Water resources assessment and solar desalination in Almería

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PhD starting date :	**15/02/2007**	Laboratory address :	**POB 22, 04200, Tabernas (Almería) Spain**

Water scarcity problems are becoming a great issue in most parts of the world. Especially in those countries such as Spain, which experience severe climate conditions like erratic droughts which can last several years and which are becoming and will become even more frequent due to climate change. The province of Almería, located in the south-east of Spain, where water plays an essential role and supposes a significant income generator for local business, experiences rigorous shortage difficulties. The need of assessing the water incomes and necessities is obvious in this kind of regions to properly manage and promote sustainable water consumption, both of them objectives included in the European Water Framework Directive (EWFD). The assessment must include an exhaustive reckoning of surface and subterranean water resources. Additionally to an improved management and estimate of the water supplies it is clear that Almería, due to its growing perspectives, needs extra water incomes.

There are several ways to tackle this problem. This Ph.D. project proposes low-cost solar desalination of either brackish or seawater. In the case of small communities where relatively little quantities of water are needed, the most suitable technology could be solar Membrane Distillation (MD). This is a relatively new thermal driven separation technology, which has low energy consumption and low heat requirements that is why Solar powered MD has been proven as a feasible technique for desalinating water. Even the possibility of using MD to desalinate brackish groundwater from inland aquifers is also pondered. MD desalination efficiency is largely independent of salt concentration, which makes extensive recycling of the feedstock possible and could lead to a very high product / brine ratio, reducing the problem of inland generation of large amounts of brine.

In the case of bigger communities an option is the coupling of Concentrated Solar Power plants with any large scale distillation technology, for example Multi-Effect Distillation (MED). Thereby, low exergy waste heat from the power plant may be employed for the thermal desalination process. Additionally, solar electricity may be used to operate conventional reverse osmosis desalination plants contributing thereby to the sustainability of this technology. A system analysis of the different possibilities of process combination is intended within the Ph.D. project.