

On-line catalogue of European adaptive initiatives of the water sector to face climate change impacts

by Matthias Staub (KWB) and Gesche Grützmacher (KWB)

Why a Catalogue of adaptation initiatives?

Far from any debate between climate sceptics and scientists, adaptation to the impacts of climate change has become a reality for many water supply and sanitation utilities. For them, the question is not 'do we need to adapt?', but rather a) 'adapt to what?', b) 'what to adapt?' and c) 'how to adapt?'. For several utilities and stakeholders, these issues are new and they thus need support to find sound answers to these three major questions.

While the answer to the question a) may seem relatively simple or beyond the scope of adaptation policies (here, the possible major threats and disruptions of urban water supply systems have been considered: water scarcity, floods and water quality issues) answering the questions b) and c) needs careful examination of existing adaptation schemes and planned or realized initiatives. Within the PREPARED-project, a Catalogue of European adaptive initiatives of the water sector to face climate change impacts has been compiled to support the implementation and development of solutions for addressing climate change impacts on the urban water sector. The catalogue is a living document that is updated regularly during the project when new solutions are found and initiatives are developed.

The need for a further development into an on-line version of the Catalogue

Although a paper version of this catalogue is essential to gather the inventoried solutions in the most exhaustive possible way, there is a need for a broader communication and participation of the target audience, namely the utilities and stakeholders, which are also potential 'feeders' of this living database. Thus, to bring these findings to a broader audience, an interactive version of the catalogue is being prepared. This on-line tool will comprise the full database of initiatives listed in the paper report, but will ultimately also list additional interactive information such as related publications, reports, web links, or interactive contents (videos, animations). The most innovative aspect of this on-line tool will be the proposed various search methods:

- a dynamic matrix to narrow down the search to given categories of initiatives,
- an alphabetical search with all the initiatives listed from A to Z,

- a geographical search (similarly to the geographical index of initiatives in the report),
- an extended full-text search to browse all initiatives independently of their respective categories.

The dynamic matrix will be used to direct the user to the different categories which may be most relevant to his query, depending on:

- the risk factor that needs to be addressed (water scarcity, floods, water quality or other issues),
- the nature of the followed adaptation strategy (simple assessment, resistance initiatives, resilience initiatives, initiatives enhancing flexibility),
- other additional criteria such as the structural or non-structural, the reactive or anticipatory and centralized or decentralized nature of the initiative.



Proposed design for the on-line tool, with the matrix used to browse the database (Jan Willem van der Mei © iBuro).

The support of the search using these criteria will definitely facilitate the access to the background information in the database.

This online version of the Catalogue will be of particular interest for stakeholders, planners or engineers from cities and utilities facing new investments and who would like to integrate climate change in their decisions. It will help them (1) to widen the scope to solutions to those implemented in other cities, and integrate innovative solutions, (2) to benefit from the ex-

perience of solutions implemented elsewhere, and (3) to get in touch with the concerned cities or utilities, and build up connections and/or alliances of cities and utilities. The web-based tool will help to go beyond the traditional approach of solving problems locally using classical, well-proven solutions, by informing and connecting the professionals in charge of projects concerned by climate change adaptation.

Further features of this on-line tool and use within and beyond PREPARED

The on-line tool will also facilitate the interaction with the PREPARED-team by providing extensive contact information. External contributions to the database will be encouraged using this platform, with a supervision and control of the proposed contributions. Finally, the on-line version of the catalogue will

also provide some statistics on the initiatives in the database, for instance on geographical origin, followed adaptation strategy or current implementation status.

The objectives of this on-line tool will be to supply the PREPARED consortium continuously with newly tested or implemented adaptation initiatives, to facilitate the exchanges with local utilities, and to support communication on the project's research findings. Moreover, the on-line catalogue could serve as a platform to be used for other PREPARED-toolboxes or databases, for instance on risk-assessment and reduction measures, or on the results of the PREPARED demonstration studies. The final goal is that this tool can be used more comprehensively outside PREPARED and be updated or developed beyond the life of the PREPARED project.



Eye on earth Network 'sharing is everything'

Eye on Earth is a global public information service for sharing data and information from diverse sources. The network is the result of a public-private partnership joining expertise from industry and public organisations. Much of the website content will be accessible for any user anywhere in the world.

Eye on Earth is an EEA initiative that has the overall goal to expand and improve the environmental knowledge base, to help its users better understand what's happening with our environment, and to inform actions which could improve the environment such as policy making initiatives.

In December 2011 the Government of Abu Dhabi organised the global Eye on Earth Summit, together with the Abu Dhabi Global Environmental Data Initiative (AGEDI). The purpose of the summit was to promote the international agenda for improved access and ability to use and leverage environmental data and information for the benefit of all communities of our global society.

The Government of the United Arab Emirates invited over 700 decision makers in governments, inter-governmental organisations, the donor community, the UN system agencies, business and industry, the science community and other civil society actors.

Leading up to Rio+20 in 2012, the Eye on Earth Summit represented an important opportunity and milestone to focus attention on the collective efforts of making the best environmental information available to support decision-making in order to achieve sustainable development, reduce poverty and transform the global economy.



A view of the Sheikh Zayed Grand Mosque in Abu Dhabi.

EYE ON EARTH Summit Declaration

The Eye on Earth Summit Declaration recognizes the need for accessing timely, credible and relevant observations and information from a wide array of actors to enable the development and implementation of goals, targets and indicators to ensure the advancement of sustainable development. Recalling Principle 10 of the Rio Declaration as well as the Bali Strategic Plan for Technology Support and Capacity-Building, it highlights the opportunity presented by Rio+20 to renew political commitment for the role of information in advancing sustainable development.

Mixed feelings after the climate conference in Durban

by Adriana Hulsmann (KWR)

With a delay of 36 hours the UN climate top at Durban South Africa ended on the 11th of December 2011. The best possible compromise the politicians from 200 countries could reach, not to end the summit as a complete failure, was to extend the current Kyoto protocol that is due to end in 2012 with another five years.

Why do we still invest in climate summits?

The intention to agree on binding emission limits by 2015 that would then come into force by 2020, more than eight years from now. However, the Kyoto protocol has not been signed by China and India and not been ratified by the US, three of the top CO₂ emitters.

The Kyoto protocol is currently the only binding agreement on international level to reduce the CO₂ emission by industrialised countries. Another result is the intention to agree on binding emission limits by 2015 that would then come into force by 2020, more than eight years from now. However, the Kyoto protocol has not been signed by China and India and not been ratified by the US, three of the top CO₂ emitters.



'We are talking an absolute minimum to avoid a catastrophe' said Evelyne Huytebroeck, Belgian Environmental Minister. The only positive result is the Climate Fund that will provide a financial tool to reduce the impact of climate change in developing countries. The fund will be based on annual contributions of € 100 million from the industrialised countries with effect from 2020.

The bottlenecks in the negotiations were predominantly the roadmap and the time path towards a new protocol and the legally binding status of the new protocol. MEP for the Green Parties, Bas Eickhout, summarised the situation as follows: 'while Tuvalu is in danger of disappearing under the sea level, drought records are broken in the Horn of Africa and the United States experience a strong increase in extreme weather events resulting in substantial damages, some countries rather protect the interests of large industries'.

The protocol was initially adopted on 11 December 1997 in Kyoto, Japan, and entered into force on 16 February 2005. In 2007 scientists predicted that the urgency was so high that in Copenhagen (2009) an agreement had to be reached to avoid a catastrophe. The Copenhagen top failed to do that as did the 2010 top in Cancún. Mostly due to strong interference of European Commissioner Connie Hedegaard (Climate Action) a roadmap was agreed upon to facilitate an agreement more than eight years from now.



In the meantime, Canada formally announced that it will no longer respect the Kyoto protocol, as the main contributors to CO₂ emission like the US did not ratify it. Environmental Minister Peter Kent considers the Kyoto protocol history and Canada is the first country to take this road and it is expected that others may follow.

Where decision-makers fail to take action and completely focus only on traditional sectors of industry another development is taking place that creates a gap between policy and innovation. Industrial innovation and development is booming creating opportunities for technological developments and creating many jobs within a green economy. Eickhout: 'In Durban I have seen companies like Elsevier, Philips and Unilever investing in the green economy. Where the political process is painfully slow, private enterprises see opportunities created by climate change. The industry exploits chances but the policymakers fail to keep up with them'.

What does this mean for the PREPARED project?

(continued from page 3)

First of all, it is unlikely that the target of a maximum temperature increase of two degrees will be reached. This will have severe implications for the world. Water-related issues will continue to cause (even more severe) problems in the water sector and utilities, such as sea level rise, more frequent and severe droughts and extreme weather events. The adaptation tools and measures developed and demonstrated in the PREPARED project will assist utilities both inside and outside Europe to cope with the impacts of climate change. The European Commission will very likely continue to invest in important research and development (R&D) projects that focus on the mitigation and adaptation measures. The failed climate conference in Durban puts even more pressure on PREPARED to both deliver the products and to actively disseminate the know-how generated in PREPARED.



*Sale of meat in the village of Funanqumbi, which is affected by drought. The EU provides emergency assistance. This assistance includes the purchase of animals that are about to die. Weak animals are bought and then slaughtered to provide meat to the villagers.
Source: EC audiovisual services*

FP7 climate change projects:

- CLIMATECOST: Full Costs of Climate Change
- Project web-site: <http://www.climatecost.cc/>
- CLIMSAVE: Climate Change Integrated Assessment Methodology or Cross-Sectoral Adaptation and Vulnerability in Europe
- Project web-site: <http://www.climsave.eu/climsave/index.html>
- IMPACT2C: Quantifying projected impacts under 2°C warming
- Project web-site: to be established (starting date 1 October 2011)
- MEDIATION: Methodology for Effective Decision-making on Impacts and Adaptation
- Project web-site: <http://mediation-project.eu/>
- RESPONSES: European responses to climate change: deep emissions reductions and mainstreaming of mitigation and adaptation
- Project web-site: <http://www.responsesproject.eu/index.html>
- Viroclime: Impact of climate change on the transport, fate and risk management of viral pathogens in water
- Project website: <http://www.viroclime.org/>
- MOTIVE: MOdels for AdapTIVE forest Management
- Project web-site: <http://motive-project.net>

Participation in FP7 projects – Why is it important for Gliwice, Poland and the Polish water sector?

by Rafał Ulanczyk (IETU)

The European Framework Programme (FP) for Research and Technological Development is the main financial instrument for supporting research and technology development in Europe. Since 1999 Polish teams have participated in nearly 3500 FP Projects, more than 500 of which were coordinated by Poles. In the current, Seventh Framework Programme (FP7), Poland has participated in more than a thousand projects and coordinated 150 of them. The total funding assigned to Poland in FP7 is approximately €25 million (till October 2011).

Poland participates in tens of FP7 projects directly dedicated to the water sector and in even more that include water management issues in the main goals. Two of such projects are: **PREPARED** and **BRIDGE** and both include demonstration tasks in the City of Gliwice (southern Poland) (Fig. 1).

The **PREPARED** – Enabling Changes project aims to develop short and long-term strategies for adaptation of urban water systems to the impacts of climate change such as extreme rainfall events, water resource scarcity, quality changes. A key part of the project is the demonstration of a set of adaptive solutions in 12 European cities / regions and two non-European ones.



Fig. 1. The city of Gliwice, Poland

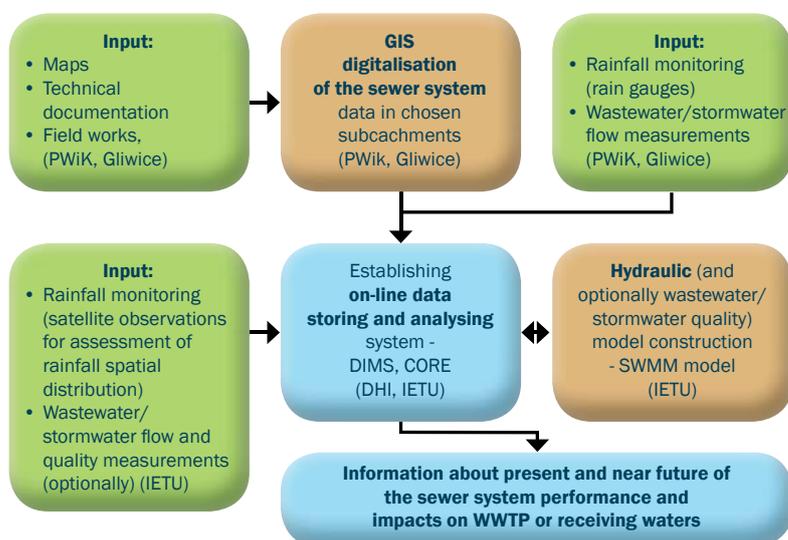


Fig. 2. Concept of the system to be demonstrated in Gliwice

The City of Gliwice (Water Supply and Sanitation Company – PWiK Gliwice) in collaboration with the Institute for Ecology of Industrial Areas (IETU, Katowice) will demonstrate an example of enhanced real-time measuring and forecasting technologies for combined sewer system (Fig. 2.). This demonstration will be done for the central, historical part of the city, where the mostly combined sewer system cannot be easily separated because of the very high-density built-up area.

The **BRIDGE** project short for ‘sustainaBle uRban planning Decision support accounting for urban mEtabolism’ was completed in 2011. The project addressed the use of resources and energy and the transformation into usable products and the disposal and recycling of waste. The DSS tool that was developed is used to assess different scenarios of urban areas development, including water balance elements as part of the urban metabolism (for instance consumption, evapo-transpiration, infiltration, run-off, potential flood risk). Gliwice, together

with London, Athens, Florence and Helsinki, participated in the design and the practical use of the DSS in urban development. Participation in the BRIDGE project had some major benefits for the city of Gliwice. Firstly it was possible to establish a Community of Practice, which includes representatives of research, local and regional authorities, and utilities significantly influencing the urban ‘metabolism’. This community facilitates the exchange of the knowledge and experiences needed for sustainable urban development, and for improving and implementing of the decision support system. Secondly the project also made it possible for Gliwice to be the first city use the DSS that was developed within the project and thus become a ‘first mover’ on the market. A set of analyses was performed for the city such as a full analysis of the city metabolism (on a basis of water, energy, pollutants and carbon fluxes, and of the mathematical modeling. Last but not least the project resulted in a quantitative assessment of the environmental and socio-economical impacts of the urban structure development.

Participation in international projects as BRIDGE and PREPARED has many advantages for the different partners in the project. End-users can participate in the demonstration tasks and have the possibility to solve their specific problems with the input from an interdisciplinary team of experts. Such a cooperation can not easily be organised by local authorities or enterprises (not even those of medium or large size).

Solutions and tools developed in this type FP7 projects are tailored to address regional problems as they are brought into the project by individual participants and end-users. The solutions developed within the project are locally tested and can then be rolled out to be applied at a larger scale in other European cities. This is a major driver for participation in FP projects. The second advantage for end-users is the ability to have early access to the newly developed technologies and knowledge generated around the world and to be able to implement tools and knowledge in their day to day practice. Participation of technology developers and manufacturers (especially SME’s) will substantially improve their competitiveness.

The main benefit for research partners (like IETU in projects realised in Gliwice), lies in the cooperation and analysis of environmental issues together with international researchers with different points of view and different backgrounds. This will result in enhanced knowledge on the interactions between the climate, ecosystems and human activities.

Recent flood event in Genoa, Italy

by Nicola Bazzurro (Iride Acquagas)

In October 2011 the region of Liguria in the northern part of Italy was hit by large floods and storms which dramatically affected the nearby coastal areas and changed the beautiful landscape of the famous tourist area the Cinque Terre. A week later another flood event occurred in the Region of Liguria. Ten days after the last flood in Liguria, the Civil Protection Agency announced a maximum alert state for all the whole Ligurian territory. Unfortunately, the general population interpreted it as a cautious alert and the general feeling was that the event would not be so extreme. However, this time the predictions were right and the people were wrong. During the night of the 4th of November heavy rainfall hit the area with some very intense rainfall in the central-eastern part of the city of Genoa, causing water levels to increase inside the river bank from one meter to more than four in about half an hour time (see Figure 1 and Figure 2).

The Bisagno, one of the five main rivers flowing across the city of Genoa, burst its banks flooding the surrounding (urban) areas. The same happened in some other tributaries such as Carrega and Fereggiano, Geirato, Trensasco flooding the whole nearby area and overflowing the culverts (see Figure 3). Other creeks literally burst their banks creating incredible potholes in the streets (Figure 4).

The streets near the aforementioned creeks became rivers transporting muddy water, vehicles (cars and scooters), garbage bins and any kind of material along their paths towards their natural outlet, the Ligurian sea. Hundreds of shops were flooded and emergency officials urged residents to move to higher ground and higher floors as the waters continued to rise and firefighters used rubber dinghies and divers to evacuate people. In the meantime people were alerted by sirens to warn them not to cross the river because another flood was expected.

Due to flash flooding six people were killed, including children. Most of those killed were reportedly seeking shelter at the ground floor of an apartment block. Motorways in the Genoa area were also closed off and flights re-routed away from the local airport.

While the authorities advised people not to use their cars, not to leave their homes, and to move to higher floors, Genoese people can not help but wonder why these events continue to happen.

The increased problems associated with flooding in the region are related to:

- The change in the nature of rainfall events in the Genoa. Nowadays, rainfall events are very intensive, sometimes with persistent showers in the same urban areas. On 4 November the downpour exceeded 330 mm in less than four hours (see the Figure 2).
- The increased urbanisation in Genoa has created high slopes and large impervious areas which, in the presence of extreme rainfall events, cause larger amounts of runoff water flowing with a high velocity towards downhill sections. Furthermore many creeks have lost their natural features and are reduced to culverts or channels covered by streets and park areas.
- In addition, some upgrading work have not yet been completed, for bureaucratic reasons, costs increase caused by bad administration of public funds distribution and expenditure cuts. At least two of them, already designed, are still not implemented: the overflow pipes of the Fereggiano creek and of the Bisagno river.

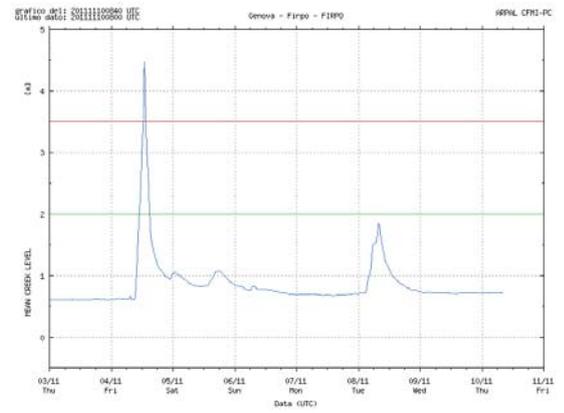


Figure 1: The flowrate hydrograph as measured in the catchment of Bisagno River at the Firpo station, close to the Ferraris Stadium

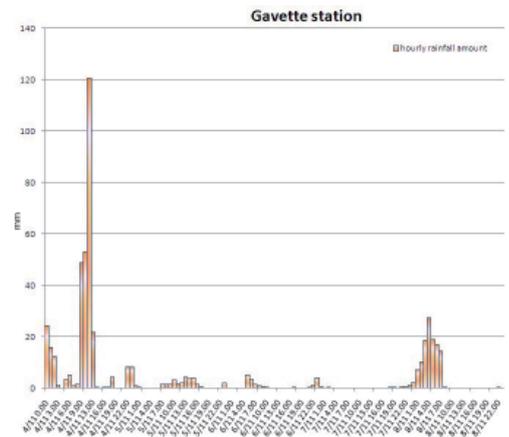


Figure 2: The hourly amount of rainfall at Gavette station, in the catchment of Bisagno River



Figure 3: The flooding crossing via Fereggiano, Genoa



Figure 4: A pothole in Via Donghi, Genoa

- People underestimate the alert advice because it was the 6th alert of the same type, given in 2011, and in none of the previous circumstances problems were registered.
- A systematic cleaning activity inside the banks of the drainage systems has not been carried out for years.

Several studies were conducted on the Genoa drainage system, it is not the first time that Genoa is so heavily hit by the strength of its rivers. In 1970 942 mm of rainfall fell in the city in less than 24 hours. Technicians and local authorities know perfectly well what can happen on the occasion of design rainfall characterised by a given return period such as 200 years (or even less). Several studies have been carried out and we know a lot in terms of floodable areas for assigned design rainfall. Unfortunately every time a flooding event happens, something is different and what we can foresee and simulate with a hydraulic or hydrological model does not completely correspond to what actually occurs in the real life.

How can PREPARED help to improve the situation?

For a start better risk assessment and risk management is needed. In addition to that a systematic approach, like the one developed in PREPARED in terms of adaptation measures, has to be demonstrated and disseminated in order to create an adequate culture making people aware about the benefits that can be derived from the application of innovative approaches for the risk assessment and risk management of urban areas.

Water Cycle Safety Plan to be tested and demonstrated in Eindhoven

by Patrick Smeets (KWR)

Ensuring a good endproduct quality through risk assessment and risk management in the whole production chain is common practice in the food industry. For a number of years now this risk-based approach has gradually taken shape in the drinking water production sector in Europe and world-wide, where it is called Water Safety Plan (WSP). Within PREPARED the WSP is taken one step further by introducing the risk assessment and risk management principle for the whole water cycle. PREPARED has the ambition to test and demonstrate the Water Cycle Safety Plan (WCSP) approach, including the impact of climate change on the urban water cycle. A draft framework for a water cycle safety plan was developed that is now tested and demonstrated in the cities of Eindhoven, Lisbon, Simferopol and the Algarve.



Stakeholders discuss climate change impacts on the water cycle around the GIS table at a Water Cycle Safety Plan workshop in

The city of Eindhoven, one of the PREPARED partners, offers a unique situation for testing and demonstrating the WCSP as the three main stakeholders in the urban water system (UWS) already work closely together in a local platform. The stakeholders in the city Eindhoven are the water supply company Brabant Water, the Dommel Water Board and the Eindhoven municipality. The three stakeholders are committed to the demonstration of the WCSP framework. Together they produced a complete description of the urban water cycle in Eindhoven. This first joint step showed many links and interdependencies between the elements of the UWS. The discussions were supported by the use of a GIS (Geographic Information System) table that directly combined the geographical information from the stakeholders to visualise vulnerabilities and the impacts of climate change in the water cycle. This allowed for quick identification of links and associated risks that were immediately stored as GIS data.

Specific risks associated with climate change can occur in places where the different water systems interact. For example, climate change effects on the local surface water levels play a crucial role as they affect the occurrence of water and sewage on streets, resulting in exposure to health risks. Water levels also impact the functioning of the waste water treatment plant resulting in environmental risk. The risks will be characterised in line with a so-called Risk Identification Database to provide a structured overview of risks that can be linked to risk reduction measures.

Investigation of new water resources for Istanbul: rainwater harvesting and greywater management

by Orhan C. Goktas (Istanbul Water and Sewerage Administration), Ahmet Baban and co-workers (TUBITAK MRC)

Adequate water supply and sanitation is a major challenge for Istanbul, not only because it is a large city with a population of 13 million people but also because it is one of the most rapid growing cities in Europe. The Istanbul Water and Sewerage Administration (ISKI) is responsible for both clean water and waste water services. ISKI operates a water network of 16,600 km that transports and distributes water from surface water reservoirs (max 910.2 million m³/year) and from groundwater sources (max 30 million m³/year). To cope with the growing demand water is now transported from the Black Sea Basin to the city of Istanbul over a distance of 180 km (recently completed Melen project). ISKI also operates a sewerage and rainwater network of approximately 13,600 km. To ascertain a more efficient management of the drinking water and wastewater infrastructure ISKI has developed an Infrastructure Information System called ISKABIS, based on GIS tools. ISKABIS also enables a more efficient protection of watersheds.

Between 60% and 80% of the water in Istanbul is used for domestic purposes (data 2001-2010). The high domestic demand is in line with data available for Europe (EEA, 2010). Second highest is the demand for public bodies approximately 6% to 7%. Figure 1 illustrates the water use per capita for the city of Istanbul between 1994 and 2008. Water consumption has decreased since 2005, and it reached the level of 161 l/day per capita in 2010. The decline in water demand is mainly caused by a reduction in the amount of water lost through leakage of the system, following rehabilitation of the distribution network. Water saving campaigns and use of water saving devices may also have had a positive effect. However, the supply has increased in parallel with the population growth over the last decade. The total supplied water of Istanbul is about 778 million m³/year in 2010, so water demand has not exceeded supply in Istanbul now, but it is expected to experience supply and demand balance in the future due to population increase and climate change effects.

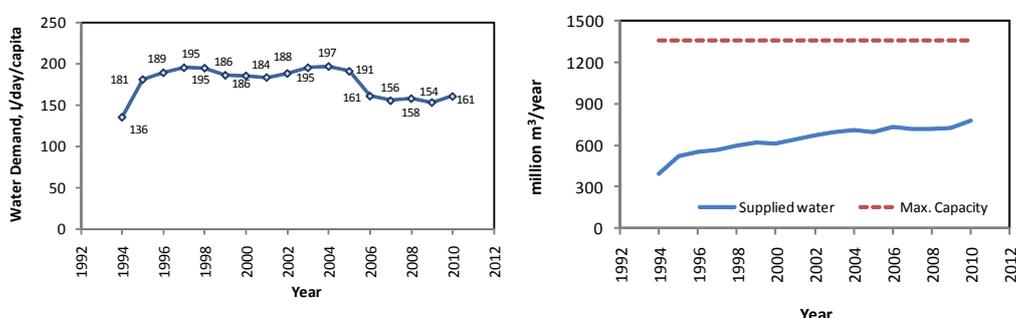


Figure 1. Supply and demand of water in Istanbul

Following the drought in 2006-2007, ISKI developed adaptation strategies and plans for sustainable use of water resources for the supply and the demand side. On the supply side, beneficial but rather costly actions were taken to increase the operational flexibility, for instance the Melen project (water transfer from an adjacent basin) reuse of treated wastewater and the construction of pipelines across the Bosphorus. On the demand side, water saving and educational campaigns that focused on a more efficient use of limited resources were carried out. Diversification of water sources is increasingly important for water utilities. Closing domestic water cycles and domestic reuse may significantly reduce the demand for water and contribute to a more sustainable use of water sources. This will support utilities in their efforts to prepare for the impacts of climate change. Utilities must consider ways in which they can make use of alternative sources, for instance through additional storage facilities, appropriate and sustainable extraction of groundwater, water trading or conservation and the use of recycled or rainwater.

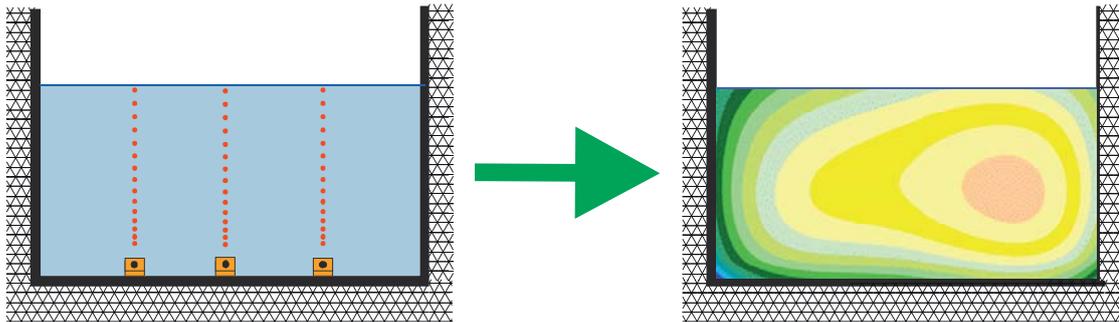
A number of developments in Istanbul put pressure on the utilities to look for alternative solutions and many plans have recently been developed to cope with the current water and wastewater management approach using mostly end of pipe treatment, increasing demand for water and the pressure of droughts/climate change on water resources. Under water stress and changing climatic conditions it is particularly important to have diversification of water sources including rainwater harvesting and waste water reuse. Rainwater usage has been suggested to promote potable water savings and ease water availability problems. Studies show that depending on the geographic region, rainwater harvesting has a significant potential for the residential environment. This may include use of treated wastewater for purposes that do not require drinking water quality for instance watering urban greens and landscaping. For the situation in Istanbul it has been calculated that it is potentially possible to cover 67% of water demand for toilet flushing by rainwater and treated greywater. The rainwater and greywater as potential alternative water resources correspond to about 21% of the overall water consumption.

Within PREPARED, a pilot plant on rainwater and greywater reuse systems will be implemented in TUBITAK MRC Campus and the outcomes will be tested conceptually in a selected case study area in Istanbul. The experience and knowledge from this pilot within the PREPARED project will be made available to other city utilities. The outcomes of the study will provide a base for technical information on greywater and rainwater utilisation, applicable monitoring implementation practices for cities which will presumably suffer from climate change impacts and water stress. Furthermore, the results may constitute a tool for technical personnel, decision makers, planners, water utilities, consumers, and various stakeholders such as treatment equipment manufacturers.

The role of PREPARED for NIVUS GmbH

by Michael Teufel (NIVUS GmbH)

NIVUS GmbH is a development and production company for a wide range of ultrasonic devices mainly for sewage-treatment plants and sewer channels. The SME NIVUS actively participates in the PREPARED project. They co-operate in the development of optimal sensor location methods to provide reliable and useful measurements in urban water systems for the most common applications. In addition, Nivus assists in the integration of their flow rate meter in a real time monitoring and management system of another PREPARED partner. The first task addresses the customer demand of an accurate reliable and permanent flow rate determination. Within the project PREPARED the standard evaluation of the flow rate meter is extended to get more information about the measurement itself. With this new evaluation it is possible to reconstruct the complete velocity flow and to detect disturbed flow rate conditions and even the level of disturbance. In picture 1 is an example of an asymmetric flow profile in a rectangular channel after a bend.

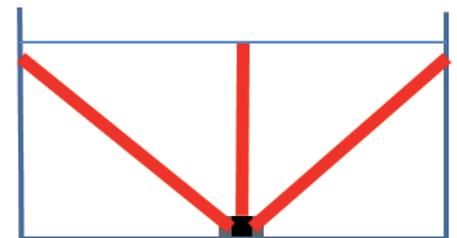


Picture 1: velocity determination in a rectangular channel with 3 sensors and calculated velocity profile.

The left part of the picture shows the three sensors installed at the bottom of a rectangular channel. The cross correlation technique makes it possible to measure the velocity along an ultra-sonic path perpendicular to the water surface. Through the application of hydraulic models

the complete velocity profile can be reconstructed. Firstly, this assures confidence of the potential of the instrument 's application in good conditions and advices on the choice of good measurement locations. Secondly, work has been done on the extensions of the actual evaluation to improve the measurement under disturbed conditions. The first results are very encouraging but several investigations will have to follow. The calculation of the volume flow rate is done applying the velocity grit; grit measurements still allow very high accuracy. Several other disturbances have to be investigated, including different, more complex channel geometries.

These investigations already clearly indicate that a single sensor with only one ultra-sonic beam cannot give reliable results under asymmetric conditions. Therefore three sensors have been used for the presented application; up to three sensors can be connected to the evaluating device OCM Pro. To ease the installation, one sensor with more than one beam would be preferable, a sensor that gets information of the asymmetry of the entire cross section. A first sketch can be seen in picture 2. The development of such a sensor is therefore a need for the near future.



Picture 2: 3 ultra-sonic beams.

The NIVUS flow rate meter is integrated in the software of DHI, another partner in the PREPARED project. This real time monitoring and management system is used in several cities and communities and the integration gives a benefit to competitive flow rate meters. A focus on the integration is also to assist during the installation, therefore much more data, such as the whole velocity profile has to be transmitted and not only the mean flow rate. It also helps to see the operation of the instrument in more difficult application and conditions, for example in case of a heavy rain event. In the head quarter where all data from all instruments are collected and it is necessary to have confidence in the reading of all devices.

The project PREPARED stimulates NIVUS as manufacturer (SME) to improve and develop their devices and instruments and to connect them together with other instruments to international standards.

Young PREPARED profile

*Interview with PREPARED Young professional Kyle Thompson
Exeter University*

What is your background?

- I studied Mechanical Engineering to Master's level at the University of Exeter where I am currently embarking on a PhD alongside my work on PREPARED. For me, the choice to study engineering did not come easily and I was unsure about what to expect from such a broad and diverse field of science; ultimately I decided to take the plunge as it seemed to be the natural extension of those things I had most enjoyed at school. And, in retrospect, I'm glad I did. Mechanical Engineering is a diverse topic with numerous pathways and opportunities in its wake. Naturally, during the course of my undergraduate years I found myself developing an affinity for all things fluid. I focused specifically on that aspect of the degree wherever possible, finally ending up in my current post.



Kyle Thompson, Exeter University

What is the topic of your PhD?

- That's a good question! The title and direction aren't finalised yet, but the work will draw on the knowledge and experience I have gained throughout my time on PREPARED.

How does that relate to PREPARED?

- My research will stem from work that is related directly to my involvement within PREPARED. I have spent a good portion of my time studying the nuances of optimal sensor location aimed at real-time model calibration. The practical application of accepted methodologies developed to meet the requirements for PREPARED provides a fantastic knowledge base from which to expand the field and push the limits of what is currently known.

What do you expect of PREPARED?

- In an era of uncertainty about the future of water resources; their continued availability in a changing climate and the increasing demands of a growing population, it is vital that water utilities are able to reduce waste and improve critical decision making. PREPARED is an industry driven project that I hope will bring about a positive shift in water management by providing the tools for a more informed administration of our water networks. Personally, from PREPARED, I expect a wealth of experience ranging from technical expertise to an understanding of the challenges of new research in large collaboration efforts across numerous institutions.

What are the main water issues in your country?

- Water resources in the UK vary greatly from region to region, starting with the water-rich north (it's always raining up there) to the relatively dry, and most densely populated, south-east. Water utilities in England are regulated privately owned companies and while there are growing strains on services in all areas due to population growth, particular regions are coming under significant pressure to guarantee the future of their services. Indeed, coping with population growth is a key agenda for water utilities in the UK.

In addition, climate change is perhaps the biggest unknown threat to the sustainability of water services. Water company operations and assets are potentially vulnerable to a more volatile climate and must act to adapt to alterations in availability. More frequent droughts, more intense rainfall and flooding are potential pitfalls in an evolving climate.

How will PREPARED relate to the problems within your country?

- Prepared will augment the adaptability and robustness of water services in the face of ever-changing circumstances. It will assist in planning and provide critical information for day to day management decisions. Increased efficiency is vital to serve a growing population whilst water companies are working to reduce their own carbon footprint.

What do you expect or how do you see European projects and your country?

- I think there is a lot to be gained from skill exchanges and joint efforts across the whole of the EU and that can only improve as ties between different European institutions grow ever stronger. I do think, however, that care must be taken in maintaining efficient and productive collaborations across so many institutions at prohibitive travel distances. There is also always a greater potential for miscommunication as culturally diverse institutions tackle tasks from the own unique perspective – not necessarily a bad thing, perhaps.

Personal ambitions with respect to Europe and European research for instance do you like EU cooperation and are you looking forward to work in or together with other countries?

- Yes, of course, working with a wide variety of people from differing cultures is always an eye-opening experience – not to mention the possibility of travelling to see and learn something on a personal level about the different countries and peoples of Europe.

PREPARED organises successful project meeting

by Gerard van den Berg (KWR)

The FP7 funded project PREPARED recently organised its 18-month Project Steering Board meeting. During a two-day event, kindly hosted by Berliner Wasserbetriebe, in September 2011 in Berlin, the progress and main outcomes of the project were discussed by members of the project consortium and the Project Advisory Committee; a forecast was made of the work plan and expectations for the next period. PREPARED is clustered around city utilities and their needs for practical instruments and planning scenarios to adapt to the projected effects of climate change on their urban water resources and assets. Tools and methodologies developed by the PREPARED researchers are demonstrated and tested within city utilities. The utilities in PREPARED, that have to deal with water resource scarcity, extreme events and integrated approaches presented their main results and experiences at the meeting. Considerable progress has been made, amongst others, in predicting the water demand elasticity, rainwater harvesting and grey water reuse, developing monitoring and software tools for sewer systems, optimising the handling of sediments in networks, demonstrating the set-up of water cycle safety plans, and the identification of transition strategies for urban water systems. A utilities session and field trip were organised as part of the Project Steering Board meeting. The main goal of these activities was to bring utilities together and give them the opportunity to network and discuss common issues. Experiences from the utilities workshop are described in more detail in this newsletter. For interested readers a booklet is available from our website that summarises the intermediate results of PREPARED (www.PREPARED-FP7.eu).



1st PREPARED Alliance Forum on May 14th 2012 in Dublin

by Gesche Grützmacher (KWB)

Cooperation between city utilities has many advantages. This is both true for PREPARED utilities but also for other utilities outside PREPARED. As part of the research project, the partners from the PREPARED consortium have committed themselves to create a forum for participating cities/utilities to exchange expertise and gain experience on their demonstration activities but also on other national water-related research. The aim of PREPARED is to build a strong network of city utilities that will continue once PREPARED as project has finished. A network that does not only include utilities that are directly involved in the demonstration activities in PREPARED but also utilities outside the project. The project has received requests from utilities outside the project to become involved in PREPARED. This is a positive development that will enhance the dissemination and ultimately the implementation of project deliverables. A first step towards creating this forum was accomplished during the 2011 Project Steering Board meeting in Berlin, when a dedicated utility session was organised for representatives from the utilities to get to know each other and their specific issues related to climate change. The next step will be a meeting of the first official PREPARED Alliance Forum, to be held during the Dublin IWA Conference on World Congress on Water, Climate and Energy on 14 May 2012. In Dublin the utilities and cities involved in PREPARED will participate in this forum and exchange experience on success and difficulties regarding their climate change adaptation efforts and strengthen the network for further collaboration. Also, utilities will be able to provide more information on their specific challenges and the demonstration activities they have scheduled within PREPARED. Other utilities will then be able to judge whether they want to visit other utilities to get more information on the demonstrations taking place in the project.

PREPARED utilities will make a poster with key information on their situation, challenges posed by climate change and how they address these challenges. In addition there will be presentations from all involved followed by panel discussions. A dedicated workshop will focus on the link between utilities needs and EU policy-makers (such as DG CLIMA), to ascertain a better exchange of information and cooperation between policymaking and the day-to-day reality of a water services provider.

PREPARED Utilities Network

by Gesche Grützmacher (KWB) & Regina Gnirß (BWB Berlin)

The project PREPARED follows a utility-driven approach. This means that the research needs have been identified by the utilities in PREPARED and the heart of the project is the demonstrations, in which the utilities demonstrate the outcomes of the research activities in full scale. Finally, the project provides a platform for the utilities to meet, exchange knowledge and practical experience in the field of climate change adaptation.

The first eighteen months of the project were dedicated to the research and development activities, with research institutes and SMEs as the main actors. As the project is proceeding, however, the utilities are becoming more and more involved. To enhance communication between them and, as part of the Project Steering Board meeting held in September 2011 in Berlin, the host Berliner Wasserbetriebe (BWB) together with the Center of Competence for Water (KWB) organised a utility session for the representatives.

The utility session started with a key-note by Professor Simon Tait from the University of Bradford on 'climate change scenarios in PREPARED'. Prof.

Tait explained how the PREPARED project uses scenarios to deal with future uncertainties. Instead of predicting the future (what will happen) or road-mapping (what researchers and scientists would like to happen) the scenario approach offers an opportunity to look at different possible futures and their effect on urban water systems. Prof Tait pointed out that it would be important to look at scenarios covering low and high climate change as well as high and low economic capacity.

The utility representatives from Eindhoven (Frank van Swol), Oslo (Arnhild Krogh), Lisboa (Basilio Martins), Barcelona (David Sunyer), Aarhus (Inge Halkjær Jensen), Berlin (Erika Pawlowski-Reusing, Bernd Heinzmann and Regina Gnirss), Katowice (Jan Suschka) and Genoa (Claudio Arena) supported by Project Advisory Committee (PAC) members Claudia Castell-Exner and Riku Vahala visited the Tegel Waterworks, located on the north-western part of the city.

Dr. Gnirss introduced the Berlin's water supply system and explained how flexible the system could cope for more than 100 years with changes like World War 2, iron curtain and the reunification. As one of the largest water utility in Germany, services are provided to the 3.8 million inhabitants of Berlin, with full responsibility for water works, waste water treatment plants, pumping stations and the network. To be prepared for future challenges a 'Water Supply Concept 2040' was developed, taking into account three scenarios, tackling specific problems as low precipitation (530 mm per year), low discharge (down to 2 m³/s) in summer and climate change.

Next the guests were led through the water works which treat groundwater for iron and manganese removal by aeration and sand filtration. An important characteristic of Berlin's water supply is that there is no final disinfection of the water supplied.

The visiting utilities were asked to fill in a form on their supply and sanitation system. The questions asked related to the number of citizens served, the size of the urban area served, the average water consumption, the average precipitation, type of water resource used, presence of combined or separate sewer system etc. In addition, the utilities were asked to give information on future challenges for their systems and the issues of most concern. In the discussion that followed it became clear that there is much similarity between utilities such as flooding, rehabilitation rate and future drinking water consumption.



The Bode Museum, Berlin

The most important conclusion was that there are many similar problems which can be solved together such as ensuring high water quality but also a decrease in consumption, dry summers as well as managing combined sewer overflows during extreme rain events. To facilitate new design data for planning as well as better online monitoring systems to prepare operational options are required.

The utility session was closed by a presentation by Dr. Erika Pawlowski-Reusing from BWB on the adaptation of Berlin's urban drainage system to climatic changes.

The overall impression was that this event was a good starting point for the utilities to begin communicating on issues of mutual concern. This was made clear by a statement during the meeting on the following day, in which Dr. Gnirss, speaking for the utilities pointed out that the coordination between utilities and researchers are already now leading to fruitful discussions. An initiative to be continued.



Utility session at Tegel Waterworks.

PREPARED's connections with policy making

Two events one in Brussels and one in Nicosia

by Adriana Hulsmann (KWR)

In October 2011 PREPARED took part in the second Technical Workshop on Adapting to Climate Change called: 'A dialogue between research and policy' that was organised by DG Research and Innovation (DG R&I). The event broadly aimed at facilitating and enhancing the dialogue between researchers and relevant European Commission Directorate Generals (DGs). The underlying objective was to explore how FP7 projects can address pressing policy questions in the field of climate change adaptation and support policy makers with the development of the climate change adaptation agenda.

For PREPARED this not only presented an opportunity to talk to various policy makers at EU level, but also to get a quick update on ongoing related FP7 projects. Links were established with the 'clearing house' that was set up by the European Commission (EC) and the European Environmental Agency (EEA). The objectives of EU Climate Change Adaptation clearing house to facilitate collection and dissemination of information, to assist in effective uptake by decision makers and to contribute to more coordination. This is achieved through coordination with national knowledge platforms and with the focus on EU and transboundary value added. Initially the focus will mainly be on decision-makers, working on the development and implementation of strategies for the adaptation to climate change. Water is one of the key sectors for the clearing house. Interesting is the overview of national adaptation strategies from twenty seven EEA member countries available on the EEA website: <http://www.eea.europa.eu/themes/climate/national-adaptation-strategies>

The EEA is interested to cooperate with PREPARED and has shown special interest in the portfolio of adaptation measures that are being developed within PREPARED. The cooperation with the EEA might offer a chance to continue the portfolio beyond the lifetime of PREPARED. Information on the clearing house can be found on the EEA website: <http://www.eea.europa.eu> .

Besides DG R&I other DGs of the European Commission present were DG AGRI, DG CLIMA, DG REGIO and DG SANCO as well as the EEA and UNEP. Specific PREPARED outcomes the DGs showed interest in were:

- Awareness-raising activities by further expanding the focus of the city utilities network; how this might be used as a capacity-building tool
- The assessment of costs of inaction / adaptation to climate change
- The identification of vulnerability hotspots, especially for water sensitive cities
- Quantitative risk assessment and hazard database in connection to urban waste water.



In November 2011 PREPARED took part in the national workshop on the Development of a National Strategy for Adaptation to Climate Change adverse impacts in Nicosia, Cyprus

Cyprus is in the process of developing a national adaptation strategy to cope with the impacts of climate change that severely impact on this Mediterranean Member State. Due to climate change the average temperature in Cyprus is increasing as does the number of heat waves. At the same time there are changes in precipitation patterns that result in shorter and more intensive periods of extreme rainfall. In a nutshell Cyprus has to cope with higher temperatures and increasing shortages of fresh water, while

at the same time there is a booming tourist industry. The tourism industry is responsible for a major part of the national income but unfortunately the tourists have a significantly higher water consumption pattern in periods that demands are already high and supply is falling short. Cyprus is looking for both adaptation methods and is also considering important changes in agriculture towards more drought resistant crops. The government has asked PREPARED for input in the national policy document. Cyprus is also interested to become more closely involved in the project, especially with the Cyprus Presidency of the EU coming up in 2012.

As PREPARED becomes better known in the European water sector increasingly more requests are received from policy makers and utilities outside the project that are interested in the knowledge and tools generated within PREPARED. The next steps within PREPARED will be the establishment of adaptation expert teams that can provide on-demand advice or organise local workshops tailored to the needs of the city/utility or Member States specific challenges posed by climate change.

Message from the PREPARED Coordinator



The PREPARED project is co-funded by the European Commission through the FP7 programme of DG Research and Innovation. External funding inevitably comes with strict obligations to deliver what is promised and to make known what has been achieved by the project. In the current times of economic 'crisis' there is even more pressure to show what value for money the project delivers. The European Commission has to make clear what has been done with the tax payer's money and how the outcomes of funded research are beneficial to the European citizens and the European economy. Here we, as beneficiaries have a shared responsibility with the Commission to make it clear to the public what PREPARED has achieved and how the outcomes of the project are being used in the day to day practice of the water sector. In other words how has PREPARED changed the way the water industry operates and is better able to cope with the challenges posed by climate change? PREPARED as well as the individual partner organisations have to disseminate outcomes and share the knowledge generated within the project together with the utilities involved. We see two ways to increase the transparency for those not directly involved in PREPARED. Firstly, information has to be made available in a way that the general public understands. To achieve this we will stimulate the production of audio-visual material such as short documentary films on

demonstration activities at the utilities. We look at our utilities together with their research partner to identify success stories that can be made public e.g. through videos on the website.

Secondly, we invite utilities outside PREPARED to voice their interest in the project with the aim to create a network of associated utilities that can directly benefit from the results of PREPARED and share in the knowledge through direct interaction with PREPARED utilities and if necessary make a request for a PREPARED expert team to assess their own situation and their preparedness.

Adriana Hulsmann
Coordinator PREPARED



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1. KWR Water b.v. - The Netherlands
2. DHI - Denmark
3. SINTEF - Norway
4. Kompetenzzentrum Wasser Berlin gGmbH - Germany
5. Institut National des Sciences Appliquées - France
6. International Water Association (IWA)
7. University of Exeter - United Kingdom
8. University of Bradford - United Kingdom
9. Cetaqua Water Technology Center - Spain
10. Iride Acqua Gas SpA - Italy
11. Tubitak Marmara Research Center - Turkey
12. The Institute for Ecology of Industrial Areas - Poland
13. Laboratório Nacional de Engenharia Civil - Portugal
14. University of Innsbruck - Austria
15. Crimean Scientific and Research Centre - Ukraine
16. NIVUS - Germany
17. S::can Messtechnik - Austria
18. Krüger - Denmark
19. Krüger - Denmark
20. Aquateam Norwegian Water Technology Centre - Norway
21. IWW Rheinisch-Westfaelisches Institut - Germany
22. Clavequeras de Barcelona - Spain
23. Berliner Wasserbetriebe - Germany
24. Municipality of Eindhoven - The Netherlands
25. Mediterranea delle Acque S.p.a. a Iride ACQUA Gas - Italy
26. Istanbul Water and Sewerage Administration - Turkey
27. Utility of city of Gliwice - Poland
28. Empresa Portuguesa das Aquas Livers, SA - Portugal
29. Water Department of Greater Lyon - France
30. Municipality of Oslo Water and Sewerage works - Norway
31. Simferopol Drinking Water Supply & Sewerage Company - Ukraine
32. Aarhus Water and Wastewater - Denmark
33. DWR Cymru Welsh Water - United Kingdom
34. Seattle Public Utilities - United States
35. Melbourne Water Corporation - Australia
36. Monash University - Australia