TRANSITIONS TO THE URBAN WATER SERVICES OF TOMORROW

trust MAGAZINE

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Sustainability

How sustainable are current urban water cycle services and how can their sustainability be improved?

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How is ”sustainability” understood in TRUST?

By Professor Helge Brattebø from the Norwegian University of Science and Technology (NTNU).

Sustainability is about to become one of the main criteria for how to design and manage urban infrastructure, so also those systems related to the urban water cycle services. Traditionally the focus has been mainly on local pollution and water quality, water scarcity, and health issues such a safe water supply. During recent years, however, other environmental problems were added, such as climate change, resource recovery, energy efficiency, toxicity, as well as a recognition of the need for life cycle thinking when examining environmental performance. One example of this new attention is the request for system-wide performance management regarding the so-called “water-energy-carbon nexus”, i.e. how greenhouse gas emissions are directly or indirectly linked to the energy and water balance of urban water services and how to optimise within this nexus. Additionally, as a result of aging pipeline networks and the increasingly common severe maintenance backlog within the urban water cycle services, long-term asset management and life cycle economics become ever more urgent.

Furthermore, various social performance criteria and governance strategies get increasingly high priority among water utilities, urban government and citizens.

The ambition of TRUST is to enable transitions to the urban water services of tomorrow, with sustainability as a holistic premise. According to this, the TRUST partners agreed to use a balanced approach, by identifying a set of sustainability objectives and criteria for the social, economic and environmental sustainability dimensions. However, since water utilities in the most powerful way can influence these three (end) sustainability dimensions by how they actually manage their assets and how they govern their external affairs, TRUST decided to also include the two dimensions of assets sustainability and governance sustainability. Hence, a set of sustainability objectives and criteria are also identified for these. In total, this led to a predefined set of 23 sustainability criteria, according to 13 sustainability objectives, within 5 sustainability dimensions, and the following sustainability definition:

> “Sustainability in urban water cycle services (UWCS) is met when the quality of assets and governance of the services is sufficient to actively secure the water sector’s needed contributions to urban social, environmental and economic development in a way that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

This definition and the predefined set of objectives and criteria will be the starting point of assessment tools and guidelines in TRUST. One example is the Self Assessment Tool that is developed in order to give water utilities a quick check on how they are on track regarding long-term sustainability, where questions are given for all 23 sustainability criteria. Another example is the WaterMet2 model, which will provide an in-depth analysis of how the resource metabolism (water, chemicals, materials, energy, emissions, costs) of an urban water system affects the metabolism-relevant sustainability criteria for a given city. A third example is the final and overall decision-theatre developed in TRUST, inspired by similar methods in AWARE-P, where decision-makers should be able to examine and simulate how different scenarios and intervention alternatives in the urban water services will influence the system’s overall performance, according to a similar 5-dimensional sustainability approach.

INTERVIEW

Roadmapping the way to 2040

Roadmapping is a creative analysis technique that analyses, forecasts and visualizes the development path of products, services and technologies of the future. The new road mapping guideline: A manual to organise transition planning in urban water cycle systems (UWCS). Links strategy to future needs and actions of the water sector and incorporates a plan for necessary adaptation measures. At the same time it serves as an excellent communication tool that supports a direct exchange between all relevant actors that are in charge with and interested in adaptation issues in their city or region.
Andreas Hein from IWW Water Centre in Germany was responsible for developing this guideline within the TRUST project.

Andreas Hein, Economist (M.Sc.)

Mr. Hein, why a roadmap process?

The roadmap process can consider good practices of water service related institutions (e.g. drinking water and wastewater utilities, local administration, local government, NGOs etc.) for urban water management and its sustainable planning. It will help to find the individual pathway to sustainable UWCS focussing on individual, regional or local adaptation needs and ambitions of the TRUST cities in the demonstration clusters and it will be very useful for policy makers, stakeholder groups and decision makers - and here especially for water professionals.

What is the difference between a roadmap approach and a conventional planning approach?

Strategic planning in UWCS needs a lot of exchange between responsible institutions and their participating representatives in this process. The roadmap approach allows combining a bottom up strategic planning process with an active communication and discussion between the involved people and institutions. It allows integrating different views and perspectives on one overall vision and supports a collective understanding of upcoming challenges in urban water management. The difference between a roadmap approach and conventional planning approach is that strategic plans are often designed on a high strategic level. The TRUST roadmap approach combines methodologically operative measurement planning in line with a UWCS vision from the participants’ perspective. This ensures a high acceptance of the outcome.

What role does communication play within the process?

The role of communication and the exchange between the partners is a core element for a successful roadmap exercise. Participants of the road mapping procedure should have an open interest in transition and adaptation needs of “their” existing UWCS. The adaptation of a roadmap supports the necessary communication between involved operators, stakeholders, administration and the public to identify a mutual understanding of the needs of transition.
It supports a collaborative planning process. Hopefully, its implementation for a sustainable future UWCS within a city or region will be pushed by this collective preparation.

Can you give me a short overview of the concept behind this?

There will be three main activities in the road mapping process: 1. Identification of relevant actors & information and local & regional topics, stressors and efforts; 2. Developing a vision for the future UWCS with forecasting and scenario techniques; 3. Defining action fields and measures by a stepwise backcasting process in order to identify the decisions and actions that must be taken at critical points if the scenario is to be achieved. In other words, the guideline considers the classical stages of the road mapping process (Scoping, Forecasting, Backcasting and Transfer) and also discloses a creative process for an interdisciplinary planning procedure that allows a lot of expert discussions – depending on the objective of each application.

Why is a roadmap approach like this suitable for a large research project like TRUST?

The roadmap approach is one of the fundamental tools within the TRUST project. It offers a wide perspective for working on future needs in terms of urban water management taking into account individual boundary conditions of each single UWCS. On the one hand the approach allows working with quantitative performance indicators (PI’s) as a tool box. On the other hand the systematic proceeding allows a concerted communication with the relevant institutions and stakeholders of UWCS on a qualitative basis.
The roadmap approach also is linked to other tools of the TRUST project, for example the self-assessment tool. The roadmap uses similar definitions of selected PI’s of the baseline assessment and can prepare the adaptation of a metabolism model which is going to be developed within TRUST as well, if metabolistic aspects should be emphasised in the city’s assessment procedure.

Is this guideline applied somewhere already?

No, it isn’t. This manual has been designed for direct practical use in TRUST and for organising sustainable UWCS planning in general. It is the first manual developed for practitioners taking into account the roadmap methodology. The guideline provides a generic understanding of the road mapping process and structure. After being tested within the TRUST demonstrations, some practical aspects will be identified to improve the clarity and understandability of this document and its templates.

Is this guideline suitable for any city or region, no matter how different?

Yes, it is. TRUST will have a sophisticated demonstration of the guideline during the upcoming months. The duration of each demonstration will be quite different because of the differences in the contents and the complexity of discussions and topics. A very important element for a successful roadmap demonstration is an open interest of the cities or demonstration areas in transition. The roadmap exercise needs information and data about the status quo and realistic assumptions about selected future trends and pressures of each participating city. This information will be collected, analysed and assessed with active involvement of the cities in workshops to define a catalogue of measures for a stepwise implementation of the urban water system and service transition. And in the end, it will be applicable to any city or region.

Download the roadmap guideline at www.trust-i.net.

Ten things you shouldn't miss about urban water cycle systems

To support water professionals and other urban stakeholders in identifying possibilities for strategic options, a state of the art review publication "Best practices for sustainable urban water cycle systems (UWCS) - an overview and enabling & constraining factors for a transition to sustainable UWCSs" has been created within TRUST. It presents best practices on four themes: Demand management, reuse and recycling, water and energy and leakage and loss reduction.
Water demand management is defined as the implementation of policies or measures that serve to control or influence the amount of water used. Urban water recycle is the procedure where grey water or wastewater from showers, baths and washbasins is treated appropriately in order to cover non-drinkable demands. The water-energy nexus deals with energy efficiency. Reducing the energy is an important objective especially since high energy consumption will affect the water industry world wide and is inextricably linked to the issue of climate change. The last of the four themes is leakage and loss reduction. The amount of water leaked in water distribution systems varies widely between 3% up to 50% and even more, according to different countries, regions and systems and an increase in break rates due to climate change is expected.
A best practice in the report refers to an on-the-ground practice where an approach, technology or technique has been implemented successfully. For the description of best practices, policy documents, strategic plans, research reports and scientific articles were collected. Also, for each of the themes, enabling and constraining factors for on-the-ground implementation were identified on the individual, intra-organisational, inter-organisational and administrative level. The results hint towards some key messages for urban water utilities and stakeholders who are envisioning a transfer to a sustainable UWCS.
To give a first impression of the outcomes of the report here are ten best practices that can increase the performance of current urban water services.

1

Efficient household appliances (Demand Management)

Why? Water used in the house is greatly affected by how much water appliances in the house require for their normal operation and how they manage it. Simple interventions such as more water efficient washing machines, self-closing faucets, low flush toilets and controlled urinals in public buildings (such as schools and offices) can save between 30-40% of pre installation demands. The installation of such appliances does not entail additional costs nor does it require any significant changes in the everyday practices of the users. Water ratings for appliances need to become more common to guide the users.

2

District Metered Areas (DMA) monitoring (Leakage and Loss reduction)

Why? When using DMAs to monitor the network, the water distribution system is divided in several zones where water loss in the entire system can be micromanaged and monitored. The important tasks of DMA establishment are to control all the inflows and outflows in the area and decide the minimum night flow. Only this way it is possible to control the hydraulic performance of the network and to estimate leakage volume. The leakage level in each area will allow the definition of priorities and adequate strategies for action.

3

Optimization of existing assets and operations (Water and Energy)

Why? Pumps and pumping represent an area with large potential for energy savings. Simple gains are possible in some pumping situations where the operational set up has been changed from the design condition. Together with applying variable frequency drives and adopting energy-efficient pumps, gains of between 5% and 30% may be realised in drinking water extraction and distribution. This has been done in e.g. Grobbendonk (Belgium) by Pidpa, the Provincial and Interurban Drinking Water Company in the province of Antwerp. It resulted in about 15-20% energy saving.

4

Rainwater harvesting (Reuse/Recycling)

Why? Harvesting rainwater (both from roof runoff but also from the much more significant source of road runoff), can reconfigure the urban area into an effective water catchment. This could be a viable option for densely populated urban areas and reduces water consumption and wastewater production. It also minimizes the entry of pollutants into the surface waters, without the need for a sewer connection. In Germany, field tests found that up to 70% of toilet-flush demands can be replaced by treated storm water without any comfort loss. Water can be treated through bio-systems (such as green roofs) and used as grey water for in house or garden purposes or passed through artificial wetlands to recharge depleted aquifers in dry climates.

5

Water Tariffs (Demand Management)

Why? Water pricing is an important way of both recovering (part of) the full cost of water and also bringing water into the attention of the household to alter behaviour. Tariff design is not a straightforward issue and should, arguably, take into account revenue sufficiency, economic efficiency and equity. Tiered systems (such as those piloted in California) and progressive water tariff structures that penalize the inefficient water usage, such as the tariffs in Singapore, are examples of different implementation of these ideas.

6

Different acoustic techniques for leak localization, especially leak noice correlators (Leakage and Loss reduction)

Why? Leak localization with acoustic techniques is an activity that identifies the spot of a leak between two manholes in a pipe system. Leak noice correlators are portable computer-based devices, which can locate leaks automatically. Some leak noise correlators are wireless and provide the flexibility needed to accurately locate water loss sites along highly inaccessible routes. The acoustic correlator is used to locate the leak with a couple of meters, and is therefore very efficient in quickly defining leak areas and pinpoint leaks on specific pipes. The leak noise correlators are more efficient, yield more accurate results and are less dependent on user experience than listening devices.

7

Grey water recycling (Reuse/Recycling)

Why? Wastewater reclamation and reuse can be implemented at several scales, including but not restricted to urban green spaces, supplying the ecological flow of urban rivers, irrigation of farm areas in the peri-urban environment and supplying water to wetlands in river deltas (as in the case of Barcelona) – stopping at the same time saline intrusion. Depending on the water stress, non-potable in-house uses (such as toilet flushing, which account for more than 30% of household demand) can be met by reuse of treated grey water (water from hand basins or the washing machine) from the household.

8

Pressure management (Leakage and Loss reduction)

Why? Leakage is tightly coupled with network pressure. When overall pressure is reduced, the same happens to leakage. Pressure control reduces the frequency of sudden bursts and postpones leaks evolution. The investment in measures to reduce pressure in the network might be efficient to reduce leakage with the following financial savings in water treatment and pumping costs.

9

The adoption of novel (but proven) technology concepts such as the Sharon/Anammox process (Water and Energy)

Why? To remove the high nitrogen content of reject water from digesters at wastewater treatment plants, energy is required for the aeration (oxygen enrichment).
In Sharon/Anammox systems conditions are such that partial nitrification takes place followed by anaerobic ammonium oxidation. These autotrophic N-removal systems for separate treatment of reject sludge water require about 60% less energy for aeration compared to traditional systems.

10

Water sensitive cities: combining interventions

Why? All these measures should not be seen as standalone interventions. Successful examples of water sensitive cities, such as Melbourne, suggest that really important is not individual interventions per se, but rather their deployment as a bundle of measures, focusing on distributed solutions and interventions, within a coherent long-term strategy and vision. This integrated management of all components of the hydrological cycle within urban areas and landscapes – including water consumption, storm water, wastewater and groundwater are able to secure a range of benefits for the city as a whole. Success stories such as Melbourne and Sydney span traditional stakeholder boundaries and cut across the public and private sector. This implies that part of the innovation and value is in how different parties are brought together, solutions implemented and corrective actions are made as knowledge from implementation builds up.

The authors of the report are Christos Makropoulos and Evangelos Rozos (National Technical University of Athens), Stian Bruaset (SINTEF Building and Infrastructure) and Jos Frijns and Mariëlle van der Zouwen (KWR Watercycle Research Institute). You can download the detailed report at www.trust-i.net.

INTERVIEW

“The biggest challenge for the water utilities is how to improve their sustainability in its different dimensions”

The first stage of the TRUST project is successfully completed. The Diagnosis & Vision work area has finalized its work and a first set of results, tools and outcomes have been created and published. Diagnosis & Vision contributed to the overall objective of TRUST by performing an initial assessment of the urban water situation in Europe - also going beyond the nine TRUST pilot regions. Outcome is a solution-oriented planning approach that supports water utilities in tackling four key questions: Where are utilities now? Where do they want to be? How might the utilities get there? How does it ensure success?

The most important results of the work area are 1) a methodology for sustainability assessment, 2) guidelines for urban water strategic planning: a review of best European practices, 3) a roadmapping process for urban water cycle systems (UWCS), including a guideline and templates to enable any urban water utility to developing and implementing specific roadmaps to improve its sustainability and 4) a first quick sustainability scan of the TRUST cities to see where they are, to identify their needs and ambitions and to show how they are performing in different dimensions of sustainability. This sustainability assessment will serve as a basis from which TRUST city/region stakeholders can discuss their vision and strategies and develop their individual roadmaps for transition to a more sustainable UWCS.

Work area leader Rui Cunha Marques, Professor at Instituto Superior Técnico (IST) in Portugal answered some questions about the results of his work area and the biggest challenges for the water utilities.

Prof. Rui Cunha Marques

Why does a project like TRUST starts with Diagnosis & Vision activities?

Diagnosis & Vision is a key working area for the TRUST project since it performs an initial assessment of urban water cycle systems in Europe and it is the basis for the next tasks in the project. It not only identifies the current state of affairs of the UWCS, but it also investigates future pressures and trends that will have impact on UWCS and on the way water utilities are answering the pressures. It also includes the development of a generic roadmapping process and structure for determining the best path for the transition from their present situation to the desired future endpoint (adaptation roadmaps).

What is the outcome of the initial assessment? How is the urban water situation in Europe?

The outcomes are overall positive and show that stakeholders, in general, and water utilities, in particular, are concerned with the future and with the sustainability of UWCS. The urban water situation is diverse in Europe and, as expected, the water utilities tend to focus on their own major problems or challenges. For example, for a water utility located in an area of water scarcity in Europe, issues related to the efficient use of water are more relevant than for a utility located in an area where water quantity is abundant. Current pressures are a determinant for the performance of European water utilities and future pressures are marking the path for the transition from the present situation to a more sustainable future.

What are the biggest challenges and problems at the moment? Where is change needed urgently and what kind of change is needed?

At the moment one of the biggest challenges for the water utilities is how to improve their sustainability in its different dimensions. Of course, the level of sustainability of water utilities is different, depending on several aspects, and each one has its own problems and challenges. Determining the best path for the transition from the present situation to a more sustainable one, taking into account current and future pressures and trends, is not an easy task, despite being necessary. If the objectives of UWCS sustainability are well identified concerning the social, environmental and economic dimensions, I believe the objectives related to the other two (supporting) dimensions concerning governance and assets (see article “How is ‘sustainability’ understood in TRUST) are the most challenging.
Nowadays, the biggest problem that some European water utilities face is that they are too concerned with the current pressures and solve problems associated to them instead of looking at the UWCS in an integrated and holistic way. The thinking needs to change. UWCS sustainability is only possible if all the dimensions are embraced in the right way and if the points of view of all the stakeholders are included.

What are the future pressures and trends that will impact the urban water systems and how is TRUST able to support the cities to respond to these pressures?

UWCS will face environmental, social and economic pressures and the pressures arising from the relationships between these three aspects. Trends are induced by these pressures. Concerning environmental pressures, aspects such as water stress (quantity and quality) and climate change (e.g. increase of temperature, high sea level or extreme events) can be pointed out. The TRUST project focuses on that and helps the decision makers to deal with them in an efficient way. For example, by means of a roadmapping process, water utilities might explore and develop their individual pathway for sustainable water cycle services. In the future, TRUST will also provide concrete and validated technology and management options that help to respond to the pressures and to actually implement their roadmaps.

What do you consider as the most important achievement(s) of your work area?

All the work that was done for Diagnosis & Vision, interrelated but different, makes good contributions for the literature and can be very useful for the water sector stakeholders. The first one highlighted the research activity, best practices, current initiatives, and knowledge gaps/research challenges related to UWCS sustainability. For this purpose an extended questionnaire was created, close to the needs of the water utilities. The second one established the future pressures and trends that will impact the urban water systems and the third package focused on the development of both, structure and process for an effective UWCS adaptation roadmap. Roadmapping has a great potential and the work developed in this scope will be very useful for the following work areas.

Who is your research directed at?

This research is directed to all the UWCS stakeholders. However, I highlight the governments, as policy makers, and water utilities as the major responsible stakeholders to implement those policies.

How might urban water use and water services be different in 30 or 50 years time and what would be your ideal?

I think that urban water use and water services will be necessarily and substantially different in the future. Water utilities will be more sustainable in their different dimensions and will be prepared to cope with the problems and adversities. For example, concerning the environmental dimension, water utilities should be efficient in terms of using water, energy, materials and other resources improving the environment and biodiversity. Urban water use will also be managed across the water cycle and the river basin and the role of water in the cities and communities will be more valued, integrated and tailored to their needs, delivering better and optimal environmental and social outcomes.

What role can consumers/citizens play in helping to deliver sustainable urban water services?

Consumers/citizens can help to deliver more sustainable UWCS if there are mechanisms to improve their participation in decision making processes at all levels. If water related issues are more transparent and decisions are made based on informed choices, consumers will be able and motivated to participate. My hope and my belief is that in the future, consumers/citizens will increase their role in the UWCS, thus ensuring a sustainable development of the UWCS.

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trust MAGAZINE

Trust reaches the 18 months milestone

After 18 months of collaborative work, TRUST is delivering its first outputs, thanks to the fact that collaboration among the project partners is both widespread and meaningful, and thanks to our partners in the cities and utilities who have provided data and engaged with the project's ambitions.

During the first project period we have made very good progress on our research, started cooperation with several national and international initiatives and succeeded to establish TRUST as a brand within the water sector. We have encountered no serious problems but effectively and efficiently dealt with some challenges, thanks to the collaborative working atmosphere in the project.

A number of our first results are presented in the current version of the TRUST Magazine and I am looking forward to the next step of the project where more and more outcomes will become available, cooperation will be intensified and first applications of our results and products will take place.

David Schwesig (project coordinator)

Next in TRUST – upcoming research results

On-line self assessment tool to determine urban water cycle services performance measures

Are you ready for 2040? The web-based self assessment tool is a qualitative quick-scan for water utilities to check how they are on track regarding long-term sustainability.

http://self-assessment.trust-i.net

Mobile software to support assessment & repair of assets

The proof of concept will be a functional application for a pre-defined use case. The tool allows mobile terminals to capture context in the vicinity of management groundwork personnel and provides innovative visualisation and management software tools to support network inspection/repair and the generation of searchable rich records.

New technological options for stormwater separation and optimized waste water treatment

This report will present cost-energy-efficient solutions (emerging technologies and operational practices) for wastewater systems based on a precise assessment of system capability to better enable adaptation to future needs. It addresses system bottlenecks and utilizes mitigation technologies, in particular with respect to storm water management and wastewater treatment in terms of customer service, energy balance, minimum discharge of pollutants, recovery of limited resources and prefers "no-regret" solutions with regard to climate change.

SEVENTH FRAMEWORK PROGRAMME

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