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# The end of scarcity? Water desalination as the new cornucopia for Mediterranean Spain

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SUMMARY

In this paper we explore the new orientation taken by Spanish water policy since the beginning of the 21st century and very specifically the shift towards desalination as an alternative to other water supply options such as river regulation or inter-basin water transfers. Desalination has been seen as the cure for everything that dams and inter-basin water transfers were unable to solve, including droughts, scarcities, social conflicts, environmental impacts, and political rivalries among the different Spanish regions. Desalination also means a new and powerful element in water planning and management that could provide water for the continuous expansion of the urban and tourist growth machine in Mediterranean Spain and thus relax possible water constraints on this growth. However, by 2012 most new desalination plants along the Mediterranean coast remained almost idle. Focusing on the case of the *Mancomunidad de los Canales del Taibillla* in South-eastern Spain, our aim is to develop a critical, integrated and reflexive perspective on the use of desalination as a source of water for urban and regional growth.



## 1. Introduction

In this paper we explore the new orientation taken by Spanish water policy since the beginning of the 21st century and very specifically the shift towards desalination as an alternative (Jefatura del Estado, 2004, 2005 and Ambienta, 2006) to other conflict-ridden water supply options such as river regulation or inter-basin water transfers (Masjuan et al., 2008). Using Mediterranean Spain, and especially the areas served by the *Mancomunidad de los Canales del Taibilla* (provinces of Alicante and Murcia), as a case study, our aim in this paper is to develop a critical perspective on the use of desalination as a source of water for urban and regional growth. In the context of repeated droughts, likely to increase in the future because of climate change, and the economic, social and environmental costs of conventional, large-scale water supply options such as dams and inter-basin water transfers, desalination appears as a sort of "cornucopia" able in principle to solve future water needs of urban expansion in Spain (Swyngedouw, 2013). As President Kennedy envisaged more than fifty years ago, "no water resources program is of greater long-range importance than our efforts to convert water from the world's greatest and cheapest natural resources – our oceans – into water fit for our homes and industry. Such a breakthrough would end bitter struggles between neighbors, states and nations" (cited in Krishna, 2004, p. 1). Likewise, proponents of desalination in Spain argue that it is one of the technologies with a greater capacity to solve water supply problems in coastal Mediterranean Spain and may become therefore a key resource for urban and regional growth in this area (Estevan, 2008a). Because it taps a seemingly endless source of water, desalination effectively removes the climatological and hydrological constraints associated with continental water resources (Feitelson and Rosenthal, 2012), and, more importantly perhaps in political terms, circumvents the social opposition and conflict increasingly associated with river regulation through dam building and long-distance inter-basin water transfers (Saurí, 2003). Desalination is not, of course, problem free. Energy availability and costs may be important, especially when compared with other water supply options (Domènech et al., 2013). In this sense, in Spain desalination costs have been compared with the cost of long-distance water transfers with conflicting evidence on which alternative is more cost-efficient (contrast, for example Prats and Melgarejo, 2006 with Valero et al., 2001). Moreover, the impacts of brine on oceanic life could be very damaging (Dawoud and Al Mulla, 2012) and there is still considerable uncertainty on other impacts such as the loss of marine life during water

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intake operations or the release of chemicals used in the desalination process through the brine.

Our objective in this paper will be to examine the so-called AGUA Program (*Actuaciones para la gestión y el uso del agua,* Actions for Water Use and Management) developed by the Spanish Ministry of the Environment in 2004 as an alternative to long-distance water transfers. This plan, while including some water-saving and efficiency improvement initiatives, was mainly aimed at building an important number of desalination plants along the Spanish Mediterranean coast to provide water for agricultural, urban and tourist uses (Jefatura del Estado, 2004, 2005 and Ambienta, 2006). Our socio-political and socio-environmental assessment of this Program focuses particularly on the economic costs of desalination in a context of competition with other water supply sources, declining demand in many municipalities and the collapse of the real estate sector in Mediterranean Spain since 2008. Taking as an example the *Mancomunidad de los Canales del Taibilla* (MCT) our analysis demonstrates that despite that desalination increases security of supplies in times of drought and has a number of advantages regarding other options it hardly represents the ultimate water source able to put an end to scarcity for all users.

Our sources of information for this paper have been published literature on the subject, the critical reading of a number of official reports (especially the viability reports of a number of water desalination plants in Alicante and Murcia prepared by the public company *Acuamed*; see Ministerio de Agricultura, Alimentación y Medio Ambiente, 2013a and Acuamed, 2012, 2013a,b), and informal conversations with water planners and managers of the *Mancomunidad de los Canales del Taibilla* (Martínez, pers. comm., 2013b) and Alicante's water company (Martínez, pers. comm., 2013a). The paper is organized as follows. In Section 2 we examine desalination in the context of water planning and management. In Section 3 we trace a brief history of desalination in Spain with a special emphasis on the so-called AGUA Program of 2004, which was responsible for the current expansion of desalination in this country. In section 4 we focus on the specific case of the *Mancomunidad de los Canales del Taibilla* (MCT) for which we examine the recent evolution of water supply sources and, in particular, the situation of desalination plants *vis à vis* other water sources. In Section 5 we situate desalination in the context of the current real estate crisis and diminishing water demand affecting the study area. Finally, we critically assess the reality of desalination in the study area and the possible implications of the lessons learned in this case for other areas interested in developing desalination projects. This last section points out to the need, not only in Spain, but also in other parts of the world, of a better integration between water planning and urban and regional planning, as well as a more integrated consideration of water supply sources, with accurate assessments in terms of water use and cost.

## 2. Desalination in the context of water planning and management

The genesis and development of cities cannot be understood without tracing how water has been mobilized in order to facilitate urban growth. In this process, water supply and sanitation infrastructures are critical as they mediate flows of nature and power (Castán Broto and Bulkeley, 2013) and become historical products of human-nature interactions (Gandy, 2002; Kaika, 2005 and March, 2013). From the use of local resources, such as groundwater, to the transportation of water through long-distance aqueducts and the development of desalination plants, the water cycle has been increasingly humanized since the Industrial Revolution, making possible the massive concentration of people in cities. More recently and in a similar fashion, the development of massive water infrastructure has made possible the growth and consolidation of large tourist resorts in many parts of the world (see, for instance, Gössling et al., 2012).

The large amounts of capital involved and the urgent need to enlarge water availability throughout the 20th century led to the prevalence of centralized approaches to water supply. This is what could be called "the hydraulic paradigm" or, in other words, the control by the state of all matters regarding water planning and management with an emphasis on technological solutions (Saurí and del Moral, 2001). Water-supply systems developed along those principles have produced large benefits to the population by improving the reliability of provision, reducing water-related diseases associated with poor water quality, and containing the vagaries of climate and the impacts of extreme hydrologic events such as floods and droughts. On the other hand, conventional water supply systems (including dams and water transfers) have also produced large costs, including ecological and environmental degradation, social disruption associated with infrastructure, and economic and financial problems (World Commission on Dams, 2000 and Gleick, 2003).

As the most recent mutation of the "hydraulic paradigm", desalination has massively expanded in the recent years across the world. According to Swyngedouw (2013), desalination is being presented increasingly as a techno-social fix, against the pressures of urbanization, climate change and population on freshwater resources. As the World Health Organization (2011, p.1) recognizes: "desalination is increasingly being used to provide drinking-water under conditions of freshwater scarcity. [...] This situation [water scarcity] is expected to worsen as competing needs for water intensify along with population growth, urbanization, climate change impacts and increases in household and industrial uses". The Intergovernmental Panel on Climate Change (IPCC) (Bates et al., 2008) presents desalination as a potential option, together with wastewater reuse, to adapt to the impacts of climate change, especially in arid and semi-arid regions. Desalination thus may contribute to enhance water security, and can "yield a reliable long-term water supply with the flexibility to be decommissioned if not needed" (Baldwin and Uhlman, 2010, p. 195).

Nonetheless, desalination presents a series of contradictions and problems. First and as said before, desalination may have deleterious effects on marine ecosystems (Sadhwani et al., 2005 and Bernat et al., 2010). Second, and more relevant for the purposes of this paper, desalination implies high-energy consumption and $CO_2$ emissions (Meerganz von Medeazza, 2004; Sadhwani et al., 2005; Bates et al., 2008 and Bernat et al., 2010). In this sense, the water-energy nexus (Gober, 2010 and Siddiqi and Diaz Anadon, 2011) becomes especially evident with desalination due to the high amounts of energy needed to desalt water. While the average energy cost of a unit of water used in Spain is 0.45 kW h/m$^3$ (this figure includes water-related electricity consumption before the final use of the water) (Hardy et al., 2012) desalination requires between 3.5 KW h/m$^3$ (under ideal conditions) and 5 kW h/m$^3$ (the modern plants with reverse osmosis) or more in the older plants (Instituto para la Diversificación y Ahorro de la Energía (IDAE), 2010; see also Bernat et al., 2010).

In any case, the economic cost of desalted water may vary depending on plant capacities, the type of water (brackish or seawater), the type of energy used (conventional, photovoltaic, etc.), water salinity, location (costs of labor and energy subsidies), capacity of the desalination plant, and desalination technology used (Multi-Stage Flash distillation or Reverse Osmosis) (see Karagiannis and Soldatos, 2008). For instance large desalination plants in Spain (with a capacity over 100,000 m$^3$/day), according to Bernat et al. (2010) using Reverse Osmosis may obtain freshwater from seawater at a cost between 0.36 and 0.53 euros/m$^3$ (as we