SUSTAINABLE WATER & ENERGY SOLUTIONS NETWORK

Sustainable Desalination, Renewable Energy and Energy Storage in the Canary Islands

Sustainable Development Goals Addressed

6 CLEAN WATER AND SANITATION

7 AFFORDABLE AND CLEAN ENERGY

Organization, Institution or Company
Canary Islands Institute of Technology (ITC)
Location of project site, Country
Canary Island, Spain
Brief narrative description of objective/project/activity/initiative
Several regions of the world are experiencing an increasing shortage of drinking water. Seawater desalination promises to provide local solutions. However, in many cases seawater desalination is powered by fossil fuels, and thus potentially expensive, also contributing to increasing GHG emissions. The group of the Canary Islands of Spain include the islands of Lanzarote, Fuerteventura, El Hierro, Gran Canaria, Tenerife, La Gomera, and La Palma. Over the years, the islands have developed a combined desalination capacity of 731,000 m^3/day, which is equivalent to 2 per cent of total global desalination capacity. A large portion of the desalinated water is provided to service the tourism industry. The Canary Islands archipelago in Spain provides an excellent example of how a region with water shortage can alleviate its local water scarcity problem. The Canary Islands Institute of Technology (ITC) has demonstrated that reverse osmosis desalination technologies can be powered by renewable energy. Water desalination can be performed in an economically feasible way with electrical energy provided by sun and wind. Additionally, intermittent energy supply can be backed up with hydropower storage. ITC, a public enterprise established by the Government of the Canary Islands in 1992, has developed and tested various prototypes for off-grid small-scale and larger-scale renewable energy driven desalination systems since 1996. Most ITC's facilities are located in Pozo Izquierdo on Gran Canaria Island. Local conditions are excellent: the site has direct access to seawater, and annual average wind speed of 8 m/s, and average daily solar radiation of 6 kWh/m^2. At its field project sites, ITC has tested different methods and products of various suppliers using water vapour compression, reverse osmosis (RO), electro dialysis, and membrane distillation. ITC holds its own patents in the area of desalination technology powered by renewables.
Economic, environmental and climate benefits, challenges and lessons learned

The ITC projects suggest that desalination stations should be designed and tailored to meet the prevailing local conditions. In locations where water demand is limited, e.g. up to 100 m^3 /day, the most feasible option may be the use of solar-PV-powered RO systems. For locations with medium or larger water demands (1,000–5,000 m^3 /day), the more suitable systems may be combined off-grid wind farm and reverse osmosis plants. The installation of automated controls is important to reduce maintenance costs. Desalination technology based on renewable energy avoids the release of greenhouse gas emissions during operations.

In some locations, the disposal of brine resulting for the desalination process can pose a challenge. Brines can be returned to the sea, but need to be diluted to prevent local environmental impacts.

International cooperation

ITC offers training and advisory services to support and guide developers of desalination projects, particularly from developing countries, to design their own sustainable solutions.

ITC has helped designing a desalination plant powered exclusively by photovoltaic solar energy that supplies drinking water to rural areas in Mauretania. The installation has been operational since 2006 and is based on the autonomous desalination technology developed by ITC, called DESSOL®, which has an international patent.

Additional information: website addresses and contacts

Canary Islands Institute of Technology (ICT) https://www.itccanarias.org/web/en/

de la Fuente, J.A., Water Department, Canary Islands Government: https://www.gwp.org/contentassets/aa500f6c8cb749d7ac324a4065395386/203.the-canary-islands-experience.pdf

International Energy Agency (IEA)/International Renewable Energy Agency (IRENA): https://iea-etsap.org/E-TechDS/PDF/I12IR_Desalin_MI_Jan2013_final_GSOK.pdf

Photos by ITC and Ministerio para la Transicion Ecologica, Spain