# DESALINATION POWERED BY RENEWABLE ENERGY

**A 3-day Intensive Course in Almería (Spain) October 19-21, 2009**

**Organized by Plataforma Solar de Almería (CIEMAT)**

**Course partially financed by the European Commission within the ProDes project (contract number: IEE/07/781/SI2.499059), co-financed by the Intelligent Energy for Europe programme.**

PRODES

Promotion of Renewable Energy for Water production through Desalination

Intelligent Energy Europe

## Objectives:

The purpose of this course is to provide experts, professionals and postgraduate students with the latest knowledge of the different existing technologies involving the use of renewable energies to drive desalination. More specifically, the course will instruct scientists and technicians on the basic principles of desalination using renewable energies, the state of the art of the most promising technologies and the experiences acquired so far. Theory lessons will be complemented with practical visits and activities at the experimental installations of solar desalination of Plataforma Solar de Almería, the most advanced in the Mediterranean area.

## Contents:

The course is organized in six modules:

A) Introduction to desalination
1. Definition, fundamentals and historic review.

B) Conventional desalination
2. Conventional technologies of desalination, state of the art of the industry, evolution and outlook.
3. Design and operation of desalination plants (pre-treatment; post-treatment; control, etc.). Experience applicable to the renewable energy case.

C) Renewable energy technologies
4. State of the art of renewable energy technologies suitable for application in desalination.

D) Solar thermal energy and desalination
5. Solar ponds.
6. Solar stills.
7. High capacity solar thermal distillation: multi-effect distillation (MED) and multi-stage flash (MSF) desalination.
8. Solar-powered membrane distillation.
9. Technologies of humidification and dehumidification for desalination.

E) Desalination associated to other renewable energy sources
10. Desalination using solar photovoltaic energy.
11. Desalination using wind energy.
12. Desalination using wave, tidal and geothermal energy.

F) Sustainability
13. Economic and environmental aspects of desalination powered by renewable energy.

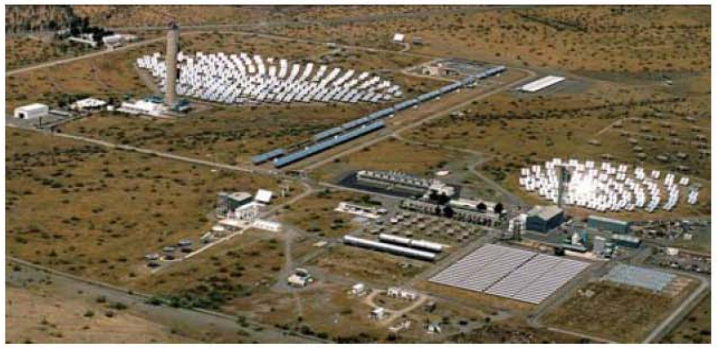
Theory and practical lectures will be given by researchers and scientists from Plataforma Solar de Almería (CIEMAT-PSA), Instituto Tecnológico de Canarias (ITC), University of Sevilla, and Befesa Agua.

## Venue:

The host of the course will be Plataforma Solar de Almería. This research centre, belonging to the public research institution CIEMAT, is one of the biggest and most complete existing facilities dedicated to the research, testing and development of solar technologies and applications. It is located next to the village of Tabernas, about 35 km of Almeria city, in the Southeast corner of Spain.

The course will take place at Hotel Tryp Indalo Almería during the first and last day, spending the middle day at Plataforma Solar de Almería for lectures and practical work. The Tryp Indalo Almería is a 4-stars hotel opened in 2004, beautiful yet modern, spacious and comfortable, providing ideal facilities and services for both business and leisure travellers, including the finest hi-tech meeting and congress venue in Almeria. The hotel is located on the prestigious Mediterraneo Avenue, only 15 minutes from the beach, near the centre of the city of Almería.


Hotel Tryp Indalo in Almería



Aerial view of Plataforma Solar de Almería

## Program:

**DAY 1 (Monday, 19th October 2009): Hotel Tryp Indalo**

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|---|---|
| 08:00 – 08:15 | **Welcome and reception. Course presentation** [Julián Blanco; CIEMAT-PSA] |
| 08:15 – 09:45 | **Introduction: Definition, fundamentals and historic review of desalination** [Diego Alarcón; CIEMAT-PSA] |
| 09:45 – 11:15 | **Conventional technologies of desalination, state of the art of the industry, evolution and outlook** [Arturo Buenaventura; Befesa] |
| 11:15 – 11:30 | *Coffee break* |
| 11:30 – 13:30 | **Design and operation of desalination plants (pre-treatment; post-treatment; control, etc.). Experience applicable to the renewable energy case** [Arturo Buenaventura; Befesa] |
| 13:30 – 15:00 | *Lunch* |
| 15:00 – 16:30 | **State of the art of renewable energy technologies suitable for application in desalination** [Lourdes García; Universidad de Sevilla] |
| 16:30 – 16:45 | *Coffee break* |
| 16:45 – 17:45 | **Solar ponds** [Lourdes García; Universidad de Sevilla] |
| 17:45 – 19:15 | **Technologies of humidification and dehumidification** [Guillermo Zaragoza; CIEMAT-PSA] |

**DAY 2 (Tuesday, 20th October 2009): Plataforma Solar**

*08:00 Departure to PSA in Tabernas (arrival at 8:45)*

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|---|---|
| 09:00 – 10:30 | **High capacity solar thermal distillation: multi-effect distillation (MED) and multi-stage flash (MSF) desalination** [Diego Alarcón; CIEMAT-PSA] |
| 10:30 – 12:00 | **Practical work in the experimental MED plant of PSA** [Diego Alarcón; CIEMAT-PSA] |
| 12:00 – 13:00 | **Guided tour to Plataforma Solar de Almería** [Julián Blanco; CIEMAT-PSA] |
| 13:00 – 14:30 | *Lunch* |
| 14:30 – 16:00 | **Solar-powered membrane distillation** [Elena Guillén; CIEMAT-PSA] |
| 16:00 – 17:30 | **Practical work in the experimental solar-powered membrane distillation plant of Plataforma Solar** [Elena Guillén; CIEMAT-PSA] |
| 17:30 – 18:30 | **Solar stills** [Guillermo Zaragoza; CIEMAT-PSA] |

*18:30 Departure to Hotel Tryp Indalo Almería (arrival at 19:15)*

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| 21:00 | *Official course dinner* |

**DAY 3 (Wednesday, 21st October 2009): Hotel Tryp Indalo**

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|---|---|
| 08:15 – 10:15 | **Desalination using solar PV energy** [Baltasar Peñate; ITC] |
| 10:15 – 10:30 | *Coffee break* |
| 10:30 – 12:30 | **Desalination using wind energy** [Vicente Subiela; ITC] |
| 12:30 – 13:30 | **Desalination with other renewable energy sources** [Baltasar Peñate; ITC] |
| 13:30 – 15:00 | *Lunch* |
| 15:00 – 17:00 | **Economical and environmental aspects of desalination using renewable energies** [Julián Blanco; CIEMAT-PSA] |

# COURSE ON DESALINATION POWERED BY RENEWABLE ENERGY

**October 19-21, 2009, Almeria, Spain**

**REGISTRATION FORM**

Registration fee: **€ 950**

The fee includes: 3 nights accommodation in 4-stars Hotel Tryp Indalo Almería, breakfasts, lunches, coffee, transportation to/from Plataforma Solar, gala dinner, course Workbook, CD with full texts of lessons and certificate of attendance.

Maximum number of attendants: 25.

Complete the following form and send back by fax or email to:

CIEMAT - ENERGY & ENVIRONMENT FORMATION UNIT
Mrs. Mirian Bravo Taranilla
Avda. Complutense, 22; 28040 Madrid
Fax.: (+34) 91 346 62 97
Email: cursodesal@psa.es

**PERSONAL DATA:**

| | |
|---|---|
| Full Name: | |
| Organization: | |
| Full address: | |
| City: | |
| Country: | |
| VAT number: | (for invoice) |
| Phone: | |
| Fax: | |
| Email: | |

**PAYMENT FORM:**

**By Bank transfer** to: CIEMAT, Reference: Desalination Powered by Renewable Energy; Bank: BBVA (Address: c/Alcalá 16, 28014 Madrid, Spain)
IBAN: ES89 0182 2370 4502 0001 9431

*Indicate your name within the transfer, send us a copy of the bank transfer details and take care of your own bank charges. Please do not proceed with payment until receiving confirmation of registration.*