**Title: Integration of Salinity Gradient Solar Pond as low temperature heat source in Industrial applications.**

**Description**

A Salinity Gradient Solar Pond (SGSP) is an artificially pond of saltwster which collectes and stores solar thermal energy. A salinity gradient forms a density gradient that increases with depth, and this counteracts the temperature gradient, thus preventing heat in the lower layers from moving upwards by convection and leaving the pond. The heat stored in the salty bottom layer can be used for many different purposes

In the last 15 years, many salinity gradient solar ponds varying in size from a few hundred to a few thousand square meters of surface area have been built in a number of countries. In the last years Solvay, UPC and RMIT have constructed the first pilot SGSP (50 m2) and after in 2014 the first industrial solar pond in Europe used to provide heat for a mineral processing process in the Escuzar Mine of Solvay in Granada Spain. A new research project will be devoted to explore and extend the applications of this technology in other industrial fields

Thus, the main objectives will be:

i) To evaluate and consolidate of the current SGSPs in Spain by improving their performance, optimizing maintenance, and developing systems for monitoring and control

ii) to integrate low temperature heat source in industrial processes. The integration of SGSP in brines management as renewable energy with membrane distillation has been selected as model system for validation or the use of absorption systems and electric power generation

**PhD Program content**

The Industrial PhD program Solvay-UPC as national core and with the integration of RMIT as international core will develop this research program through two main areas:

**a) Scientific and Technical part (to be developed at UPC-RMIT-Solvay):**

a.1) Follow-up of the Efficiency of current Solar Ponds installed in Spain.

a2) integration of MD with salinity gradient solar ponds will pave the way to a sustainable Zero Liquid Discharge desalination.

a3) using the heat from the pond in Absorption systems is also possible:

i) using the heat from solar ponds to create refrigeration effect (cooling effect ) is possible through "absorption systems".

ii) application of "heat pumps  " to boost the temperature of the heat produced by the pond to  higher  temperature heat  for applications that they need temperature higher than what is available from the pond.

a4) electric power generation utilizing the temperature difference between the bottom(heat source ) and the top of the pond (heat sink ) using Organic Rankin Cycles using some kind of expanders (such as screw expanders ) as well as thermometric generators

**b) Economic part, to the be developed in Solvay Energy Services Ibérica with support from UPC and RMIT:**

b1) Estimate and quantify the Energy Cost impact on Industry by using holistic methodologies as life cycling costing analysis

b2) Based on the data obtained an Energy Markets Analysis would be performed,

b3) Economics of solar ponds is very important for the acceptance and the diffusion of the technology

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**Industrial PhD schedule**

The candidate will develop the doctorate working at Solvay Energy Sources and UPC in Barcelona and part of the research project will be completed with stays at the RMIT in Melbourne (Australia).