Zaragoza: Taking pride in integrated water management in the city[1]

Stef Smits[2], Victor Bueno Bernal[3] and Javier Celma[4]

I. INTRODUCTION

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

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 & Villanúa, 2006), most of which falls during the cold winters.

[1] Smits, S. et al. 2010. *Zaragoza: taking pride in integrated water management in the city*. [Online]. Available at: http://www.irc.nl/page/58311 [Accessed 13 December 2010].

[2] IRC International Water and Sanitation Centre, the Hague, the Netherlands (smits@irc.nl)

[3] Ayuntamiento de Zaragoza, Agencia de Medio Ambiente y Sostenibilidad (vbueno@zaragoza.es)

[4] Ayuntamiento de Zaragoza, Agencia de Medio Ambiente y Sostenibilidad (unidadambiente@zaragoza.es)

Figure 1 Map of the Ebro basin, with Zaragoza located in the centre

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. It is now a heavily regulated river, with over 138 dams, 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. 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).

The water supply from the Ebro for human consumption in Zaragoza was secured as a priority use by the Ebro River Basin Confederation (*Confederación Hidrográfica del*

Ebro – CHE), in the 1990s, Nevertheless, Zaragoza city has embarked on ambitious water demand management initiatives (Kayaga et al., 2008). The Municipal Strategic Plan 1996-2010 set out an 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, but financial and economic considerations were also drivers. 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 Barberán (ed.), 2006; Barberán, 2008; Barberán & Arbués, 2009 Kayaga et al., 2008, for a more detailed description of these measures. The results have been impressive in terms of the reduction per capita of water consumption. Table 1 shows the history of average water consumption over the last decade. Note that this had already come down from a peak consumption of 180 litres per capita per day (lpcd) 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.

Year	Total measured domestic consumption (m^3)	Population (on 31 Dec)	Consumption (lpcd)
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

Table 1 Decline in per capita domestic water consumption in Zaragoza

Source: Ayuntamiento de Zaragoza (2010a).

All wastewater generated in Zaragoza is treated in two treatment plants (Ayuntamiento de Zaragoza, 2010a), the costs of which are included in the water tariff (Barberán et al., 2008). In fact, part of the tariff paid by users in Zaragoza is used to cross-subsidise 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. Part of the mix of water governance 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 departments that are part of the broader municipal administration. For example, the Infrastructure Area department operates the water and sewerage infrastructure, alongside other municipal infrastructure. The Treasury is responsible for water billing and tariff collection, again alongside the management of other municipal funding streams.

The Ebro is strongly regulated. The Ebro River Basin Confederation (CHE) was established in the 1930s. This government agency manages the waters of the river basin on behalf of the different user groups, using modern infrastructure and equipment. This was the first such agency of its kind in Spain and has acted as point of reference for river basin organisations in other parts of the World as well. Water management in the Ebro basin and in Aragón has subsequently been extensively studied (e.g. Embid et al., 2007; Garrido and Llamas, 2009).

The CHE is 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 as the largest user, but still one of many users.

At the next level down, the Aragón Water Commission was created in 2004 as a decision making platform for the Autonomous Community of Aragón, 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, there is the Municipal Water Commission, which finds its origins in the Local Agenda 21 process for addressing local environmental management, to which Zaragoza committed in the 1990s. As part of that process, water was prioritised as a key area of work in the Municipal Strategic Plan 1996-2010, which included citizen participation in various Agenda 21 Commissions. The Municipal Water 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 Ecology and Development Foundation (Fundación Ecología y Desarrollo - ECODES) (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 has implications for the way in which SWITCH has been structured. First of all, it requires research to be more integrated and interdisciplinary, 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 (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 an intervention logic focused on local context and needs. (The intervention logic is the way in which the different activities are deigned to achieve the overall objectives.) Zaragoza started off as a "demonstration city", in which good practices around sustainable urban water management could be showcased and

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 as an organised method of reflecting at regular intervals on the intervention logic and its effectiveness in each of the cities. In 2008, a first round of assessments was undertaken in the cities 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. Globally, the set of assessments was very well received, but for operational reasons, one could not be conducted in Zaragoza.

In 2010, towards the end of the project, this exercise was repeated with different objectives and scope, and this time Zaragoza was included. 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 is based on the results of the 2010 city assessment of Zaragoza. It outlines the methodology used, followed by an elaboration of the SWITCH approach in Zaragoza, highlighting the intervention logic, team composition, activities, inputs and resources. The next section discusses the results. Finally, conclusions and recommendations are made, addressed to the SWITCH team in Zaragoza.

II. METHODOLOGY

Since SWITCH aims to change traditional patterns, attitudes, relationships, approaches and ways of thinking about urban water management, it needed to understand 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, a method designed to help project staff and stakeholders 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, together with a process of reflection on the strengths and weaknesses and on expected and unexpected outcomes. At a number of specific moments, this process of (self)-reflection should be brought together in a synthesis document that facilitates looking back at lessons learnt and looking forward to define recommendations to adjust the project approach. This paper represents such a synthesis.

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, strengths and weaknesses of the project. In this meeting various tools were used, including reflecting on a 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.
- 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 material used for 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 involved in SWITCH 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.

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 department) Joaquín Garcia Lucea (Treasury) Marta Colomer and Carmen de Campo (Municipal Volunteers Corps)
Other	Manuel Omedas and Rogelio Galván Plaza (CHE)

authorities	
Civil society	Francisco Pellicer (formerly with the Expo) Josefina Maestu (UN Office for the Water Decade) Marisa Fernández (Fundación Ecología y Desarrollo)

Table 2 Interviewees

Source: Smits, S. et al. (2010).

Note: Descriptions of the organisations for which interviewees work can be found 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. 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. 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.

III. 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, (the way activities are designed to achieve the overall objectives). Information is 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

As the SWITCH consortium developed in 2004-2005, Zaragoza had already experienced a long trajectory of addressing IUWM problems and had already moved ahead in areas like water demand management and citizen participation. Despite this, the Municipality was interested in joining this partnership, with three main expectations.

- First, it was expected that SWITCH would be an opportunity to showcase Zaragoza's experience in this field and share it with other European cities.
- Second, it was expected that SWITCH would provide an opportunity to strengthen Zaragoza's water demand management, particularly by analysing the efficacy of

different technical, financial and educational measures and improving on them through research and demonstration activities. An implicit decision was taken not to focus on other aspects of water management, such as wastewater treatment or stormwater management, as these didn't present a priority problem for the city at the time.

- Third, it was expected that the pride of participating in a European project would be an extra motivation for municipal staff and citizens to continue to address water management and to add new activities. These expectations were mutual, i.e. it was expected by the SWITCH consortium that Zaragoza could provide these experiences. To some extent these expectations were met.

Where mutual expectations were not clear was in the field of the project management, conditions and modalities. There appears to have been a gap in understanding about the operational conditions that come with such an FP6 (EU Framework Programme 6) project, e.g. in terms of contracting additional staff specifically for this project under the Municipality. Expectations of what the Municipality could do in terms of research and documentation were not realistic at the start of the project. This later 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 a much broader set of responsibilities. Under municipal rules, it was not possible to hire additional staff, 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. Staff from other municipal departments were also involved, particularly from the Infrastructure Area department, 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 would be technical in nature and engineering focused, research skills that were not clearly present at the University of Zaragoza. However, after a year or so, the need to bring research capacity into SWITCH Zaragoza became apparent and discussions started to bring in the university as additional partner. Two years of attempts to formalise a

partnership with the university followed, exploring different formal arrangements. For a number of reasons, none of these 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 at the heart of SWITCH, never formally became part of the project.

Various consortium partners from other countries collaborated with the Municipality. WEDC/Loughborough University collaborated on the technical side of water demand management and a WEDC PhD student did 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 for the multi-stakeholder process.

As can be seen from Annex 1, the project team and students involved are well-balanced in terms of gender, although the supporting from other SWITCH 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. The reasons for that include:

- 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 these other IUWM activities. For others, the most important thing is 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 unfolded. 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.
- The language barrier was in some instances a limitation to adequately share what was being done with the rest of the SWITCH consortium which mainly operated in English, while the Zaragoza team functioned in Spanish.

The 2010 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 note of what was already happening in water management, the main objective for SWITCH was to help Zaragoza become a demonstration city, with the following objectives:

- To showcase results and experiences of Zaragoza in integrated urban water management through various platforms at local, national and international level
- To demonstrate the possibilities for improvement in water demand management through technical, financial and education measures
- To obtain continued commitment of officials and citizens to 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 conceptualisation, design and putting in practice of sectionalisation - dividing the city's water supply network into separate sectors. This is what has been called in SWITCH a demonstration activity, i.e. demonstrating certain technical measures and research around them. Specifically it consisted of conceptualising how such a sectioning process could work in Zaragoza, and then the subsequent design and implementation of this approach (Box 1).

Box 1: Sectionalisation of the water supply network

Sectionalisation is the process of dividing the entire water supply network into 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 supply pipe homes can still be supplied through other parts of the network. The main disadvantage is that it is more difficult to detect bursts and leakages. It also makes it more difficult to regulate pressure. When a system is divided into sectors, 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. Some redundancy is retained in the network to avoid an entire sector running dry in the event of a pipe burst. Sectionalisation is seen as an important strategy to improve water supply network management and efficiency (Ayuntamiento de Zaragoza, 2010b)

- Research and analysis of changes in water use as a result of sectionalisation to obtain further insight into water consumption in different parts of the network and better identification of losses.
- A second area of research that was identified was into how different water demand management measures (technical, financial and educational) affect actual water consumption at household level. The results would 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 an input into a new municipal by-law on "eco-efficiency and the quality of integrated water management".
- Using existing platforms for sharing information about SWITCH. A common element in SWITCH was the establishment and facilitation of learning alliances for uptake of research results. As Zaragoza already possessed various multi-stakeholder platforms, it was decided not to establish a new dedicated learning alliance, but 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 international and local audiences 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 international water management professionals and local citizens.
- All these activities are interlinked with the spectrum of other water-related activities and initiatives in the city, that fall formally outside SWITCH. 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 ongoing activities.

Study area

Demonstration work on sectionalisation and on-demand management measures was focused in the Actur area of the city, a 1970s neighbourhood with broad lanes, high-rise blocks and 40,000 inhabitants. This was chosen as study site as it is an area of relatively easy access, but efforts are also being made to scale up results to other parts of the city. In addition to the original four sectors in the Actur neighbourhood, sectionalisation has been implemented in another 18 sectors (total 22 sectors). Another 19 sectors have been chosen, but sectionalisation has not yet happened there. Work is also planned in another 30 sectors (Ayuntamiento de Zaragoza, 2010b).

Phasing and timing

The project did not plan a clear phasing of activities in Zaragoza. In retrospect, some clear phases and milestones can be identified, some related to the water themed Expo which occurred in the middle of the project and others reflecting difficulties and delays in starting some of the demonstration and research work. Table 3 presents a compilation of main activities, derived from the activity reports provided by the

project team, divided into phases and grouped under the main methodological elements outlined above.

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	• Sectionalisation in sector 3 and 4 and development of plan for sectionalisation of the other 95 sectors	• Start of PhD research on water demand management • Preparing household consumption survey	• Water and Sustainable Development Expo, with SWITCH presentations in the "Water and the City" theme and "Water Tribunal"	
2009	Start of the research on water demand management	• Collaboration in improving household consumption in 'green houses'.	• Household visits to install measuring devices and water saving devices • Start of research on	• Urban Water Management: Water governance and institutional	• Start of elaboration new by-law

	measures and continuation of other activities	• Testing of different pressure management operations • Finalisation of an additional 12 sectors. • Leakage detection in 3 sectors of Actur	water demand management measures • Continuation PhD research	mapping in Zaragoza, Spain.	
2010	Finalisation and consolidation	• Extension of sectionalisation to another 23 sectors	• SWITCH City Assessment	• Report of the sectionalisation 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

Table 3 Main activities of SWITCH in Zaragoza 2006-2010

Source: Smits, S. et al. (2010)

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 the costs of other consortium partners (e.g. WEDC)

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	74%
3.1Demonstrations	New equipment for water measurement	250,200	195,237	78%
Total		€ 251,179	€ 195,959	**78%**

Table 4 Budgets and resources used up to 31 January 2010

Source: Smits, S. et al. (2010).

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

IV. 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 building on the research outputs

For a research project the size of SWITCH, the research results have been somewhat limited, in spite of the high potential that interviewees still see. The reasons are as follows:

- Research on the impact of different types of demand management measures on household water consumption was being finalised towards the end of 2010 (Barberán and Salvador, 2010), and specific results could not be assessed before the end of the project. Formally, the results of this work do not even fall under SWITCH research even though there was strong collaboration, as the study was carried out by the University of Zaragoza using its own funds.
- The demonstration work on sectionalisation holds the greatest potential for further analysis and research. For most of the project the focus was on identifying and implementing sectionalisation measures. It was only towards the end of the project that a start could be made on in-depth research and analysis on how sectionalisation can help to reduce water losses in the network.
- A similar story can be told for one of the major pieces of PhD research focusing on leakage reduction and energy externalities. This started in 2008, and by late 2010 was still in the phase of processing information and analysis. It is not expected that first consolidated results will be available until after the end of the formal project.

In terms of the SWITCH timetable, this represents a setback. However, it is also true to say that the research can be seen as valuable in the longer-term process of improving water management in Zaragoza. If research results are available in a year's time or so, the Municipality and city stakeholders will be in an equally good position to use the results. Municipal staff and researchers reflect that all three areas of research hold great potential for future use. The disappointment is that it was expected that SWITCH would be able to provide scientific evidence of the work done in Zaragoza. In that sense, interviewees also felt that more could have been done on documenting and analysing 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 past experiences would have allowed conversion of these experiences into tangible capital in the form of research outputs.

Notwithstanding the limited results in terms of direct research outputs, interviewees were broadly positive about the research agenda that SWITCH brought to water management in Zaragoza. Some municipal officials commented that research on sectionalisation or on the analysis of the impact of demand management measures would not normally be conducted, and only happened thanks to a project like SWITCH. This is seen as having added value in the opinion of interviewees, bringing a

more evidence-based analysis to the operations of the Municipality. The work on demand management has generated discussion on how far to go with such measures, since there is a feeling that current household consumption levels are more or less as low as can be achieved and that further water use reduction can probably be best achieved by reducing losses in the network or in municipal buildings and green areas. The research has stimulated these discussions and it is expected that its final results will substantiate these reflections.

For the researchers, the close link between research and municipal operational practices has been valuable. As one interviewee commented: “It was sometimes difficult to obtain information, as data were spread over different departments, or non-existent. 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 allowed the involvement of a wider group of stakeholders, including resident associations who were briefed about the research. Some resident groups were given additional environmental education on water saving measures in the household, whilst others (a control group) were not. 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-sensor water meters. At installation, householders were also provided with information about the purpose of the research. This factory that makes the water meters is actually located in Zaragoza, and it donated a large number of meters to the Municipality. The factory wanted to showcase its product, but it also hoped to learn from the results and to improve its meters.

In summary, the contribution to the scientific base so far has been limited, at least within the framework of the project. Yet, the work that is still under development holds potential to contribute to the scientific base for the operations of the city’s water supply network and for its water demand programmes. 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 it strengthens the scientific basis for their operations, and it also grounds research in operational reality.

Demonstration: taking inspiration from the sectionalisation approach

The work on sectionalisation has been one of the core activities of SWITCH in Zaragoza and has been appreciated by interviewees as having some of the biggest added value. The issue has been on the agenda of the Infrastructure Area department within the Municipality for a while, after an earlier exchange visit to the city of Barcelona where this approach had been developed earlier, partly driven by the topographical conditions of that city. The Barcelona exchange visit inspired staff of the Infrastructure Area department and made them think about applying such an approach in Zaragoza, but it was SWITCH that triggered staff to actually take it

further. SWITCH provided a broader conceptual framework that encouraged staff at the Municipality to think through the sectionalisation approach –it triggered discussions on why to follow this approach and how to do so. Being a time-limited project, SWITCH also helped to provide this work with deadlines and milestones. Last, but not least, SWITCH, being a European-funded project, provided staff with extra motivation and inspiration to embark on this work and to showcase Zaragoza in this field.

The demonstration on sectionalisation 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 sectionalisation, as described in the final report on demonstration activities in 2010. As can be observed sectionalisation has been put into place or is being studied in almost half the city. For a full description of the details of the sectionalisation, see Ayuntamiento de Zaragoza (2010b).

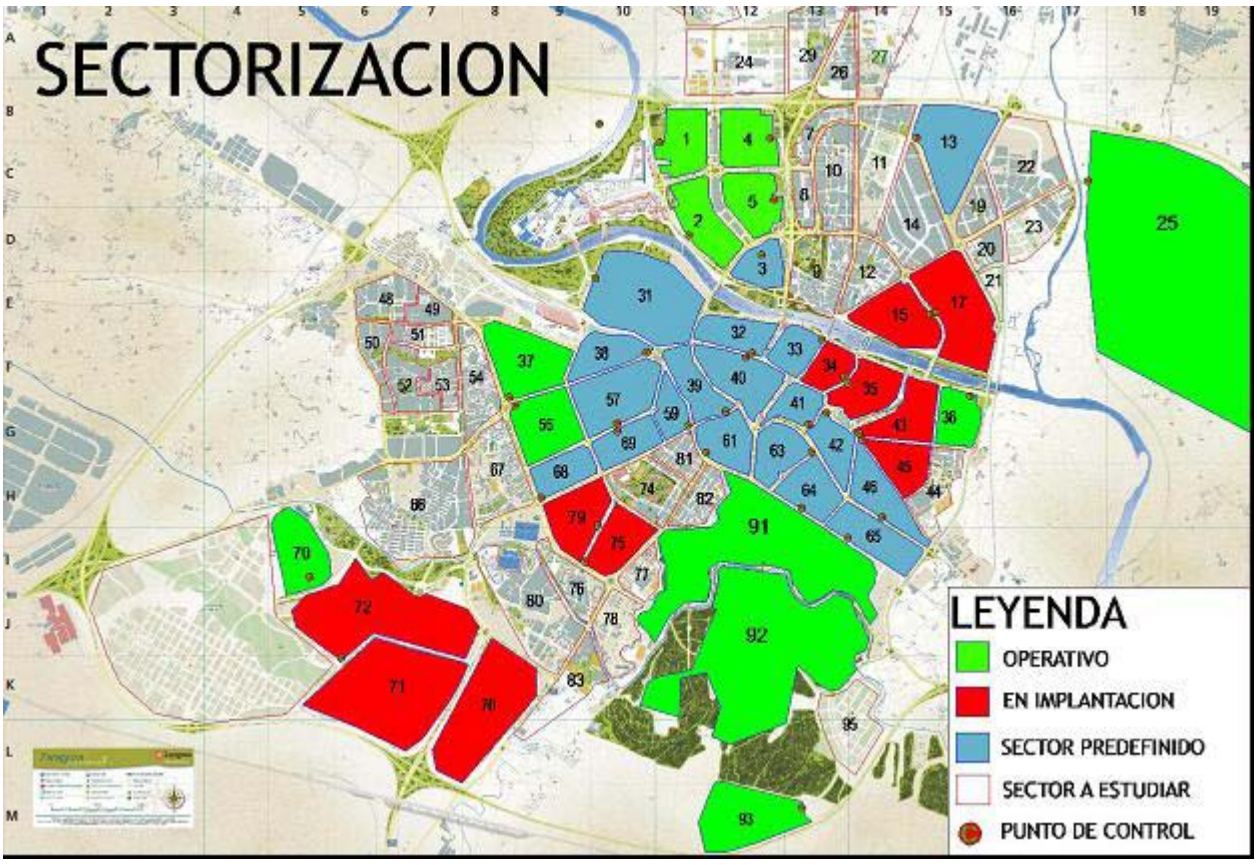

Figure 2 Map with progress on sectionalisation
Source: Ayuntamiento de Zaragoza (2010b).

Note: Legend

Green: Operational Red: Being implemented Blue: Planned sector White: Sector to be studies

Red dot: Control point

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

Where the demonstration has not yet succeeded is in moving into a research phase. Data were only being collected late in 2010 on how the sectionalisation is changing the behaviour of the water supply network. Data can already be collected on how the new system is used to address immediate emergencies like pipe bursts or to analyse consumption at night. However, longer time-series are needed to analyse the full effects of sectionalisation. It is anticipated that data collection has been set up in such a way that these more detailed analyses will be possible.

Sharing results through platforms at different levels

An explicit decision was taken not to establish a separate learning alliance in Zaragoza, as stakeholder platforms already existed at different institutional levels. It was decided to use these as platforms for dissemination and to obtain feed-back on research and demonstration activities:

- Municipal Water Commission. This was seen as the primary stakeholder platform as the Local Agenda 21 commission. SWITCH was presented here with some frequency: overall objective and approach, specific plans for research and demonstration and the first emerging results. This was also the main platform in the development of the new municipal by-law on eco-efficiency. This Commission acted both as the main direct channel for dissemination of SWITCH to local stakeholders and the mechanism for feed-back. The Commission was not proactively involved in the research and dissemination (although individual members have been).
- Aragón Water Commission. This platform has not so far been used to share information as SWITCH focused on the city of Zaragoza rather than on 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 lessons may be valid for other towns in Aragón.
- CHE. This platform was not directly used, as the council of the CHE is a stakeholder body that decides on the distribution of water resources and sets user charges, and it is not focused on sharing and disseminating good practice. However, the CHE compiled a document about 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 the results. 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 occasions when Zaragoza showcased its work on water resources management. Expo-2008 formed a key moment, being focused entirely on the theme of "water and sustainable development" (Expo Zaragoza, 2008). Within that theme, a wide range of water-related activities was developed. The Expo site itself included building and pavilions, as well as public spaces in which water was central, while the river banks were restored to create more accessible public spaces. Alongside these physical works, attention was paid to raising the awareness of citizens and involving them in improving water management. Box 2 describes an interesting experience in setting up the Municipal Volunteer Corps.

Box 2: Municipal Volunteer Corps

The Expo required the involvement of a large number of volunteers for activities from assisting visitors to preparing information material. The Municipality set up a dedicated section to coordinate the work of volunteers, with the perspective that this should not be a one-off effort, but should lead to a longer-term involvement by volunteers. The Municipality also wanted to make this more worthwhile for the volunteers by providing them with accredited skills. In total, some 15,000 volunteers supported the Expo, 7,000 of them from the city of Zaragoza itself. Training for volunteers consisted of a general module covering the city of Zaragoza, the Expo and sustainable water management. A specific curriculum developed for this recently 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 3,000 volunteers, a quarter of whom specialise in water and the environment. They provide environmental education in 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 household. All volunteers received training on water management, including water-saving at household level. This knowledge is easily spread by volunteers in their voluntary work and in their interactions with family and friends. For volunteers themselves the accredited skills training is attractive, particularly in the current economic crisis with high unemployment levels, as such skills provide added value on a curriculum vitae. It is not known how many people have managed to obtain formal employment in water or environmental management thanks to this volunteer programme.

The Expo was set up as a platform for sharing Zaragoza and SWITCH experiences with an international audience, as well as interested local citizens. The main means of interaction was the Water Tribune, a series of lectures and discussions that lasted for

93 days. One lecture series focused on urban water management. According to interviewees involved in this, SWITCH made an important contribution, by showing the philosophy behind SWITCH and the practical experiences from Zaragoza and other cities. The intellectual legacy of the Water Tribune is a source of great pride among the people who were involved. The Municipality is taking care to maintain that legacy, amongst other ways by keeping a Blue Box with material from the Water Tribune on its website (Ayuntamiento de Zaragoza, 2008). It has also opened up a municipal library, of books and literature entirely dedicated to water and environmental management.

It is 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 usually finds in other cities. Two of the most important NGOs in water management in Spain, ECODES and Alianza por el Agua, have their origins and offices in Zaragoza. The Municipality of Zaragoza, in partnership with the Government of Aragón and the national government of Spain, showed its commitment to water issues, 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.

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 instead created a duplication. However, 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 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 first author of this paper, 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 during 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, reviewing and expanding the

content into one single by-law. So, in 2009 the process started of writing this by-law. The Municipal Water Commission 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 and results from SWITCH into the by-law. The current draft text, for example, includes sections dedicated to management of the water supply network (linked to the sectionalisation work), and conditions for household connections and water saving measures at household level. Interviewees who were involved in writing the by-law see this as the main way of institutionalising the work done by SWITCH in the city, also recognising, of course, that large parts of the by-law find their origins in the broader water demand management work done by the municipality.

No further inputs were made into municipal plans and policies. However, as several municipal departments worked on SWITCH, much of the institutionalisation can be found in the form of changed municipal operational procedures. For example, sectionalisation is fully institutionalised in the operational procedures of the Infrastructure Area department 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, 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 opportunity to collaborate and exchange with other cities and consortium members. However, experiences in this regard have been mixed.

Various SWITCH consortium partners have indeed come to Zaragoza to learn from the city's experiences. They include a delegation of Hamburg researchers, learning alliance members from Latin American SWITCH partners, and researchers from other partners including IRC and Loughborough University. However, learning from other partners and cities has remained below the expectations of the Zaragoza team. To some extent, many of the proposed techniques and approaches from elsewhere were already employed here as Zaragoza is one of the few cities with such a strong emphasis on water demand management. Language barriers also played a role in limiting exchanges.

What was appreciated by the project team in Zaragoza was 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 problems, such as those that prevented a formal arrangement with the university.

V. CONCLUSIONS AND RECOMMENDATIONS

Conclusions and lessons learnt

SWITCH aims to contribute to a paradigm shift in urban water management towards a more integrated and participatory approach, 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, 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 experienced more than 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 no 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 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. SWITCH was expected to:
1) Showcase the experiences of Zaragoza in integrated urban water management,
2) Contribute to the city's water demand management measures on the basis of research and demonstration activities, and
3) Provide additional motivation, 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 knowledge base on IUWM, but results to date are limited. Ongoing research on sectionalisation and analysis of the impact of different types of demand management is very relevant for an improved scientific basis for municipal operations of the water supply system. This research also holds the potential to yield insights that are relevant for cities with similar conditions. Local stakeholders are appreciative of this potential and see the added value from SWITCH as

providing an impetus to link their operations to scientific research. However, more consolidated research results were expected from a five-year research project. The shortfall is partly because the main research components started late and much of the analysis and documentation is still going on. It is also 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 showcasing the experiences of Zaragoza, and contributing to the scientific base of integrated urban water management.

2. The sectionalisation 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 demonstration responded to a clear demand from the Municipality, giving both conceptual and practical follow-up to ideas that already existed, 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 several platforms already 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 (such as the Expo and the water library). Nor was there an explicit need to strengthen these bodies that have proved important vehicles for sharing philosophies about sustainable water management, further strengthening citizen awareness and civil society involvement in water management in Zaragoza. The showcasing of more practical SWITCH experiences from Zaragoza, in sectionalisation or water demand management through these platforms has been done in a more limited way. This kind of information sharing was focused mainly on the stakeholders who were directly involved, partly because this is a very technical topic. Some platforms, particularly at regional and basin level have also been used to a very limited extent. Learning from other cities within the SWITCH consortium has remained below expectations.
4. The concepts behind integrated urban water management and the 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. SWITCH has only been one source of input 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, although there is a gap at regional level. The showcasing has largely been done through events like the Expo and local forums. However, a more structured and systematic documentation of the Zaragoza experience has not happened and this has been a

missed opportunity. The SWITCH project is seen by local stakeholders as giving an important impetus to both the work on sectionalisation and to 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 for 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.

The reasons for objectives not being met lie in the contradiction between 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 by 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 and no possibility of hiring additional staff capacity for this. As a result, delays occurred and not all the work was done.
- Big investments were already being made by the Municipality in sustainable water management. However, municipal financial management procedures made it difficult to earmark SWITCH funds for specific activities, resulting in delays in spending the budget and further delays in the work.
- The 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, limiting the research results to date.
- Zaragoza has a lot to show in terms of past and present water management practices. However, specific SWITCH contributions have not always been visibly recognised by stakeholders, nor have past experiences been sufficiently documented. Those responsible for promoting sustainable water management (i.e. the Municipality) have neither the mandate nor the professional background for such research and documentation work. The difficulties in involving a research partner with skills in this field contributed to the limited progress in documentation.

These shortcomings at project level reflect the difficulty in embedding specific projects into a broader process of improving urban water management. However, it is the latter process that counts, and in this respect, the city has obtained just as important results over the five years of SWITCH, as it has in the decades before. SWITCH has been able to provide an additional impetus to this process and results. It is hoped that the continuing process will be able to take the lessons forward and finish the work.

Recommendations

This section presents the recommendations that will provide direction for finalising what SWITCH has not yet been able to fully achieve. Most of these recommendations inevitably fall outside the time frame of the project, although some can be started before the project ends. Specific recommendations related to the overall SWITCH objectives include:

Recommendations for objective 1: scientific basis for IUWM

As this is probably the objective where most progress still needs to be made, these recommendations carry the highest priority:

- Finalise research activities that started under SWITCH. Specifically continue with the analysis and validation of the research results on the impact of water demand management measures, and start research and data analysis on sectionalisation
- Consider investing in a more complete documentation of the entire journey that Zaragoza has followed in IUWM in line with one of the major gaps identified above. It is felt that Zaragoza can showcase a lot through such research and that this will also help stakeholders in Zaragoza identify areas for further work.
- Define a research agenda for the future, to help in prioritising further research. Already some elements for that agenda were discussed during the interviews. These suggestions need further elaboration:
    - Possibilities for reducing water losses in industries and in the network
    - Tariffs for wastewater treatment and for industry
    - 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 the sectionalisation work where it has not been finished. In the future, there is possibly 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 for sharing SWITCH experiences. Two specific recommendations are:

- Present the SWITCH process and results in Zaragoza to international consortium partners, particularly at the conference “Sustainable Water Management in Cities: engaging stakeholders for effective change” held in Zaragoza in December 2010.
- Present 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. This will be an important way to institutionalise the work done. Recommendations for the medium term include:

- Follow up the research on water demand management and sectionalisation so as to include these in a future updated version of the by-law
- 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 relatively untapped potential for scaling up the Zaragoza experience.

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

VI. ACKNOWLEDGMENTS

The authors would like to thank all the interviewees for their time and willingness in contributing to the analysis presented above. SWITCH is an action research programme co-funded by the European Commission and implemented by a consortium of 33 partners from 15 countries (www.switchurbanwater.eu).

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ANNEX

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 sectionalisation in water network	Head of the Infrastructure Department of the Municipality	Civil Engineer
6	M	Demonstration on sectionalisation in water network	Head of the water supply network management	Civil Engineer
7	M	Demonstration on sectionalisation in water network	Technician in water supply network management	Civil Engineer
8	M	Demonstration on sectionalisation in water network	Technician in water supply network management	Industrial engineer
9	F	Demonstration on sectionalisation in water network	Technician in water supply network management	Industrial engineer
10	M	Work on tariffs	Head of the Treasury	Economist
1	F		Councillor on	Journalism

1			Environment	
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 sectionalisation. From the original four sectors in the Actur neighbourhood this has been upscaled to 22 sectors. Another 19 sectors have been identified, but sectionalisation has not yet been physically implemented there. 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-law 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 many scientific products. Most of the documentation has only very recently emerged and it is early to assess how this work will be referenced.

ACRONYMS AND ABBREVIATIONS

CHE	Ebro River Basin Confederation (*Confederación Hidrográfica del Ebro)*
ECODES	Fundación Ecología y Desarrollo (NGO)
FNCA	New Water Culture (NGO)
FP(6)	EU Framework Programme (6)
IUWM	Integrated urban water management
IRC	IRC – International Water and Sanitation Centre, The Hague, the Netherlands

lpcd	Litres per capita per day
NGO	Non-governmental organisation
SWITCH	Sustainable Water Management Improves Tomorrow's Cities' Health
UNESCO-IHE	(UNESCO) Institute for Water Education, Delft, the Netherlands
WEDC	Water, Engineering and Development Centre, Loughborough University, UK