Global Water Partnership Mediterranean

Regional Conference
Advancing Non-Conventional Water Resources Management in Mediterranean islands and coastal areas: local solutions, employment opportunities and people engagement.
Malta, 10-11 May 2018

The Canary Islands experience: current non-conventional water resources and future perspectives

CANARY ISLANDS INSTITUTE OF TECHNOLOGY (ITC)

Juan Antonio de la Fuente
Water Department

itc INSTITUTO TECNOLÓGICO DE CANARIAS

Gobierno de Canarias

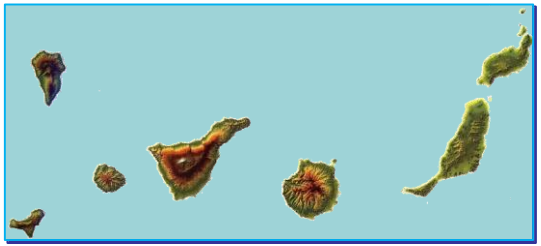
- **CURRENT ROLE OF NCWR IN THE CANARY ISLANDS.**
- **THE WATER-ENERGY NEXUS IN THE CANARY ISLANDS.**
- **ONGOING PROJECTS: DESAL+ & MAGIC.**
- **NCWR FUTURE PERSPECTIVES IN THE CANARY ISLANDS.**

The Canary Islands Institute of Technology

Public company of the Canary Islands Government, that fosters the industrial development of the Canarian Archipelago, by means of R&D activities.

Mean annual solar irradiation:

5.6 kWh/m² d



ITC FACILITIES

Mean annual wind velocity:

7.8 m/s

Up to 4,000 equivalent hours

ITC facilities in Gran Canaria are an ideal platform for testing all the combinations of DES & RES technologies.

ITC has carried out R&D activities in the field of RE driven desalination since 1996 (16 pilot systems tested in our facilities).

The Canary Islands Institute of Technology

Created in 2003, the ITC **Water Department** leads and participates in large European and regional R+D+i projects, **focused on:**

- ✓ **Energy-efficient water desalination.**
- ✓ **Decentralized wastewater treatments.**
- ✓ **Water quality evaluation and improvement.**
- ✓ **The use of RE in the water cycle.**

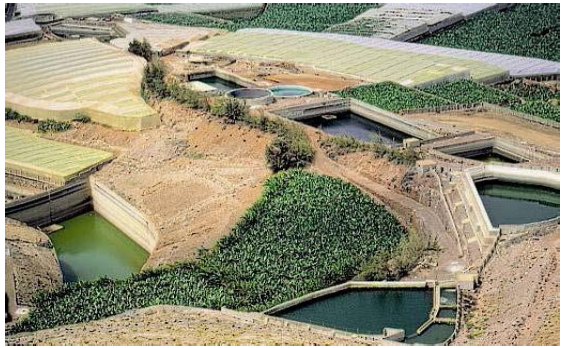
DESALINATION DOME. Technologies testing platform (Pozo Izquierdo – Gran Canaria)

Water resources availability in the Canary Islands

Historically, the Canary Islands have suffered water scarcity associated to: low rainfall, high permeability of soils and over-exploitation of aquifer resources.

Conventional solutions applied:

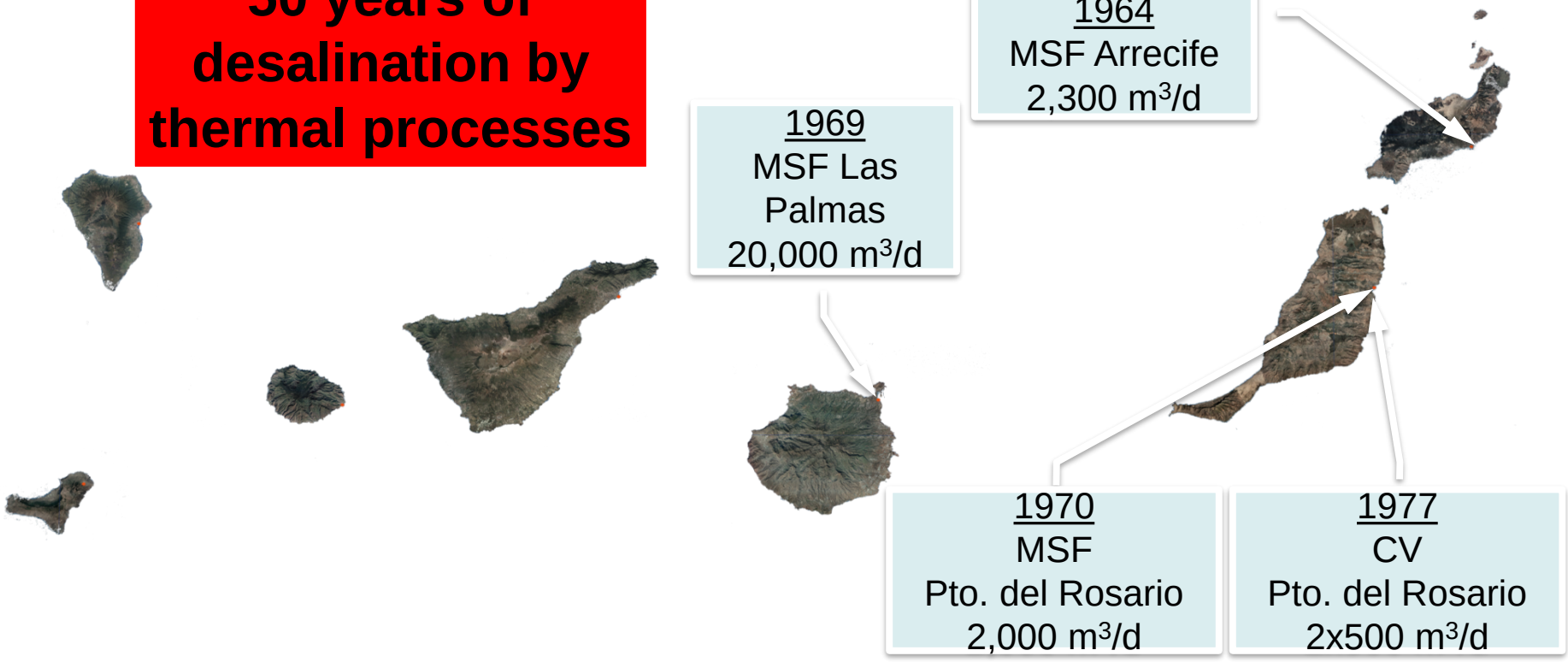
- Groundwater catchment by horizontal water tunnels (“galerías”) and vertical wells.
- Rainwater catchment and storage.
- Construction and waterproofing of reservoirs.
- Efficient use of water.



ORIGINS OF DESALATION IN THE CANARY ISLANDS

50 years of desalination by thermal processes

First SW desalination plant in Europe for human consumption.



1964
MSF Arrecife
2,300 m³/d

1969
MSF Las Palmas
20,000 m³/d

1970
MSF
Pto. del Rosario
2,000 m³/d

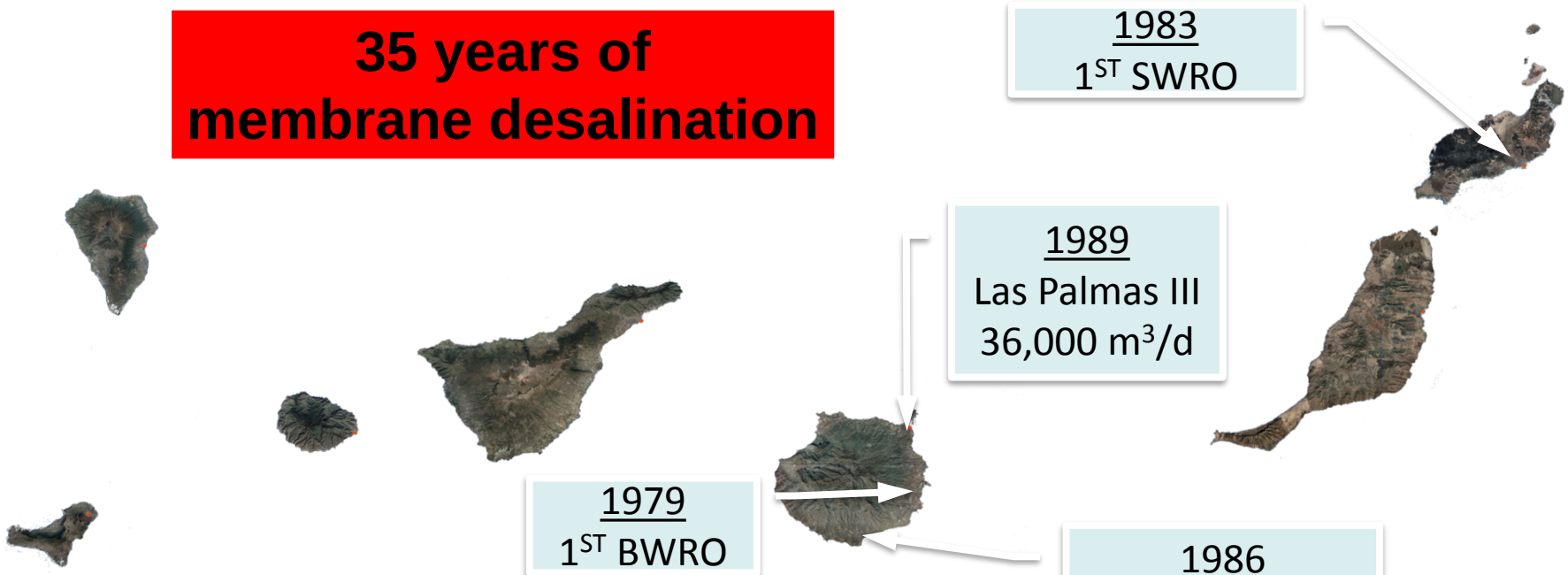
1977
CV
Pto. del Rosario
2x500 m³/d

ORIGINS OF DESALATION IN THE CANARY ISLANDS

MSF Las Palmas I

ORIGINS OF DESALATION IN THE CANARY ISLANDS

35 years of membrane desalination



1983
1ST SWRO

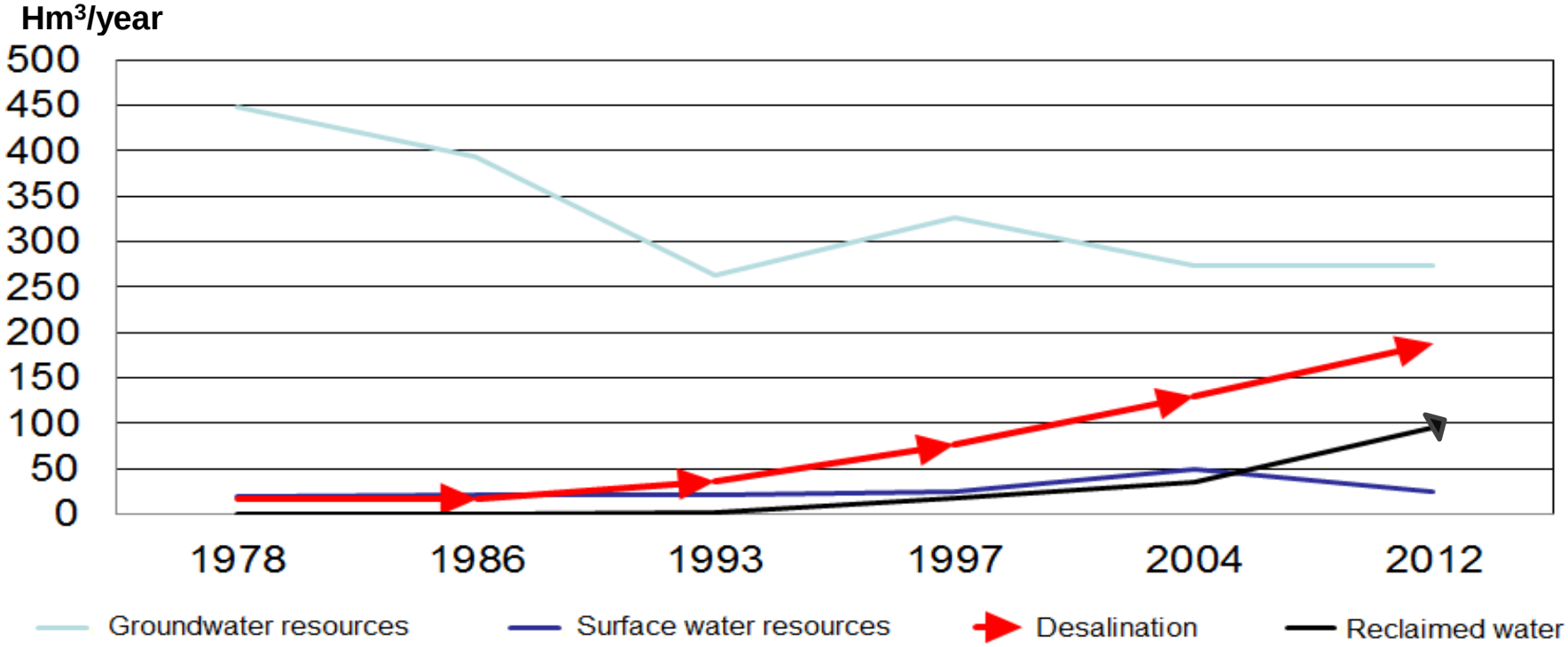
1989
Las Palmas III
36,000 m^3/d

1979
1ST BWRO

1986
1ST ED
22,000 m^3/d

ROLE OF NCWR IN THE CANARY ISLANDS

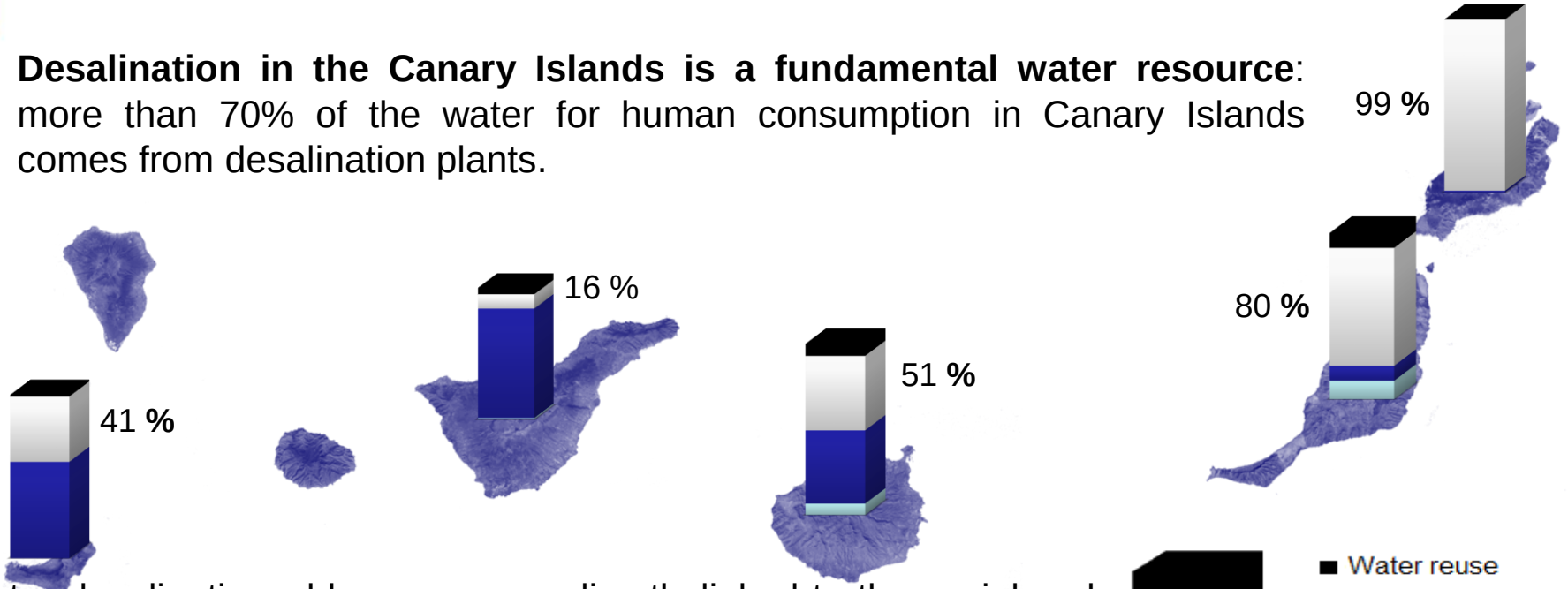
Evolution of water production in the Canary Islands during the period 1978-2012



Source: Plan de Eco Gestión en la producción y distribución de agua de Canarias (2014-2020)

ROLE OF NCWR IN THE CANARY ISLANDS

Desalination in the Canary Islands is a fundamental water resource: more than 70% of the water for human consumption in Canary Islands comes from desalination plants.



Water desalination - blue economy: directly linked to the social and economic stability of the Canary Islands. Supplying:

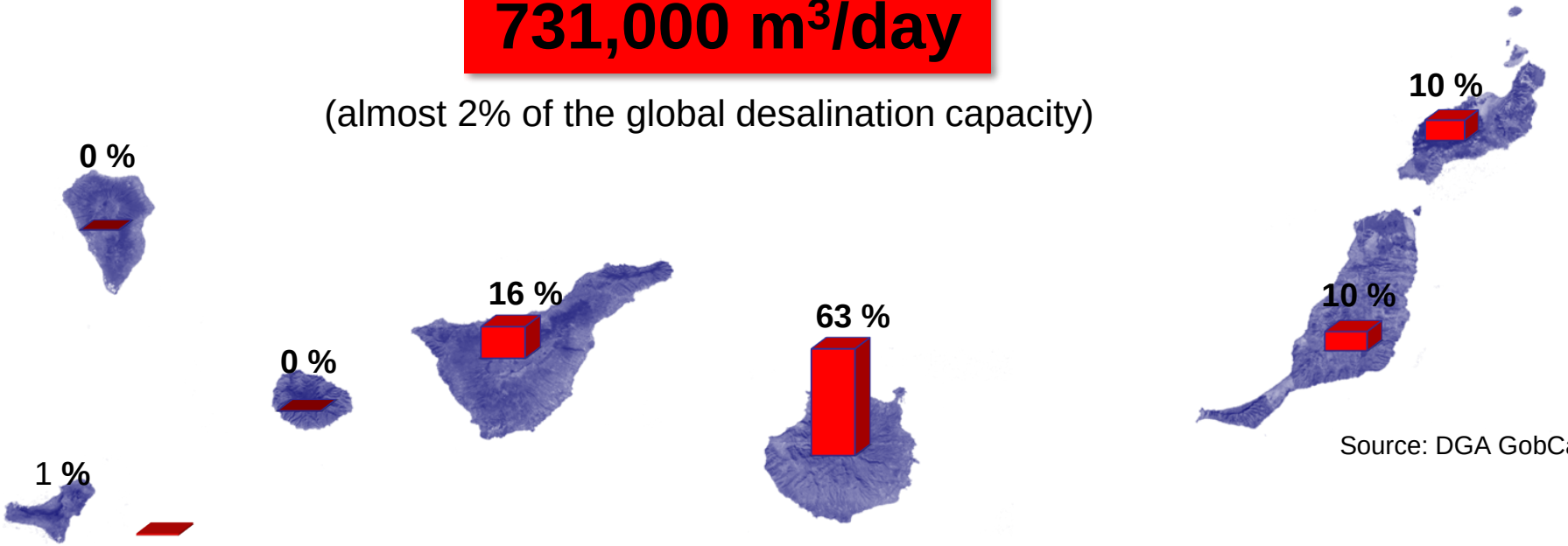
- Main water resource in Lanzarote and Fuerteventura.
- Alternative to the scarcity of natural water resources, represents:
  - ➢ Almost 2 million inhabitants per year/ 14 million tourists.
  - ➢ Multitude of agricultural hectares.
- > 50% of the water resource available in Gran Canaria.
- > 40% of the water resource available in El Hierro.
- > 10% of the water resource available in Tenerife (and increasing).

Around 1,300 people are employed in the desalination sector.

NCWR in Canary Islands: desalination installed capacity

731,000 m³/day

(almost 2% of the global desalination capacity)



Source: DGA GobCan

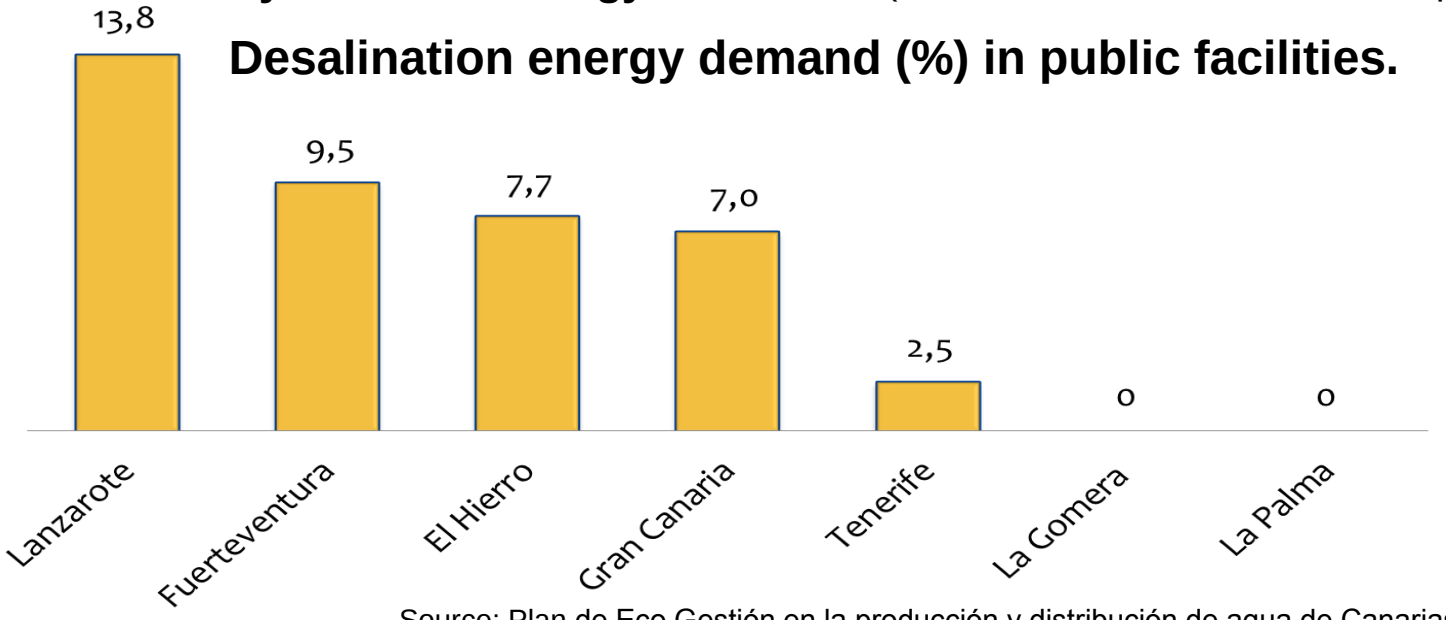
Distribution per island.

319 desalination plants
- 278 in Las Palmas (eastern islands).
- 41 in Santa Cruz de Tenerife (western islands).

THE WATER-ENERGY NEXUS IN THE CANARY ISLANDS

- The water-energy nexus in the Canary Islands is as important as complex to manage.
- Water managers incur in very important energy costs, and therefore economic costs.
- There is an increasing dependence on industrial water production (desalination).

Integrated water cycle → 20% energy demand. F (island & desalination installed capacity)



Source: Plan de Eco Gestión en la producción y distribución de agua de Canarias (2014-2020)

ROLE OF NCWR IN GRAN CANARIA

Groundwater extraction without marine intrusion

Groundwater extraction with marine intrusion

Groundwater extraction abandoned or dry

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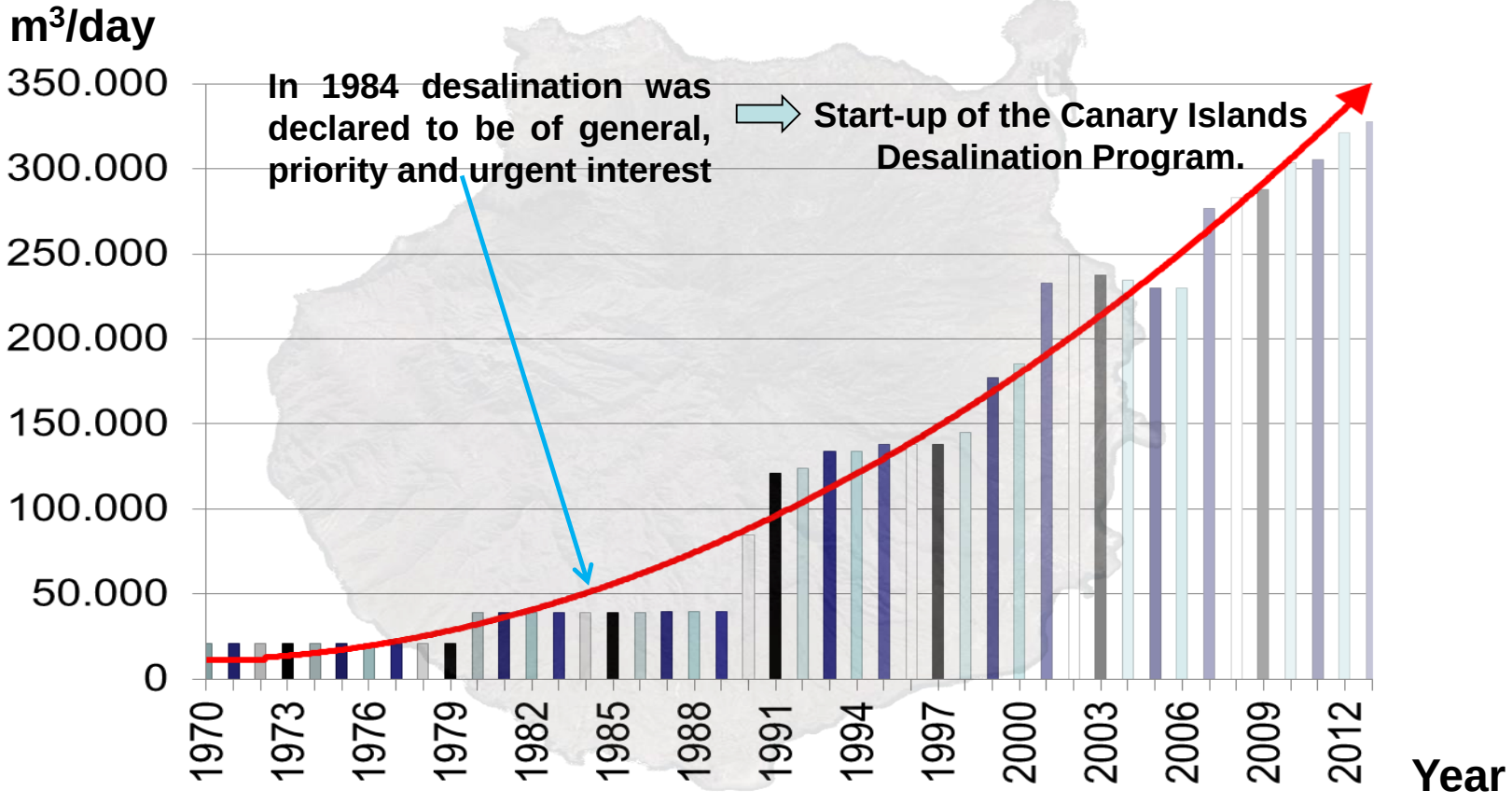
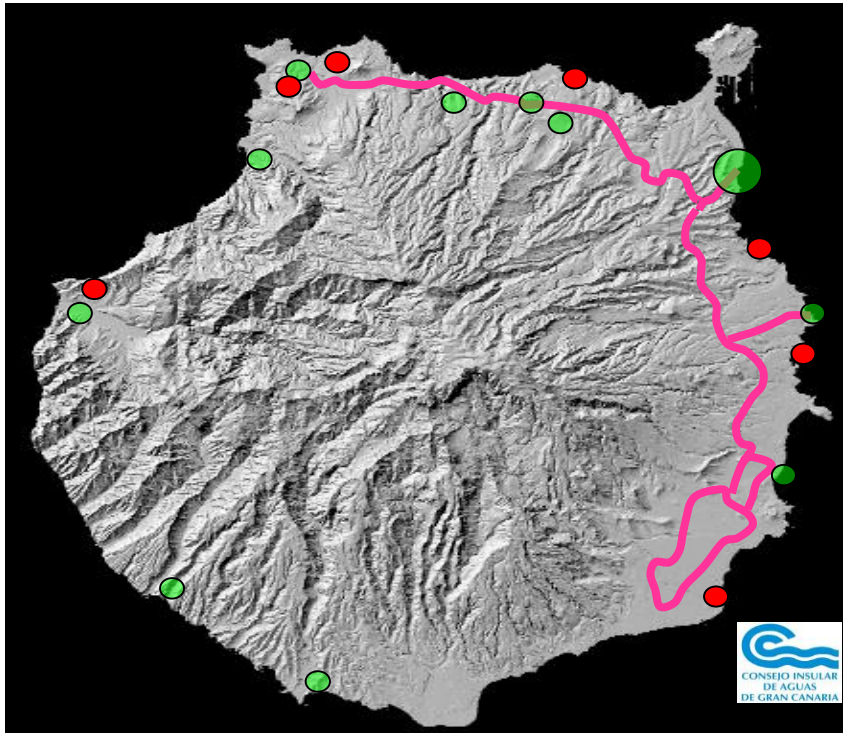
ROLE OF DESALINATION IN GRAN CANARIA



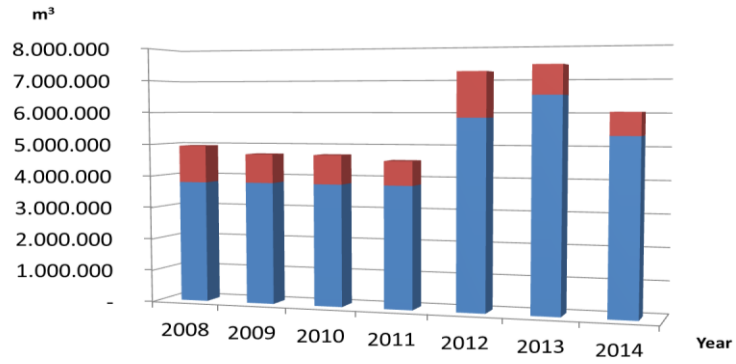
ROLE OF RECLAIMED WATER IN GRAN CANARIA

Reclaimed water reuse network in Gran Canaria



Main WWT plants Main desalination plants

Distribution North/South (Gran Canaria)



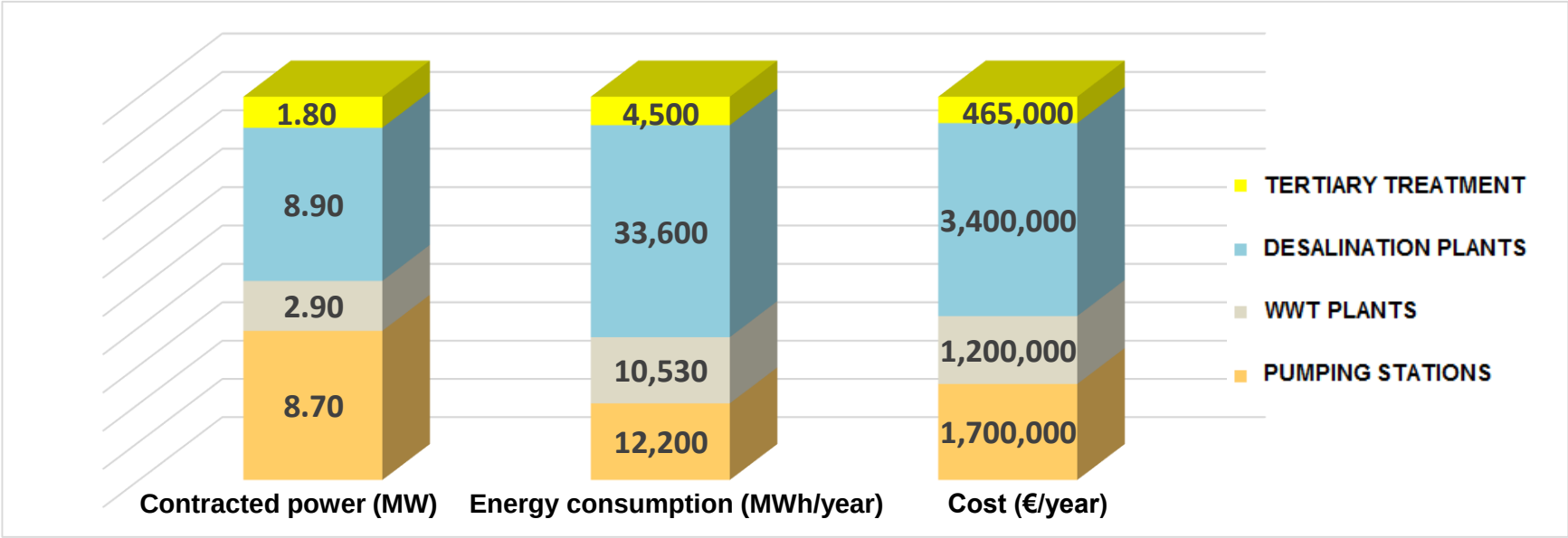
	2008	2009	2010	2011	2012	2013	2014
Zona Norte	1.154	892.2	899.9	744.8	1.379	894.2	692.4
Zona Sur	3.792	3.807	3.796	3.796	5.862	6.536	5.347

- 27 WWT plants (8 Hm^3/year).
- 6 Tertiary treatments (35,000 m^3/d).
- 25 Pumping stations.
- 41 Water storage tanks (455,000 m^3).
- 315 km distribution network.
- > 2,100 users.

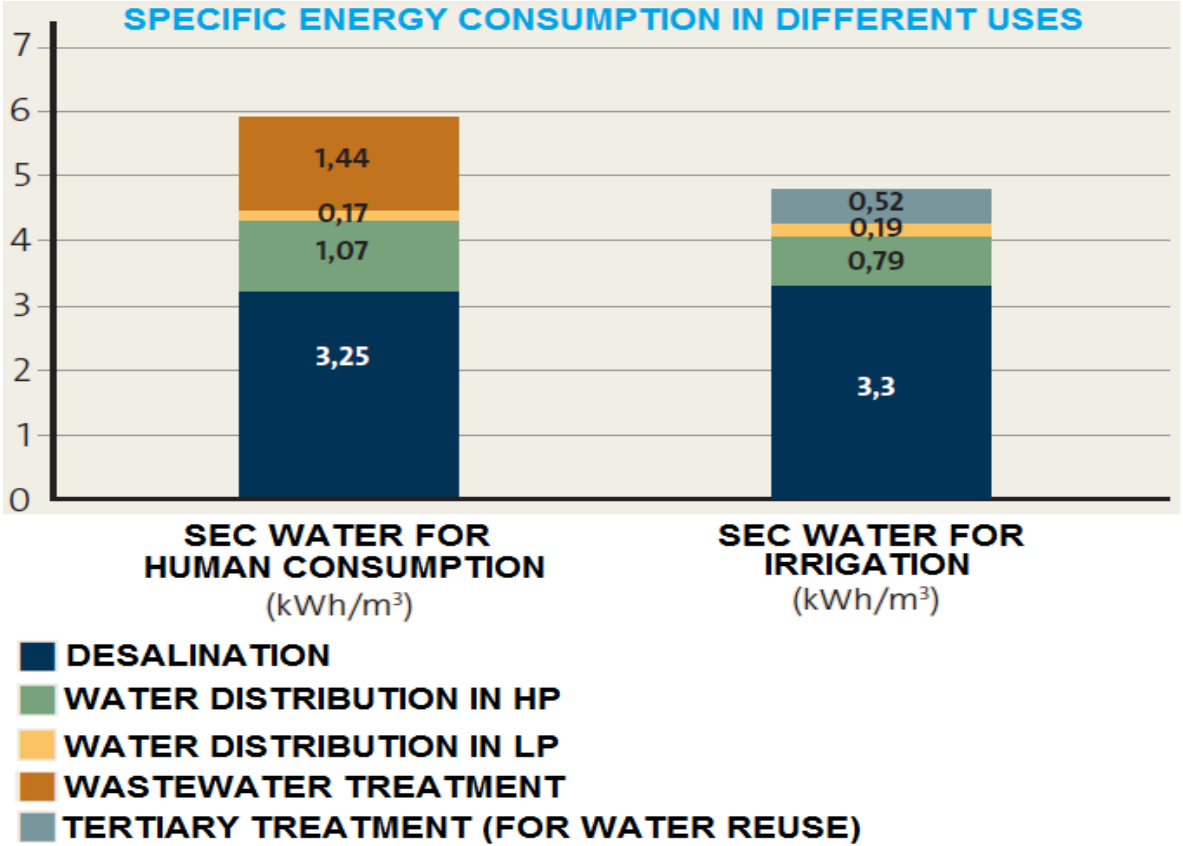
Coastal wastewater treated and reclaimed water reused balance in Gran Canaria → **>90% wastewater treated**, **35% reclaimed water**

THE WATER-ENERGY NEXUS IN GRAN CANARIA

Contracted power, energy consumption and cost by type of installation in Gran Canaria (2014)



CASE STUDY. THE NORTHWEST OF GRAN CANARIA



Installations of the Insular Water Council of Gran Canaria included in the Energy Efficiency Plan.

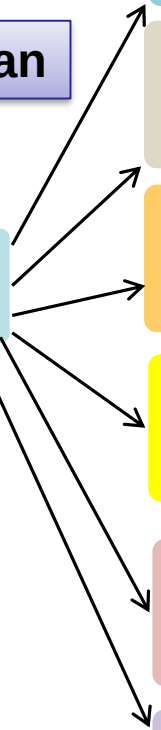
RENOVAGUA Plan

142 Installations

6.8 million€/year in electricity

22.5 MW Contracted power

61,000 MWh Energy consumption



4 DESALINATION PLANTS	Contracted power: 8.9 MW Energy consumption: 33,600 MWh Electricity cost: 3.4 million €/year
26 WWT PLANTS	Contracted power: 2.9 MW Energy consumption: 10,500 MWh Electricity cost: 1.2 million €/year
85 PUMPING STATIONS	Contracted power: 8.7 MW Energy consumption: 12,200 MWh Electricity cost: 1.7 million €/year
3 TERTIARY TREATMENTS	Contracted power: 1.8 MW Energy consumption: 4,500 MWh Electricity cost: 465,000 €/year
WATER STORAGE TANK	Contracted power: 7 kW Energy consumption: 409 kWh Electricity cost: 330 €/year
OTHERS (23 infrastructures like remote controls, flow meters...)	Contracted power: 241 kW Energy consumption: 215 MWh Electricity cost: 39,100 €/year

Moving towards Adaptive Governance In Complexity: informing nexus security

Using Quantitative Story Telling to address the challenges of conducting science for policy in the EU water, energy, food and land nexus.

http://magic-nexus.eu/ https://www.facebook.com/MagicNexusEu/ #MAGIC_NEXUS @MAGIC_NEXUS

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MAGIC NEXUS

MAGIC PROJECT

MAGIC addresses the topic Water-2b-2015 for proposing integrated approaches to food security, low-carbon energy, sustainable water management and climate change mitigation.

The MAGIC project implements a novel and comprehensive approach to understanding and managing the WEF Nexus.

The project brings together nine of Europe´s leading research institutions in the fields of climate, energy, water, agriculture, data analysis, bio-economics, and science-society interfaces to implement a framework within which policy and technical options can be assessed in terms of their feasibility, viability and desirability.

Policy case studies:

- Common Agriculture Policy (CAP).
- Energy Policy.
- Water Framework Directive (WFD).
- Environmental policies.
- Circular Economy.

Innovation case studies:

- Biofuels and bio refineries.
- Environmental protection.
- Shale Gas Extraction.
- Green bonds.
- **Alternative Water Sources.**
- Water saving in irrigation.
- Electric Vehicles (EVs) and energy storage systems.

DESAL+ PROJECT

DESAL+
Desalination Living Lab

Macaronesian platform to increase excellence in R&D&i in water desalination and knowledge of the desalinated water-energy nexus – blue economy.

The instrument that will help us go from being a global laboratory in desalination to an **international living lab of R&D in desalination**.

Canary Islands has:

- ✓ An outstanding desalination park, unique in the world because of its variety and dimension.
- ✓ An important group of researchers, engineers, plant operators with high qualification and knowledge in this sector.
- ✓ All the invented desalination technologies have been tested and improved.

Although we are more than a global laboratory in desalination, it has not been possible to exploit this advantage adequately. Local R&D has been scarce in this area, with few internationally recognized developments.

This condition of pioneers has not allowed us to clearly position ourselves in the international scenario of desalination research.

DESAL+ PROJECT

DESAL+
Desalination Living Lab

The Living Lab offers:

- Technical and logistic support for the installation and testing of prototypes and new devices focused on desalination, related fields and RE desalination.
- Technical support and consultancy for the development, upscaling and demonstration in real conditions of innovative solutions using local-scales desalination open infrastructure for R&D purposes.
- Training activities, educational programs, knowledge and technology transfer of desalination and use of RE.

NCWR FUTURE PERSPECTIVES IN CANARY ISLANDS

THE DEPENDENCE ON NCWR WILL INCREASE.

ENERGY DEPENDENCE – ENERGY MIX (FOSSIL AND RENEWABLE ENERGIES SHOULD EXTEND TOGETHER).

NCWR MANAGEMENT SHOULD BE LINKED TO WATER PLANS (WATER FRAMEWORK DIRECTIVE) – costs, environmental issues and social participation.

NCWR FUTURE PERSPECTIVES IN CANARY ISLANDS

Fog water collection

The trade winds push the clouds towards the islands with the highest mountains forming the sea of clouds, this natural phenomenon is known as "horizontal precipitation". This NCWR can be exploited through fog collectors (FCs).

Nieblagua SL is a company from Tenerife that markets **Breeze water**, collecting this high quality water, drop by drop, with passive volumetric collectors under their own patent, called **Recogedores de Agua Atmosféricas (RAA)**.

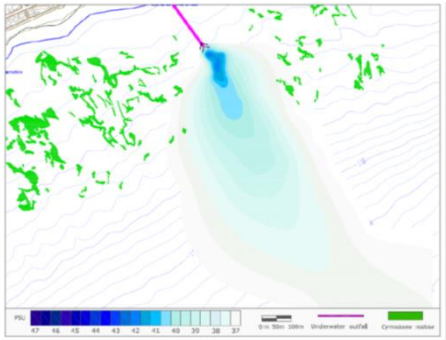
Average productivity 15,000 litres/RAA/year.

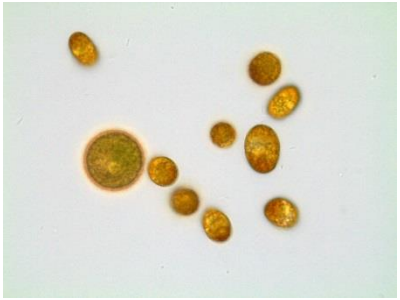
The maximum yield of a single RAA 1,350 litres/day occupying an area of 1.6 m^2.

NCWR FUTURE PERSPECTIVES IN CANARY ISLANDS

Venturi diffusers in brine discharges from desalination plants to improve the dilution process and reduce the environmental impact on marine ecosystems.

For exit velocities usually < 6 m/s, the capacity to improve the dilution of Venturi system is greater than 2.3 times the dilution obtained with conventional diffusers.





Utilization of brine for the culture of the microalgae Dunaliella salina for the production of molecules such as β-carotene and polyunsaturated acids. The biomass obtained can be used in animal nutrition and nutraceutics.

The company “Algalimento” is commercializing the biomass of a native strain of Dunaliella salina.

FOR FURTHER INFORMATION

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Thank you very much for your attention