

TURNING LATIN AMERICA'S WATER UTILITIES GREEN: LESSONS FROM SPAIN

By Carlos E. Velez, Carmen Yee-Batista and Elizabeth H. Eiseman, LCSUW

Background

From June 13 to June 17, 2011 a delegation from the Administración de las Obras Sanitarias del Estado (National Water Supply and Sanitation Company of Uruguay, or OSE) and the LCSUW Unit at the World Bank traveled to Spain to observe how Spanish water and sanitation utilities are responding to climate change. The trip was planned as part of the preparatory stage of a project to build OSE's capacity to respond to climate change.

To develop a comprehensive understanding of Spain's response to climate change, the delegation met with a full range of water management entities, from government ministries to watershed agencies, including Canal Isabel II, the Catalan Office of Climate Change, the Hydrographic Confederation of Tajo and the Center for Hydrographic Studies at CEDEX. In addition, the delegation traveled to three different cities, Madrid, Barcelona and Sevilla, in order to understand how cities with different water challenges have shaped their responses.

Specifically, the delegation sought to learn how Spanish water management entities have approached strategic planning in light of climate change, pursued integrated watershed management, and employed good water management practices. Key questions included:

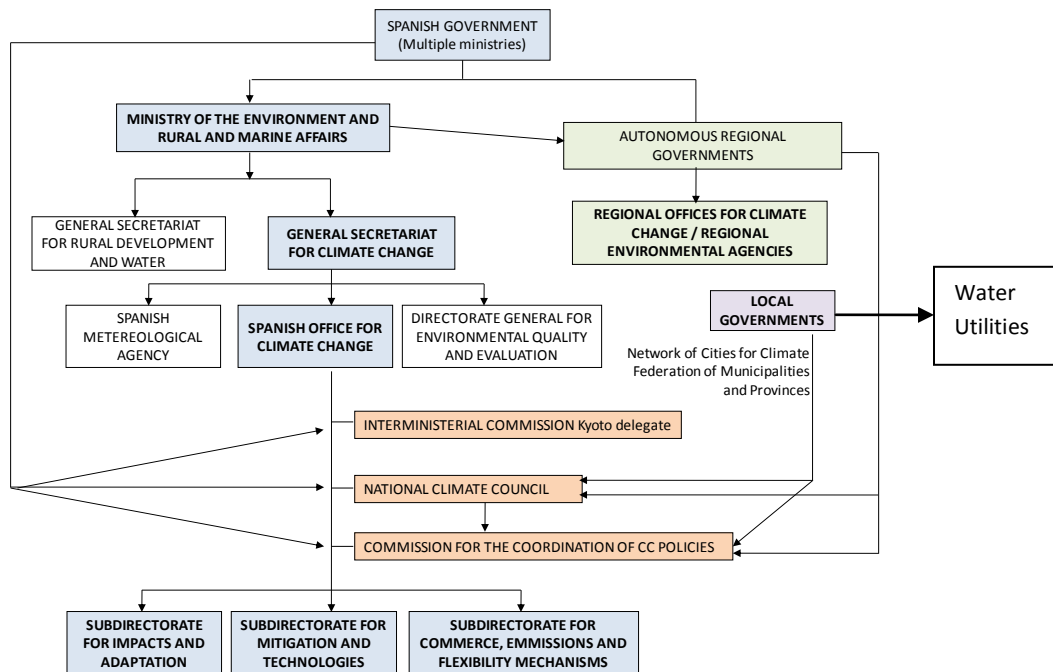
- How is climate change integrated into the decision making process for water management agencies in Spain? How are they surmounting the uncertainty surrounding the effects of climate variability? How are stakeholders incorporated into this process?
- What are the institutional arrangements for reducing contamination in the water supply and protecting the quality of potable water? How have water utilities engaged in the environmental field to protect and maintain their water sources?
- How have water utilities both reduced non-revenue water loss and promoted water conservation? How have they conserved energy in daily operations? What mitigation and adaptation methods have they employed to manage residual water?

Why Spain? Spain is at the forefront of water management strategies that address both climate change and efficiency. This is largely a result of the country's first hand experience with climatic shifts. Spain has a Mediterranean climate that is characterized by recurrent droughts of varying degrees of intensity and length. In spite of having a highly regulated hydrologic network (Spain has the highest number of big dams per inhabitant in the world) the severity of drought periods and the inadequateness of management approaches in the 1980's and 1990's resulted in rivers running dry and cities, in risk of evacuation, requiring emergency supply from water tankers. These emergency situations led to a significant shift in policy and management approaches to climatic risks.

The European Union's emphasis on responding to climate variability has also played an important role in spurring the development of institutional structures to facilitate adaptation and mitigation plans in Spain. The national government in Spain has established the Spanish Office

for Climate Change and most regional governments have created their own climate change offices that develop adaptation and mitigation strategies in coordination with the central government. These climate change offices work with a variety of government offices, including those devoted to water management, to help them increase their capacity to respond to extreme weather and climate variability. Exhibit 1 contains a diagram detailing the institutional structure of Spain's climate change offices.

Exhibit 1. Spain's Institutional Structure for Climate Change



Source: Nuria Hernandez-Mora

In addition, Spain's water laws and water strategies reflect the need to use water in a sustainable manner given current climate instability. For instance, the Spanish Water Law calls for the "economizing of its use," and one of the goals of the 2001 National Hydrological Plan is to "manage the distribution of water and satisfy demand in both the present and future through using water rationally, *sustainably*, sensibly and equitably." The NHP also calls for all river basin agencies to develop Drought Management Plans and for cities of over 20,000 inhabitants to develop Drought Emergency Plans. Additionally, the European Water Framework Directive, transposed into Spanish law in 2003, calls for water policy and management that enhances the status of aquatic ecosystems, promotes sustainable water, aims at enhanced protection and improvement of the aquatic environment, and contributes to mitigating the effects of floods and droughts.

Lessons from Spain

During the delegation's visit, several elements essential to Spanish water utilities' success in responding to climate change emerged. These components include: (i) a strong national

institutional framework for climate change; (ii) a capacity to strategically plan for risk; (iii) a focus on improving efficiency; and (iv) the adoption of mitigation measures that focus on energy efficiency and explore the nexus between water and energy.

Spain's strong institutional framework for climate change has prompted water utilities to prioritize green growth initiatives. In addition, institutional involvement has helped structure and coordinate climate change responses among different sectors. For instance, the Spanish government has sponsored research studies on the effects climate variability will have on water resources in Spain (which forecast reductions of as much as 15 percent in several Mediterranean river basins), and Spanish water utilities have used these findings in structuring their strategic plans. One of the biggest challenges Latin American water utilities will face in responding to climate change will be building institutional support.

Spain's water utilities have emphasized demand management. During the drought periods of the last two decades of the 20th century, Spain was unable to successfully employ water supply augmentation strategies. As a result, Spain's water utilities emphasize demand management when addressing water scarcity. Inexpensive measures to manage demand and increase system resiliency include water conservation initiatives, innovative pricing, and reduction of non-revenue water losses. Another challenge for many Latin American water utilities will be instilling a culture of conservation amongst the population. Not all Latin American countries have experienced the extreme weather scenarios that Spain has and as a result do not have the same level of support to plan for risk to guard against future disasters.

In addition to responding to the potential effects of climate change, Spain's water utilities have incorporated green growth strategies that emphasize energy efficiency and the nexus between water and energy. These strategies have enabled Spanish water utilities to reduce energy and water use in operations and green house gas emissions. Key strategies Spain has employed in shaping its response to climate change are discussed in more detail in the following section.

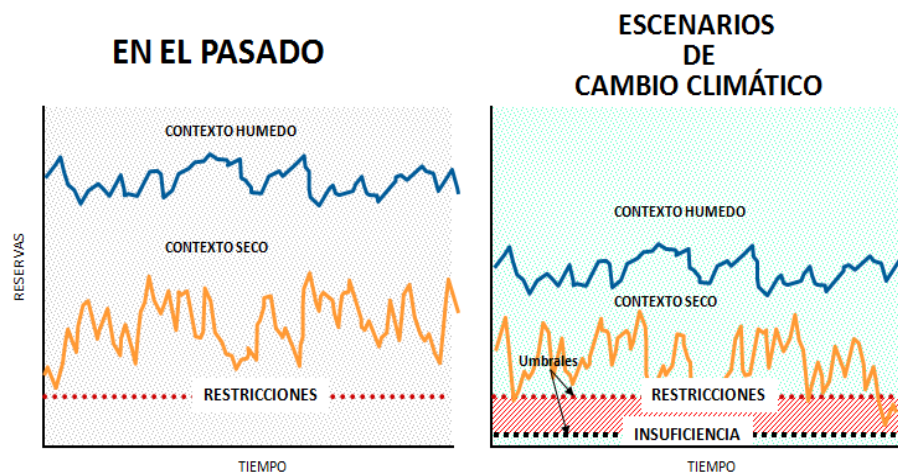
Key Strategies

Key strategies that Spanish water utilities have utilized in their responses to climate change include: (i) risk management plans; (ii) diversification of sources; (iii) water monitoring systems; (iii) advanced drainage plans; (iv) water conservation; (v) energy efficiency and green house gas reduction programs; (vi) self-sufficient energy production; and (vii) green growth city programs.

Risk Management Plans: One of the first steps to developing a long term risk management plan to respond to climate variability is to conduct a vulnerability assessment based on different climate scenarios. Without understanding the long term risk that these weather variables pose to water resources, it is both difficult to take the potential risk seriously and to form an appropriate risk management plan. In Spain, numerous studies have been undertaken to simulate possible future scenarios. As a result of these studies, most water operators are planning for a five percent decrease of water in Spain's natural regime by 2027. This number is not meant to be static. The

occurrence of extreme weather events in conjunction with scientific research will lead to the adjustment of this number. Water utilities that do not have access to the scientific research that Spain has can look back at historical weather data in order to project the potential future risk they face. Essentially, the Spanish water utilities have adjusted their strategic plans by planning for more intense weather events than they had previously. The “Change in Conceptual Assessment of Risk of Failure” graphs (Exhibit 2) from Canal Isabel II, the central water operator for Madrid, illustrate how potential risks increase once climate change is incorporated into the strategic plan.

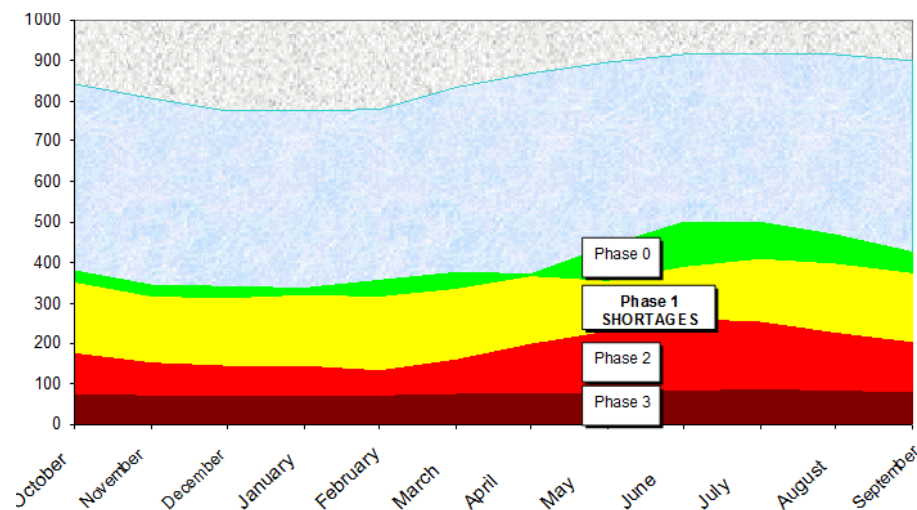
Exhibit 2. Change in Conceptual Assessment of Risk of Failure



Source: Canal Isabel II

One of the ways in which Spanish water utilities have planned for this greater risk is through developing protocol for actions to be taken in the event of floods and droughts. Both EMASESA, the water and sanitation operator for Sevilla, and Canal Isabel II have developed drought and flood manuals. Indicators should be established alongside the development of these protocols so that the level of risk the country is currently facing can be systematically identified and the proper protocol can be followed. For example, what level of water shortage constitutes a drought? When are risks of drought high or low? Exhibit 3 contains a diagram illustrating Canal Isabel II’s thresholds to cope with different levels of risk of shortages in Madrid.

Exhibit 3. Thresholds for Risk of Shortage



Source: Canal Isabel II

Diversification of Sources: One of the ways in which Spain is adapting to its water supply limitations and preparing for future decreases in its water supply is through diversifying its water sources. Spain is employing a variety of methods including integrated use of surface and groundwater, water reuse and desalinization to guard against water shortages. The government-funded Center of Hydrographic Studies at the Center for Studies and Experiments for Public Works (CEDEX) has overseen a number of cutting edge studies on the reliability and efficiency of reuse technologies. Since 1994, the Ministry of the Environment, Rural and Marine Affairs (MARM), has overseen the construction or expansion of 20 desalination plants on the Mediterranean coast of Spain. Studies are also being conducted on the reuse of treated wastewater for agricultural irrigation. This is particularly important for Spain as 70 to 80 percent of all water consumed in Spain is used for irrigation. Canal Isabel II is also focusing on water reutilization. They currently regenerate 6.82 hm³ of water and are trying to increase that amount to 70 hm³ by 2013.

Water Monitoring Systems: Spain has a highly advanced water monitoring system. Each water operator we visited had a control center, monitoring water flows throughout the city, water levels and water quality. The level of integration of each monitoring system varied from operator to operator. Watershed agencies also employ advanced technology to monitor water levels and water flows. The Hydrographic Confederation of Tajo gauges water levels, water flows and gates-valves positions throughout the watershed. The collected information is channeled to the Automatic System of Hydrologic Information (SAIH), a network in which data from watersheds throughout the country is compiled. In addition, the Spanish Meteorological Agency provides a database of both current and historic meteorological readings. This inventory of data is used to build simulation models for possible future scenarios enabling Spain to respond to climate change in an informed manner. The constant flow of data also keeps Spain abreast of recent

developments and changes in its water regime allowing Spain to proactively respond to potential challenges.



Control Center at Canal Isabel II

Advanced Drainage Plans: Climate change is not only expected to lead to a decrease in the overall volume of water in the natural regime, but is also projected to lead to periods of greater rain intensity, extreme storms and flooding. Drainage operators need to ensure that their systems are prepared to handle greater water inflows. In Barcelona, a city that has traditionally been prone to floods, CLABSA, Barcelona's drainage operator, has developed source control measures, storage tanks, seafront gates to guard against sea rise, an integrated real time control of its system, emergency operation procedures for floods, and the ability to forecast real time flash

floods. These measures are particularly important in light of the fact that Barcelona has a combined sewer system and is thus more susceptible to flooding.



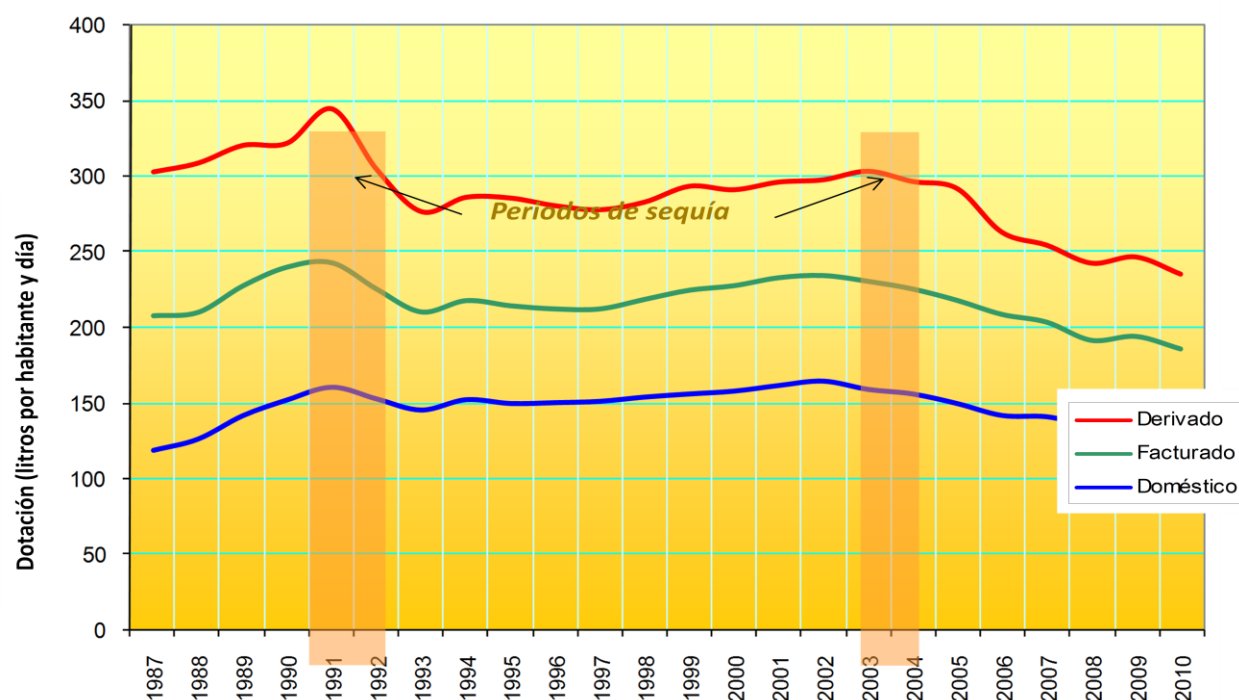
Joan Miró Park lies above CLABSA's urban storm water storage system

Water Conservation: The scarcity of water in Spain and the fear that water will become even scarcer with climate change has brought water conservation to the fore. The level of non-revenue water has become an issue of particular concern. From 2006 to 2010, Canal Isabel II successfully decreased real water loss in distribution from 9.63 percent to 5.5 percent. The Ministry of the Environment has also invested in projects in order to minimize water loss. For example, in Extremadura the Ministry invested in a project to modernize the water and sanitation system of Alagon. The 21 million Euro investment resulted in approximately 70 hm³ of water saved per year, the equivalent of 18.1 percent of total consumption in Alagon in 2006. Water utilities have also engaged in innovative pricing schemes to encourage households to consume less water. Canal Isabel II was the first water utility in Europe to use a seasonal tariff program, whereby water prices for water consumed in excess of a consumer's usual intake increase during the dry season. EMASESA offers a discount rate for consumers who use less than 3 m³ of water per month. EMASESA's sliding cost /use scale is detailed in Exhibit 4.

Exhibit 4. EMASESA's Cost Scale	
Amount of water consumed per person per month	Monthly cost
Less than 3 m ³	24.3 Euros
Less than 4 m ³ per month	30.9 Euros
Less than 5 m ³ month	48.4 Euros
More than 5 m ³ month	112.7 Euros

Firsthand experience with droughts has also helped build a culture of water conservation among Spaniards. Exhibit 5 illustrates how water consumption in Madrid not only decreased during the time of drought, but also how these decreases were maintained after the crisis period had passed.

Exhibit 5. Water Consumption in Madrid



Source: Canal Isabel II

In addition, local governments and water operators have launched outreach campaigns to help raise awareness about the importance of water conservation. For example, Canal Isabel II has begun an educational program called “Canal Educa,” which provides classes for children on the importance of using water sustainably. EMASESA also has educational outreach programs on the importance of water conservation.

Exhibit 6. Principal Actions of EMASESA'S Integrated Demand Management
(1) Progressive tariff program
(2) Encourage the installation of personal meters in communities
(3) Establish collaborative pacts among different sectors
(4) Publicize water saved in both public and new buildings
(5) Installation of a water network exclusively for non-drinkable water
(6) Restrict the use of potable water in irrigation
(7) Help limit the impact of contaminating industrial effluents



Source: EMASESA

Energy Efficiency and Green House Gas (GHG) Reduction Programs: Water conservation is directly tied to energy efficiency and GHG reduction. For example, from 2006 to 2010, Canal Isabel II was able to save 483 million m³ of water, which equates to 409 GWh of energy and 213.5 kt of Carbon dioxide. Water operators are focused on increasing their efficiency through, among other measures, installing more efficient pumps and modernizing systems. EMASESA has begun a campaign to improve hydraulic efficiency through requiring that the average age of its electronic meters does not exceed five years. In addition, water utilities are reducing their GHG emissions through utilizing a number of renewable energy sources including photovoltaic energy, aeolic energy, hydropower energy, and biogas from wastewater plants. Canal Isabel II has built eight small hydroelectric plants, 11 biogas energy generation plants, and a plant for compost and thermal drying. These measures helped the Canal curb emissions by 23.3 percent (equal to 54.485 t of Carbon Dioxide) in 2010. Both energy efficient efficiency and green house gas reduction programs help water utilities minimize their environmental impact and reduce operational costs.

Self-Sufficient Energy Production: Several Spanish utilities are striving to become self-sufficient energy producers. For example, EMASESA is aiming to increase energy efficiency,

produce more renewable energy, and reduce current levels of energy use. EMASESA needs to produce 23,171.50 Mwh more energy to become self-sufficient; the operator currently consumes 61,678 Mwh and produces 38,507.5 Mwh of energy. To assist in the achievement of this goal, EMASESA established “Aquaenergia” a cross-sectoral team within the utility devoted to coordinating and promoting energy efficiency.

Green Growth City Programs: In Andalucía and Barcelona, local governments are sponsoring Voluntary Agreement programs. Under these programs, private companies voluntarily decide to commit to lowering their environmental impacts. The incentives for participation include the cost benefits of operating with greater energy efficiency and the marketability of being a green business. In Andalucía, in order to participate in the program, businesses conduct an inventory of emissions and produce a plan for reducing their emissions. The plan must be measurable and verifiable. Water utilities can participate in these programs through incorporating energy efficiency and renewable energy activities into their water management plans. In addition, water utilities can use this concept to promote community involvement in water conservation and watershed preservation.

The wide array of strategies Spanish water utilities have employed to respond to climate change present water utilities throughout Latin America and the world with a menu of adaptation and mitigation measures they can use to begin building their own responses to climate change.



The delegation, reflecting on lessons learned throughout the week (Source: OSE)

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Additional information on the delegation’s study tour to Spain can be found at:

<http://connectlcr.worldbank.org/units/lcrsd/LCSUW/default.aspx>

Approving Manager: Guang Zhe Chen, LCSUW Manager

