Zaragoza: taking pride in integrated water management in the city

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INTRODUCTION

The city of Zaragoza takes great pride in the way water has been managed in this city. Amongst others, it has achieved impressive results in reducing water losses in its water supply system, increased investments in wastewater treatment, and above all, obtained high degrees of participation of citizens, organised civil society and local government departments in aspects of water management. All of this culminated in the 2008 Expo, which was held in Zaragoza and had as its theme "water and sustainable development". This paper aims to provide a background to how these results have come about, and what role the SWITCH action-research project has played in that.

Water management in Zaragoza

The city of Zaragoza is the capital of the Autonomous Community of Aragón in North-eastern Spain, with a population of around 700.000 inhabitants (Ayuntamiento de Zaragoza, 2010a). This is a semi-arid region with an average annual precipitation of only 314 mm (Arbués and Villanúa, 2006), most of which falls in the cold winter.

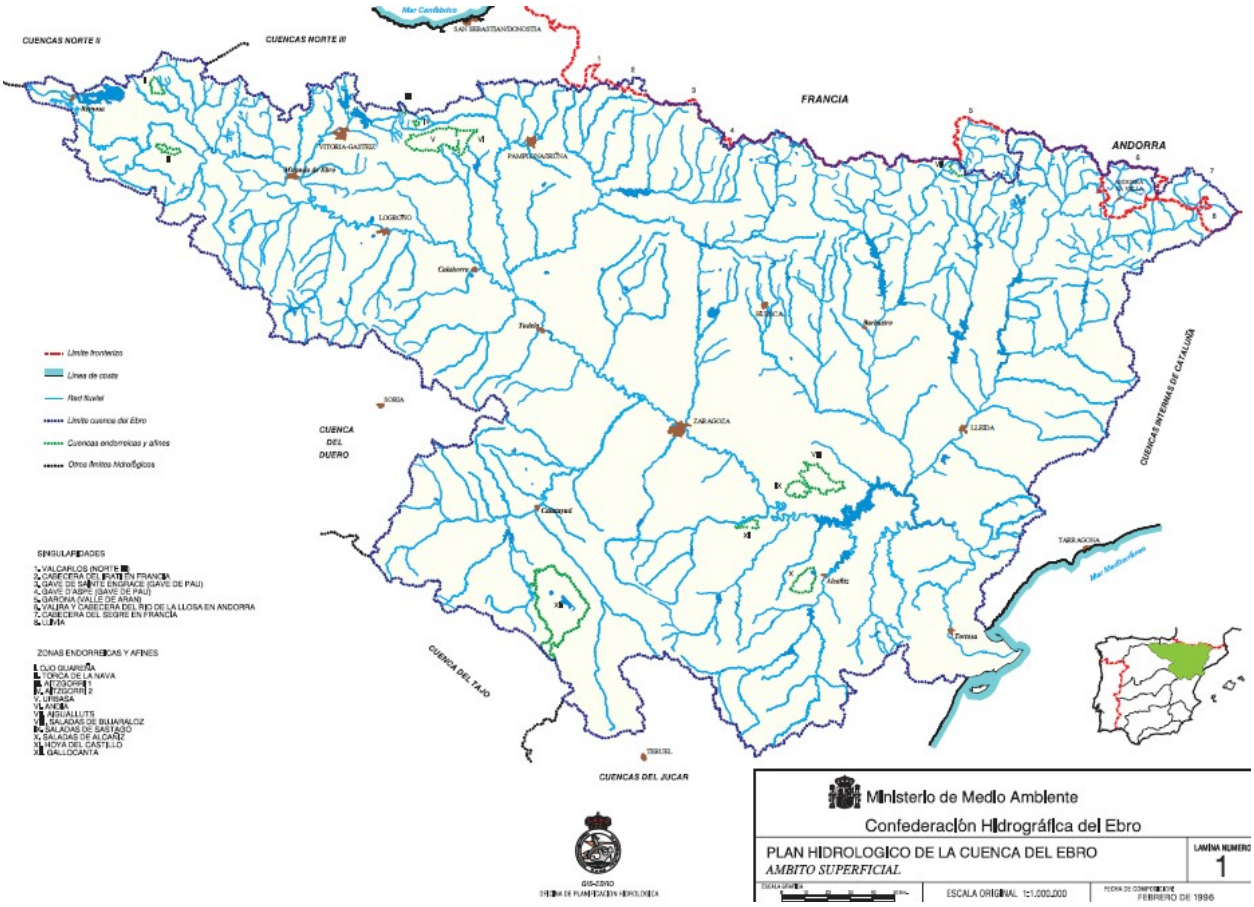

Figure 1: Map of the Ebro basin, with Zaragoza located in the center (Source: CHE, 2010)

Zaragoza is located in the centre of Ebro river basin (see Figure 1). The Ebro has been developed since Roman times for agricultural, domestic and many other uses. As a result it is now a heavily regulated river, with over 138 dams having been constructed, providing a total storage capacity of 687,300 m3 (Penagos, 2007). These dams serve a large network of irrigation systems, feed urban water supplies and help in flood control.

The Ebro basin is also the source of water for Zaragoza. Raw water for the city supply has historically been abstracted from the Ebro, mainly through the Aragón Imperial Canal. Since 2009, the city has shifted its source towards the Yesa reservoir, much higher up in the Pyrenees, because of the better quality of that water. Water is transferred from the Yesa to Zaragoza (and many other settlements in Aragón) through an extensive network of pipes and pumping stations. Although there are plentiful groundwater resources in Zaragoza, underground water has not been exploited for the municipal water supply, mainly because it contains high concentrations of minerals such as sulphates, nitrates, sodium and magnesium (Arbués et al, 2004).

Even though the supply from the Ebro for human consumption in Zaragoza has been secured as a priority use within the allocation arrangements of the CHE, already from the 1990s onwards, Zaragoza city has embarked on ambitious water demand management initiatives (see Kayaga et al, 2008). The Municipal Strategic Plan 1996-2010 put down the ambition to reduce total city water consumption from 84.7 Mm^3 in 1995 to 65 Mm^3 by 2010. Water scarcity (particularly a drought in the early 1990s) has been an important consideration in that, but also financial and economic considerations were a main driver. At the time, users needed to start paying to cover costs of an increase investment in wastewater treatment. To keep the total water and wastewater bills affordable, water demand management measures were proposed at household level. In addition, the city aimed to reduce unaccounted for water. In various phases, water demand management was introduced through a combination of technical and educational measures and financial (tariff) incentives (see see Barberán (ed.), 2006; Barberán, 2008; Barberán y Arbués, 2009 Kayaga et al., 2008), for a more detailed description of some of these measures. The results of these measures have been impressive in terms of the reduction of per capita water consumption. Table 1 shows the history of average water consumption over the last decade. Note that this has already come down from a peak consumption of 180 l/p/d in 1980 (Ayuntamiento de Zaragoza, 2003). As a result the city achieved much more than its own target: in 2009 total water consumption was 59.9 Mm^3.

Table 1: development of per capita domestic water consumption in Zaragoza (Ayuntamiento de Zaragoza, 2010a)

Year	Total measured domestic consumption (m^3)	Population (on 31 Dec)	Consumption (l/p/d)
2000	30.348.390	613.433	136
2001	30.152.510	622.601	133
2002	29.905.184	628.400	130
2003	30.233.534	641.581	129
2004	30.504.197	650.592	128
2005	29.864.630	660.895	124
2006	29.882.252	667.034	123
2007	28.581.816	682.283	115
2008	26.879.816	693.086	106
2009	26.769.055	696.658	105

All wastewater generated in Zaragoza is treated in two treatment plants (Ayuntamiento de Zaragoza, 2010a). The costs of these are included in the water tariff (see Barberán et al., 2008). In fact, part of the tariff paid by users in Zaragoza is used to cross-subsidize wastewater treatment facilities in other, smaller, settlements in Aragón.

Water governance in Zaragoza

Water governance in Zaragoza can be characterised by a strict separation of responsibilities for water resources and water services management. A second characteristic is the existence of multi-stakeholder platforms at different institutional levels.

Water supply and sewerage and wastewater treatment services are provided directly by the Municipality, through municipal departments that are part of the broader municipal administration. For example, the Infrastructure Area operates the water and sewerage infrastructure, alongside other municipal infrastructure. The municipal Treasury is responsible for water billing and tariff collection, again alongside the management of other municipal funding streams.

Also from an institutional perspective the Ebro is strongly regulated. In the 1930s already the *Confederación Hidrográfica del Ebro* (CHE), or Ebro River Basin Confederation was established. This government agency manages the waters of the river basin on behalf of the different user groups in the basin, using modern infrastructure and equipment. In fact, this was the first such agency of its kind in Spain and has acted as point of reference for river basin organizations in other parts of the World as well. Water management in the Ebro basin and in Aragón has subsequently been extensively studied (e.g. see Embid et al., 2007; Garrido and Llamas, 2009).

The CHE is itself an example of a formalised multi-stakeholder platform at the highest level. Different user groups are represented in its council, where decisions are made on water allocation and the setting of water use tariffs to cover operation and development of water resources in the Ebro. The Municipality of Zaragoza is represented in this as one out of many users, albeit a very important one as it is the bigger users.

One level lower, there is the Aragón Water Commission. This is an institution that has been created in 2004 as platform for decision making on water issues, as far as these concern the competences of the Autonomous Community, which are mainly in promoting investment in wastewater management. Again this Commission is made up of different stakeholder groups, and their representatives (see Embid et al., 2007 for further details on the specific mandates and functions of this Commission).

Finally, at Municipal level, there is the Municipal Water Commission. This finds its origins in the Local Agenda 21 process of addressing local environmental management, to which Zaragoza committed in the 1990s. As part of that Local Agenda 21 process, water was prioritised as a key area of work in the Municipal Strategic Plan 1996-2010. This then foresaw in citizen participation in various Agenda 21 Commissions. The Municipal Water Commission is one of these. This Commission is made up of representatives of different Municipal departments, from citizen groups, organised civil society and other stakeholders. This is a deliberative body providing advice on municipal policies and by-laws around water supply and sanitation services.

Citizen involvement goes well beyond these formal spaces for stakeholder participation in decision-making on water. For example, there is an active corps of municipal volunteers, who carry out voluntary work around environmental management and education, including water management. The work on water demand management has also triggered the emergence of a number of active environmental NGOs, working on issues of sustainable water use, such as the Fundación Ecología y Desarrollo (ECODES) (Ecology and Development Foundation) (see also Kayaga et al., 2008), the Foundation for a New Water Culture (FNCA) and the San Valero Foundation.

SWITCH in Zaragoza

It is against this backdrop that the SWITCH (Sustainable Water Management Improves Tomorrow's Cities' Health) project was carried out in Zaragoza. SWITCH is a major research partnership funded by the EC (2006-2011), with a budget exceeding €20 million, undertaking innovation in the area of integrated urban water management (IUWM) in 12 cities across the globe. Its objectives are:

- To improve the **scientific basis** for integrated urban water management
- To **test and demonstrate** the feasibility and potential of **innovative technologies**
- To support **cross-institutional platforms** and better linkages between urban water stakeholders in a city, and between research providers and users, to support an integrated approach to urban water management, and to maximise the uptake and impacts of science
- To improve **decision-support processes** towards the realisation of IUWM through evidence-based and far-sighted strategic **plans** and better **policies**.

Rather than focusing solely on new research, the project is explicitly aiming to put research into use, through its impact on stakeholders and, through them, on urban plans and policies.

This focus on getting research into use has implications for the way in which SWITCH has been structured. First of all, it requires research to be more integrated and inter-disciplinary, trying to study water management from different angles to illuminate its technological, hydrological, economic and governance aspects. In addition, SWITCH aims to engage the relevant stakeholders and establish linkages between research providers, knowledge managers and research users through what have been called learning alliances (LAs) (Smits et al., 2007; Butterworth and Morris, 2007). The aim of these platforms is to guide the research agenda, participate in the research itself and to act as the main channel for dissemination and scaling up.

The SWITCH generic objectives and approaches were translated into city-specific objectives with a focused intervention logic to achieve the objectives, according to context and needs. Zaragoza started off as a "demonstration city", in which good practices around sustainable urban water management could be showcased, but also further developed. In addition, further research and dissemination activities would be done to improve urban water management in Zaragoza.

This assessment and the structure of this paper

In order to review progress and test assumptions underlying the generic SWITCH approach, the project undertakes process documentation activities. To that effect, at regular intervals, a reflection has been made on the intervention logic and its effectiveness in each of the cities. In 2008, a first round of assessments was undertaken, with a focus on making the intervention logic in each of the cities explicit, mapping the initial outcomes of the project, and making recommendations for successful implementation. For operational reasons, however, such an assessment could not take place in Zaragoza in 2008. Yet, the set of assessments was very well

received, as a method for critical self-reflection on the assumptions underlying each of the cities' intervention logic and the expected impacts.

In 2010, towards the end of the project, this exercise was repeated but with different objectives and scope. Specifically the 2010 assessments aimed to:

- Identify lessons learned on the effectiveness of the intervention logic
- Define recommendations for actions in the last months of the project
- Identify mechanisms and make recommendations for scaling up and sustaining impact beyond the life-span of the project.

This paper presents the results of the 2010 city assessment of Zaragoza. It first outlines the methodology used. This is followed by explanation of the SWITCH approach followed in Zaragoza, highlighting the intervention logic, team composition and activities, inputs and resources. The next section presents and discusses the results obtained so far. Finally, conclusions and recommendations are made, addressed to the SWITCH team in Zaragoza.

METHODOLOGY

Since SWITCH aims to change traditional patterns, attitudes, relationships, approaches and ways of thinking about urban water management, it needed to understand their context and background. In addition, it has needed to track what it is doing (inputs) to achieve changes (outcomes). The tool used for tracking was process documentation. Process documentation can help project staff and stakeholders to carefully track meaningful events in their project, 'in order to discern more accurately what is happening, how it is happening and why it may be happening' (Annie E. Casey Foundation, 2003; Schouten, 2007; Schouten *et al*., 2007). It does this through a process of continuous documentation of what a project is doing and achieving. At a number of specific moments, this process of (self)-reflection should be brought together in a synthesis that facilitates looking back at lessons learnt and looking forward to define recommendations to adjust the project approach. This paper represents a synthesis of such moments of reflection.

The main methods used to carry out the current process documentation exercise included:

- Review of project documents. This was mainly a desk-top based activity in which the authors reviewed project documents and tried to (re)construct a description of the project intervention logic to make activities and inputs more explicit.
- Reflection meeting with the project team. The project team met to discuss and reconstruct the intervention logic and reflect on the main results and weaknesses of the project. In this meeting various tools were used, including a reflection on the set of overall SWITCH indicators of success (see Annex 2) and a time-line exercise, the results of which are described in the next section of this paper.
- Review of the "gender and disciplines" composition of the project team and broader group of stakeholders (see Annex 1). One of the objectives of SWITCH is to bring different types of stakeholders together and assess water management problems in an inter-disciplinary way; this gender and disciplines matrix was completed to provide further insight into the types and background of members of the project team and the wider stakeholder group.
- Interviews with project stakeholders. These provided the bulk of the data used for the process documentation. The interviews sought stakeholders' perspectives on their role in the project, and the main changes they have seen as a result. An attempt was made to include representatives from different groups of stakeholders, who were somehow involved in SWITCH but in different roles. Table 2 provides an overview of the interviewees.

- Analysis within the SWITCH team. The final step was the analysis of the results of the interviews, the matrix and review of project documents with the team. These discussions led to the formulation of conclusions and recommendations.

Table 2: Interviewees

Stakeholder group	Interviewees
Core project team	Javier Celma and Victor Bueno (Ayuntamiento de Zaragoza, Agency for Environmental Management and Sustainability)
Researchers	Pilar Egea and Ramón Barberán Ortí (Universidad de Zaragoza)
Researchers from other SWITCH consortium partners	Carol Howe (UNESCO-IHE), John Butterworth (IRC), Sam Kayaga (WEDC/Loughborough University), Chris Jefferies (Abertay University)
PhD Students	Camilo Munoz-Trochez (WEDC/Loughborough University)
Other Municipal staff	Alfonso Narvaiza and Esteban-Raul Bello Perez (Infrastructure Area) Joaquín Garcia Lucea (Treasury) Marta Colomer and Carmen de Campo (Municipal Volunteers Corps)
Other authorities	Manuel Omedas and Rogelio Galván Plaza (CHE)
Civil society	Francisco Pellicer (formerly with the Expo) Josefina Maestu (UN Office for the Water Decade) Marisa Fernández (Fundación Ecología y Desarrollo)

Note: Descriptions of the organisations for which interviewees work can be found in Box 1 above or in the description of the project team, below.

Limitations of the assessment

Because of the role of one of the authors as facilitator of SWITCH in Zaragoza, some interviewees may not have been fully open in their responses and critique. However, by triangulating results from interviews with the review of project documents, we have aimed to obtain the most realistic analysis of the process. However, following the best practice principles of process documentation (Schouten *et al*., 2007) we have sought to be self-critical and reflective and to check own our perceptions and views. In addition, the lead author of this paper has not been involved directly in SWITCH in Zaragoza and was brought in to facilitate the analysis, and provide a further degree of impartiality.

SWITCH APPROACH IN ZARAGOZA

This section describes the way that the SWITCH project was approached in Zaragoza. It briefly outlines the project's origins, the efforts made to link this to the urban water situation described above, and the initial steps in establishing the project. This is followed by a description of the intervention logic of the project, i.e. the way in which the different activities aim to achieve the overall objectives. Information is then provided on the project team, partners and stakeholders. Finally, an overview is given of the actual activities and inputs made to date.

Project origins and expectations

When the SWITCH consortium developed in 2004-2005, Zaragoza had already followed a long trajectory of addressing IUWM problems, and as shown in the introduction has already moved ahead in areas like water demand management and citizen participation. Yet, still the Municipality was interested in joining this partnership, with three main expectations. First of all, it was expected that SWITCH could be an opportunity to showcase Zaragoza's experience in this field and share it with other European cities that have embarked on similar processes. Secondly, it was expected that this would provide an opportunity to strengthen its water demand management work, particularly by analysing the efficacy of different water demand management

measures (technical, financial and educational measures) and improving on these measures through research and demonstration activities. In this, an implicit decision was taken not to focus on other aspects of water management, like wastewater treatment or stormwater management, as these didn't present the priority problem areas for the city at the time. Finally, it was expected that the pride of participating in a European project would bring extra motivation to municipal staff and citizens to continue addressing water management and be a trigger to go ahead with additional activities in this field. These expectations were mutual, i.e. it was expected by the larger consortium that Zaragoza could provide these contributions. And, as we will see to some extent these were met.

However, where mutual expectations were not clear enough was in the field of the project management conditions and modalities. First of all, there appears to have been a gap in understanding of operational conditions of such an FP6 (Framework Programme 6) project, e.g. in terms of contracting additional staff specifically for this project under the Municipality. Also, expectations of what the Municipality could do in terms of research and documentation were not realised sufficiently at the start of the project. As we will see later, this later on led to misunderstandings and delays in the execution of the project.

Project team and partners

The only SWITCH consortium member in Zaragoza is the *Ayuntamiento* (Municipality) of Zaragoza. The core project team within the Municipality is located in its Agency for Environmental Management and Sustainability. This core project team was responsible for coordinating SWITCH in Zaragoza with other municipal departments, city stakeholders and other consortium members. In addition, this Agency has had an executive role in the demonstration activities, organising dissemination and awareness raising activities and directing the research. The core project team, however, only consisted of two persons, who had SWITCH among their much broader set of responsibilities. Under the Municipal personnel contracting rules, it was not possible to hire additional staff, not even on a consultancy basis, to carry out the significant amounts of work that SWITCH brought to this Agency. This meant that the core project team was often pressed for time, and was not always able to carry out all activities as planned. Apart from this Agency, also staff from other municipal departments was involved, particularly from the Infrastructure Area, the Treasury and the Municipal Volunteers Corps.

Initially, there was no university or other research partner participating in SWITCH in Zaragoza. The expectation of the Municipality was that most research that would be required would be more technical in nature and engineering focused. This type of research skills was not clearly present at the local university in Zaragoza (Universidad de Zaragoza). Hence the University of Zaragoza didn't join the SWITCH consortium from the onset. However, after a year or so, the need for bringing in research capacity into SWITCH Zaragoza became apparent and discussions started to bring in the university as additional partner. Two years of attempts to formalize a partnership with the university followed, exploring different formal conduits. For a number of reasons, none of these arrangements proved feasible within the project management boundaries, and in the end the University of Zaragoza never became a formal SWITCH partner. The work that they carried out, albeit it on a topic to the heart of SWITCH, never formally became part of the project.

Various other consortium partners from other countries collaborated with the Municipality of Zaragoza. WEDC/Loughborough University has collaborated on the technical side of water demand management. This included above all the research work of a PhD student doing his data

collection and case study analysis alongside the demonstration work in Zaragoza. UNESCO-IHE and IRC have had several interactions on issues of project management and support to the multi-stakeholder process.

As can be seen from the gender and disciplines matrix (Annex 1), the project team and students involved are well-balanced in terms of gender, although the ones supporting from other consortium partners are all male. In terms of disciplines the project team, broader stakeholder group and supporting colleagues all are biased towards engineering. This reflects the main focus of the project in Zaragoza, with strong emphasis on technical aspects of water demand management. However, other disciplines have also been brought into the research team, particularly around economics.

Intervention logic

SWITCH in Zaragoza has not had an explicit intervention logic. Whereas the overall objectives - of the project, components of the project and activities have been clear to the core project team, - this has not always been made clear to outsiders. Reasons for that include: -

- Alongside SWITCH, many activities around IUWM were being carried out in Zaragoza for - the duration of the project. This means that it has not always been easy, or even relevant, to single out SWITCH activities from the set of activities being carried out on IUWM in Zaragoza. For outsiders it is most important that water management issues are addressed, irrespective of the project or initiative under which that was done.
- Some of the activities only became clear as the project unfolds. This is a truism that applies more broadly to an action-research project like SWITCH. Even though a broad focus can be set at the beginning, the specific details and the way these interrelate will invariably alter in the course of the project.
- Language. The Spanish language was in some instances felt to be a limitation to adequately share what was being done with the rest of the SWITCH consortium which mainly operated in English.

This assessment was therefore used to reconstruct the intervention logic of SWITCH in Zaragoza. This helped the project team to reflect and provide a framework for analysis of the results achieved and gaps therein. The intervention logic consists of:

- Objectives
- Methodological elements
- Study area
- Phasing and timing

Objectives

Taking cognisance of what was already happening in water management in Zaragoza, the main objective for SWITCH here was to show Zaragoza as a demonstration city, with the following specific objectives:

- To showcase results and experiences of Zaragoza in integrated urban water management through different platforms at local, national and international level
- To demonstrate the possibilities for improvements in water demand management through technical, financial and education measures
- To obtain a continued commitment of officials and citizens towards improved water management

Methodological elements

To address these objectives, the following methodological elements were used. These are summarised here and further discussed in the results section.

- The conceptualization, design and putting in practice of the **sectorization o**f the city's water supply network. This is what has been called in SWITCH a demonstration activity, i.e. demonstrating certain technical measures and research around these. Specifically it consisted of conceptualizing how such sectorization could work in Zaragoza, and then the subsequent design and implementation of this approach. See Box for more info on what sectorization entails

Box 1: sectorization of the water supply network

Sectorization is the process of dividing the entire water supply network in a limited number of sectors. Originally the Zaragoza water supply network was a maze with a number of interconnections between parts of the network. This has the advantage of creating certain redundancy, so that if there is a burst in a pipe all houses can still be supplied through the redundant parts of the network. The main disadvantage is that it is more difficult to detect bursts and leakages. Besides, it makes it more difficult to regulate pressures. In sectorization, the number of interconnections is reduced, so that each sector can be seen as a stand-alone network, making it easier to detect irregularities and operate the water supply network in each sector. Obviously, there would still be some redundancy in the network to avoid that an entire sector runs dry in case of a pipe burst. Sectorization is seen as an important strategy to improve water supply network management and efficiency. More info on sectorization in Zaragoza can be found in Ayuntamiento de Zaragoza (2010b)

- **Research** and analysis of changes in **water use** data as a result of sectorization. The aim of this was to obtain further insight into water consumption in different parts of the network, and better identification of losses, with sectorization measures in place.
- A second area of **research** that was identified was into how different **water demand management measures** (technical, financial and educational) aimed affecting water consumption at household level affect actual water consumption. This would then help in better directing and balancing these types of measures.
- This research, alongside the results of other work on integrated urban water management, would serve as input into the new Municipal **by-law** on "eco-efficiency and the quality of integrated water management".
- Using existing **platforms** for **sharing information** about SWITCH. As explained in the introduction a common element in SWITCH was the establishment and facilitation of learning alliances for uptake of research results. As in Zaragoza already various multi-stakeholder platforms existed, it was already early on decided not to establish a dedicated learning alliance. Rather, it was opted for to use existing platforms to share information about SWITCH, particularly the Municipal Water Commission for the Local Agenda 21.
- **Demonstrating** experiences and sharing information for an international audience and for local citizens, through the **Expo** and other events. The Expo which was held in the midst of SWITCH was expected to play an important role in showcasing the experiences of Zaragoza. This attracted an audience of both international water management professionals, but also of local citizens.
- All of these activities are highly **interlinked** with the spectrum of **other water-related activities and initiatives** in the city, that fall formally outside SWITCH. But as already mentioned, the boundary between what is inside and outside the project is not easy to draw, and probably not so relevant. What is important is that in the intervention logic, SWITCH was expected to give an extra impetus to activities that were already ongoing.

Study area

Both the demonstration work on sectorization and the on demand management measures was focused in one area of the city called Actur. This is a neighbourhood with some 40.000 inhabitants. This was chosen as study site as it is an area of relatively easy access, as this is a neighbourhood from the 1970s with broad lanes and high building blocks. Although this was the originally designated study area, efforts are taken to scale up results to other parts of the city. For example, from the original 4 sectors in the Actur neighbourhood, a sectorization has been implemented in 22 sectors. Another 19 sectors have been predefined, but the actual physical implementation of sectorization has not yet happened. The work still needs to start in some 30 other predefined sectors (Ayuntamiento de Zaragoza, 2010b)..

Phasing and timing

The project did not foresee a clear phasing in the activities in Zaragoza. However, in hindsight some clear phases and milestones can be identified. These are on the one hand related to the Expo, as a major event in the middle of the project. On the other hand, the phases reflect the difficulties to start some of the demonstration and research work and the delays that occurred in that. Table 3 presents a compilation of the phases, with the main activities that were carried out, according to the various activity reports provided by the project team, and grouped under the main methodological elements outlined above.

Table 3: Main activities of SWITCH in Zaragoza 2006-2010

Year	Phase	Demonstration activities	Research	Dissemination activities	Policy and planning
2006	Preparatory phase	• Detailed defining of the scope of demonstration	• Defining scope of research • Internship of UNESCO-IHE student	• Presentation to Municipal Water Commission, and to Actur neighbourhood association	
2007	Start of demonstration and research	• Start of the defining of sector 1 and 2 of the network	• UNESCO-IHE student MSc thesis on the systems analysis of the Zaragoza urban water system • Preparatory discussions with the university on domestic consumption in Actur	• Report on water demand management in Zaragoza	
2008	Expo year	• Sectorization in sector 3 and 4 and development of plan for sectorization of the other 95 sectors	• Start of PhD research on water demand management • Preparing household consumption survey	• Expo, with the theme week “Water and the City” and the “Water Tribunal”, with SWITCH presentation	
2009	Start of the research on water demand management measures and continuation of other activities	• Collaboration in improving household consumption in green houses. • Tests with pressure management in the water supply network • Finalization of an additional 12 sectors. • Leakage detection in 3 sectors of Actur	• Household visits to install measuring devices and water saving devices • Start of research on different water demand management measures • Continuation PhD research	• Urban Water Management: Water governance and institutional mapping in Zaragoza, Spain.	• Start of elaboration new by-law
2010	Finalisation and consolidation	• Extension of sectorization to another 23 sectors	• SWITCH City Assessment	• Report of the sectorization experience • Report of the impact of different water demand management measures on water consumption • Final conference on water and cities, with participation of Zaragoza and other cities	• Final steps in elaborating new by-law

Resources

Table 4 provides a rough indication of how resources have been allocated to different budget and expenditure items. A number of observations can be made:

- Most of the budget has gone into demonstration activities particularly for water measurement.
- Staff costs of researchers are not included here as these fall under other consortium partners (e.g. WEDC)

Table 4: Budgets and resources used up to 31 January 2010

Work package	Types of activities covered	Budget (€)	Spending up to Jan 2010 (€)	% of budget spent
1.1 Paradigm shift	Situational assessment, some workshops	979	722	
3.1Demostration	New equipment for water measurement	250,200	195,237	78%
Total		€ 251,179	€ 195,959	**78%**

Even though the budget size was not a limitation for carrying out the project, there were serious difficulties in managing and accessing the budget the Municipality had for SWITCH. SWITCH funds enter the general Municipal budget. From there the Agency for Environmental Management and Sustainability receives an extra allocation corresponding to SWITCH, but it has limited autonomy in managing these funds. For example, internal staff contracting rules of the Municipality mean that the Agency couldn't hire additional "replacement" staff nor hire this externally for the additional work SWITCH brought. This then lead to difficulties in carrying out the work. This became even more difficult when the economic crisis hit Spain and the Municipality needed to reduce expenditure. In addition, there were difficulties in contracting the University of Zaragoza as already described above.

RESULTS AND DISCUSSION

This section presents the results obtained by SWITCH in Zaragoza. It is structured according to the main elements of the intervention logic, presenting for each element, the main results and reflections on the lessons learnt.

Research: potentially interesting experiences, but limited capitalization on those in research outputs

For a research project like SWITCH, the results in the field of research are still limited, in spite of the high potential that interviewees see for that. The reasons for that are the following:

- The research on the impact of different types of demand management measures on household water consumption is only now being finalised (Barberán and Salvador, 2010). Its specific results cannot be assessed yet. And formally, the results of this work do not fall under SWITCH. This study has been carried out in the end by the University of Zaragoza using its own funds, and not under a SWITCH contract, even though there was strong collaboration with the SWITCH project
- Also the demonstration work on sectorization holds great potential for further analysis and research. However, for most of the project focus has been on identifying and implementing the sectorization measures. Only now can in-depth research and analysis start on how sectorization can help in reducing water losses in the water network.

- A similar story can be told on one of the PhD researches. This research, focusing on leakage reduction, and energy externalities in that, only started in 2008, and is now still in the phase of processing information and analysis. It is not expected that first consolidated results will be available until after the formal project end.

For all these points it is also true to say that the research should be seen in the much longer-term process of improving water management in Zaragoza. If research results will be available in a year's time or so, the Municipality and city stakeholders will equally be in a good position to use these research results. And indeed, reflections of both municipal staff involved and researchers indicate that all three areas of research hold great potential for future use. Yet, for a research project like SWITCH, it was expected that it could also provide more scientific evidence of the work done by it in Zaragoza. In that sense, interviewees also felt that more could have been done on documenting and analysing more of the past work on water management in Zaragoza, and providing substantiated evidence of the results obtained. Some of the SWITCH outputs have contributed to that (e.g. a short historical overview by Kayaga et al., 2008). But there is a feeling that a stronger research on and documentation of these past experiences would have allowed a stronger capitalization of these experiences in the form of research outputs.

Notwithstanding the limited results in direct research outputs, interviewees were broadly positive about the research angle that SWITCH brought to water management in Zaragoza. Some of the municipal officials commented that research on sectorization or on the analysis of the impact of different demand management measures would normally not happen in the Municipality. Only thanks to a project like SWITCH this has happened. This is seen as an added value, as it brings more substantiated analysis to the operations of the municipality, in the perspective of the interviewees. For example, the work on demand management measures has generated a reflection on how far to go with such measures. There is a feeling that current household consumption levels are more or less at the minimum of what can be achieved. Any further investments in reducing water consumption can only yield marginal results. Further water use reduction can probably not be achieved at household level, but rather by further reducing losses in the network or in municipal buildings and green areas. Thanks to the research such reflections are stimulated, and it is expected that its results can substantiate these reflections further. Also for the researchers involved the close link between research and operational practices of the municipality has been valuable. As one of the interviewees commented: "It was sometimes difficult to obtain information, as data were spread out over different departments, or non-existent at all. But these limitations are very enriching, as they help one to ground the research in reality. You have to learn to work within the limitations that exist".

The research on water demand measures also allowed the involvement of a wider group of stakeholders. This included for example resident associations. They were briefed about the research. Certain resident groups were given additional environmental education on water saving measures in the household, whilst others not (a control group). This allowed for further involvement of the former in water management at household levels. Some homesteads and apartment blocks were equipped with digital and remote-sensed water meters. At installation, householders were also provided with information about the purpose of the research. Notable was the involvement of the factory of water meters. This factory is actually located in Zaragoza, and it donated a large number of water meters to the Municipality. Its aim of doing so was that the research would enable the factory both to showcase its product, but also learn from the results to improve its meters.

In conclusion, the expected contribution to the scientific base so far has been limited, at least within the frames of the project. Yet, the work that is still under development does hold potential to contribute to the scientific base for the operations of the city's water supply network and for its water demand programmes. Probably, it may even hold potential for the broader scientific base, but the full value of that is difficult to assess now. In spite of the relatively limited progress, stakeholders have appreciated the action-research component of the work, as on the one hand it strengthens the scientific base for operations, but also grounds research in operational reality.

Demonstration: taking inspiration from the sectorization approach

The sectorization work has formed on of the core activities of SWITCH in Zaragoza and has been appreciated by interviewees as one of biggest added values of SWITCH. The issue has been on the agenda of the Infrastructure Area within the Municipality for a while, after an exchange visit to the city of Barcelona a few years earlier. In Barcelona this approach has been developed earlier, amongst others driven by the topographical conditions of that city. The Barcelona exchange visit had inspired staff of the Infrastructure Area and made them think about applying such an approach in Zaragoza. But SWITCH triggered the staff of that Area to actually take it up further. The main reason for that is that SWITCH provided a bigger conceptual framework that helped thinking through the sectorization approach, i.e. it triggered discussions on why to follow this approach and how to do so. Besides, SWITCH being a time-bound project, also helped in giving this work deadlines and milestones. Last, but not least, SWITCH, being a European-funded project, provided staff an extra motivation and inspiration to embark on this work and showcase Zaragoza in this field.

The demonstration itself progressed quite rapidly. Initially, it was carried out only in four sectors of the Actur neighbourhood, as the main SWITCH research area in Zaragoza. After a successful test in that area, it was rapidly scaled-up to other neighbourhoods. The figure below provides an overview of progress on the sectorization, as reported in the final report on the demonstration activities in 2010. As can be observed in nearly half of the city have sectorization been put in place, or is being studied. For a full description of the details of the sectorization work, see Ayuntamiento de Zaragoza (2010b).

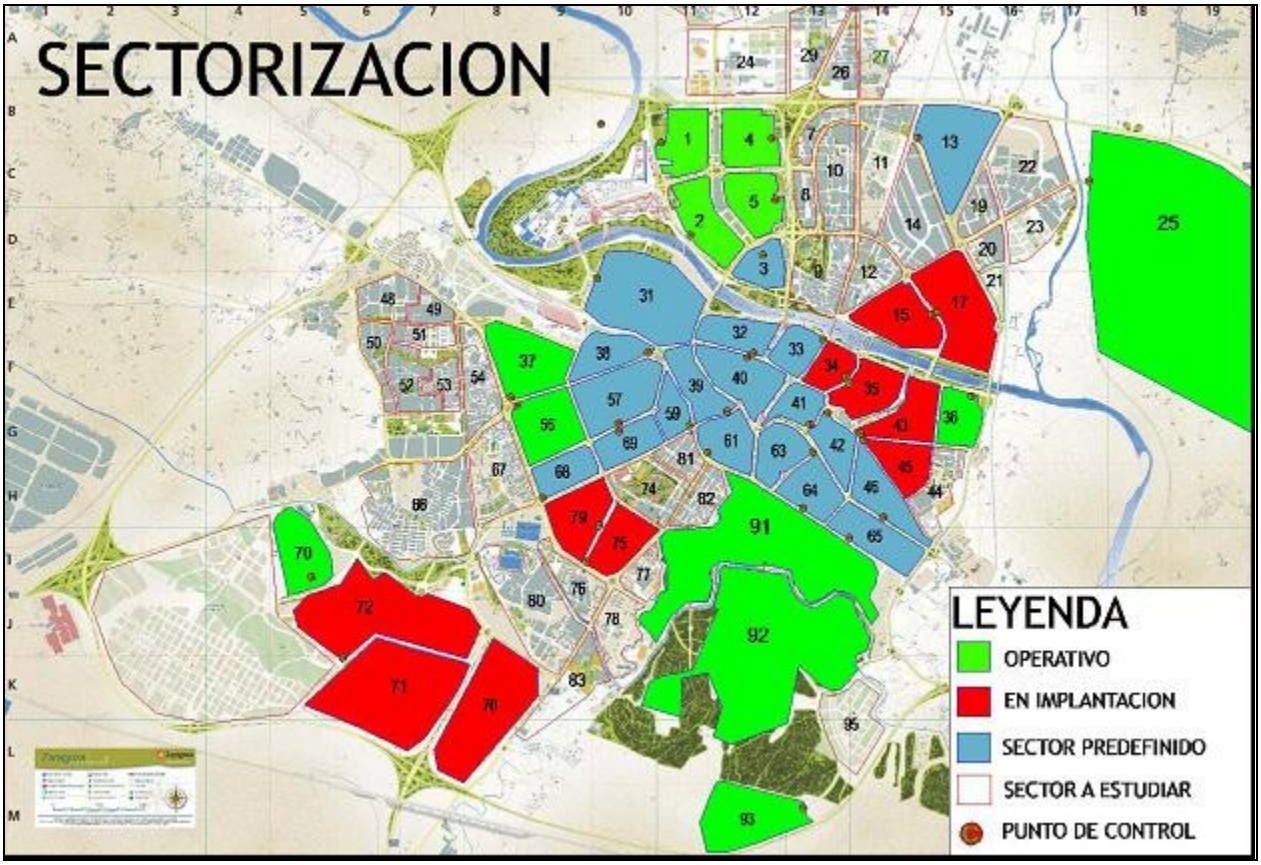

Figure 2: Map with progress on sectorization (Ayuntamiento de Zaragoza, 2010b)
Note: legend
Green: operational
Red: being implemented
Blue: predefined sector
White: sector to be studies
Red dot: control point

The demonstration work involved a small working group, with staff of different municipal departments, including Infrastructure, Environmental Management and Treasury. Beyond the Municipality, there has been limited active involvement of other stakeholders, also because of the highly technical nature of the demonstration, which bears little interest to a wider audience. Citizens were only involved in a passive manner, as neighbourhood associations were informed about this work. In addition, the work has been disseminated through the Municipal Water Commission.

Where the demonstration has not yet succeeded is in moving into a research phase. As mentioned in the previous section, data are only being collected now on how the sectorization is changing the behaviour of the water supply network. This can already be used to address immediate emergencies like pipe bursts or to analyse consumption at night. However, longer time-series are needed to analyse the full effect of sectorization. But, it is expected that all data collection has been set up in such a way that such kinds of analyses can start from now on.

Sharing of results through platforms at different levels

As outlined above, an explicit decision was taken not to establish a learning alliance in Zaragoza, as already various stakeholder platforms existed at different institutional levels. It was decided to use those as platforms for dissemination and obtaining feed-back on research and demonstration

activities. The following results were obtained in using existing platforms for information sharing and dissemination:

- Municipal Water Commission. This was seen as the primary stakeholder platform, this being the Local Agenda 21 commission. So, with some frequency SWITCH was presented here, for example, its overall objective and approach, specific plans for research and demonstration and the first results as they are emerging. In addition, this was the main platform in the development of the new municipal by-law on eco-efficiency. So, in the end, this Commission acted both as the main direct channel for dissemination of SWITCH to local stakeholders and mechanism for feed-back. However, this Commission was not proactively involved in the research and dissemination itself (although some its individual members have been).
- Aragón Water Commission. This platform has not been used to share information about SWITCH as most of SWITCH focused on the city of Zaragoza itself and not to the broader Aragón Autonomous Community. In reflection with the project team, it was felt that now that SWITCH results are emerging, this could be a useful platform for sharing, as the lessons learnt may be valid for other towns in Aragón as well.
- CHE. The council of the CHE is a stakeholder meeting to decide on the distribution of water resources and setting user charges, and not focused on sharing and dissemination of good practices. So, this platform was not used directly. However, the CHE compiled a document with the status of water management in different towns in the Ebro basin (CHE, 2008). This included an overview of water demand practices being employed in Zaragoza and results of that. It is felt that this could be another way of sharing results with other municipalities in the basin.

Alongside these formal platforms for information sharing, there have been many other instances through which Zaragoza has been showcasing its work on water resources management. Amongst these, the Expo formed a key moment. The Expo in 2008 was focused entirely on the theme of "water and sustainable development" (Expo Zaragoza, 2008). And with that, a wide range of water-related activities were developed. First of all, the Expo site itself included building and pavilions, as well as public spaces in which water was central. Also, the river banks were restored into more accessible public spaces. Alongside physical works, lots of attention was given to raising awareness of citizens and involving them in improving water management. An interesting experience in that was setting up the Municipal Volunteer Corps (see Box below).

Box 2: Municipal Volunteer Corps

The Expo required the involvement of a large number of volunteers, to help out in aspects ranging from assisting visitors to preparing information materials. To coordinate the work of volunteers a dedicated section was set up in the Municipality. The vision of the Municipality was that this should not be a one-off involvement, but lead to a longer-term involvement of volunteers. Secondly, the Municipality wanted to make this also more worthwhile for the volunteers by providing them with accredited skills. In total some 15.000 volunteers supported the Expo, 7000 of which came from the city of Zaragoza itself. Volunteers received a special training, consisting of a general module with an introduction to the city of Zaragoza, to the Expo and, importantly, to the topic of sustainable water management. A specific curriculum was developed for this, which recently also received formal accreditation. In addition, volunteers received specialised training in their area of interest, e.g. hospitality, environment, or safety and security. The involvement of volunteers was so successful that the Municipality decided to institutionalise this further, by establishing an office for the Municipal Volunteer Corps. This office would continue coordinating volunteer efforts, and providing them with access to accredited skills training, in a number of areas. Currently there are some 3000 volunteers, a quarter of which with a specialisation in water and environment. They for example provide environmental education at schools, or help in looking after parks and public spaces. For the coordinator of the Municipal Volunteer Corps this has been an important mechanism to contribute to awareness raising about good water management practices in the households. All volunteers received a training on water management, including into water saving at household levels. This knowledge is easily multiplied by the volunteers, when they do their voluntary work, but also in their interactions with their family and friends. For volunteers themselves the accredited skills training is attractive. Particularly in the current economic crisis with

high unemployment levels, such skills provide an added value on one's curriculum. However, it is not known how many persons managed to obtain a formal employment in water or environmental management, thanks to this volunteer programme.

The Expo also was a platform for sharing Zaragoza's and SWITCH experiences to an international audience, as well as to interested local citizens. The main modality for that was the Water Tribune, a series of lectures and discussion that lasted for a period of 93 days. One of the lecture series focused on urban water management. According to interviewees involved in this, SWITCH made an important contribution, by both showing the philosophy behind SWITCH, as well as the practical experiences from Zaragoza and other cities. The intellectual legacy of the Water Tribune forms a source of great pride among the people who were involved in it. The Municipality therefore is taking great care to maintain that legacy, amongst others by a Blue Box with material from the Water Tribune on its website (Ayuntamiento de Zaragoza, 2008). But, also, it has opened up a municipal library, entirely dedicated to water and environmental management books and literature.

It is difficult, and probably not feasible, to assess the impact of such kinds of dissemination and outreach activities. Yet, it has become clear from the interviews that water management has a more prominent place in the community of Zaragoza than one finds usually in other cities. For example, two of the most important NGOs in water management in Spain, ECODES and Alianza por el Agua, have their origins and offices in Zaragoza. Alongside the Expo, the Municipality of Zaragoza, in partnership with the Government of Aragón and the national government of Spain, showed its own commitment to water issues elsewhere in the World, by hosting the United Nations Office to Support the International Water Decade. The Municipal Volunteer Corps showed that water and environment are popular issues among the citizens of Zaragoza. The Expo has surely played an important role in this level of awareness on water issues, but it is above all the result of a much longer process of awareness raising of the population on water issues by the Municipality and by civil society movement.

In view of the above, it was felt by interviewees to have been an appropriate decision for SWITCH not to initiate another movement or stakeholder platform on water. It would probably have been difficult to define its niche alongside the other initiatives, and rather created a duplication of efforts. At the same time, this means that SWITCH and its results are not always visibly recognised by stakeholders. People recognise the work done by the Municipality on water management, but the contribution from SWITCH is then only seen as one out of many initiatives, some of which are much bigger in terms of scale and visibility than SWITCH. In the view of the author this is not a problem, as it is the result of the whole set of initiatives that counts, not the specific contribution of a single project. The project team in Zaragoza has done well in selecting specific channels for dissemination of its work on SWITCH both at local and international level. However, there are still untapped opportunities for dissemination towards neighbouring towns and cities in Aragón and the Ebro basin.

Inputs into the new municipal by-law

The main contribution that SWITCH has made to institutionalising its concepts and research findings is the development of the new Municipal by-law on eco-efficiency and integrated water management. Zaragoza already had a number of by-laws dealing with water management. However, in 2009, the need emerged to join some of these together to create more coherence, and thereby reviewing and expanding the content of them into one single by-law. So, in 2009 the process started of writing this by-law. The Municipal Water Commission thereby acted as the main stakeholder body providing feed-back on the text towards a version that could be approved

by all members. In spite of this being quite a technical topic, it obtained strong interest from politicians as they saw this as a way of further formalizing the city's commitment to sustainable water management. At the moment of writing this report a final draft text of the by-law is ready for approval by the City Council.

As the responsibility for preparing this new by-law was with the Agency for Environmental Management and Sustainability, this provided a good opportunity to introduce concepts promoted by SWITCH, but also results of SWITCH work into the by-law. The current draft text, for example, includes sections dedicated to management of the water supply network (linked to the sectorization work), conditions for household connections and water saving measures at household level. The interviewees who were involved in writing the by-law therefore see this as the main way of institutionalising the work done by SWITCH in the city, thereby of course also recognizing that large parts of the by-law find their origins in the broader water demand management work done by the municipality.

Apart from this, no further inputs were made into municipal plans and policies. However, as different municipal departments did work on SWITCH, much of the institutionalization of SWITCH takes place in the form of changed municipal operational procedures. For example, the sectorization is fully institutionalised in the operational procedures of the Infrastructure Area, and is part of the day-to-day network operations. The research on water demand management measures also holds potential for inclusion into the operational practices of the municipality. However, the specific ways of doing this can only be defined once the results are known.

International support, collaboration and exchange

One of the expectations of the Zaragoza project team of participating in this European project was the possibility to collaborate and exchange with other cities and consortium members. However, the experiences in this have been mixed.

Indeed, various SWITCH consortium partners have come to Zaragoza to learn from the experiences there, including a delegation from Hamburg researchers and learning alliance members from some of the Latin American SWITCH partners, and researchers from other partners including IRC and Loughborough University. However, learning by the Zaragoza team from other partners and cities has remained below their expectations. One of the reasons is that Zaragoza was one of the few cities with such a strong emphasis on water demand management. And, many of the proposed techniques and approaches by others were already employed in Zaragoza. Language barriers also played a role in the limited learning from other cities.

What was appreciated by the project team in Zaragoza was the support in project management by other consortium partners, particularly by UNESCO-IHE and IRC. In spite of that support, it was not possible to overcome some of the problems, such as the limitations in sub-contracting of the university.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions and lessons learnt

SWITCH's aim is to contribute to a paradigm shift in urban water management towards a more integrated and participatory approach. It aims to do this through a combination of demand-driven research and engagement with stakeholders, brought together within learning alliances. Each of

the cities in SWITCH has built its own intervention logic and methodology, although using some common elements. The objective of this paper has been to assess the intervention logic of SWITCH in Zaragoza, Spain, and to define recommendations for the future, so that the processes set in motion could be sustained and scaled up where relevant. It draws its conclusions on the basis of interviews with stakeholders from the city, as well as meetings with project staff involved in SWITCH Zaragoza.

The Municipality of Zaragoza has gone through trajectory of over 20 years of improving water management, based around principles such as reducing water consumption and losses, stakeholder participation, investing in wastewater management and sustainable and equitable tariff setting. In that sense, there was not an apparent need for a paradigm shift in water management. Rather SWITCH was expected to provide both an additional impetus to processes already in place and to have synergy with specific water-related initiatives that were being carried out at the same time as SWITCH, such as the Expo and the establishment of the United Nations Office to Support the International Water Decade. The specific expected contribution of SWITCH was 1) in showcasing the experiences of Zaragoza in integrated urban water management, 2) in providing contributions to the city's water demand management measures, on the basis of research and demonstration activities, and 3) in an additional motivation and source of pride and inspiration to officials and citizens involved in these activities.

We conclude that the following results have been achieved.

1. - SWITCH research in Zaragoza has the potential to contribute to the scientific base on IUWM, but actual results to date are limited. The ongoing research on sectorization and analysis of impact of different types of demand management is very relevant as an improved scientific basis for the municipal operations of its water supply system. In addition, it holds potential to provide insights that are relevant for cities with similar conditions as well. Local stakeholders are appreciative of this potential and see an added value in SWITCH in actually providing an impetus to using more scientific research for their operations. However, the actual contributions of research to date are limited. This is partially due to the fact that the main research components have started late, and much of the analysis and documentation is still going on. For a five-year research project more consolidated research results could have been expected. In addition, it is felt that an important opportunity has been missed by not putting more effort into structured documentation of the very interesting past experiences of Zaragoza in improving its water management. This could have been a very important way of both showcasing the experiences of Zaragoza, and contributing to the scientific base of integrated urban water management.
2. - The sectorization approach has been successfully demonstrated and is being scaled up well beyond the pilot area by the Municipality. This was due to the fact that this kind of demonstration work has responded to a clear demand from the municipality, giving both conceptual and practical follow-up to ideas that were obtained before, and hence contributing to its institutionalisation into the municipality's operational water supply system management.
3. - Stakeholder platforms were appropriately used to showcase the work of Zaragoza in sustainable water management, although the specific SWITCH experiences were not always visibly recognised by stakeholders. An explicit decision was made not to establish a dedicated learning alliance for SWITCH, as already various platforms existed where stakeholders could participate in decision-making (such as CHE and the Municipal Water Commission), in carrying out water management practices (such as the Municipal Volunteer Corps or ECODES) and in information sharing (e.g. the Expo and the water library). Nor was

there an explicit need to strengthen these. These all proved important vehicles to share the philosophies of sustainable water management, and have further strengthened citizen awareness and civil society involvement in water management in Zaragoza. The showcasing of more practical SWITCH experiences from Zaragoza, in for example sectorization or water demand management measures, through these platforms has been done in a more limited way. This kind of information sharing was focused mainly on the directly involved stakeholders, amongst others because it was a very technical topic. Some platforms, particularly the ones at regional and basin level have only been used to a very limited extent as well. Learning from other cities within the SWITCH consortium has remained below expectations of the interviewees.

4. - Both concepts behind integrated urban water management and results of past and present work on this have been taken up in a new municipal by-law on eco-efficiency and integrated water management. This is seen as one of the most important ways of institutionalising the results of many years of work on water demand management. However, it must be recognised that SWITCH only has been one source of inputs to this.

On an overall balance it can be concluded that the objectives have been partially met. The experiences of Zaragoza in its sustainable water management have indeed been widely showcased at local and international level, though leaving a gap at regional level. The showcasing has largely been done through events like the Expo and different local fora. However, a more structured and systematic documentation of the Zaragoza experience, however, has not happened and this is a missed opportunity for SWITCH. SWITCH itself is seen by local stakeholders as having given an important impetus to both the work on sectorization and on research on water demand management measures, and its subsequent institutionalisation through the new municipal by-law. Above all, it has proved to be a source of additional motivation of municipal officers to improve the use of research data in water supply network operations and planning of water demand management measures. In spite of this, the actual contributions to research results to date have remained limited, due to serious delays caused by a range of factors.

The reasons for those aspects where objectives have not been met lie in the contradiction between the seemingly favourable conditions for a project like SWITCH and the difficulties in embedding it into the broader complex of initiatives in the city. This is for example witnessed for example in the following facts:

- Officials in different municipal departments were already dedicated to working on sustainable water management. However, there was little capacity to assume the additional work that SWITCH required, compounded by the fact that there was no possibility to hire additional staff capacity for this. As a result delays occurred and not all the work could be done.
- Already big investments by the municipality in sustainable water management were happening. However, municipal financial management procedures made it difficult to earmark SWICTH funds for specific activities, resulting in delays in spending the budget, causing further delays.
- The local University of Zaragoza had prior experience and capacity for research in relevant water-related themes. However, their late involvement made it impossible to bring that expertise into the project. This is a major reason for the limited research results to data.
- Zaragoza has a lot to show for in terms of its past and present water management practices and has tried to show that. However, showing specific SWITCH contributions have not always been visibly recognised by stakeholders, nor have the past experiences been sufficiently documented. This again is due to the fact that the ones responsible for promoting sustainable water management (i.e. the Municipality) do not have the mandate nor the

professional background for such research and documentation work. The difficulties in involving a research partner with skills in this field definitely contributed to limited progress in documentation.

However, these are shortcomings at project level, reflecting the difficulty of embedding specific projects into a broader process of improving urban water management. It is the latter that counts. And in this, the city has obtained important results over the past 5 years of SWITCH, as it has in the decades before. The assessment has shown that SWITCH has been able to provide an additional impetus to this process and results. Likewise it is hoped that the continued process will be able to take the lessons from SWITCH forward and finish the work, where SWITCH has not been able to fully achieve the objectives.

Recommendations

This section presents recommendations to do exactly that, to provide direction for finalizing what SWITCH has not been able to fully achieve. Therefore most of these recommendations will fall outside the time frame and scope of the project, although some of them can still be started in the few months of the project that are left. The specific recommendations are related to the overall SWITCH objectives and include:

Recommendations for objective 1: scientific basis for IUWM

This is probably the objective where still most progress needs to be made, these recommendations carry highest priority. These include

- To finalise the research activities that have started under SWITCH. Specifically this entails continuing with the analysis and validation of the research results on impact of water demand management measures, and starting research and data analysis on sectorization
- To consider investing in a more complete documentation of the entire trajectory that Zaragoza has followed in IUWM. This is in line with one of the major gaps identified in the conclusions above. It is felt that Zaragoza can showcase a lot through such research but this can also help stakeholders in Zaragoza identifying areas for further work.
- To define a research agenda for the future. This can help prioritising further research work, when having such an agenda articulated. Already some elements for that were obtained during the interviews. These are suggestions, but need for further elaboration:
    - Possibilities for reducing water losses in industries and in the network
    - Tariffs for wastewater treatment, also for industries
    - Cost-benefit analysis of water demand measures
    - Wastewater reuse

Recommendations for objective 2: demonstration of alternative technologies and approaches

As this objective was met, the only recommendation here is to continue with the sectorization work where it has not been finished. For the future, possibly there is scope for more demonstration activities. The research agenda mentioned above should be linked to that.

Recommendations for objective 3: support to cross-institutional platforms

Although a lot of effort has gone into this objective, it is felt that not all platforms have been fully utilised to share SWITCH experiences. Two recommendations in this include:

- To presenting the SWITCH process and results in Zaragoza to the other consortium partners, particularly through the conference "Sustainable Water Management in Cities: engaging stakeholders for effective change" to be held in Zaragoza in December 2010.
- To present specifically the SWITCH project results in a structured way to the existing platforms in the city.

Recommendations for objective 4: strengthen decision-making through plans and policies

The main recommendation under this objective is to promote the final steps towards the approval - of the new by-law. That will be an important way to institutionalise the work done. - Recommendations for the medium term include: -

- To give follow up to the research on water demand management and sectorization so as to - include these into a future updated version of the by-law
- To promote and share the results of this work at the level of the CHE and Aragón Water Commission, so that the findings can also be included into regional water policies or in local water policies of neighbouring municipalities. This represents a potential that hasn't been take to the maximum yet.

It is hoped that by adopting these recommendations the contributions made by SWITCH can be taken forward and completed, where this has not yet been the case, and in that way fully capitalize on the project results to the water management that the officials and citizens and Zaragoza are, rightfully so, proud of.

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ANNEX 1: GENDER AND DISCIPLINE MATRIX

Project team Ayuntamiento de Zaragoza

No.	Gender	Role in SWITCH	Profession	Academic training
1	M	Project coordinator	Director Environmental Agency	Industrial engineering
2	M	Project team member	Technician	Chemist
3	F	Project team member	Technician in environmental education	Chemist
4	F	Project team member	Legal and administrative officer	Lawyer
5	M	Demonstration on sectorization in water network	Head of the Infrastructure Department of the Municipality	Civil Engineer
6	M	Demonstration on sectorization in water network	Head of the water supply network management	Civil Engineer
7	M	Demonstration on sectorization in water network	Technician in water supply network management	Civil Engineer
8	M	Demonstration on sectorization in water network	Technician in water supply network management	Industrial engineer
9	F	Demonstration on sectorization in water network	Technician in water supply network management	Industrial engineer
10	M	Work on tariffs	Head of the Treasury	Economist
11	F		Councillor on Environment	Journalism
12	F		Councillor on Environment	Lawyer

Researchers with limited involvement in SWITCH Zaragoza

No.	**Gender**	**Role**	**Profession**	**Academic training**
1	M	Study on domestic water use	Professor in Economy at the Universidad de Zaragoza	Economist (PhD)
2	F	Study on domestic water use	Lecturer in Economy at Universidad de Zaragoza	Economist (PhD)
3	M	Study on domestic water use	Director of a water meter factory	Industrial engineer
4	M	Study on domestic water use	Estate manager	Lawyer

Students and interns involved in SWITCH

No.	Gender	**Role in SWITCH**	**Profession**	**Academic training**
1	M	Internship in 2008-2010	PhD Research Scholar	Civil engineer
2	F	Internship in 2006-2007	PhD Research Scholar	Environmental scientist
3	F	Internship in 2006-2007	PhD Research Scholar	Environmental scientist
4	M	Internship in 2005-2007	PhD Research Scholar	Civil engineer

Staff of European SWITCH consortium members, working in SWITCH Zaragoza

No.	**Gender**	**Organisation and role in SWITCH**	**Profession**	**Academic training**
1	M	Coordinator WP 3.1	University professor	Civil Engineering (PhD)
2	M	Associate Coordinator WP 3.1	Lecturer	Civil Engineering (PhD)
3	M	Coordinator WP 3.2 ??	University professor	Civil Engineering (PhD)
4	M	Coordinator WP 6.2	Programme officer	Geographer (PhD)

ANNEX 2: SWITCH INDICATORS OF SUCCESS

1. **Newly developed innovations are demonstrated at semi-full scale and towards the end of the project the first signs of replication should be identifiable.**

The main demonstration is on sectorization. From the original 4 sectors in the Actur neighbourhood this has been upscaled to 22 sectors. Another 19 sectors have been predefined, but there sectorization has not yet been physically implemented. The work still needs to start in some 30 other sectors.

2. **The [sustainability] indicators should be operational, meaning that they are used in practice by learning alliances in demonstration cities, to facilitate discussions on and planning for improved sustainability of the urban water system.**

The sustainability indicators being developed by SWITCH are not being used in an explicit way by the project team.

3. **The SWITCH approach contributes to policies, in that it is referred to in policy documents or used in policy implementation.**

The main indicator for that is the new by-law on eco-efficiency and the quality of integrated water management. This by-law is currently in the phase of final approval after it has gone through various rounds of stakeholder consultation and review, amongst others via the Municipal Water Commission. This by-laws draws heavily on concepts and elements promoted by SWITCH.

4. **Wide recognition of SWITCH approach and products in scientific and sector reports**

SWITCH in Zaragoza has not yielded a lot of scientific products. Most of the documentation has only very recently come out. So, it is early to assess reference to this work.