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Analysis of the process of environmental impact assessment for seawater desalination plants in Spain

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HIGHLIGHTS

- Desalination enables the development of areas with insufficient water.
- Spain has used desalination plants since the seventies (mainly with RO process).
- EIA enables the development of environmentally sustainable projects.
- This paper discusses the EIA process for new seawater desalination plants in Spain.
- It is necessary a greater public participation in the Spanish EIA process.

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ABSTRACT

Desalination generates drinking water and enhances the economic, social, and environmental development of many areas with few water resources, such as parts of the Middle East, North Africa, and southern Europe (such as Spain and Cyprus).
Desalination plants may cause environmental impacts in coastal areas and so it is necessary to submit plans for new plants to a process of environmental impact assessment (EIA) in order to achieve more environmentally viable projects, meaning: optimal locations; appropriately used systems and technologies; effective preventive, compensatory, and corrective measures; and social and environmental acceptance.
This article contains a study of the process of environmental impact assessment for seawater desalination projects during the last 12 years in Spain through an analysis of information published in the Records of Decisions (RODs). The study describes the main aspects of the process and identifies areas for improvement.

1. Introduction

Water is an abundant resource that covers about three-quarters of the surface of the earth, yet only 2.5% is drinkable. Water availability is declining and there is no spatial or temporal uniformity [1]. The problems of scarcity affect a third of the world population and these problems will increase in the future [2–4].

Desalination is being used by many countries to alleviate the shortage of water and enable economic, social, and environmental [5,6] development, and is ultimately a tool to preserve natural resources and protect the environment [7].

Commercial desalination technologies can be divided into two main categories: thermal distillation (multi-stage flash or MSF, and multiple-effect distillation or MED); and membrane separation (reverse osmosis or RO) [8,9]. Thermal processes were mainly used in large and medium sized plants, while reverse osmosis was employed in smaller installations; however, improvements in membranes in recent years have enabled the use of reverse osmosis in large installations [1,6,10].

Thermal processes are currently used in the Gulf and North Africa, which have considerable energy resources; while reverse osmosis is used in the majority of developed countries [1,10] and those nations with few energy resources [9,11] because it is more efficient in terms of energy and cost [1,12].

Desalination is a process that can generate unintended impacts and damage coastal areas and so to avoid unsustainable and poorly planned developments, planning policies must be integrated into the management of water resources and coastal resources [10,13]. The most useful tool to study the potential impact of a seawater desalination plant (SWDP) on the local environment and choose the best site for installation is the environmental impact assessment (EIA) [6,10,12,14–16].

An EIA involves a set of studies and techniques that enable an estimation of the effects of the implementation of a project, work, or activity [17].

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The main environmental impacts of desalination plants are land use, impact on the marine environment, impact on surface water, noise, and high energy consumption [6,12,18].

1.1. Desalination in Spain

Desalination has been used in Spain since the 1970s, mainly in water supply in the Canary Islands near the African coast and in the Spanish enclave cities of Ceuta and Melilla on the African mainland. Spain is the largest producer of desalinated water in the European Union [19]. Some 106 million cubic meters of water was desalinated in Spain in 2010—equalling 2.9% of total water demand [20] with 84.49% being desalinated in the Canary Islands and 6.54% in Ceuta and Melilla.

A Spanish National Hydrological Plan [21] was cancelled in June 2004. The central proposal of the plan was the annual transfer of 1050 Hm^3 of water from the Ebro river basin in Catalonia in NE Spain to the Júcar and Segura rivers further south to rectify water shortages in the southern Mediterranean regions (Fig. 1).

An alternative to the Ebro transfer was presented in September 2004 in the AGUA programme (an acronym in Spanish for action for the management and use of water) whose objectives included: increased availability of water; improved management of water resources; improved water quality; prevention of flooding; and restoration of the environment.

Actions proposed in this programme were included in the Spanish legislative act 11/2005 [22] which specified the use of desalination and recycling to meet growing demand, alleviate the exploitation and pollution of aquifers, and protect ecosystems of natural interest.

The act outlined a series of urgent priority actions in the Mediterranean basins. Some of these actions were intended to increase the availability of water—including improving the distribution of desalinated water. The construction of 22 new SWDPs was also proposed (7 in the southern basin, 10 in the Segura basin and 5 in the Júcar basin).

1.2. Environmental impact assessment (EIA)

The EIA process in Europe is regulated by two laws, the Directive 2011/92/EU [17] on the assessment of the effects of certain public and private projects in the environment (known as Environmental Impact Assessment—EIA Directive) and the Directive 2001/42/EC [23] on the assessment of the effects of certain plans and programmes on the environment (known as Strategic Environmental Assessment—SEA Directive).

Directive 2011/92/EU modifies and completes the following laws, the Directive 85/337/EEC [24] and the Directive 97/11/EC [25]. The first Directive defined the European normative framework on EIA and marked the realisation of the prevention principle in environmental policy. The second Directive introduced the prior authorisation for projects subject to EIA, the process of scoping, and established the relationship between EIA and IPPC [26]. It also regulated the procedure of projects with an impact on environment in a transboundary context as set out in the Spoo Convention [27]. Furthermore, it expanded the list of projects for EIA (Annex I of the Directive) from nine to twenty-one blocks, and developed a list of possible projects which should be subject to EIA (Annex II) by judgement of the administration.

Fig. 1. Water basins in Spain. Adapted by authors.