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The Canary Islands and its passion for water desalination

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ABSTRACT

Water has a huge economic, social and environmental importance, so the search of the precious liquid has become an intensive process in water policies of different countries. Therefore, the provision of water suitable for human consumption has now become a problem of vital importance for the population. The water desalination has led to a new strategy for water supply, especially in areas with high water stress and with opportunities of abundant new alternative sources of supply (seawater and brackish). Desalination technologies allow greater savings and efficiency in water use, exploitation of resources that were unusable previously like the peculiar case of sea water, as well as a greater guarantee of supply in terms of availability and quality, particularly in areas with poor water resources. In these areas often merge several factors that greatly favor the use of desalination. The Canary Islands are a clear example of this, as it has a large population, a great tourist industry, a shortage of the liquid element and a high demand for agricultural irrigation that conditions the availability and the need of new sources of high quality water. Water desalination, in the water policy of the Canary Islands, has been deeply rooted in the last forty years, allowing to solve and overcome the shortage and to ensure a quality suitable for human consumption. This article discusses the importance and significance that has had water desalination in the Canary Islands, made with a historical development of the evidence and key outcomes.

Keywords: Desalination; Technologies; Canary Islands

1. The context of water in Canary Islands

Water today has become one of the main problems of humanity. Water resources are insufficient as there are a number of evidence that affect us, such as the unequal distribution of these on Planet Earth, the adverse weather conditions that frequently are increasing and condemning certain areas of a bigger reduction of water yields, the incessant rise in demands that we face to attend the needs of the

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population, overexploitation of natural resources, the progressive saline intrusion of aquifers, etc.

It is not surprising that a society developed like ours based on the strategic pillar of consumption, where the leisure and welfare as well as the economic and touristic growth causes a direct effect on consumption of water, increasing it. However, we can have a paradoxical scene of rising demands with a poor availability of natural water resources.

The Canary Islands are a clear example of this, where due to its geographical location, its climate and low rainfall, the constant demands of agriculture, and the growing population, based on the tourism as an engine of development has leads to find new water resources and to adapt to new technological solutions that have ensured the demands of water consumption.

We have gone from the search, catchment, extraction, and distribution of surface water and groundwater to other processes to obtain freshwater, in order to slow down a situation of gradual and progressive deterioration of our water resources available in the nature of our territory. The Canary Islands have also a peculiarity that no other coastal areas have: an abundant source of seawater so that through technological processes freshwater suitable for consumption was obtained.

However, it is remarkable that even today the culture of water it is still present permanently in the Canary Islands. For centuries, we have lived with the shortage of this precious element, but also, with the application of human ingenuity to the regulation and use of our resources, as well as the incorporation of technologies and water treatments. Therefore, when we talk in Spain of water, treatments, technologies, and processes, the Canary Islands are a necessary reference, an example to follow, because in this thirsty land, we know better than anyone that water is life that every drop of water is a treasure and that thanks to the desalination technologies used in the Canary Islands have allowed to solve problems of shortage and urban supply, accumulating years of experience and knowledge.

2. Water resources in the Canary Islands

Water distribution in the Canary Islands is not homogeneous in all the islands, being scarce in Gran Canaria of the eastern islands. The weather conditions, geographic, and geological factors of each island are different. These are crucial reasons for understanding the uneven distribution of the natural water resources.

On the other hand, water consumption is higher as the population increases and therefore, the available water resources decrease. The following Fig. 1 shows the evolution in the last 112 years of the population census in the Canary Islands. In 1950, the population was 807,773 people and in 2013, the census has increased 2.62 times.

From the point of view of the Canary Islands' geometry, they have a surface area of about 7,447 km^2. In Table 1, the percentage distribution of the surface island as well as the length of coastline of each island is reflected.

Finally, Table 2 shows the changing demand of water available in the Canary Islands for the period between 2004 and 2010.

Natural water resources in the islands depend mainly on weather conditions. Through the natural water cycle, these resources are unequally distributed in the islands, due to the geographical and geological factors. Finally, the high water consumption depletes the availability of these and therefore, it is necessary to seek other alternatives of water supply through unnatural resources.

The current balance of natural water resources (surface water and groundwater) is insufficient to satisfy the demand of water of different sectors; urban, agricultural, tourism, industrial, recreational, etc. Only a 70% of the total demand can be attended, so it is necessary to supply water through new non-natural resources such as desalination and water reuse. In the Canary Islands, water desalination accounts for a 24 and a 6% reuse of all water resources [2].

3. The historical development of water desalination technologies

Desalination of brackish and sea water has had a remarkable and spectacular growth, and today is a fully developed and efficient technology for water supply. This circumstance allows facing the challenge of the availability of water in coastal cities, where the most abundant source is seawater, even in low levels of precipitation rates.

Although its beginnings are attributed to the Middle East, we must not forget that the Canary Islands have been the birthplace of desalination technologies, in which several processes installed have allowed to know in-depth of the advantages and disadvantages of these, exporting knowledge to the world.

Talking about desalination in the Canary Islands, it is more than just technology and processes, it is a necessary factor and indispensable to the survival of the islands, and of course, is part of our own history and culture of water.

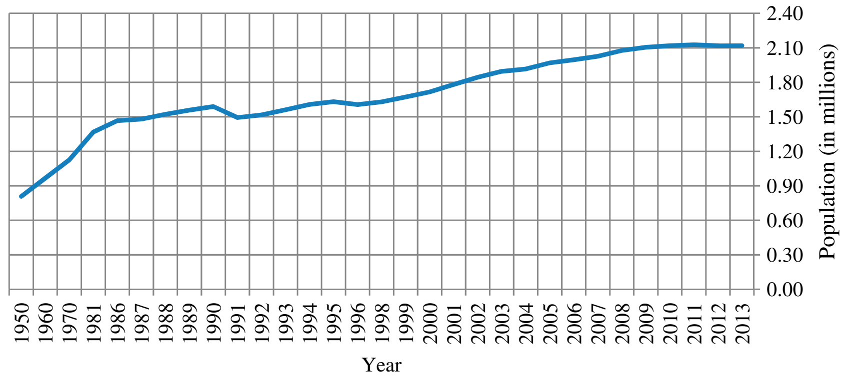

Fig. 1. Evolution of the population census in the Canary Islands (1950–2013) [1].

Table 1
Analysis of the surface of each island and the length of coastline

Island	Lanzarote	Fuerteventura	Gran Canaria	Tenerife	La Gomera	La Palma	El Hierro
Surface (%)	11.36	22.29	20.95	27.32	4.97	9.51	3.61
Length of coastline (km)	191	304	256	342	100	166	110

Source: The authors.

Table 2
The changing demand of water available in the Canary Islands [1]

Year	2004	2005	2006	2007	2008	2009	2010
L/person.day	400	413	347	401	355	364	342

Water Desalination in Spain began in the Canary Islands and meant the entry of the desalination industry in Europe. The seawater as raw material for its processing into drinking water has allowed in the last 50 years the settlement of the population and the development of arid geographical areas, and have made the Canary Islands the world leader in desalination technologies, with a highest densities of operation at an international scale [3].

Starting from the sea, water desalination has a defined location, usually in coastal areas. In the Canary Islands, there is a desalination plant approximately every 6 km of coastline.

Since, the first desalination plant is under construction until today, Spain is known for its high water desalination capacity with more than 700 desalination plants, being in fourth place in the world ranking [4].

The number of desalination plants operating in the Canary Islands has not changed significantly since 2008, being at that time, 330 units of different technologies and production capacities. Most of these are distributed in the islands of Gran Canaria, Lanzarote, Tenerife, and Fuerteventura. The 96.67% of the total number of desalination plants are using membrane technology and the remaining use distillation technologies. [5,6].

As it is shown in Fig. 2, the Canary Islands occupies at a national level, a relevant position in the production capacity of desalinated water [7].

Water desalination consists in separating the components of the dissolution, the solute formed by salts and the solvent formed by water, being necessary for it an energy supply to the system. The energy that contributes to the system can be of two types: thermal or electrical and in both cases, the primary energy source of greater use is fossil fuels.

Table 3 is intended to analyze the dates and relevant events in the development of desalination in the Canary Islands, and shows that in the last 50 years, the bond and passion for desalination in the Canary Islands have been kept alive; since the firm commitment for the distillation technologies in 1964 until today, with the incorporation in the General State Budget for economic aids.

3.1. MSF in Canary Islands

In the Canary Islands, desalination plants that were built since the 60s were based on processes of evaporation–condensation from seawater. In other words, it tries to reproduce the phenomenon of the

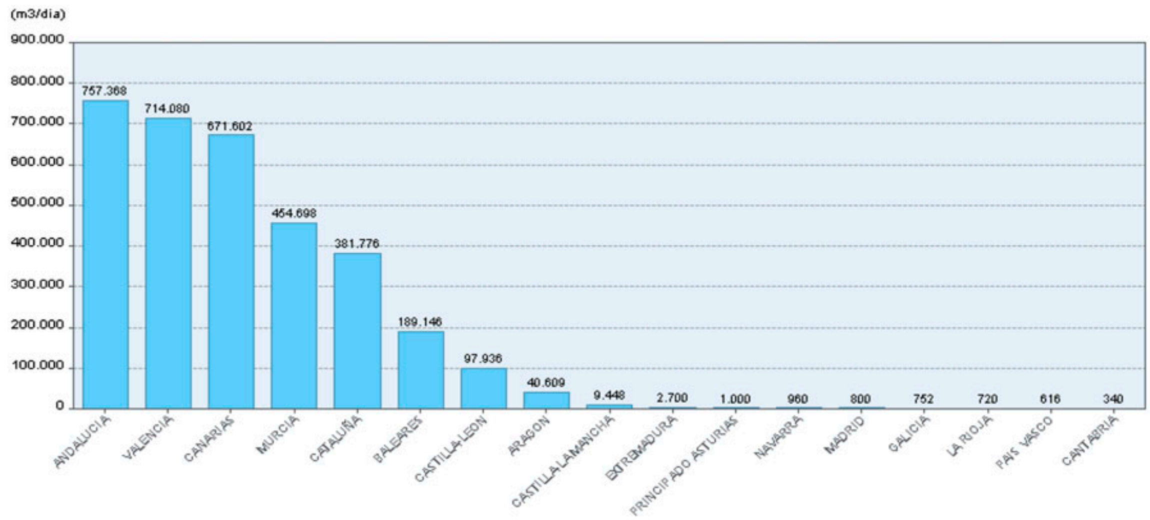

Fig. 2. Desalination capacity [7].

Table 3
Relevant events of the passion of desalination in the Canary Islands

Date	Some relevant events in the evolution of desalination in the Canary Islands
1964	First private desalination plant by evaporation MSF. Termolanza
1984	Desalination in the Canary Islands is declared as general interest of the state
1985	Transfer of the ministry of public works, transport and environment to the Canary Islands
1987	First desalination program in the Canary Islands. 48,000 m^3/day
1992	Second desalination program in the Canary Islands. 65,000 m^3/day
1997	Third desalination program in the Canary Islands
2000	First desalination plant by multi-effect evaporation
2013	The state subsidizes 4 million for water desalination in the Canary Islands

Source: The authors.

natural hydrologic cycle and the final target was the water supply suitable for human consumption.

Multi-stage Flash Distillation (MSF) desalination plants were the first ones installed. These facilities had a dual nature; they were able to produce water and energy. This is due to the fact that Canary Islands had some initial dependence on the convenience of production of electricity and desalinated water together. The steam required in the evaporator for heating the brine comes mainly from an external source, but connected to a thermal power plant, simple or combined cycle, that also produces electricity. This means that there could be a fragmentation in the management of the dual plant, when it is managed by organizations or different companies [8].

Babcock & Wilcox CA was the company responsible for the Centre for Hydrographic Studies of the Ministry of Civil Engineering of the Government of Spain to implement the MSF desalination plants. Afterward, the operation of the service and the maintenance was ceded to the beneficiaries of the facilities.

The MSF desalination plants' more characteristics are summarized in Table 4. This is the case of one of the first private MSF desalination plants built in 1964 by Termolanza SA, which was the concessionaire of services of electricity and water supply in Arrecife (Lanzarote Island). The nominal water production capacity was 2,500 m^3/day with a single unit flashed of 18 stages. The steam required for heating the brine was attained by the backpressure turbines from the thermal power system.

In the city of Las Palmas de Gran Canaria (Gran Canaria Island), in 1970 and 1979, the MSF desalinations facilities, called Las Palmas I and II were built with capacities of 20,000 and 18,000 m^3/day, respectively, with the beneficiary's own city Hall. Both of them had also a dual character. Las Palmas I was capable of producing 20 MW of electricity with a

Table 4
Overview of MSF desalination plants more features of the Canary Islands [9]

Name of de MSF desalination plant		Lanzarote	Las Palmas I	Fuerteventura	Las Palmas II
Energy production	Boiler number	2	2	1	2
	Steam production (Tm/h/cal)	10	76	10	41
	Number of turbines	2	2	1	2
	Electricity generation (kW/turbina)	750	12,100	720	–
	Energy to the grid (kW)	1,000	20,000	–	–
Water production	Number of evaporators	1	4	5	2
	Number of stages	18	22	35	24
	Production (m^3/day)	2,500	20,000	2000	18,000
	Pretreatment	Acid	Polymers	Polymers	Acid
	Maximum temperature of the brine (°C)	95	90	90	115–120

capacity of 20,000 m^3/day. Iit was consisted of four units of flash evaporation of 5,000 m^3/day each one and formed by 22 steps each unit.

In Puerto del Rosario (Fuerteventura Island), there is another similar example with an installation of 2,000 m^3/day with four units of flash whose inauguration was in 1970 and the beneficiary was the Island Council of Fuerteventura.

As highlights on technological progress experienced in MSF desalination technology applied in the Canary Islands, it could be say that MSF processes had scaling problems due to the high operating temperatures (120°C) but nevertheless, they obtained a greater economic relationship and chemical pretreatment with antifouling was needed. At temperatures of 90°C, the risk of precipitation of salts was reduced while the economic ratio decreased.

3.2. MCV in Canary Islands

As a result of the oil crisis of 1973, in the late 60s and early 70s a new technology for water desalination by distillation appears in the Canaries based like the previous evaporation–condensation, called Mechanical vapor compression (MCV). Unlike the previous one, it does not require external steam extracted from turbines of dual installations.

The modular production capacities (50–1500 m^3/day), the low energy consumption compared with the previous decade, and commercial development made by the company IDE Technologies, enabled that the number of modules of MCV was increased.

The main references between 1969 and 2008 MCV desalination plants are summarized in Table 5. It can be seen that the water supply was basically the tourist sector. It is followed by industry sector due to distilled water was required for the operation of the boilers in the power plants of the islands. Finally, and a lesser extent, the final water supply destination was for urban water supply.

An example of this technology is the public facility of Fuerteventura II (1978) of 2,000 m^3/day consisting of four units of 500 m^3/day each one. Two years later, it was expanded to the double of its production capacity. Finally, in 1979 a new dual installation starts to operate, consisting of 18,000 m^3/day, with two units of flash evaporation of 9,000 m^3/day each one. This last desalination plant with the same system as the previous ones had more efficiency ratio in regard to the kg of distilled water produced versus kg of steam required.

One of the first private desalination plants of MCV was installed in 1970, to give service to the hotel users in Tarajalejo (Fuerteventura) [10]. This technology has an important development in the Canary Islands, as it can satisfy the needs of water supply in the tourism sector in a take-off development phase, which later in fact was the engine of the economic development of the islands. Therefore, the number of private facilities is high and with different modular production capacities.

As highlights on technological progress experienced in MCV desalination technology applied in the Canary Islands, it could be say that MCV processes were easy to install and of modular nature, requiring electricity to drive the motor coupled to the compressor, in order to compress the steam generated in the process. No external steam was required and the operating temperatures were around 60–65°C, so the risk of precipitation was reduced.

3.3. MED in Canary Islands

Multiple effect distillation (MED) desalination technology has its origins in the 90s, specifically in 1994. The first MED desalination plant with a capacity of

Table 5
Overview of the MCV desalination plants in the Canary Islands (adapted [9])

Builder	Island					Total capacity (m^3/day)
	Gran Canaria	Fuerteventura	Lanzarote	La Graciosa	Tenerife	
Agramar (1976)	1					250
Cañada del Rio (1986–1987)		2				2,400
Concervas, Garavilla (1973)			1			150
Dehesa de Jandia S.A. (1988)		1				1,200
E. Rio Tinto (1975–1985)			3			1,550
Holiday Land, S.A (1984–1987)			2			1,800
Hotel San Antonio–Hocasa (1972)			1			600
Hotel Tres Islas (1982)		1				400
Island Council Fuerteventura (1977–1982)		4				4,000
Island Council of Gran Canaria (1992)	1					500
Island Council of Lanzarote (1974–1978)			1	2		1,175
Jandia Playa, Hotel (1975)		2				450
Lanzorete Sur, S.A. (1986)			1			600
Las Palmas Port (1987–1988)	2					850
Las Salinas Melia (1988)			1			350
Los Gorriones Hotel (Terra Sol) (1974–1984)		2				700
Maxorata (1969)		1				125
Ministerio de Obras Públicas (MOPU) (1992)	1					1,500
Neckerman (1982)		1				200
Pajara (1976)		1				100
Playa Blanca S.A. (1987)			1			300
Puerto Rico, S.A. (1987)	1					3,400
Tuineje, Gran Tarajal (1978)		1				250
Union Electrica de Canarias (Unelco) (1989–2008)	4				6	8,488
Xinxol, S.A.			1			1,200

3,600 m^3/day was built by IDE Technologies in order to supply water to the refinery in Santa Cruz de Tenerife, by the company Tenerife Cogeneration SA [11].

The second MED desalination plant called Las Palmas-Telde was built in 1999 by IDE Technologies; however this is not in service today [11]. It was a facility provided with two evaporators of 17,500 m^3/day where the number of evaporator effects was 14, being the design temperature is 70˚C.

As highlights on technological progress experienced in MED desalination technology processes applied in the Canary Islands, it could be say that MED processes can work with temperatures around 70˚C, obtaining higher economy ratios and scaling problems were reduced. Commonly, they use steam ejectors to recompress thermally the steam generated in each group of stages and reduces the external steam injection for heating the brine.

3.4. RO in Canary Islands

By the late 70s, it appears processes of separation of salts as other water desalination technologies for both seawater and brackish water: reverse osmosis (RO) and electrodialysis. This is a result of a new oil crisis, so new seawater desalination technologies were sought, with a lower cost of operation and maintenance of thermal systems, although with a higher quality. For brackish water, the competition of technologies is exclusively between the two processes of salt separation: RO and electrodialysis.

In the middle of the decade of the 70s, the first desalination plant was installed with RO membranes technology. It was a brackish water system with hollow fiber membranes and with a capacity of 80 m^3/day whose destination was agriculture. Later, at the end of the decade, in the same place (Finca de los Moriscos, belonging to the Agricultural Service of the Insular Savings Bank of Gran Canaria) a second installation of 200 m^3/day was installed with spiral wound membranes. Both cases were involved the Spanish subsidiary of Babcock & Wilcox CA [12].

Regarding seawater RO desalination in Canary Island, the first run installation of these features corresponds to Lanzarote (1983) with a production capacity of 500 $m^{3/}$day. Since 1987, the desalination technology with RO membranes started the deployment and development with the desalination plant of Lanzarote II (Lanzarote Island) with a capacity of 7,500 m^3/day. Then followed in 1988, by the one in Gáldar (Gran Canaria Island) with a capacity of 3,000 m^3/day and in 1989, Las Palmas III (Jinámar, Gran Canaria Island) with 36,000 m^3/day and since then, a large number of plants were installed.

As a highlight, thanks to the commissioning of the seawater desalination plant “Las Palmas III,” ended the process of water supply for human consumption in the city of Las Palmas that the Ministry of Public Works and Transportation of the Government of Spain had started more than 20 years before the construction of the Desalination Plant “Las Palmas I” and later continued with the name of “Las Palmas II” [13]. Today, the production capacity of desalinated water has expanded considerably, being this about 83,000 m^3/day.

Even in the Western Islands, like in Tenerife, the first one was built in Adeje-Arona in 1995 with 10,000 m^3/day, followed later by one in Santa Cruz of 20,000 m^3/day.

An overview of the RO desalination plants of each island are summarized in Table 6. It can be seen that the largest construction company installed capacity in the Canary Islands is Pridesa–Emalsa with a total capacity of 65,000 m^3/day in 2004; however, it is not the construction company with the largest number of installed plants. Tedagua has a total of 77 desalination plants in a range of 60–5,400 m^3/day with a total installed capacity of 59,763 m^3/day most of them are of brackish water.

The evolution of desalination technology by the RO process in the Canary Islands has been spectacular. Aspects such as the know-how of each installation that are acquired for the knowledge and understanding of this process in the operation and maintenance of this type of seawater installations and have reduced the costs of the cubic meter of desalinated water by lowering the frequency of the chemical cleaning of the membranes, or the use of chemical pretreatments when necessary.

Another important aspect has been the gradual incorporation of new systems of energy recovery in the brine, allowing significantly, reducing the specific energy consumption. In this regard, a special mention is made to the use of different options: backpressure turbines, pelton turbines, pressure exchange systems, etc. which in most of the existing installations has led to a greater efficiency and has reduced energy consumption that is required for the production of desalinated water.

Another innovative example is the new designs of membranes which have also been incorporated to all the installations, capable to give a higher productivity and better quality, as well as satisfying certain levels of requirements in the legislation, in both for human consumption and agriculture through new techniques of remineralization or discharges.

The gradual incorporation of renewable energies to the water desalination is another important technological development. This combination has also been given in the Canary Islands, particularly in the town of Aguimes (Gran Canaria), which existed a decade ago, a private desalination plant for the agricultural sector with the technology of RO membranes. Its production capacity is of 5,000 m^3/day and is powered by four high-power wind turbines.

Finally, the knowledge gained in the Canary Islands, thanks to the experience of the professionals in this sector, it has been one more evidence of the importance that water desalination technologies has had. In other words, it has not only solved the problem of water supply, but also, thanks to the wide range of processes, technicians were able to develop in this sector as a professional in a fruitful way, accumulating knowledge and experience, which has allowed to go beyond the territory of the islands through scientific communications in various forums, national and international conferences.

In the other hand, the different islands' governments and especially the Canarian universities have received the baton, giving them qualified staff and researchers in this strategic and necessary sector, with new research themes that can face a future according to the demands of society under the premises of more efficient and sustainable technologies.

3.5. ED in Canary Islands

Another innovative technology of desalination of brackish water also reaches the Canary Islands. It is the electrodialysis system; being the first desalination

Table 6
Overview of the RO desalination plants by construction company (adapted [14])

Builder	Island												Total capacity (m^3/day)
	Gran Canaria		Fuerteventura		Lanzarote		Tenerife		El Hierro		La Gomera		
	SW[a]	BW[b]	SW	BW	SW	BW	SW	BW	SW	BW	SW	BW	
Pridesa/Emalsa (1992–2004)	1												65,000
Tedagua (1983–2006)	3	48	2	6	1	1	5	10			1		59,763
Pridesa (1993–1995)	4												43,000
Ionics (1995–2006)	4	3		1	1								35,100
Cadagua (1990–2000)	3		1		1								24,300
Degremont (1988–2003)	1		9		2								22,440
Necso—Infilco (2006–2007)	2												21,000
Cadagua–Pridesa (2001)							1						20,000
Fomento–SPA (2002)							1						20,000
Inima (1999)					1								20,000
Canaragua–Degremont (1999)	1												15,000
Isolux (2005)	1												15,000
Focsa (1991–1999)	2		3										14,300
Drace (1999–2000)	1		1										13,500
HOH (1984–2004)	3		6		37								12,010
La Naval (1991)	1												8,000
I.D.E. (1970–2003)	2		2										5,800
Babcock–Wilcox (1991–1996)					3								5,000
Bekox–Usfilter (1994–2005)			2					1					4,500
Hydrot.		4		4									4,210
Canaragua (1999–2004)									4				4,100
Canag Sur		4											3,530
Bonny (1985)		1											2,500
Aqualing (2000)	1												2,000
CAAF–Degremont (1996–1999)			2										2,600
Falcón S.A. (1998–1999)		2											1,590
Framape (1999)		1											850
El Cruce (1999)		1											750
M.T.								2					635
Cida		1		1									540
Infilco (1992)	1												500
USF					1								400
Millipore (1991)	1												100
Jubindo (2000)		1											40

[a]SW, seawater.
[b]BW, brackish water.

plant built in 1986 in the southern part of the island of Gran Canaria, by a private company called Elmasa. Subsequently Ionic installed numerous plants from 1986 to 2003 with total capacity of 65,450 m^3/day [13].

4. The cost of desalinated water

The RO technology in order to desalinate seawater and brackish water has developed tremendously over the past 40 years. Particularly in the Canary Islands, which have been a model for the rest of the Spanish territory, where over a 96% of the desalinated water, uses the RO membranes process [15] (Fig. 3).

In the Canary Islands, a 73.5% of the desalinated water comes from the sea, as it is shown in the following Table 7 which collects the production capacity of desalinated water depending on the type of water supply [16].

The great challenge of the desalination is to get a competitive cost of desalinated water compared with other resources. In relation to the cost of desalinated water, the published numbers shown are estimates made by companies in the sector, based on the typical structure of their analysis: cost of the initial investment or construction and operation, including the energy cost, operation and maintenance staff, filter cartridges and membranes replacement, etc.

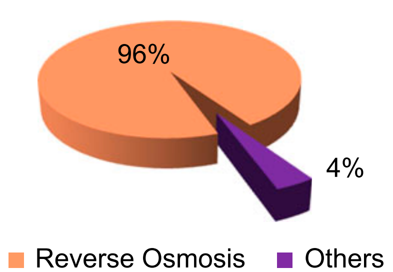

Fig. 3. Production of desalinated seawater according technologies. Canary Islands (2010).
Source: The authors.

Table 7
Production capacity of desalinated water depending on the type of water supply

	Supply source	
Island	Sea water	Brackish water
Fuerteventura	50,700	8,790
Lanzarote	85,135	–
Gran Canaria	207,800	86,218
Hierro	2,300	–
Tenerife	37,215	42,960
Total	383,150	137,968

To achieve a competitive cost, the influence of the energy component should be minimized in the cost, both fixed costs (power term) and the variable costs (energy term). If the water price is affected by the amortization, it is estimated that about a 40% of the total cost comes from the energy while the amortization is between 30 and 40% [17].

Ignoring the amortization, then the energy represents nearly three quarters of the total cost of the water.

Hence, the importance of further research on systems which can reduce the specific consumption of the RO process, whose recent achievements have helped to reach high levels of production capacity.

It is really difficult to determine exactly in the Canary Islands the common and typical cost of the cubic meter of desalinated water by the process of RO membranes, because it depends on several factors: the production capacity, the size of the desalination plant, the energy recovery systems, the energy cost, etc. So for example, the greater the production capacity of the desalination plant, the more the operating costs can be reduced, though the investment costs would be higher.

Due to that in the Canary Islands, there is a great diversity of desalination plant sizes, it has been chosen to take as a reference, the estimated operating cost per cubic meter of desalinated water for seawater of a capacity of 50,000 m^3/day; information based on inquiries to companies in the sector and developed by the Canary Centre of Water [18].

The operating cost rises to 0.4357 €/m^3 in 2005 [18], where a 34.06% corresponds to the energy cost. With the new energy recovery systems, this cost could be updated and can be reduced around 10–15%.

However, recently in Spain, it has been detected a low percentage of available and operational plants, representing an increase in the cost of the cubic meter of desalinated water. Recent statements made by the Minister of Agriculture and Environment, confirm this as there is a small percentage of average performance (16.45%) out of 17 new desalination plants and a total investment of 1,600 million euros. This type of situation has not been given in the Canary Islands yet, probably because the characteristics of the implementation are completely different in form and time. In the Canary Islands, the number of macro installations is very poor, though in the Mainland, the trend is the opposite. The Canary Islands have a significant number of desalination plants, but of different production capacities and mostly below 2000 m^3/day but with a total cost of 0.89 €/m^3 [19].

5. Health aspects of desalinated water for human consumption

In the Canary Islands, the desalinated water suitable for human consumption that comes from both seawater plants and brackish water must satisfy the state regulations, contained in the Spanish Royal Decree 140/2003 of 7 February that establishes the health criteria of water quality for human consumption.

Normally, the process of seawater desalination reduces to very low concentrations the presence of certain constituents, especially the calcium, bicarbonates, and sulfates, requiring in some cases the incorporation of these compounds (remineralization) to achieve a desirable concentration, in order to adapt it to the requirements of the RD 140/2003.

On the other hand, at the level of the Autonomous Community of the Canary Islands, there is a responsible body, the Department of Public Health, responsible for protecting the health of the population and in particular to ensure that the drinking water satisfies the criteria established in the Community and National law. Therefore, with the "Health Surveillance Program of Water for Human Consumption," approved by the Resolution 1,067 of the Department of Public Health, in June 27 of 2008, it is established that desalinated water suitable for human consumption with origin either from seawater plants or brackish water plants, they must be subjected to at least a disinfection process and its Langelier index will be between ±0.5 [20].

These will be required to all new desalination plants. Desalination plants already in operation, will comply with this requirement before 1 January 2012, unless the Regional Health Administration requires it before, for health reasons.

On the other hand, the consumer must have the information about the water quality suitable for human consumption. This should be done by the Environmental Health Service of the Department of Public Health, who must prepare the water quality report required in the Canary Islands and publish it. In this report, data should be seen about the health criteria of the desalination plants, and the health criteria about the water quality for human consumption, based on the content in the SINAC and on the results of health surveillance.

6. Conclusions

The Canary Islands are not only a community where its weather gives them eternal spring conditions during the year.

The scarcity of natural resources has been a constant shortage in the last 50 years, leading to find other technologies such as water desalination to ease this situation.

Water desalination technologies burst in widely and become established in the Canary Islands, successfully due to it passion for obtaining the precious liquid as a firm commitment to supply drinking water. Currently, the RO process is the most used process. Many of the desaliantion plants are not of a high production capacity of desalinated water, but of a moderate size, being distributed the seawater plants in coastal areas with higher population influx.

The Canary Islands continues to develop in this sector, consolidating its leading position, through the incorporation of renewable energies to water desalination. The Canary Islands have been and still are an exporter of knowledge and experience in the field of water desalination having a special relevance and consideration in different forums and national and international technical conferences.

Also thanks to the established experience for half a century has professional technicians too, who transfer their knowledge to new generations in the field of specialized training, maintaining the baton, and its passion for the desalination.

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