural variation and overfishing are more dominating causes. However, important for the fishing is the alarming level of heavy metals and a range of environmental toxics like PCB, DDT and dioxin compared to fish harvested in neighbouring marine areas like the Kattegat.

The Black Sea

The Black Sea is polluted by nutrients, pathogens, heavy metals, pesticides, oil products, radioactive agents etc. The monitoring of the actual load is poor, but the problems are estimated to be very serious. The effect has been that the Black Sea over the last 30 years has developed from being characterised by a diverse animal and plant life to a situation dominated by eutrofication and a significant reduction in the biodiversity. In 1970, 26 different species of fish were harvested for consumption whereas in the 1990s only 5 species were left. In Romania some coastal areas cannot be used for bathing due to high risk from pathogenic pollution caused by discharge of untreated urban wastewater.



Source: EEA 1995

Proportion of river reaches with poor/bad water quality

Rivers

Rivers in the CEEC have been characterised according to their water quality based on monitoring in the period 1989-1992. This includes level of pollution with organic matter, toxic substances, oxygen concentration, and the diversity and health condition of fish.

It is important to notice that in many of the countries, especially the larger urban areas, river water is used as drinking water resource. There are large differences between the individual countries, however, Poland and the Czech Republic shows considerably worse water quality in rivers compared to the other countries.

Almost 60% of the rivers in Poland have a poor water quality. Poland has limited water resources and therefore pollution of rivers is a large problem. Besides the pollution with organic matter and nutrients there are distinct problems with heavy metals from the industry and pollution with salts from salt mines discharging into the Vistula and Oder Rivers.

The Czech Republic is also experiencing pollution with organic matter, nitrogen and phosphorous as well as heavy metals to their rivers. Bulgaria has problems with poor water quality, in rivers, related to organic matter, oil products and nitrates.

Groundwater quality at many locations in the CEEC is deteriorated due to poorly functioning individual wastewater disposal systems, uncontrolled landfills and industrial waste disposal. This is particularly a problem for rural areas. For example, in Romania 45% of the total population relies on shallow (5-20 m deep) individual wells.

Health

The shortage of good quality water has been the cause of many water-related health problems in the CEEC. Contamination of surface water and groundwater with domestic or industrial wastewater has frequently been reported as leading to health hazards in drinking water. The health hazards could be either from chemicals such as pesticides, nitrates, and heavy metals or from pathogenic bacteria, protozoa, and virus.

The magnitude of the health impact from infectious diseases is borne out in the statistics for infant mortality. Around 1990 the infant mortality rate in Western Europe was around 8 per 1,000 live births compared to the CEEC which were on a level of about 19 per 1,000 live births. At the same time it was estimated that infants deaths caused by infectious diseases accounted for about 4.7 per 1,000 live births in the CEEC compared to 0.4 in Western Europe. The difference clearly indicates that infectious diseases play an important role in infant mortality in the CEEC. Polluted water and air together with general poverty are the dominant factors facilitating infectious diseases.

In the beginning of the 1990ies both Latvia and Lithuania reported serious outbreaks of hepatitis A, Salmonellosis and dysentery. Similar reports came from the Republic of Moldova, the Russian Federation and Ukraine. In Ukraine the incidents of hepatitis A grew by 30% from 1990 to 1991. High

Benefit category	Estimate
Total number of customers enjoying improved water supply	over 500,000
Water savings due to reduced wastage and losses	35 million m3/year
Energy savings due to improved energy efficiency	2,500 million kWh/year
Reduced CO_2 emissions	2,500 tons/year

Environmental effects of water supply projects supported by DANCEE

incience of hepatitis A was reported in the mid to late 1990s in Odessa and Crimea during a prolonged drought.

In general, it is difficult to conclude on diseases related to chemical contamination of water supplies. Health impact from chemical contamination like heavy metals accumulates over the years and is thus related to chronic diseases. An exception is the contamination with nitrates, which can lead to Methemoglobanemia in infants ("blue babies"). This has been reported especially for rural areas where shallow wells are contaminated from manure, fertilisers or from discharge of untreated sewage.

Drinking water is frequently polluted between the source and the consumer when ageing distribution networks allow cross-contamination from sewerage systems particularly in systems not able to sustain 24 hours continuous supply. This has repeatedly caused short-term outbreaks of intestinal diseases. Many of the supply systems were not maintained as rapidly as they deteriorated.

Along the inland streams and rivers in the CEEC microbiological contamination of water resources is also a problem in urban areas. Towns that have their raw water source a few kilometres downstream of a wastewater discharge cannot be protected against intestinal diseases even when water treatment is proper, let alone when there is a breakdown in the water treatment.

Many countries in CEE report groundwater contamination by heavy metals, hydrocarbons and chlorinated hydrocarbons

Discharge of untreated wastewater to lakes and coastal areas used for recreation also gave rise to a number of recurring health effects both along rivers and lakes in the CEEC and in the Black and the Baltic Seas. The health risks to people bathing relate both to microorganisms causing intestinal diseases and hepatitis A, but also to oil-spill related products. For example, in the Baltic States many of the beaches were closed because of heavy contamination with sewage and industrial discharges (Bay of Riga). The same situation applied to the resort settlements along the Black Sea coast where epidemics of intestinal infections frequently occurred in the 1990ies.

3.2 Project Outcome

Water Supply

Water treatment plants and water supply systems have been constructed, upgraded or rehabilitated in 35 towns. The overall effect is improved quality of drinking water, improved reliability of 24-hour supply, and reduced energy consumption and loss of treated water.

Danish leakage detection technologies and well nodig rehabilitation methods have been introduced through training and demonstration projects.

While not all of the benefits derived from these interventions can be expressed by simple quantifiable indicators, rough estimates are produced as shown in the table above.

Water Supply, City of Craiova, Romania

The City of Craiova, situated in the southwestern part of Romania suffers from lack of water to supply the population, both due to high consumption and a deficit of available resources. A large part of Craiova is supplied with water only 12 hours a day, and supply to top floors of tall buildings is problematic.

The overall project objective was to design, supply and implement submersible pumps for the existing groundwater wells at four catchment fields, as well as pumps for pumping stations for distribution of water to the City of Craiova.

A feasibility study was elaborated during 1996-1997 in cooperation with Danish and Romanian consultants and the local water company.

The main implementation activities consisted of modernising and increasing the capacity of the four wells. The Danish contribution comprised pumps for 100 wells and 20 pumps for pumping stations. The Romanian contribution comprised civil works, hydraulic installations, and power supply.

Groundwater Protection

DANCEE assistance has also been employed in remediating jet fuel and oil spills from former military air bases and decontaminating soil from railways operation, industrial sites, and uranium mines as well as implementing measures to prevent further contamination.

The remediation projects have especially taken place around decommissioned military sites in the Baltic States, Russia, Ukraine, Slovakia, and Poland.

The emphasis of many projects has been on training and equipping local experts so that they can carry out remediation measures throughout the country over the long term.

Groundwater Contamination from the Polish Railway Installations in Wroclaw Region

The objective of this project is to reduce the contamination of soil and groundwater with diesel oil from operating the railway system in the Wroclaw Region.

The project comprise 2 main goals:

- Institutional strengthening including preparation of an environmental management programme for the Polish Railways (PKP-Wroclaw)
- Remidiation of groundwater contamination at the Vegliniec Railway Centre.

Pollution of the soil and groundwater with diesel oil both at railway filling stations and along the railway tracks have had a substantial impact both on groundwater quality and nearby surface waters. In this area most villages and minor towns are served by groundwater supply. Further there are along the tracks sensitive wetland areas where pollution from the railway have had a negative impact on the wild life.

Since these contamination sites frequently threaten local water supply, the DANCEE assistance has had a significant local impact for up to 300,000 inhabitants.

Location of DANCEE supported water projects in the CEEC. At most locations more than one project has been carried out.

	BOD ton/year	Nitrogen ton/year	Phosphorous ton/year
Discharge reductions on DANCEE-projects (in the CEEC)	60,000 (2.5 million pe)	17,000 (3.9 million pe)	2,500 (1.7 million pe)
Discharge reduction during Danish Action Plan 1987-95 (in Denmark)	50,000	16,000	5,000
Discharge from Danish treatment plants, 2000	3,304	4,654	543

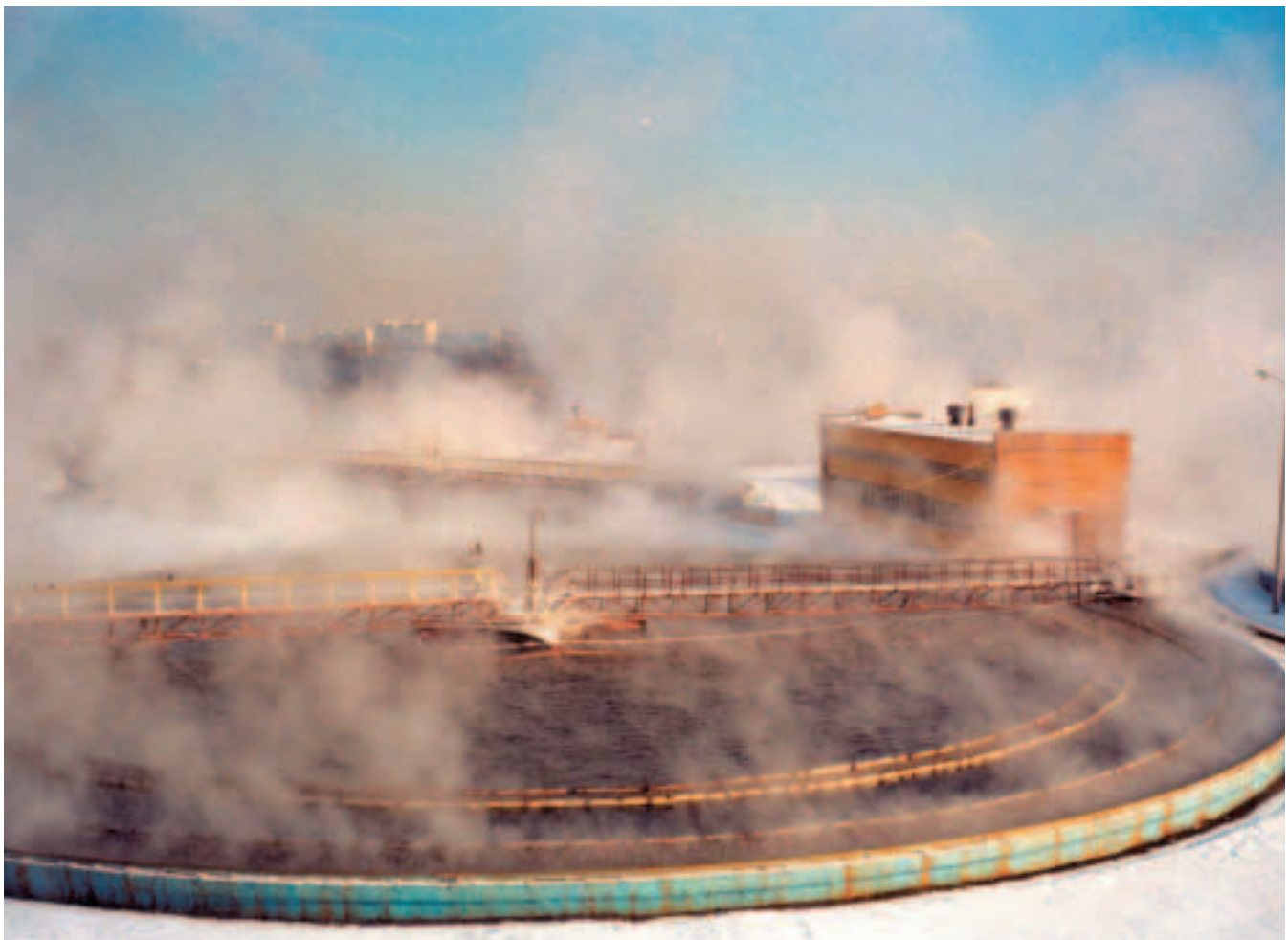
Comparison of the results of DANCEE supported projects and the Danish Action Plan for the Water Environment and discharges year 2000 in Denmark. All discharges relate to wastewater treatment plants.

Wastewater Treatment

Wastewater treatment plants have been constructed, upgraded or rehabilitated in 120 towns. The overall effect is a reduction in discharge of BOD, Nitrogen, and Phosphorous as indicated in the table above.

The reduction of discharge can be distributed on the catchment area draining to the Baltic Sea and the catchment area draining to the Black Sea. The DANCEE interventions in Moscow have primarily reduced pollution of the Moscow River. This river drains to both the Black Sea and the Caspian Sea because of the canal systems connected to the Volga River.

The clarifyers at the Kuryanovo (Moscow) wastewater treatment plant in winter



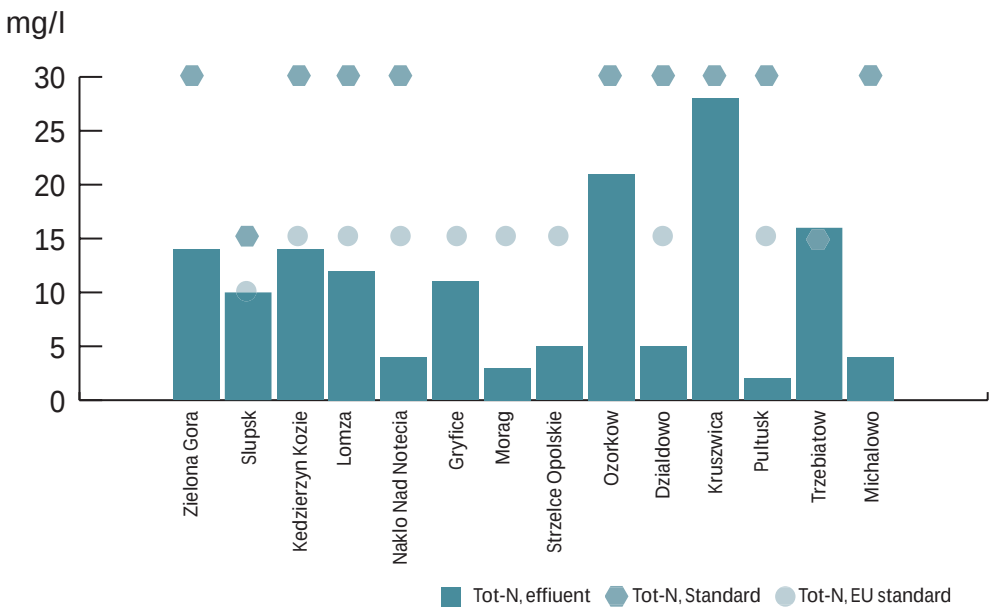
In the Baltic Sea area 20 DANCEE wastewater projects have targeted "hotspot" areas as defined by HELCOM. These are:

- Poland: Warsaw (Czajka and Pancerz WWTP), Bydgoszcz, Torun, Szczecin, Poznan, Lodz, and Zielena Gora
- Ukraine: Lviv
- The Baltic states: Matsalu (Est.), Daugapils (Lat.), Kaunas, Marijampole, Alytus, Vilnius, and Siauliai (Lit.)
- Russia and Belarus: Pskov (Rus.) and Brest (Bel.)

Reduction of discharges in the Baltic Sea and Black Sea catchment areas for DANCEE supported projects

Location of DANCEE supported wastewater projects in the CEEC. At most locations more than one project has been carried out.

DANCEE has evaluated the performance of wastewater treatment plants that have received DANCEE support. Treatment plants in Poland (14) and Lithuania (16) all comply with local effluent standards. Most of the treatment plants evaluated also complied to the EU discharge standard for Nitrogen.



Performance of DANCEE supported wastewater treatment plants in Poland.

In some countries the capacity of the constructed wastewater treatment plants are not fully exploited as the sewage system and the house connections have not been fully implemented. DANCEE therefore supports extension of sewer systems to speed up the connection rate and the close down of outdated individual disposal systems.

The DANCEE supported interventions at the Kuryanovo wastewater treatment plant in Moscow (10 million p.e.) showed that relative small changes in the processes resulted in a 25% reduction of the discharge of nitrogen.

Vilnius Wastewater Treatment Plant

DANCEE has since 1992 assisted Vilnius Water Company in extending the wastewater treatment plant serving the capital of Lithuania, Vilnius. The treatment plant will be rehabilitated and extended to a capacity of 700,000 p.e.

The project will be financed through grants from DANCEE and EU's Phare program, Danish softloans (export credit fund), and local funds.

The total budget was EUR 1.5 million. Besides design, the project included provision of mechanical equipment like centrifuges, screens and aeration equipment, and computerised control system especially to support nitrogen and phosphorus removal.

The discharge from Vilnius was on HELCOM's list of priority hot spots in the Baltic Sea catchment area. The treatment plant discharges to Neris River which flow into the Nemunas River, one of the major rivers to the Baltic Sea.

Many wastewater treatment plants have in the CEEC no means of dewatering sludge. This is kept in lagoons potentially polluting groundwater or causing risk of an environmental disaster to surface water when lagoon walls burst. DANCEE therefore has supported the introduction of Danish sludge dewatering technology gradually closing down these lagoons.

Sewer Rehabilitation

Within sewer rehabilitation Danish technology has been demonstrated in most countries of the CEE, especially in larger cities like St. Peterburg and Kiev. All together 20-30 kilometres of sewer pipeline have been rehabilitated in demonstration projects showing the advantage of Danish techniques. The demonstration projects in themselves have resulted in reduced wastewater loads on groundwater, reduced infiltration of groundwater which could lead to hydraulic overloading of the wastewater treatment plant and reduced collapse of main sewers below busy urban streets.

Rehabilitation of Sewer Pipes in St. Petersburg

The objective of this project was to introduce the Danish technology on nodig rehabilitation. The project comprised of:

- Theoretical training
- Pre-investigation in the testing area, including cleaning inspection, computerised mapping, and registration
- Nodig rehabilitation of 6 km of sewer pipes.

The environmental effect of the project was that the exfiltration of wastewater from the sewer pipes was reduced from 75% to 0%. This reduced the poluttion of both groundwater and surface waters.

The project convinced the St. Petersburg water company of the economic, social, and environmental benefits of the Danish nodig technology, and the Danish company has now established a local company in Russia.

Relining of main sewer in St. Petersburg

The reduction in energy consumption from the rehabilitation of sewage pumping stations has not been directly measured but commonly the energy consumption is more than halved. The result is both reduced operational cost and reduced emission of CO2 from energy consumption.

Industrial Pollution

The support to the industry projects has in general concentrated on demonstration projects for cleaner technology. In cooperation with local authorities a number of industries have been selected, and through a demonstration project the advantages of cleaner technology have been demonstrated. DANCEE has supported industrial pollution projects in a big variation of industries. These interventions in itself had led to water savings of over 2 million m^3/year, a reduction of heavy metals, and toxic substances of more than 100 tons/year and also reduced discharges of BOD, nitrogen, and phosphorous. The effect of cleaner technology has therefore been clearly demonstrated inspiring the countries to continue along the ideas and principles in the demonstration projects.
Overall the demonstration projects has resulted in a 50-90% reduction in water consumption, reduction of BOD/COD by 70-90%, reduced discharge of nitrogen by 50%, and reduced discharge of heavy metals by up to 97%.

Industrial Wastewater Pollution Projects

Type of industry	No. of projects	Results from DANCEE Projects	Reductions
Fishing	5	Water consumption	40%
		Oil and fat	90%
		BOD/COD	76/86%
		Energy consumption	Not specified
Meat processing	3	Water consumption	50-60%
		COD	42%
Various food	5	Water consumption	Not specified
		Oil and fat	
		BOD/COD	
Textile	4	Water, energy and chemicals	80%
Tanning	4	Water consumption	80%
		BOD/COD	25%
		Nitrogen	50%
		Chrome	97%
Metal-plating	5	Water consumption	75-90%
		Heavy metals	50-80%
Casting and			
Surface coating	5	Training projects	
Paper	1	Water consumption	60%
		BOD/TSS	50%
Power	1	Heavy metals	12 tons/year
Chemical	2	Not specified	Not specified
Industrial lagoons	3	Disaster prevention	
Water saving in			
various industries	5	Water consumption	50-85%

Slurry Utilisation Project in Pskov, Russia

The objective was to reduce the emission of nutrients from pig slurry to the Pskov lake which discharge into the Baltic Sea. Special priority were given to the immediate risk of sudden pollution of Pskov City water intake in the event of collapse of the dams around the existing 4 ha slurry lagoon. Modern Danish water saving equipment were introduced in the stables as well as slurry handling equipment. Introduction of computer based field and fertiliser planning together with improved farm management, where the slurry were reused as fertiliser increased the crop production significantly.

The project proofed that Danish technology related to handling of slurry and subsequent utilisation can successfully be applied with minor adjustment to Russian conditions.

Receiving Water

The effect of supporting environmental monitoring in the CEEC is improved local monitoring of water quality. The Regional Environmental Centre for Central and Eastern Europe (REC, receives support from Denmark) collects and disseminates environmental information on the water environment. The water quality monitoring in rivers in the Baltic States, Poland, and the Czech Republic are now improving and as a result future interventions can be targeted based on an improved knowledge of the actual condition of water environment.

The support has included both regional and national environmental monitoring and management systems covering rivers, coastlines, and the sea.

The effect of the improved knowledge on the river hydraulics in Poland, Czech Republic, Slovakia, and Ukraine will be seen at the next flooding incident. The modelling provides the basis for protective measures and forecasting flooding incidents, which increase the time for reaction. In this way properties can be better protected reducing the loss from flooding.

Warning System to Protect Intake to Warsaw Drinking Water in Zegrynskie Lake

The rivers Bug and Narew runs into the lake Zegrynskie before they discharge into the Wisla River. The project was identified during a DANCEE supported project for the Narew River catchment area. Three online monitoring stations were installed one for each of the discharge points from the Bug and Narew Rivers and one in the lake itself. By monitoring relevant parameters the system can warn against discharge of toxic or other harmful components to the lake whereby the drinking water intake can be closed before harmful matter reach the intake. The system can also indicate when water quality again is acceptable and the water intake can be started again.
The system which is based on the computer program MIKE 11/12 is also used to identify the source of pollution. This is important in preventing future accidents.

Oil Spill

DANCEE has supported the three Baltic States in developing a national oil-spill contingency plan. Further have these plans been implemented by providing equipment, airborne-surveillance systems, and reception facilities in ports.

Data collection of estimated quantities of oil spill in e.g. the Baltic countries, shows a general decline from 1996 to 1999 of 17 tons in 1996 (excluding Lithuania due to lack of data) to less than 7 tons in 1999 (including Lithuania). The decline is important to note due to HELCOM quantification of statistic increase in the amount of anticipated oil spill from 207 tons in 1996 to 343 tons in 2001. With an expected statistic increase of 60% in oil spills from oil handling activities in the Baltic region, a decrease of more than 40% in actual oil spills shows the effective results of a targeted and longterm committed technical and hardware assistance from among others the DANCEE programme.

3.3 Environment and Health Impacts

Impact on Local Water Environment

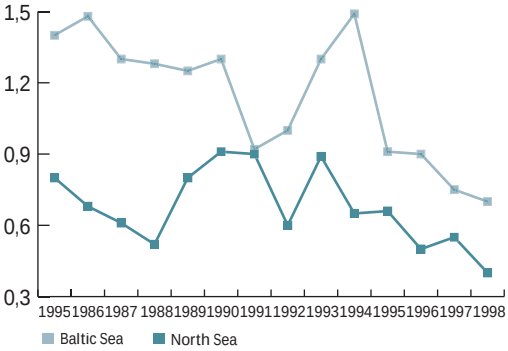
The "hotspots" as defined by HELCOM focus on the environment of the Baltic Sea. However, all over the CEEC there are local "hotspots" where the river environment is threatened by wastewater flooding, water resources are threatened by accidental spills from e.g. sludge or slurry lagoons or domestic and industrial wastewater discharge etc. The sewer pipeline renovations in St. Petersborg, Kiev, and other places have ensured stable function of main sewer systems and prevented collapse of sewers below main streets in central urban areas. Rehabilitation of pumping stations in Latvia and Ukraine have prevented discharge of untreated wastewater to urban water courses and wastewater flooding in urban streets.

Discharge from a wastewater treatment plant downstream of one town can be a threat to the water supply of the downstream town. Wastewater treatment plants do reduce the concentration of pathogens but since disinfection is not applied to the discharge a substantial amount of pathogens are still discharged to rivers. This poses both risks to the drinking water supply and to water recreational areas. DANCEE supported projects have improved local water conditions by improving wastewater treatment but also by centralising treatment cutting off discharges to recreational waters and discharging effluent downstream of main water intakes.

Biala and Nysa Rivers

The Biala River originates in the Jesenik area in the Czech Republic before it runs into Poland where it continues in the Nysa River. After Nysa the river joins the Oder River at Wroclaw. The DANCEE supported project for Mikulowice (4,000 inh.) on the Czech/Polish border reduced the discharge of pollutants to the Biala River less than 1 km upstream from the water intake to Glucholazy (25,000 inh.). Between Glucholazy and Nysa there is a major recreational area important for a growing tourist industry. DANCEE supported a project where Glucholazy town and villages along the Nysa river were intercepted in a collector and led to Nysa wastewater treatment plant. Support were given to the expansion of Nysa wastewater treatment plant. The projects also contributed to the improvement of the water quality in the river downstream of Nysa which serves as the water source for the Wroclaw urban agglomerate (1.5 million inh.).

Generally spoken it is not straight forward to compare river water quality from 1990 to year 2000. In the beginning of the 1990s many monitoring stations were out of function and data quality was doubtful. DANCEE has supported many projects setting up monitoring stations to be able to analyse the change in river water quality from interventions in the upstream areas. The effect in the immediate downstream area of a large wastewater treatment plant being commissioned for an urban area is evident especially concerning organic matter, nitrogen, phosphorous, and pathogens. However, the impact on many environmental toxics are less dramatic since many components accumulate in bottom sediments and are released over time.



Source: European Environment Agency
Change in average winter phosphate concentration in the Baltic Sea in the period 1985-98

Groundwater

The impact on groundwater from reduced discharge of heavy metals and hydrocarbons (in particular mineral oils) is evident but can not yet be documented. The improvements in groundwater quality will take many years to achieve because of time taken for pollutants to enter and move with the groundwater.

Baltic Sea

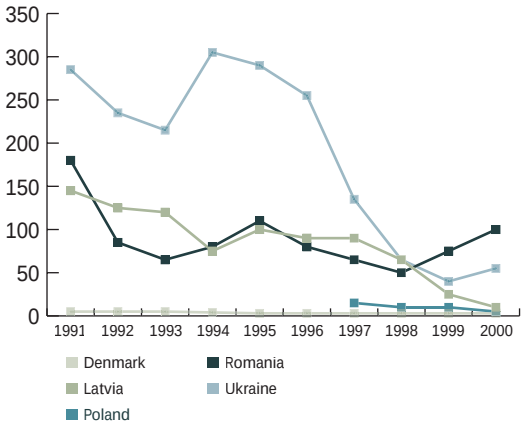
According to the latest report by the Helsinki Commission 22 out of 132 "hotspots" have been deleted to date. This originates both in introduction of wastewater treatment, cleaner technology in large industries, clean-up of military sites, improved slurry handling on large scale lifestock farms and reduced consumption of fertilisers and pesticides in agriculture. DANCEE has targeted 20 "hotspots" in the Baltic Sea region, which are not yet deleted from HELCOM's list.

The European Environment Agency (EEA) evaluates the causes of eutrofication in Europe's coastal water. The EEA report that both the coastal as well as the open Baltic Sea is affected by eutrofication with enhanced nutrient concentrations although the levels has decreased over the last 10 years. The highest load are found in estuaries and coastal areas close to rivers that drain agricultural and densely populated areas. Especially nitrogen loads have decreased into the Baltic Sea among others because of reduced fertiliser use in the CEEC draining into the Baltic Sea. Concerning phosphorous the targets set in the 1998 Ministerial Declaration of a 50% reduction of discharge from point sources has been reached. This is a clear result from interventions on both domestic and industrial wastewater.

In August 2001 HELCOM announced that the Baltic Region has reached its goal of reducing discharges of hazardous substances into the sea by 50%. HELCOM defined 47 hazardous substances such as dioxins and antifouling agents, and the discharge of the substances into the Baltic Sea have largely been reduced using both legal means and direct interventions. Also the phasing out of leaded vehicle fuel significantly decreased the discharge of lead into the Baltic Sea. Lead discharged through the exaust pipe ends on street surfaces and are washed into streams during rain. The reduction in discharge of hazardous substances comes also from closing down of factories but the introduction of cleaner technology and the cleaning up of contaminated sites has made its substantial contribution.

Impact on the Black Sea

Impact on the Black Sea will still be only at a few local spots. DANCEE support has concentrated on urban areas along the Danube river in Romania and urban areas in the Crimea Peninsula in Ukraine. Local effects can be registered but the massive environmental impact will come from implementing the EU supported wastewater projects in large cities like Constanta on the Black Sea coast. DANCEE has supported the preparation and the application for financing of these projects.



Source: EUPHIN

Viral hepatitis A incidence per 100,000

Health impact

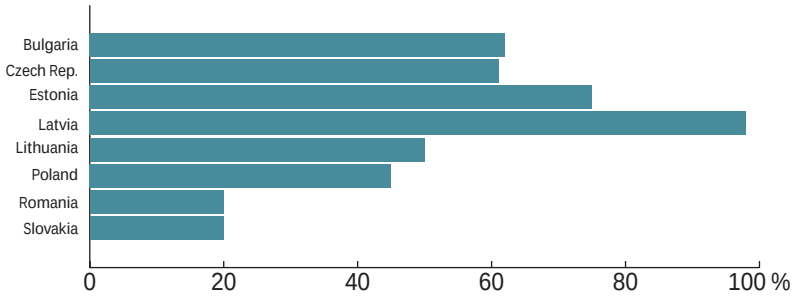
The DANCEE supported water quality projects in the CEEC can potentially impact health as follows:

- Improved treatment of municipal wastewater will reduce the discharge of pathogens. Less pathogens in surface waters means reduced risk of contamination of drinking water and reduced risks from direct contact with the surface water e.g. during bathing.
- Water saving measures leads to reduced hydraulic overloading of sewer systems whereby flooding of wastewater and discharge of untreated wastewater into surface waters are reduced. Thereby the risk of direct contact with wastewater is reduced.
- Rehabilitation of sewer lines reduces the incidents of collapse and thereby wastewater flooding. Rehabilitation of water pipelines reduce the possibility of drinking water being contaminated between production facilities and the consumer.
- Protection of groundwater against contamination with organic solvents, oilproducts etc. protects human health from drinking chemically contaminated water. The same apply to the reduction of industrial discharge of heavy metals, and other toxic substances.
- The reduction and improved control of oil-spill reduces incidents of chemical contamination either through bathing or through the consumption of fish (marine products).
- Connection of households to a central sewer system reduces the incidents of contamination of shallow wells by pathogens and nitrates from individual wastewater disposal systems.

The development of public health in the CEEC is monitored by the European Public Health Information Network for Eastern Europe, EUPHIN. It is a network supported by the WHO (regional office for Europe), the European Union, and the individual countries of CEE. Overall, the CEEC are experiencing a reduction in infant mortality rate and an increase in life expectancy. Health has improved considerably better in the Czech Republic, Poland, and the Baltic States but improvements are also recorded in the remaining countries of the CEE.

An indicator of improved health from improved water quality is the decrease in incidents of hepatitis A. This disease has not been prevalent in Poland and Czech Republic, but the Baltic States and Bulgaria and Belarus have come down from incidents levels between 150 to 250 per 100,000 to well below 100 incidents per 100,000 in year 2000 (EUPHIN).

A range of factors influences the above expressions of health where water environment is one factor. Other influencing factors are poverty, access to health care, and other environmental factors.
The DANCEE supported projects also assist the CEEC in moving towards compliance with the Protocol on water and health signed by 42 European Environment and Health ministries in London, June 1999.



Source: EU-DGENV (ECOTEC)
Wastewater treatment rates
(as % of population)

3.4 Cost Effectiveness

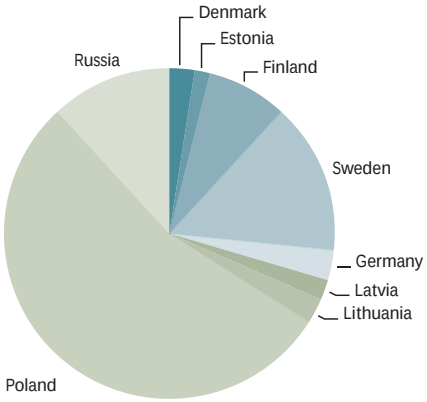
Improvements to the water environment can be achieved by a range of interventions, which include:

- Improvement in sewage treatment
- Reduction in airborne emissions
- Reduction in agricultural application of fertilisers on land

Generally the reduction in airborne transmission of e.g. nitrogen is relative expensive compared to interventions in agricultural land management and sewage treatment. Reducing the discharge of phosphorous can not be obtained by reducing air emissions.

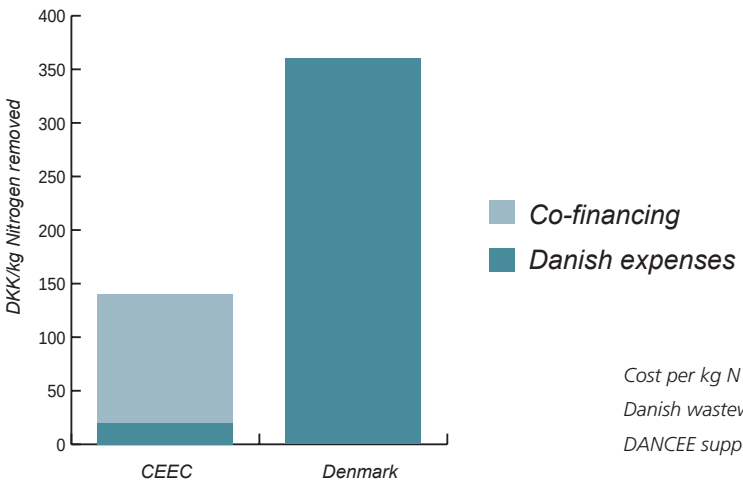
The cost efficiency of an intervention has to be measured against the objective of the intervention. The objective could be the local water quality of a river or a bay or it could be regionally like interventions for improving the nutrient conditions in the Baltic Sea. An investment can thus have both a primary objective in improving local water quality and a secondary objective of contributing to reduced nutrient discharge to the sea.

As a consequence of the Danish Action Plan for the Aquatic Environment Denmark has the most extensive treatment of wastewater and the highest level of connection rates when compared to Eastern European countries around the Baltic Sea. Nitrogen and phosphorous is reduced by more than 90% in general in Danish waste water treatment plants. Investments in Danish treatment plants to remove further nitrogen and phosphorous will have a relative high cost in terms of investment per kg nutrient removed per year. In the CEEC 20 to 70% (depending on country) of all wastewater is treated before discharge to rivers or directly to the sea. In most of the CEEC treatment plants up to 30% of nitrogen and phosphorous is removed. A considerable investment is required to upgrade these treatment plants to more than 90% removal of nitrogen and phosphorous, which will be required in the EU Urban Wastewater Directive. Still, the nutrients that are removed has a comparable lower investment cost per kg nutrients removed per year compared to the necessary investment in the present Danish wastewater treatment plants.



Source: HELCOM
Distribution of N-discharge in the Baltic Sea countries 1995

On DANCEE wastewater treatment projects in the CEEC the total investment cost in nitrogen removal has been DKK 2,300 million (EUR 300 million) with a DANCEE support of DKK 377 million (EUR 50 million). On average the cost per kg N removed has been about DKK 135. As DANCEE on average only has financed 16% the cost for DANCEE has been DKK 22 Per kg N removed. The investments in Danish wastewater treatment plants during the Action Plan for the Danish Water Environment was about DKK 6,500 million (EUR 855 million) which resulted in an investment cost of about DKK 360 per kg N removed.



Cost per kg N removed compared between Danish wastewater treatment plants and DANCEE supported plants in CEEC.

The 50% reduction in nitrogen and phosphorous discharge to the Baltic Sea required according to the Helsinki Convention is according to R.K. Turner achieved with a mix of measures in agriculture wetlands and sewage treatment plants. According to Turner the most cost effective strategy is applied to Poland which accounts for 40% of the necessary reduction. The most cost effective way of reducing phosphorous is by sewage treatment. A relative higher load of phosphorous comes from household and industries. Poland, Russia and the Baltic States around the Baltic Sea accounts for 72% of the most cost effective nitrogen reduction and 90% of the phosphorous reduction. It is part of DANCEE's strategy to support investments in nutrient reductions in these countries around the Baltic Sea.

The municipality of Nysa, Poland raised this stone in 2001 to show gratitude towards the Danish support to environmental improvements

References

Baltic Environmental Forum: 2nd Baltic State of the Environment Report, 2001.

Baltic 21: Development in the Baltic Sea Region towards the Baltic 21 Goals – an indicator based assessment. Baltic 21 Series No. 2/2000, 2000.

BOING: Eutrophication in the Baltic Sea. Newsletter 2, May 2001, 2001.

DANCEE: Application of Institutional Development Indicators, 2001.

DANCEE: "Expost Examination" of the DANCEE supported Wastewater Treatment Plants in Poland, 2001.

DEPA/DANCEE: Annual Reports 1995-2000.

DEPA: Environmental factors and health, 2001.

DEPA/DANCEE: Danish cleaner production projects in Central and Eastern Europe 1991-1995. Environmental Review No. 2, 1996.

DEPA/DANCEE: Miljøsamarbejde i Østersøregionen, 2001.

DEPA: Romanian-Danish Environmental Co-operation, 1998.

DEPA: EU's enlargement towards the East – environmental perspectives, 1997.

DEPA/DANCEE: Annual reports 1995-2000.

EU-DGENV: The benefit of compliance with the environmental acquis, ECOTEC, 2001

European Environment Agency: Europes Environment, The Dobris Assessment, 1995.

European Environment Agency: Marine and coastal environment. Annual topic update 2000. Topic report 11/2001.

European Environment Agency: Europe's Environment: The Second Assessment. Elsevier Science Ltd. 1998.

Helsinki Commission: Environment of the Baltic Sea Area. Baltic Sea Environment Proceedings No. 82A, 2001.

Helsinki Commission: Evaluation of the Implementation of the 1988 Ministerial Declaration regarding Nutrient Removal, 2001.

Helsinki Commission: Oil Handling in the Baltic Sea Area, 1996-2000.

PLS Consult: Project Evaluation of the Environmental Support Fund for Eastern Europe 1991-1996, 1999.

REC: Strategic environmental issues in Central and Eastern Europe, 1994.

R.K. Turner et al.: Ecological Economics 30 (1999) 333-352.

UNEP: Bucharest Convention. Convention on the protection of the Black Sea against pollution, 1994.

WHO: European Public Health Information Network for Eastern Europa, EUPHIN. WHO regional office Europe, 2001.

WHO: Concern for Europes Tomorrow. WHOs European Center for Environment and Health, 1995.

World Bank: Environment and Health in Central and Eastern Europe, 1994.

CHAPTER 4

DESCRIPTION OF THE DANISH ASSISTANCE

Within the water environment sector more than 400 projects have been executed in the CEEC at a total Danish support of DKK 1.4 billion. About DKK 0.9 billion was allocated for investment projects which directly attracted DKK 4.5 billion of local investments. The about DKK 0.5 billion for technical assistance were targeting project preparations, which is now leading to an overall investment of the size DKK 20 billion. This investment is a combination of local financing, export credits, loans and grants.

The high degree of co-financing from recipient countries indicates that the supported projects have been clearly in demand in the CEE.

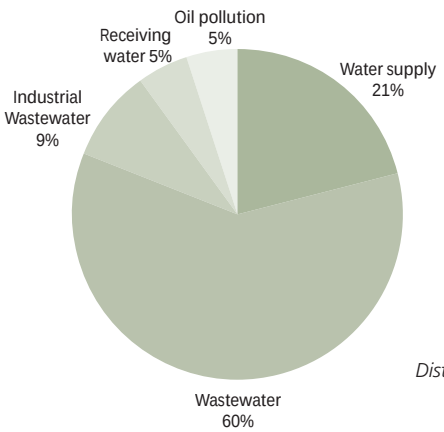
4.1 Basis for Prioritising the Assistance

The Danish support to the water environment in the CEEC has grown from approximately DKK 40 million/year to over DKK 200 million/year in 1999. Projects have been selected based on a set of priority factors and in co-ordination with donorcountries and international financing institutions. The DANCEE prioritisation includes:

- Priority in the recipient country
- The efficiency of the intervention
- The location of the project
- Possibility for co-financing

The Ministry of Environment in the individual recipient countries co-ordinates and prioritises projects, which are presented by municipalities or other national or local authorities for external financing. Included in the national prioritisation is the contribution from the project to comply with international environment and nature conventions signed by the country. To reduce potential conflicts between countries, Denmark also emphasises cross-border projects where e.g. discharges from one country pollute the water resource of a downstream country.

The supported intervention projects should have their environmental effect clearly expressed to evaluate the investment efficiency in terms of environmental improvement.

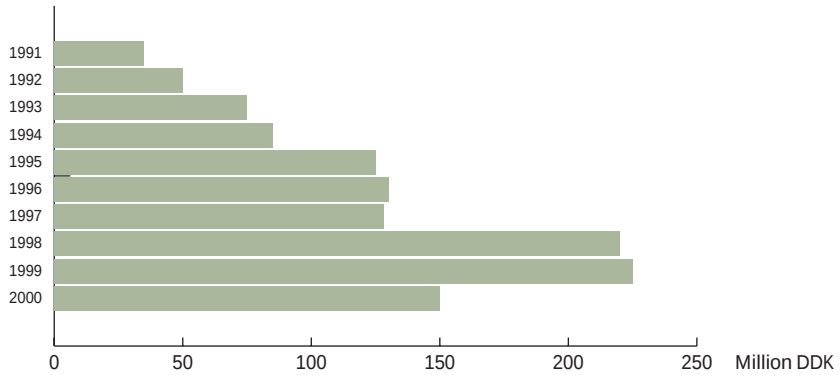


Distribution of water quality projects based on costs

Distribution of 10 years support

The overall geographical prioritisation for Denmark was in the beginning of the period primarily targeting the improvement of the Baltic Sea. This included countries like Poland, The Baltic States, Belarus, The Baltic catchment area of Russia and Ukraine. Through the 1990s the projects have also targeted countries in Central Europe and countries discharging to the Black Sea (Romania and Bulgaria).

Until 1998, projects that showed visible results were prioritised over studies and project preparation. Towards the end of the 1990s, project preparation increased because of the need to support countries of the CEE first in line in preparing for EU supported projects (LSIF, ISPA). At the same time increasing



Development of DANCEE support to the CEEC water environment

focus have been on the remaining CEEC where the Danish support also is paving the way for EU grant financing. The development is seen on the following graph, which shows the development of the Danish annual commitment to countries of the CEE within water environment.

Since 1999 the assistance to the preparation for the large EU grants (institutional projects) has played an important part of the total Danish support. This includes support to identifying the needs for adapting local regulation to EU directives and to identify the required investments. The strong participation of Denmark in this preparation phase is ensuring that Danish know-how and technology is continuously being presented to all countries of the CEE.

Following the formation of the Helsinki Commission (HELCOM) Denmark contributed to identifying "hotspots" in the catchment areas around the Baltic Sea. The identification of "hotspots" assisted in targeting interventions supported by the donor countries. DANCEE projects have contributed to the deletion of 20 "hotspots" (out of 132) in the CEEC discharging to the Baltic Sea.

Source: HELCOM

HELCOM, The Baltic Marine Environment Protection Commission, or Helsinki Commission, launched a programme called the Baltic Sea Joint Comprehensive Environmental Programme (JCP) in 1992. The programme aimed to reduce the input of nutrients, heavy metals and toxic or persistent organic substances to the Baltic Sea by 50% before 1995. A major goal of the JCP was to create an inventory of "Pollution Hotspots" and the priority needs for each. These "hotspots" constitute various point sources of pollution – such as industries and sewage plants – and regions having considerably diffuse nutrients loads.

According to HELCOM, municipal and industrial "hotspots" include those emitting high and/or significant amounts of polluting substances, such as hazardous substances, phosphorus, nitrogen and organic matter released via rivers or directly into the Baltic Sea. Examples include wastewater collection and treatment systems that fail to efficiently treat hazardous substances, leaking sewer networks, and industrial facilities leaking high, and/or significant amounts of substances such as salts and oil, contributing to effects such as turbidity, siltation, and thermal effects significantly effecting marine and coastal species.

DANCEE concentrates the support to the water environment on five intervention areas:

- Drinking water and ground water
- Domestic wastewater
- Industrial water pollution
- Receiving waters
- Oil spill

For each of the prioritised intervention areas a set of indicators have been applied to express the environmental effect of the intervention.

4.2 Integrated water and wastewater development

DANCEE has from the early start of its assistance focused on development of water and wastewater according to a holistic and integrated approach in order to obtain a maximum environment and health impact from investments in the sector.

Therefore, a part of the DANCEE support to the sector has been allocated the preparation of feasibility studies and other project preparatory work for water and wastewater development. DANCEE has up to now focused mainly on large and medium sized cities and the assistance has covered several countries of the CEE.

Focus has been given to the identification of affordable service levels, tariff scenarios, and development of prioritised investment plans. The project preparatory work has been carried out in advance of further DANCEE investments in a particular city or has been project preparatory work for envisaged loans by one of the large international financing institutions (eg. WB and EBRD).

Increasingly over the years, the link and interaction between technical, institutional, and financial aspects of sector development have been incorporated in the project portfolio. Therefore, DANCEE has supported preparation of country and regional financing strategies as well as a tool for addressing the affordability question. The legal framework, hereunder approximation towards EU, has also been part of the project portfolio.

4.3 Drinking Water and Groundwater

Under the drinking water and groundwater heading DANCEE has carried out some 100 projects within water resources management and water supply operations at a total amount of EUR 36.6 million. The total cost of projects supported by DANCEE has been EUR 155 million.

Water resources management projects have been implemented within the whole spectre from overall groundwater resources management and monitoring at country level to groundwater and surface water investigations at city level, hereunder modelling of the groundwater resources.

A large part of the DANCEE financial support has been allocated to physical improvement of water supply systems in both large and smaller cities spread over the entire CEEC. Investments have been within water intakes, water treatment plants and distribution systems. Often the investments have been identified in a project preparation/feasibility study carried out previously or simultaneously with the investments. The projects have mainly two objectives either a health objective by ensuring an acceptable water quality or a cost reduction objective. Cost reduction is achieved either through a reduction of the Unaccounted-for-Water in the distribution or through rehabilitation of energy consuming parts of the existing system.

A few projects have focused on establishment of hydraulic network models for the distribution network a necessity for efficient management of the water system and a tool in water demand control.

Increasingly projects dealing entirely or partly with water conservation are being implemented. The reason for this is an acknowledged need for demand management to control the currently high unit water demands (in particular in CIS). Control of the water demand might reduce the investment needs in water supply and wastewater treatment. Projects have dealt with water conservation on many levels. A national strategy has been prepared for a whole country, metering programmes have been designed and implemented in several cities, leakage detection equipment and training has been provided to several water utilities, and several projects have included development and implementation of water conservation campaigns.

Training has been an important part of most projects but some projects could however be categorised as training or capacity building projects in themselves. A couple of twinning type arrangements have been made between Danish municipalities and municipalities in the CEEC. Chapter 5 describes the cooperation with stakeholders in more detail.

Finally, DANCEE has over the years provided technical assistance to local water and wastewater utilities in the implementation of large scale internationally financed projects. This assistance has been in the form of **provision of staff to PIU** (Project Implementation Units). The demand for this type of assistance is increasing with the implementation of the ISPA-programme.

4.4 Wastewater

DANCEE has supported over 200 projects within municipal wastewater management. The total support has amounted to EUR 102.5 million. The total cost of projects supported by DANCEE has been EUR 497 million

The recipient countries have prepared many of the wastewater projects themselves. Still there has been a need to update projects and to adapt them to more advanced technology. Projects that could be directly continued in an intervention were prioritised. The project preparation included the dimensioning of wastewater treatment plants, of sludge handling facilities, and hydraulic modelling of wastewater systems.

The interventions in **wastewater treatment plants** have included Danish technical assistance in dimensioning, specifying, and supervising installations and supply of mechanical and electrical equipment. The recipient countries typically financed civil and structural works. Many treatment plants have been upgraded to reduce the discharge of nitrogen and phosphorous. This includes provision of Danish equipment like blowers, mixers and instrumentation. Another common intervention has been the installation of automatic control and computerised monitoring, which greatly improves control and supervision of plant operation.

A number of projects have developed lowtechnology solutions for small communities (where the water environment was sensitive to pollution). This includes sandfilter, reed beds or lagoon systems.

Other interventions concentrated on the sludge handling to reduce the water pollution from sludge lagoons, which has been a typical way of disposing surplus sludge. By providing sludge dewatering equipment and improvements to digester performance, the amount of sludge to be disposed of is reduced by more than a factor 10.

Within sewer systems there has been a great need to reduce infiltration and exfiltration from corroded or broken pipes. Wastewater is leaking out above the groundwater, and water is seeping into untight sewer pipes where they are located below groundwater levels. This has led to groundwater pollution and hydraulic overload of wastewater treatment plants. Denmark has a particularly high level of expertise within pipeline renovation of the Nodig method. This has been demonstrated through a number of projects in the CEEC where both the construction time and the disturbance to urban traffic were dramatically reduced.

Energy saving in wastewater treatment plants and pumping stations targeted to reduce operating cost and CO_2-emissions from coal-based energy production. The payback period for new pump installations has in cases been less than two years where energy consumption has been more than halved.

During the implementation of the projects, expertise has been provided for **construction management** to apply modern Danish methods within quality assurance, financial management and construction planning. Assistance has been provided both on partly Danish financed projects, but also on projects financed through the EU and other international financing institutions.

Training has been an important part of many projects. Some projects are capacity building as its main focus to ensure the future handling of the investments. The training both included technical and administrative matters. The technical aspects include everything from planning, project preparation and project implementation including computer modelling. On the administrative side the focus has been on future organisation of institutions and development of water companies into autonomous and efficient operators.

The Vilnius wastewater treatment plant have greatly impoved water quality of the Neris River

4.5 Industrial Wastewater

The focus on industrial water pollution control is similar to the focus on municipal wastewater treatment. DANCEE has supported 50 projects at an amount of EUR 15.7 million. The total cost of projects supported by DANCEE has been EUR 45 million

The goal is to protect surface water resources, major rivers, the Baltic and the Black Sea. HELCOM identified a long range of **industrial "hotspots"** located either on the cost or along the major rivers leading to the Baltic Sea. Many types of industries are represented like metal, pulp and paper, chemical, food, textile etc. Also included are the large livestock farms particularly present in Russia. "Hotspots" has similarly been defined for the Black Sea particularly in the Donau river basin.

Compliance with **EU's IPPC-directives** has been another goal of the industrial projects. This implies that Best Available Technology (BAT) is applied, a technology that in general is available in Denmark.

The DANCEE supported projects within industrial water pollution has concentrated on applying **cleaner technology.**

Cleaner technology means to arrange production in a way that will result in:
- Minimum consumption of water, energy, and raw materials
- Minimum amounts of wastes
- Reduced toxicity of waste
- Substitution of chemical compounds and processes harmful to the environment and health.

Formerly it was an acknowledged procedure to get rid of industrial waste products by discharging into rivers and lakes. Alternatively to treating the discharge, which require energy, leading to increased discharge of SO_2, NO_x and CO_2, the concept of cleaner technology were introduced.

The key difference between pollution control and cleaner technology is one of timing. Pollution control is after the event "react and treat approach", cleaner technology is preactive "anticipate and prevent" philosophy.

DANCEE projects within industrial pollution have concentrated on a broad range of industries, where Denmark today have a highly modernised (also in environmental terms) production facilities. The support from Denmark was typically provided through a combination of consultants, institutes, and representatives from industries. Food industries (like slaughterhouses), metal industries (like galvano) and chemical industries (like pulp, paper and tanneries) were targeted to reduce water consumption, reduce wasting of organic matter, heavy metals and chemical components and to reduce energy consumption. In many places a typical win-win situation was the result when **production cost** was dramatically **reduced** and at the same time **pollution was minimised**. A substantial part of the potential for this was realised through a change in operation, better maintenance, and minor improvements of existing equipment.

Some of the industries targeted in the DANCEE industrial projects could not discharge their wastewater to their municipal wastewater treatment plant. The reason was that their wastewater was either toxic to the biological processes or it would contaminate the sludge and thereby prevent it to be applied on agricultural land. Through a combination of **cleaner technology and pretreatment** these discharges can now be directed to the municipal wastewater treatment plant and the direct discharge to a recipient from the industry can be closed.

Through all the projects, **training** has been a key component both for local consultants and industrial engineers and technical personnel at the enterprises. Projects also served as demonstration projects stimulating local investments in further introduction of cleaner technology.

A special type of industrial water pollution control projects has been the support to **large scale livestock farms.** The pollution problems from storing of slurry were substantial and Danish technology from industrial farming i.e. water conservation and slurry handling have been introduced. Also in this case it was demonstrated that waste is a resource as slurry has been applied as fertiliser (frequently unaffordable to farmers) leading to a substantial increase in crop production.

The containment of industrial sludge in **earth dams** has created situations where potential pollution disaster is eminent. DANCEE supported projects have as an immediate intervention supported the securement of earth dams and provided a shortterm plan for treatment of the highly toxicious sludge and thereby the future closure of these dams.

4.6 Receiving Waters

DANCEE has funded 28 receiving water projects primarily in Poland and the three Baltic States. The support amounted to EUR 8 million. The total cost of projects supported by DANCEE has been EUR 13 million.

Generally speaking, the projects fall into two main categories: **environmental monitoring** and **environmental/nature management.** Within each category, both projects at the national level and at a local level have received funding.

Environmental monitoring is carried out with different purposes. It is a prerequisite for evaluation of status and trends in environmental quality, in this case of the aquatic environment, and the recipients of information from monitoring exercises can be both local, regional and national authorities, and international bodies e.g. the HELCOM. Based on such monitoring, policies aimed to control and manage the water environment are developed and specific action initiated as necessary. Moreover, monitoring programmes are often set up to study the effect of actions implemented to improve water quality or of projects that are known or anticipated to have a qualitative or quantitative impact on the water environment. In some cases the monitoring results are used to adjust projects or regulatory actions to ensure compliance with water quality objectives.

The political and administrative structures and processes in the region have undergone major changes following the collapse of the old regimes in 1989/1990. This has resulted in a significant need also among the authorities and institutions involved in environmental monitoring to adapt to the new situation and requirements, both nationally and internally and in particular in the light of the efforts of most of the CEEC to access the EU as soonest as possible. Institutional capacity strengthening and revision of monitoring strategies and programmes have therefore become key elements of many of the projects within this field.

Also the scientific and technical aspects of monitoring in the aquatic environment have been addressed in the projects. Some projects have directly aimed to establish the technical basis and know-how to monitor water quality and identify pollution sources in a local context, e.g. in relation to port activities or the creation of reservoirs for water supply. Others have comprised monitoring activities in a pilot area with the aim to illustrate how general strategies for national monitoring programmes can be implemented in practice. Both types of projects have typically involved the whole sequence of activities related to monitoring: setting up the monitoring stations in the field, undertaking analyses in the lab, analysing, storing and presenting data using modern IT-technology.

Often the monitoring projects have contained some elements of environmental management and vice versa. However, **the environmental management projects** differ from the monitoring projects by focusing on analysis of the obtainable information, e.g. from monitoring activities, to identify possible needs for measures to improve the situation and to develop specific proposals for policies and actions to reach the goal.

Mathematical models are often used as decision support tools for such purposes and in several cases both hardware and software has been delivered, and training in the understanding and use of the models has constituted an integrated part of the projects. E.g. in relation to a planned water supply reservoir in Poland, it could be demonstrated by use of mathematical computer models that the design of the reservoir would not lead to significant negative effects downstream. On the other hand it was shown that with the existing pollution level in the major river supplying the reservoir, eutrophication resulting in inadequate drinking water quality would probably occur.

Over time Poland has been hit by serious **flooding** along the Oder and the Vistula Rivers. The flooding along the Oder River in the summer of 1997 was disastrous as water rose to 4 m high in the streets. More than 140,000 people were evacuated as 86 towns and 845 villages were flooded. Flooding also hit the Czech Republic and in both cases the damages to infrastructure and properties were several billions DKK.

DANCEE reacted immediately by providing equipment for emergency water supply and drain pumps, and by identifying infrastructure components that needed immediate rehabilitation. The projects included rehabilitation of water works, boreholes, supply systems, and wastewater treatment plants.

The MARPOL 73/78 *Convention, "The International Convention for the Prevention of Pollution from Ships", contains detailed regulations covering the various sources of ship-generated pollution World-wide and is also binding for countries bordering the Baltic Sea region. The Helsinki Convention of 1992 also aims to prevent the Baltic Sea from pollution of crude oil and oil products.*

The flooding assistance also provided a flooding monitoring and alert system for both Poland and the Czech Republic. Included was a computer model which can simulate flow and water level in the river systems and forecasting of flooding based on weather forecasts on precipitation. The model also provided the possibility of developing a long term strategy for controlling flood.

4.7 Oil Spill

DANCEE has supported 20 projects within oil spill at a total amount of EUR 8 million. The total cost of projects supported by DANCEE has been EUR 18 million.

The main environmental and economic consequences of oil spills are:

- Death to oiled sea birds and other aquatic marine organisms
- Local contamination of the seabed by sinking heavy fractions of oil causing adverse impacts to fish spawning areas, resulting in reduction in fish stocks. Consequently, economic losses to the fishing industry
- Economic losses for the tourism industry and local communities, and thus the state because of oil-contaminated beaches
- High costs associated with the cleanup of shorelines and beaches

DANCEE is the largest financial contributor supporting oil contingency plan preparation and reception facilities for shipgenerated waste in the Baltic Sea region. The assistance within preparation of oil contingency plans (institutional investment plans and cofinanced hardware deliveries) and reception harbour facilities (organisational, institutional and investment plans) allows the cooperative countries to comply with the MARPOL Convention and HELCOM requirements.

DANCEE has in close cooperation with e.g. Finland and HELCOM launched a number of activities assisting the environmental and harbour authorities along the Baltic Sea preparing for and beginning to implement oil contingency plans and upgrading of reception facilities in main harbours. Furthermore, purchasing of international compliant response equipment enables the countries to take targeted actions in case of marine oil spill.

References

DANCEE: Danish-Polish Environmental Co-operation 1991-2000, 2001.

DANCEE: Cleaner Technology Transfer to the Polish Textile Industry

EU, DG Regio: ISPA, mandate, programming and implementation, 2000.

Helsinki Commission: Home page www.helcom.fi, 2001.

CHAPTER 5

DANCEE SUPPORT TO THE CEEC ACCESSION INTO THE EU

The EU accession countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia) have in the socalled Accession Partnerships – the national programmes for implementation of the European Community's regulation – committed themselves to gradual implementation of the Environmental Acquis.

The DANCEE support to the CEEC accession into the EU takes two principle forms:

- Approximation to EU directives
- Preparation of EU financed projects

5.1 EU Approximation

The EU directives, which are directly relevant for the water environment are the Directives on Water Quality and the IPPC Directive targeting industrial installations. DANCEE has supported especially countries of CEE around the Baltic Sea, in adapting their legislation to the Water Quality and IPPC directives. The studies include necessary investments to bring countries in line with the requirements in the directives. A realistic implementation plan is prepared taking into account the financial, administrative, and technical capacity of the recipient country. Many countries are given a 10-15 year period to fully comply to the directives. Included in the financial capacity is the affordability of consumers to pay tariffs and for industries to invest in cleaner technology.

EU Water Quality Directives

The EU Water Quality Directives is a term encompassing the EU Directives related to Water Quality i.e. Directives on Urban Wastewater Treatment, Drinking Water, Bathing Water, Dangerous Substances to Water, Nitrates, and other directives.

In year 2000 the EU passed the Water Framework Directive which is an umbrella directive for all the Water Quality Directives.

The IPPC-Directive (Integrated Pollution Prevention and Control)

The IPPC-Directive is about minimising pollution from industrial point sources. All installations covered by Annex I of the Directive are required to obtain a permit which must be based on the concept of Best Available Technique (BAT). The IPPC Directives implies that uniform EU permitting rules are applied which will avoid the socalled environmental dumping where companies move from one part of EU to another because the environmental requirements are less strict there.

5.2 Preparation of EU Financed Projects

EU is supporting investments in large environmental projects through the ISPA funding. Every year the ISPA resources are allocated among the recipient countries according to population, per capita GDP and land surface area.

ISPA. Instrument for Structural Policies for Pre-Accession

Over the period from 2000 to 2006 a total of EUR 1,058 million per year are allocated for large infrastructure projects in the CEEC applying for EU memberships. Half of the funds are earmarked for transportation projects, the other half for environmental projects. The projects must be larger than EUR 5 million and the project should clearly document that they support EU membership and compliance to EU Directives.

In the beginning of 1999 it was realised that virtually no project preparation for the ISPA facility were taking place because EU had not provided resources for technical assistance to the project preparation. DANCEE therefore in 1999 supported the preparation of terms of reference for 65 ISPA environment projects in 9 of the 10 applying countries of the CEE. The terms of reference were handed over to the applying countries and the EU for further project preparation.

Following the support to prepare terms of reference for ISPA application, DANCEE has supported preparation of ISPA applications for countries of the CEE in the Baltic Sea watershed and Bulgaria and Romania. These applications typically included feasibility studies, financial analysis, and environmental impact assessment. These projects are purely technical assistance as it is the policy of EU not to co-finance these projects with bilateral grants. The remaining financial resources for an ISPA project is to be provided by the recipient country sometimes through a loan from EBRD, NEFCO/NIB or EIB.

CHAPTER 6

CO-OPERATION WITH RECIPIENT COUNTRIES

The cooperation with recipient countries has developed positively in the 10-year support period. The mutual understanding of technical, institutional and political issues on both sides has resulted in efficient implementation of projects and sustainable operations of investments. Both in Denmark and in the CEEC has the employment in the water sector increased. In the CEEC new industries have been developed and local democracy enhanced by involving all relevant stakeholders in project preparation.

6.1 Basis for Co-operation

Over the past 10 years DANCEE has increasingly implemented environmental projects in CEEC following a holistic approach. The socalled Project Cycle provides a good illustration of the context in which projects are implemented. Danish and Worldwide experience has shown the high value of focusing on appropriate project preparatory activities and postimplementation activities in order to achieve sound, sustainable and efficient solutions.

Proper project preparatory activities (identification, preparation and feasibility studies) are necessary to ensure that environmental efficient solutions are implemented, which are acceptable and affordable to the recipient communities. DANCEE has emphasised this to avoid projects with too large or too small capacities, inappropriate technologies or projects located in the wrong place.

Project sustainability also requires that the postimplementation activities are properly considered. DANCEE has therefore supported the developing organisations (or companies) that are capable of protecting the investments and ensuring its expected benefits by enhancing autonomous decision making, developing management skills and operation and maintenance procedures.

6.2 Co-operation with Stakeholders

National level

DANCEE has cooperated with stakeholders at national, regional, and local levels. Through its first ten-year period DANCEE has co-ordinated its works with its national counterparts in the Ministry responsible for the environment. The Ministry has ensured that projects selected for DANCEE support follows national policies and priorities within improvements to the water environment.

Over the years DANCEE has cooperated with a number of national line ministries in approximating local legislation to EU directives (see Chpt. 2.2), developing water sector strategies and management of international funding.

DANCEE Support for Capacity Building in the Russian Environmental Funds

DANCEE has, in order to contribute to Russia's potential for financing of environmental projects, supported capacity building in the Russian Environmental Fund system. The project resulted in an action plan for strengthening the management and operation of the funds, manuals for use by fund employees, and the dissemination and approval of these results at a seminar with participation from the Russian ministry of environment and most of the regional and local environmental funds.

A long range of local projects also involves cooperation with national ministries, institutions, and commissions, e.g. in setting of water tariffs, financing of projects and improvement of waterrelated public health.

Co-operation on national level has also taken place within the industrial sectors, where sector research institutes or environmental committees have assisted in identifying industries for demonstration projects and have been in charge of dissemination of the results.

Local project co-ordinators located in the recipient countries have facilitated the co-ordination between DANCEE and the local stakeholders, and have contributed to the sustainability of the projects.

Regional level

Co-operation with regional stakeholders has taken place on a number of DANCEE supported soil and groundwater protection projects. An example of a regional groundwater project is the project on training the Polish Railway Company in the Wroclaw region (see chapter 3.2).

Nature protection projects have been carried out in The Baltic States and Poland with both regional and national authorities. These projects also focussed on clarifying future responsibilities in managing natural treasures.

Other projects supported the cooperation between Danish counties (Fyn, Vejle and Sonderjylland) and local regional authorities on improving monitoring of the water environment.

On a broader level the feasibility of regional focusing is also taken into account in the country-programming process.

Local Level

The most extensive cooperation on DANCEE water environment projects has taken place with municipal owned water companies. In connection with project preparatory activities and actual project implementation, a wide range of skills and technical know-how has been transferred to the management level of a water company. DANCEE projects have included an institutional component in most feasibility studies, which focussed on financial and operational improvements of a water company and general management skills. The cooperation on projects has also introduced the advantage of new (and often Danish) water technology.

Modernisation of the Kiev Vodokanal

DANCEE has supported the modernisation of Kiev Vodokanal serving approximately 2.6 million inhabitants in the capital of Ukraine.

The project consisted of feasibility study and project preparation for:

- An institutional development programme
- A financial and operational performance improvement programme and an immediate investment programme.

The institutional development programme focused on a development of the water company into a more autonomous organisation, which requires development and formulation of the legal basis, a functional analysis, and development of the management information system.

The financial and operational performance improvement programme focussed on the day-to-day business of the water company including:

- Billing, collection and customer services
- Financial management and reporting
- Tariff policy
- Organisation effectiveness and efficiency
- Operational effectiveness and efficiency.

An immediate investment programme for about EUR 200 million was identified comprising efficiency improving investments in water supply, wastewater collection and wastewater treatment.

In Russia, Ukraine, and Belarus the local professional partners have been branches of government institutes or design bureaus. In the remaining recipient countries a growing number of local consulting companies are involved on DANCEE projects as local professional partners.

With the large investment support from EU through the ISPA program, DANCEE has responded to the need for preparing projects for international financing and developing skills in international tender procedures and contracting (FIDIC).

The transfer of Danish know-how takes place during the day-to-day cooperation on projects, on workshops, and seminars, and finally through dissemination of project results and by demonstrating the effect of implemented projects.

A number of twining projects in the Baltic States between Danish (Copenhagen, Aarhus and Viborg) and local municipalities served the purpose of longterm cooperation to improve technical-administrative skills in municipal departments.

DANCEE supports the implementation of the Aarhus convention by supporting public participation and awareness activities. This has been necessary in many aspects, among others to convince consumers of the necessity of water saving and increasing water tariffs. Within nature protection the management of natural park, the provision of facilities for visitors has improved the awareness of the necessity in protecting the nature and enjoying it in a sustainable manner. Increased awareness has also increased the public pressure on authorities in meeting the EU environmental requirements.

CHAPTER 7

EXPORT OF DANISH KNOW-HOW AND TECHNOLOGY

7.1 The Danish expertise

The Danish Action Plan for the Aquatic Environment has supported the development of equipment and technology so that wastewater can be treated in the best way possible and groundwater reserves better protected. A significant additional benefit is the technological innovations, which provide Danish companies great export opportunities in international markets. In 1998 Danish companies exported for more than EUR 270 million within the water sector alone. About 12% of all Danish product export to the water sector went to the CEEC. Of the total export of consultancy services 36% went to the CEEC.

About 80 different companies or public institutions have been project holders of the 400 DANCEE water environment projects. A similar amount of sub-suppliers have been involved.

When OECD at the end of the 1990ies accessed the Danish environmental policy it concluded that the Danish environmental policies did not adversely affect Denmark's economic growth or international competitiveness - on the contrary. According to the OECD, environmental protection is an important sale pitch for Danish industry.

7.2 Product export

The value of product export to the water sector was calculated in 1998 as more than EUR 220 million, equal to 0.5% of Denmark's total exports in 1998. The export to the CEEC has been promoted and stimulated through DANCEE supported projects. In the beginning of the 1990ies this export was almost totally donor financed. Through the 1990ies some Danish companies have increased their export reducing their dependency on Danish donor projects. Customers to Danish products are projects, which are financed through combination of local and international contributions.

Company	Annual turnover 2000 (million EUR)	DANCEE-turnover (%)
Grundfos	Approx. 130	< 1%
Per Aarsleff	19,7	17%
Alfa Laval	5,2	12%

Annual turnover on the CEEC market for selected Danish suppliers/contractors

Within water supply the product exports have been dominated by groundwater pumps, valves and control systems for groundwater supply, equipment for water works and rehabilitation of water networks.

Within wastewater the product exports have constituted online monitors, valves, pumps and aeration equipment for wastewater treatment plants, sludge dewatering equipment, turn-key treatment plants, automatic control systems and sewer rehabilitation technology.

For the cleaner technology projects in the industrial sector product exports have included installations for saving water consumption and a variety of equipment related to the individual production type with the purpose of reducing consumption of resources. Product exports have also included improvement to the working environment.

Within receiving water projects the Danish product exports have included automatic water quality monitoring stations both on rivers and at the sea, environmental information systems, river modelling programmes, laboratory equipment and a variety of nature preservation equipment.

Control equipment for marine oil spill incidents are exported, which includes ships, booms, and oil skimmers. Export to improve reception facilities for ship-generated waste, which includes pumps and tanks.

7.3 Consultancy export

A broad range of Danish consultancy companies and specialist institutes export consultancy services to the water sector.

The Danish environmental assistance programmes have allowed Danish consultancy companies to gain experience in working with environmental problems in the CEEC-markets and to build-up new markets preparing these companies to participate in the competition for future international project export.

The total annual turnover on the CEEC-market for members of the Danish Association of Consulting Engineers grew from almost 2000 in 1990 to over EUR 40 million in year 2000 on water projects. Of this 35% was on DANCEE financed projects.

Industries:

A	Alfa Laval
D	Danfoss
F	Per Aarsleff
G	Grundfos
V	AVK

Consultants:

B	Carl Bro
C	Cowi
H	DHI
N	Niras
R	Rambøll

Location of subsidiaries for selected Danish industries and consultancy companies

References

Environment News, No. 41: Danish Environmental Exports of Products and Consultancy services within the Water sector in 1998. Danish Environmental Protection Agency, 2000.

Direct contact to selected companies.

FRI (Danish Association of Consulting Engineers): Statistical report 2001.

CHAPTER 8

FINANCING OF PROJECTS

8.1 Strategies

When considering the financing of environmental investments, there are significant differences in the problems faced by the EU accession countries in the CEEC and the problems faced by the CIS countries

The EU accession countries primarily need to mobilise significant internal and external resources for the investments which are necessary for complying with the EU environmental standards – the so-called Environmental Acquis.

	Sewerage (EUR million)	Sewage treatment (EUR million)	Drinking water (EUR million)
Bulgaria	1,534	522	
Czech Republic	397	767	
Estonia	119	49	
Hungary	602	1,076	
Latvia	408	171	197
Lithuania	250	185	
Poland	4,860	1,554	110
Romania	1,385		
Slovakia	170	329	
Slovenia	914		235
Total	10,640	4,652	542

Source: DANCEE 2001

Detailed investment estimates for water and wastewater directives in the ten accession countries

In contrast to this, the CIS countries primarily need to develop the internal regulatory and institutional framework which can enable mobilisation of sufficient funds for operating and maintaining the existing environmental infrastructure.

Concepts such as environmental investments or more broadly environmental expenditures are often problematic to compare between countries due to differences in the methodology used. In response to this problem, OECD has, with financing from among others DANCEE, contributed to establishing a common frame of reference within the area. Environmental expenditures (technically termed Pollution Abatement and Control expenditures or 'PAC') are defined by OECD as covering expenditures for operation, maintenance, and investments in relation to activities directly aimed at preventing, reducing or eliminating pollution. In general, this definition does not include expenditures in relation to water supply.

The funds for environmental expenditures in the CEEC and the CIS come from both the public budgets and the individual enterprises. In some countries national and local environmental funds are furthermore a significant source of funds for environmental expenditures.

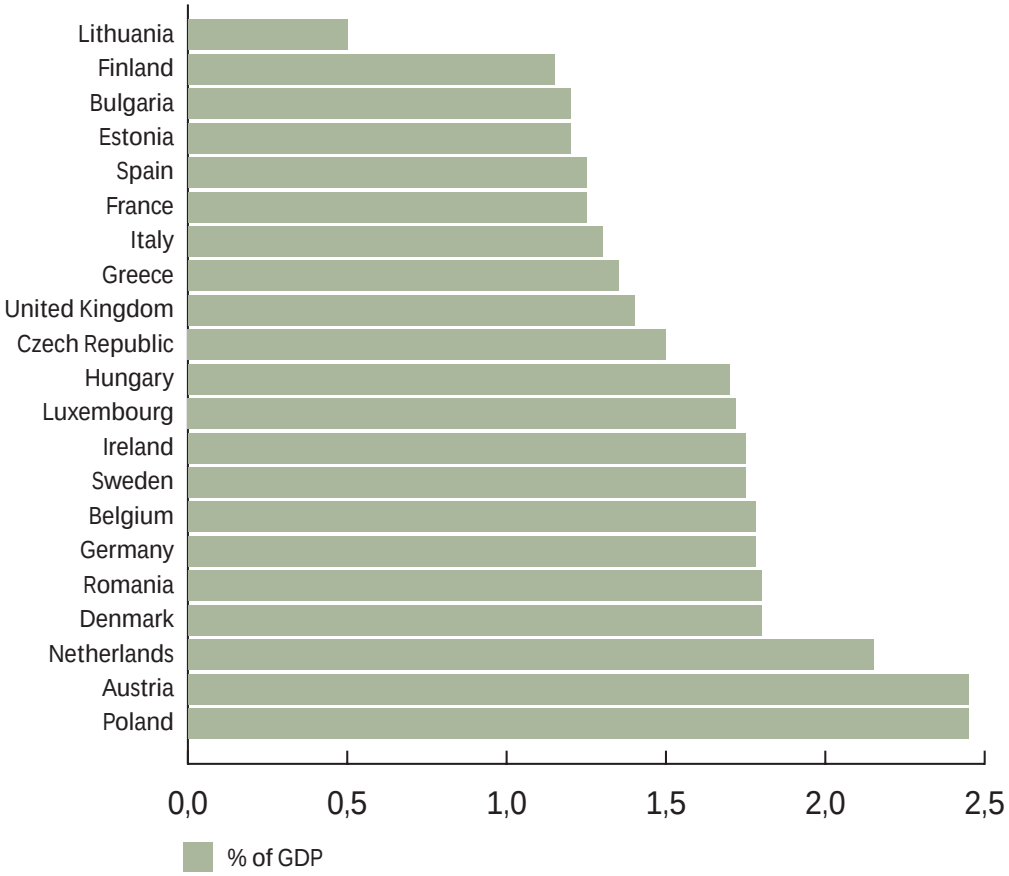
Environmental Funds

Environmental funds are a significant local source of funds for environmental expenditures in some countries of the CEEC and CIS. The revenue sources of the environmental funds are typically earmarked environmental taxes and fees. These taxes and fees are recirculated to environmental expenditures through the funds rather than going into the consolidated budget, where environmental priorities often have relatively low priority. The environmental funds share of the total environmental expenditures vary from 40% in Poland over 20% in Hungary and Lithuania to 5% in Russia where as in some countries, e.g. Georgia, no environmental fund system exists.

Although environmental expenditures in the CEEC and CIS are lower in absolute terms than in the EU countries, they are on average at a comparable level to the EU when seen in relation to the income level. At the same time important differences exist between the countries in the region. Poland has a well functioning system of earmarked environmental fees and environmental funds, has been able to maintain a significantly higher environmental expenditure level. At the other end of the spectrum, a country such as Georgia, which has suffered due to political instability and low income, has only been able to mobilise very limited internal funds for environmental expenditures.

Water supply and wastewater treatment has generally represented the major share of the total environmental expenditures in most countries during the period. Air pollution interventions have however increasingly become the local priority in some of the countries towards the end of the period.

When compared to the EU, a higher share of the total environmental expenditures in the region have been operating costs, thus making only limited funds available for actual investments.



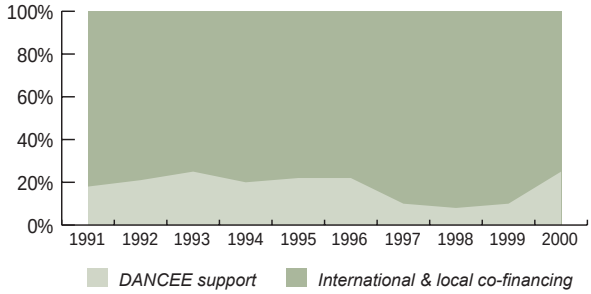
Source: EUROSTAT 2001
Environmental protection expenditure as a percent of GDP

8.2 DANCEE as a catalyst for environmental investments

Although local financing sources have contributed with the majority of the total environmental expenditures in the CEEC and the CIS during the period, assistance from bilateral donors and international financial institutions has played a very important role in connection with actual investments in improved water environment.

In the longer term local financing will have to play an increasing role, also in actual investments in improved water environment. It is hence important for the countries to find a balance between ambitious plans for improving the water environment and realistic increases in tariffs for water supply and waste water treatment – tariffs which presently in some cases are below the long term cost of maintaining even the present infrastructure.

DANCEE's assistance is envisioned as being a means of furthering a sustainable development and local co-financing of the projects supported is therefore viewed as a priority. At the same time, DANCEE can



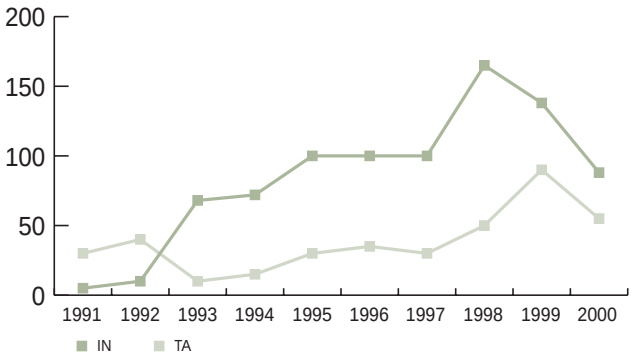
Financing of investment projects with DANCEE support

provide full financing of preproject activities or demonstration projects where the project is expected to be instrumental in leading to a larger scale implementation financed e.g. by international financial institutions.

Some countries in the CEEC are today able to finance up to 90% of its investment in environmental improvements themselves. For other countries where the degree of local co-financing is low, the combined local and international co-financing for investment projects has often been substantial. Thus, the support provided by DANCEE has had a significant leveraging effect. This is illustrated by the graph above which shows the total costs of DANCEE financed components of investment projects distributed between DANCEE support and other funding sources.

For the period 1991-2000 the DANCEE support on investments geared a 5-6 times higher co-financing.

The DANCEE assistance for preparing for the large EU grants including support to identifying the need for adapting local regulation to EU directives and to identify the required investments has been quite significant since 1999. This is reflected in the distribution of funds between technical assistance and investment projects in the figure below.



Distribution of funds between technical assistance(TA) and investment projects(IN)

About 150 companies have supplied equipment or expertise to the water quality projects. The result is that a number of Danish companies today have established a growing business on the Central and East European market. The largest companies within industry or/and consultancy have established subsidiaries in one or more of the Central and East European countries. For the year 2000 the total turnover on the Central and East European market for Danish companies, was estimated to be at a level of EUR 260 million. This level has been reached within a period of 10 years.

8.3 Funding

International Financing Institutions

Apart from bilateral donors, such as Denmark, a number of the international financial institutions are active in connection with the financing of improvements in the water environment in the region.

The most important actors are the Nordic Investment Bank (NIB), the Nordic Environmental Financing Company (NEFCO), the European Investment Bank (EIB), the European Bank for Reconstruction and Development (EBRD), the World Bank, and the European Union through ISPA, PHARE and TACIS.

There is a well developed cooperation between DANCEE and the international financial institutions, and Denmarks bilateral support complements the financing from the international financing institutions in an important manner. The bilateral donors such as Denmark typically concentrate on funding preproject activities and pilot projects and bilateral assistance is most often given as grants whereas the large international financing institutions such as the World Bank and EBRD typically provide long term loan financing of large scale investment projects.

Complex Financing Models

In some situations a project may involve a large number of local and international sources of financing. This was the case in financing the Daugavpils waste water treatment plant in Lithuania where no fewer than 8 sources of financing apart from DANCEE contributed to the project; the World Bank, NEFCO, PHARE, Sida, the Finnish ministry of environment, the Lithuanian Ministry of Environment, the Daugavpils city council and the local water company. Such situations necessarily require close contact between the involved partners. DANCEE is in an ongoing dialogue with the international financing institutions to ensure that the best possible use is made of the advantages of the individual institutions.

The financing provided by the international financial institutions will typically be loans that in the end have to be repaid by the project sponsor in the recipient country. The international financing institutions are therefore very focussed on limiting the risk of the project running into financial troubles or otherwise failing.

The bilateral support from Denmark and other countries has an important role in insuring that the projects are well documented and well structured through support for feasibility studies and pilot projects. Without the combination of Danish or other bilateral assistance for feasibility studies and pilot projects with international financing of subsequent larger scale implementation many projects with important environmental benefits would not be implemented or their scope would be significantly reduced.

Financing of Operation and Maintenance

In the long term there is no realistic alternative to user tariffs as the source of funds for operation and maintenance of the water infrastructure.

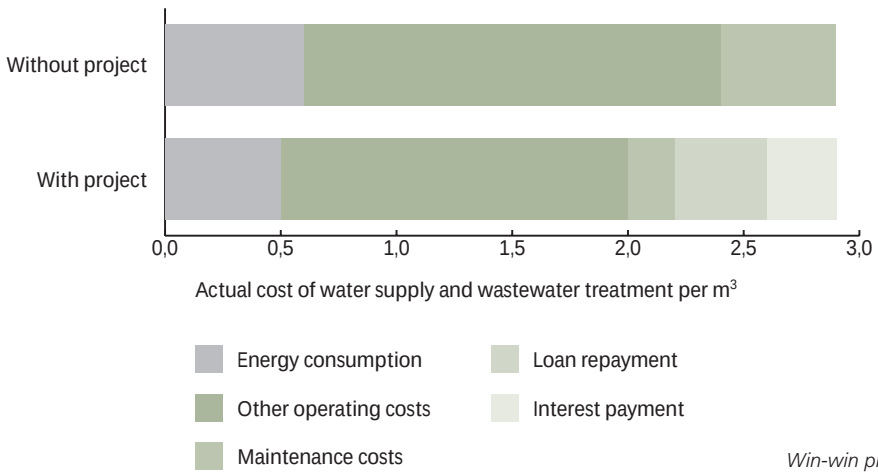
The generally accepted international norm for household affordability of water supply and waste water treatment, in countries at the income level of the Central and East European countries, is 4% of disposable income.

However, water tariffs in the Central and East European countries are in general somewhat lower than this level. This is also the case in the CIS countries where a degree of cross subsidisation between households and industry furthermore prevails.

DANCEE has in cooperation with EBRD sponsored the development of a 'toolkit' for analysis of the demand side in connection with design of water supply and waste water treatment projects. The willingness to pay is important if additional financial resources are to be mobilised longer term through increasing involvement of the private sector in water supply and waste water treatment in the region.

Toolkit for Analysis of the Demand for Water Supply and Waste Water Treatment

DANCEE has in cooperation with EBRD sponsored the development of a Tool Kit for evaluating the public acceptability of various mixes of tariffs and service level in water supply and waste water treatment in the CEEC and CIS. The Tool Kit is designed for use by municipalities, water companies, consultants, financing institutions, and donors in connection with project evaluation. The Tool Kit enables an assessment of whether the combination of tariffs and service levels presumed in a project is realistic in the sense that it can be implemented and enforced without popular or political protests and if not which changes in the project could contribute to ensuring a sustainable and socially acceptable design of the project.



Win-win project example

In countries where the tariff level is close to the international norm, there will often be a possibility for implementing win-win projects where cost rationalisation in connection with the project implementation, e.g. in the form of lower energy consumption and reduced maintenance costs, may be sufficient to allow interest and principal payments without requiring increases in the tariff levels.

Involving the Private Sector

The need to mobilise additional resources for investments in water supply and waste water treatment and in parallel increasing the operational efficiency of the water companies in the region have increasingly led local authorities and international financing institutions to consider new organisational forms of infrastructure delivery where the private sector is involved in a Public-Private Partnership (PPP).

The two most typical forms of Public-Private Partnership considered in the water sector are a management contract, where the responsibilities for operations and maintenance is transferred to the private sector, and a concession agreement, where also the responsibility for investments and finance is transferred to the private sector. The private sector can be e.g. a West European water company.

DANCEE has in cooperation with EBRD and the World Bank assisted in a number of cases with the analysis prior to decisions on Public-Private Partnerships involving water companies in the CEEC and CIS. In particular assistance has been provided to ensure that the local authorities fully understand the implications of and requirements for involving the private sector, e.g. with respect to necessary increases in tariffs to ensure financial viability of the water company.

Public-Private Partnership in Wastewater Treatment in Brno, Czech Republic

DANCEE has in cooperation with EBRD assisted the city of Brno in designing and negotiating a lease contract with a private operator in connection with the rehabilitation and extension of the wastewater treatment plant. The assistance also included design of tariff adjustment mechanism, forecasting expected tariff developments and analysing of the return to the private operator

It should be expected that the opportunities for mobilising additional resources for environmental investments through involvement of the private sector in a Public-Private Partnership will increasingly be tested in both the EU accession countries and the CIS countries in the coming years. DANCEE will be following these developments and seek to contribute constructively to ensure that such new cooperation models are implemented in a way that secures the public interest.

8.4 Environmental financing strategies

DANCEE has been the main international financing source for the development of an innovative analysis concept for financing of environmental investments – the Environmental Financing Strategies.

Environmental Financing Strategies

Environmental Financing Strategies are a practical and powerful tool in the political process as they, through an explicit inclusion of the ability to pay, forces decision makers to take necessary though difficult discussions about priorities, tradeoffs and cost efficiency in the use of limited financial resources.

A financing strategy for Lithuania's compliance with investments required in order to reach EU-compatibility in the environmental sector has recently been completed. This study also included the investments needed in the water sector.

Most water companies in the region are characterised by tariffs, which do not leave sufficient funds available for the planned increases in the service level. This problem is particularly acute in the CIS countries where tariff levels often do not even allow for maintenance of the existing service level thereby leading to continuous decline in the infrastructure.

At the same time water companies are often not solvent by international standards and hence, have no immediate possibilities for loan financing and the tight public budgets and limited national borrowing capacity preclude the public sector from assisting the water companies.

Nevertheless, political targets for future water quality and service levels are often very ambitious.

In light of this, one of the fundamental problems is to identify practical and realistic solutions which in the short and medium term can contribute to attaining realistic targets for water quality and service level. This is where the development of financing strategies is necessary.

DANCEE has in close cooperation with OECD analysed the financing of water infrastructure in selected countries in the region. The analysis documents the extremely critical situation in the water sector in the CIS. Without access to additional funds these countries will not be able to maintain the existing service level let alone increase the service level. This will imply disbursement of untreated wastewater even in the largest cities, interrupted drinking water supply, and repeated incidents of contaminated drinking water. The maintenance of existing facilities will require the implementation of ambitious reforms including in particular increasing the user tariffs for households and improving the payment record of enterprises and organisations.

References

DANCEE: The environmental challenge of EU enlargement in Central and Eastern Europe, 2001

OECD: Background Paper on Financing Strategies in Urban Water Sector in the CIS, 2000.

OECD: Transition Impact Retrospective, 2001.

OECD: Environmental Expenditures in the NIS: Overview Report, 2000

DANCEE: Lithuanian Financing Strategy, In press

CHAPTER 9

THE CONSULTANT'S ASSESSMENTS AND COMMENTS

The consultant reviewed more than 400 DANCEE-supported projects in the water sector for grants have been allocated in the period April 1991 – April 2001. The overview of the achievements of the DANCEE programme support is based on statistical summary reports submitted to DANCEE by the individual project holders, other project reporting and publications available from the Danish EPA.

General Conclusion

Based on the review of 10 years support by DANCEE towards improving the water quality in Central and East European Countries (CEEC) the following general conclusions are made:

- The support has provided cost efficient environmental improvements in all recipient countries
- The support has facilitated approximation to EU Environmental directives and thereby EU membership for countries in the CEE
- The support has strengthened the cooperation between on the one side CEEC national and local governments and enterprises and on the other side the Danish government and Danish environmental expertise
- The support has been successful in promoting Danish technology and know-how in the CEEC

Support to Improved Water Quality

There have been the following characteristics:

- There has only been a few technical barriers in transferring the environmental technology from Denmark to CEEC. The DANCEE supported projects achieved their intended environmental impact by applying Danish technology for improved water supply, better wastewater treatment, cleaner technology in industries etc.
- The Danish support to CEEC projects has been significant in reducing the discharge of the most common water pollutants and has achieved a similar reduction as achieved during the same 10-year period in Denmark.
- Wastewater treatment plants, which have received Danish support, comply with EU effluent standards.
- When comparing the cost to similar investments in Denmark, the cost of for instance nitrogen removal from waste water in the CEEC has only been approximately one third of the cost for a similar reduction in the Danish National Plan for the Water Environment
- The high level of local and international co-financing on DANCEE projects (80-90%) result in removal of pollutants at a cost for Denmark of 5-10 times less than the cost would be in Denmark
- Public health has been an important prioritising parameter in selection of projects. Public health has improved in CEEC among others due to improved provision of drinking water

EU Approximation

There have been the following characteristics:

- DANCEE has provided assistance to adapting national legislation in CEEC to the EU waterdirectives and preparing the implementation of necessary investments.

- The road to EU membership contains many large and small barriers and the candidate countries need assistance to overcome these. The Danish support programme can react fast when these barriers appear and an important part of the support at the end of the first 10 year period was indeed focussed on overcoming these barriers, which still keep appearing.
- DANCEE has frequently been approached by local CEEC authorities for assistance to prepare a proper basis for project identification, which is required by among others EU

Co-operation with the Recipient Countries

There have been the following characteristics:

- The need for project identification and environmental investment planning in a broader context has increasingly been acknowledged. Projects are implemented including both the technical, financial and institutional aspects. The Danish way of using an integrated planning concept is thereby transferred to the recipient countries.
- The Danish support programme has been able to respond swiftly and effectively to the requests and demands put forward by the individual recipient countries and the implemented projects proved the efficiency of Danish environmental expertise and technology.
- DANCEE has also supported the development of national sector strategies and financing strategies to ensure that projects on a wider scale are implemented according to local needs and affordability. For instance support has been provided for the development of autonomous water companies in improving their efficiency in operating water and wastewater systems.

Financing of Projects

There have been the following characteristics:

- DANCEE has supported the EU applicant countries in mobilising significant local and international resources for the investments, which are necessary for complying with the EU environmental standards.
- DANCEE has supported the CIS countries in developing the internal regulatory and institutional framework, which can enable mobilisation of sufficient funds for operating and maintaining existing environmental infrastructure.
- The DANCEE support has had a significant leverage effect by attracting up to 90% co-financing on investment projects in environmental improvements. Thus, the period 1991-2001 DANCEE support on investment in average geared a 5-6 times higher co-financing. DANCEE projects were therefore successful in attracting both local financing and financing from international financial institutions. This is a proof of local commitment.
- DANCEE has managed to initialise and contribute to the cooperation between the public and the private sector by demonstrating cooperation models that secures the public interest.

ENCLOSURE 1

EXPRESSIONS

General organic (oxygen consuming) pollution

The general organic pollution is usually measured and expressed as Biological Oxygen Demand (BOD), which is the fraction, which consumes oxygen in the receiving water body shortly after discharge (within a few days).

The oxygen demand caused directly by the wastewater is localised to the near downstream part of a river, or to the near field in larger lakes and marine areas.

Microbiological pollution

Microbiological pollution refers to the spreading of pathogenic organisms (bacteria, virus, protozoas and helminth eggs). Instead of measuring a multitude of organisms, the microbiological pollution is usually characterised by the occurrence of a single indicator, namely the number of E.coli bacteria.

Microbiological pollution causes health risk when humans are exposed to wastewater or water influenced by wastewater. As pathogenic organisms survive only for short periods in the natural environment, microbiological pollution, like oxygen demand, is in general a relatively local phenomenon.

The nutrient elements N and P

The nutrient elements Nitrogen and Phosphorous are essential for plant growth, including all sorts of water plants, notably phytoplankton. In the natural state, plant growth in lakes, reservoirs and the Sea is limited by the amount of either or both of these nutrient elements.

When the water bodies receive excessive amounts of the nutrient from e.g. discharge of wastewater, the condition of the water body is changed into a state of "overfertilisation" (eutrophication). This state is characterised by the water being turbid (green) by an excessive growth of microscopic plankton organisms. In particular, masses of blue-green algae (or cyanobacteria) are common in late summer, and often cause problems for water treatment.

ENCLOSURE 2

LIST OF ABBREVIATIONS

BOD5	Biological Oxygen Demand (over 5 days)
CEEC	Central and Eastern European Countries
CIS	Commonwealth of Independent States
DANCEE	Danish Co-operation for Environment in Eastern Europe
DEPA	Danish Environmental Protection Agency
DKK	Danish Kroner (for exchange rates see next page)
EEA	European Environmental Agency
EBRD	European Bank for Reconstruction and Development
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EU	European Union
EUR	Euro – (for exchange rates see next page)
GDP	Gross Domestic Product
GNP	Gross National Product
HELCOM	Helsinki Commission – Baltic Marine Environment Protection Commission

IN	Investment Projects
IPPC	Integrated Pollution Prevention and Control
ISPA	Instrument for Structural Policy for Pre-Accession
LSIF	Large Scale Infrastructure Facility (EU)
MARPOL	International Convention for the Prevention of Pollution from Ships
NEFCO	Nordic Environment Finance Corporation
NGO	Non-governmental Organisation
NIB	Nordic Investment Bank
NIS	Newly Independent States
N	Nitrogen
OECD	Organisation for Economic Co-operation and Development
P	Phosphorous
TA	Technical Assistance
WB	World Bank

FURTHER INFORMATION ON THE DANISH ENVIRONMENTAL ASSISTANCE TO EASTERN EUROPE:

DANCEE releases successively various types of publications on the Danish environmental assistance to Eastern Europe. Each type has its own colour.

STRATEGY

Strategy of the Danish government for assistance to Eastern Europe 2002-2003. April 2002. Danish. For free.

ANNUAL REPORT

Contains a description of all projects launched and initiatives taken in connection with the Danish environmental assistance to Eastern Europe for the actual year. For free.

COUNTRY PROGRAMME

DANCEE's strategy and priorities in the individual recipient countries are described. Country programmes are planned in cooperation with the recipient country. English and the recipient country's language. For free.

COUNTRY BOOK

The country book describes the Danish environmental assistance in each recipient country. It contains among others, description of the assistance's progress and the environmental effects. It reviews typical projects within the different field sectors. English and recipient country's language. For free.

COUNTRY PAMPHLET

A brief and popular version of the country book which, with focus on concrete projects, explains the Danish environmental assistance to the recipient country. English and recipient country's language. For free.

THEMATIC REPORT

Technically-orientated report dealing with subjects of specific importance to the environmental aid, e.g. wastewater treatment or control instruments. Danish and English.

PROJECT PAMPHLET

Describes a specific environmental project and is released typically in connection with the opening of the project. English and recipient country's language. For free.

The publications are available at:

Miljøbutikken (The Danish Ministry of the Environment outlet)
Læderstræde 1-3
1201 Kbh K
Tel.: 33 95 40 00
Fax: 33 92 76 90

The report describes the Danish support to improve water quality in Central and Eastern Europe during the period 1991-2001. The report describes the results of the support and how this was achieved.

DANCEE PUBLICATIONS:

PROJECT PAMPHLET
COUNTRY PAMPHLET
COUNTRY BOOK
COUNTRY PROGRAMME
ANNUAL REPORT
STRATEGY
THEMATIC REPORT

Udgiver
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Strandgade 29, 1401 København K.
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1201 København K
Telefon: 33 95 40 00
Fax: 33 92 76 90
e-mail: butik@mem.dk

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Ministry of the Environment

DANCEE
Danish Cooperation for Environment in Eastern Europe

Miljøstyrelsen
Strandgade 29
DK-1401 Copenhagen K
T: +45 32 66 01 00
www.mst.dk