dina-MAR

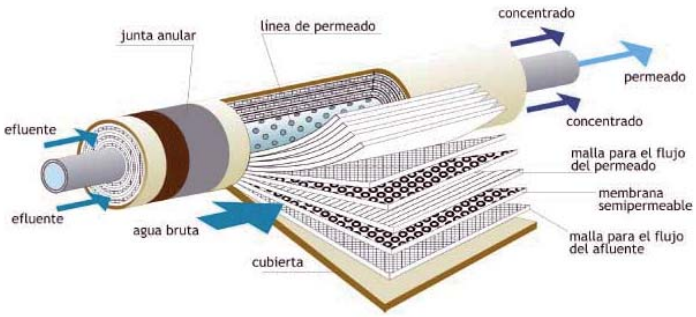
SPECIAL WATER MANAGEMENT TECHNIQUES

DESALINATION, MANAGED AQUIFER RECHARGE AND RE-USE. PROS AND CONS

Desalination, managed aquifer recharge and re-use are the so-called "special techniques" of water management, and they constitute an alternative or a complement to "conventional techniques" (dammed reservoirs, groundwater exploitation and water basin transfers). The main advantage of the special techniques is that they generally have more possibilities for sustainable development. Their main drawback is the lack of knowledge on the part of public institutions and bodies and the scarce experience in this country about details of the matter.

Desalination

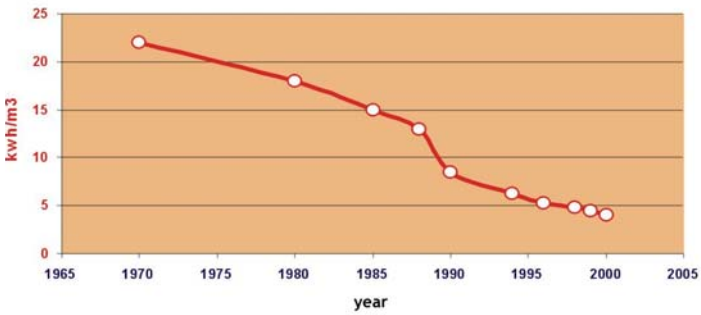
This is a possibility in coastal areas. In this country there are currently over 900 desalination plants, which produce more than 800,000 m^3/day (Hispagua, 2006). There are various desalination processes, with reverse osmosis being the most effective.



Reverse osmosis equipment.

The main advantages afforded are: the possibility of using briny water from aquifers, thereby halting saline intrusion, the stability of the supply in terms of both quality and quantity, and the possibility of adapting quickly to demand, within certain limits.

The main problems that arise are the high energy cost (which is a limiting factor for many users) and waste management (brine). According to the Spanish Desalination and Re-use Society, the average energy consumption in Spain in 2005 was to the tune of 3 Kwh/m^3 in sea water.



The evolution of energy consumption in Spain in sea water desalination plants.

One recently-opened line of research is desalination using renewable energies.

Management aquifer artificial recharge (MAR)

Reverse osmosis waste water treatment plant.

Managed Aquifer Recharge (MAR) consists of a set of techniques that make it possible to act on the quantity and quality of water reserves in aquifers by means of intervention at the entry and exit points for the system's water. There are various methods that make it possible to act on different shallow, intermediate and deep aquifers.

This requires detailed knowledge of the chemical nature of the recharge water, of the aquifer's natural water, and of the possible interaction between them.

Picture of the infiltration pond and artificial recharge channel of the Cubeta de Santiuste facility (Segovia).

The main advantages they provide are: elimination of pollutants by biochemical and mechanical filtration, reduction of losses by evaporation, buffer effect of the recharge water against others of lower quality, the possibility of regenerating ecosystems, and saving in space (the water is stored below the surface) and in distribution costs.

Madrid's Tertiary Detritic aquifer alone has a storage capacity (around 11,000hm^3) double that of all the reservoirs in the Tagus basin: 5,709 hm^3 (Hispagua, 2005).

The main drawback of the MAR techniques is the lack of knowledge and dissemination of these techniques, and their scarce precedents in Spain.
Grupo Tragsa is currently carrying out a series of pilot trials in Santiuste and Carracillo (Segovia) with positive results, contributing to the development and implantation of this technique in this country. Over the 2006/07 hydrological year, 17hm^3 have been introduced into the Arenales aquifer by means of MAR techniques.

Re-use

The successive use of the resource allows for more uses with the same volume, increasing the system's efficiency. It is worth differentiating between direct reuse, in which the second use occurs following on from the first use, and indirect reuse in which the second use occurs after some time has elapsed, during which time the residual water has become diluted in the water course of some stretch of water.

Cangrejo T.M desalination plant, Valverde – El Hierro- Canary Islands.

In Spain there are currently over 100 direct reuse activities, making it one of the most advanced countries in this field. Direct reuse requires prior planning and pre-treatment. The water is transported from the first point of use to the second via a conduit, without being poured into any other watercourse, generally for industrial use.

Costes de algunos dispositivos MAR actualmente operativos en España	
Dispositivo AR superficial Santiuste (Segovia)	0,39 €/m^3 (Grupo Tragsa, 2006)
Dispositivo AR superficial Carracillo (Segovia)	0,15 €/m^3 (Grupo Tragsa, 2007)
Dispositivo AGBAR Cornellá (Barcelona)	0,04 a 0,08 €/m^3 (Fuente: AGBAR)

In this country, the reuse of residual waters allows demand to be met for 230 hm^3/year (83% for irrigation, the rest for recreation, industry, municipalities, etc.). (Libro Blanco del Agua 2000, MMA).

WWTP in Abrucena, Almeria.

The main problem faced by reuse is the lack of specific rules to regulate the quality criteria demanded and matters pertaining to management. In this vein, in February 2007 the MMA presented a Royal Decree proposal to regulate the reuse of treated waters, which will partially modify the Hydraulic Public Scope Regulation, in keeping with RD 509/1996 of 15th March. (Norms applicable to the treatment of urban waste water).

Ratios Medios de Inversión	
Balsas	9,75 €/m^3
Presas	0,80 €/m^3
Desaladoras	0,45 a 0,90 €/m^3
Ratio dispositivo AR superficial	0,21 €/m^3
Ratio dispositivo AR profunda	0,08 €/m^3

As for economic aspects of the different techniques in Spain, there follows a list of investment ratios calculated from experiments carried out by Grupo Tragsa (in CONAMA, 2006 and www.dina-mar.es).

It is worth noting that the price of "alternative" techniques, and especially aquifer recharge management, is lower than the costs of conventional techniques, as well as having a lower environmental impact.

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