



European Desalination
Society



Wind and solar PV powered desalination systems (RO and EDR)

A 3-day intensive course

6th – 8th October 2014,
Pozo Izquierdo - ITC facilities
Gran Canaria
Canary Islands, Spain

Introduction

Fresh water shortage is a raising problem, especially in some parts of the world, as North Africa and Middle East areas. Global climate change and progressive increment of population are reducing day by day the availability of per capita drinking water supply; this is becoming a critical question for certain developing countries.

Desalination has narrowed the gap of water demand for more than 20 years thanks to a cheap energy supply; but the age of “easy oil” is coming over and the link water – energy is more and more critical. A hopeful option is desalination powered by renewable energies (RE).

The Canary Islands Institute of Technology (ITC) has been testing and monitoring wind and solar photovoltaic powered desalination systems for more than 15 years. This course summarizes the main outcomes of this long experience, focusing on the more practical questions to be considered in order to implement new RE desalination projects.

The ITC facilities in Pozo Izquierdo (Southeast of Gran Canaria Island), with approximately 100.000 m², are an ideal platform for testing RE desalination systems due to the local excellent conditions: direct access to seawater, abundant renewable energy resources (annual average wind speed of 8 m/s, average daily solar radiation of 6 kWh/m²) together with the staff formed by high qualification experts; all this makes ITC one of the best places to offer this specific training

Objectives

The main purpose of this 3-day intensive course is to provide experts, professionals and postgraduate participants from any country with the latest knowledge of the different existing systems and technologies on wind and solar PV powered desalination. More specifically, the course will instruct on the basic theory of desalination using RE, the experiences acquired so far, the current state of the art and the most promising initiatives. Theory lessons will be complemented with technical visits and practical sessions using the facilities of ITC in Pozo Izquierdo, including a wide set of RE powered desalination units.

Venue

The course will take place at the facilities of the Canary Islands of Technology (ITC) in Pozo Izquierdo (Gran Canaria Island, Canary Islands). The accommodation will be in a hotel located in the touristic area of the island; the organization will provide a bus for the transport to the ITC (about 15 minutes)

This research institute belongs to the Government of the Canary Islands. The facilities of Pozo Izquierdo are probably the most diverse existing for the

research, testing and development of renewable energy technologies and their applications. It is located near the village of Pozo Izquierdo, about 40 km from Las Palmas de Gran Canaria main city.



Maps of the Canary Islands archipelago and Gran Canaria Island



ITC facilities in Pozo Izquierdo (Sta. Lucía, Gran Canaria Island, (Spain))

Gran Canaria is a miniature continent. An island close to Europe, with a wide range of beaches as diverse as the changing sceneries waiting to be discovered. Nearly 60 kilometres of beaches on 236 kilometres of coastline under a gentle sun that seems to have settled down here for good. This is what makes Gran Canaria the port of destination of a huge crowd of Europeans. This has been so for generations. Sailors, divers, surfers, deep-

sea fisherpeople, and windsurfers. All getting away to an island that works like a magnet. It hides a magnetic spring with which it attracts anyone wanting to get away to a sea of fine weather.

Gran Canaria is a sampler of quite uncommon sceneries in the middle of an extremely diverse archipelago. This is why UNESCO awarded the island the Biosphere Reserve label, to actively support the conservation of the pieces that make up this puzzle of natural settings, a different and very peculiar micro-world. Nearly half the island's geographical space has been included in this reserve, comprising six rural communities linked to traditional activities.



View from the air of the sand Dunes at Maspalomas (Gran Canaria, Spain)

Syllabus

The course is organized in three modules:

A) Introduction

1. Fundamentals of wind / PV power.
2. Fundamentals of RO desalination.
3. Application of PV power to RO
4. Application of wind power to RO

B) Advanced issues of Wind / PV - RO

5. Theoretical & practical aspects
6. Fundamentals of design. Practical cases
7. Economic and environmental aspects.

C) Technical visits

8. 2.6 MW wind farm associated to a RO unit
9. Large RO plant (33,000 m³/d)
10. Biodiesel-powered compact RO system
11. Solar MD systems (3 units)
12. Pumping station
13. Desalination dome: PV-EDR unit; PV-RO unit
14. Wind powered RO unit



30 mcd solar PV powered RO plant



Autonomous solar PV-RO system installed in Tunisia

Lecturers:

The course will be given by researchers and scientists from the ITC:

Mr. Vicente J. Subiela (Mech. Eng.): Head of Section of the Water Department. He has been working on different RE powered systems (solar distillation, wind powered desalination, PV – RO units) since 1998. He has been researcher and coordinator of EU and international cooperation projects, and projects manager of autonomous desalination units. 20 publications.

Mr. Juan A. de la Fuente (Chem. Eng and Marine Sci. Grad.): Researcher of the Water Department. He is expert on the design, operation and optimization of RO desalination plants. He has been involved in assessment of wind and PV powered RO units and testing of different energy recovery systems for low capacity RO desalination plants since 2007. 7 publications

Mr. Baltasar Peñate (Ph.D. Chem. Eng.): Head of the Water Department and coordinator of national and international projects on RE powered desalination, non-conventional wastewater treatments, water quality analysis, management and sustainability in water treatment projects. Co-author of the PV-RO international patent DESSOL[®] (PCT ES 2004/000568) and the CONTEDES[®] utility model. 20 publications.

Mr. Fernando Castellano (Elec. Eng.): Head of Section of the Renewable Energies Department. He has a long background on off-grid wind / PV power applications and has led different R&D projects and technical services. He is expert in RES data analysis and design of stand-alone systems for different applications. 13 publications.

Mrs. Penélope Ramírez (Ph. D. Mech. Eng.): Renewable Energies Department. She is expert in wind data analysis and the characterization of wind resources. She has collaborated in different R&D projects at national and international level and in sustainable energy planning. 10 publications

Mr. Gonzalo Piernavieja (Physicist): Director of the R&D Division. 20 years of experience in solar and wind energy projects. Co-author of the PV-RO international patent DESSOL[®] (PCT ES 2004/000568). 20 publications.

Course Program:

DAY 1 Introduction

09:00 - 09:15	Opening and Introduction to the course. Presentation of ITC
09:15 - 11:30	Fundamentals of wind and PV power. Off-grid applications <ul style="list-style-type: none">• Introduction & main concepts• Wind power. Components, installation and off-grid operation• PV power. Components, installation and off-grid operation
11:30 - 12:00	<i>Coffee break</i>
12:00 - 13:00	Fundamentals of RO desalination <ul style="list-style-type: none">• Main principles• Definitions and fundamental parameters• Operation and maintenance• Current world outlook and last trends
13:00 - 14:00	Application of PV power to RO <ul style="list-style-type: none">• Description of the combinations• Main components• Principles of operation• Examples
14:00 - 15:30	<i>Lunch</i>
15:30 – 17:00	Application of wind power to RO <ul style="list-style-type: none">• Description of the combinations• Main components• Principles of operation• Examples
17:00 - 17:30	Review of main points, questions and clarification of doubts
17:40	<i>Return to hotel</i>

DAY 2 Advanced training

09:00 – 10:30	Wind powered desalination <ul style="list-style-type: none">• Theoretical analysis. Energy & power balances• Operational aspects• Monitoring and control aspects• Real tested systems (ITC experience)• Current state of the art: challenges and future trends
10:30 – 11:30	Practical case of wind desalination design <ul style="list-style-type: none">• Input data• Analysis and solution• Conclusions
11:30 – 12:00	<i>Coffee break</i>
12:00 – 14:00	PV powered desalination <ul style="list-style-type: none">• Theoretical analysis. Energy & power balances• Operational aspects• Monitoring and control aspects• Real tested systems (ITC experience)• Current state of the art: challenges and future trends
14:00 - 15:30	<i>Lunch</i>
15:30 – 16:30	Practical case of PV desalination design <ul style="list-style-type: none">• Input data• Analysis and solution• Conclusions
16:30 – 17:30	Economic and environmental aspects <ul style="list-style-type: none">• Possible options and related cost. Future perspectives• Environmental impacts
17:30 – 18:00	Review of main points, questions and clarification of doubts
18:10	<i>Return to hotel</i>

DAY 3. Visits

09:00 – 11:15	Visit to a 2.6 MW wind farm associated to a RO unit (Playa Vargas)
11:15 – 11:30	Bus to Pozo Izquierdo
11:30 – 12:00	<i>Coffee break</i>
12:15 – 13:45	Visit to 33,000 m ³ /d RO plant (South East region)
14:00 - 15:30	<i>Lunch</i>
15:30 - 17:30	Technical visit to ITC facilities in Pozo Izquierdo <ul style="list-style-type: none">• Biodiesel-powered compact RO system• Solar MD systems (3 units)• Pumping station• Desalination dome: PV-EDR unit; PV-RO unit• Wind powered RO unit
17:45 – 18:15	Closing session. Evaluation. Certificates of attendance
18:30	<i>Return to hotel</i>



Desalination dome. ITC facilities in Pozo Izquierdo

Wind and PV powered desalination systems

A 3-days intensive course

6th – 8th October 2014, Gran Canaria, Spain

Lecturers: PhD Baltasar Peñate, Eng. Vicente J. Subiela
Eng. Juan A. de la Fuente, Eng. Fernando Castellano, PhD Penélope
Ramírez, Phys. Gonzalo Piernavieja

REGISTRATION FORM

Surname _____ Name _____
Address _____
Country _____ Telephone _____
Fax _____ Email _____

Registration fee: For EDS members: **€2,300** For non-members: **€2,500**
(Special price for those who have registered the online course in September)¹

The fee includes 4 night accommodation, internal displacements, lunches, coffee, dinners, course Workbook, pen-drive with documentation and insurance for participants.

Payment can be made by:

Credit card

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Signature _____

Please fill in the form and send as an attachment to:

balaban@desline.com or fax to: +1 928 543 3066

¹ If you attended the online course (September 2014), then the registration for this intensive course will be reduced in 50% of the amount paid for the online course registration.