



ProDes methodology for supporting the use of renewable energy systems in desalination applications

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ABSTRACT

ProDes started on the 1st of October 2008 and it will run initially for 2 years. It brings together 14 leading European organisations and will support the market development of renewable energy desalination in southern Europe. Using renewable energy to power desalination, either in stand-alone or grid connected systems, will allow better load control and consequently wider renewable energy use. The project has four phases. First, the foundations will be laid for European wide R&D coordination and a dedicated industry working group will be established within the European Desalination Society. A course for students and professionals will be developed and implemented initially in four southern European countries, and also later through other interested institutions. The course will be also offered as an e-learning option. Phase 2 facilitates communication and networking among the industry, investors and SMEs on the local level. Emphasis will be put on helping companies raise capital for further product development or project implementation. An analysis of the European and international markets will help companies for planning their growth strategies. The third phase is concentrated on the improvement of the framework conditions for facilitating the implementation of renewable energy desalination. The last phase will create widespread awareness about the benefits of the technology through a promotional campaign involving use of the local media.

Keywords: Renewable energy; Desalination; Southern Europe; Network; Training; Awareness raising

1. Introduction

Southern Europe has many remote or isolated areas with weak electricity grids that can accommodate only a small percentage of renewable energy. It is very common in such areas to have agriculture, tourism and industry competing between them and with the growing population for the scarce water resources. As a result,

desalination of sea and brackish water is growing rapidly and it is expected to boom the coming years in the Mediterranean region.

From the point of view of the electricity grid operator, this might be similar to the air-conditioning boom of the 1980s and 90s in southern Europe. Within a few years the annual peak load moved from the winter to the summer months mainly because of small air-conditioning systems installed in private properties. Overall this had a significant contribution to the total electricity demand on a

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European level. When this boom was taking place, there was no coordinated effort to promote the use of “solar-cooling”, which was probably a bit immature at the time.

For the case of desalination, it is important to take immediate action and support the plethora of renewable energy (RE) desalination technologies in the commercialisation or pre-commercialisation phase to gain a fair share of the market especially in remote and isolated areas. This will have an important effect in the medium and long term to the energy use and the share of renewable sources in these areas. The penetration is expected to be achieved both by small domestic systems, like PV directly connected to small desalination units, and with medium-sized systems, like wind turbines powering a desalination system and providing any excess energy to the grid.

The project ProDes that began in October 2008 is funded by the Intelligent Energy for Europe Programme (contract number: IEE/07/781/SI2.499059) and will be active for 2 years aiming to promote the wide use of RE for powering desalination systems in southern Europe. The countries that are using desalination for part of their water needs or are planning to do so will be covered. Special focus will be put on Greece, Italy, Spain and Portugal, which have the highest demand for desalination. However, other countries like Malta, Cyprus and France, which have interest in the results of the projects, will be involved in the consultation phases of the project and the dissemination of the results. Additionally, markets outside Europe will be examined for the export opportunities they offer to European technology producers. Finally, companies and research institutes from other European countries that have an interest in the technology are also involved in the project.

2. Background

Various initiatives and projects over the past few years have been covering the field of RE desalination. The ProDes work programme has been carefully designed in order to build on the past and existing efforts and coordinate its activities with them in order to maximise the expected outcomes. Here we present an overview of the most relevant initiatives to which ProDes will be linked.

The ADU-RES project [1] was a major effort to bring together all actors related to RE desalination in the Mediterranean. The state of the technology was analysed [2] and a strategy to bring it into the market was developed. The outcomes of ADU-RES have shown the need for more concerted action and the formation of a group that will push forward all necessary changes and will raise awareness about the technology.

In 2005 the European Solar Thermal Technology Platform (ESTTP) was established to help accelerate the

use of solar thermal technology in Europe. One working group within ESTTP is dedicated to solar thermal desalination and has been working on the development of a research roadmap in their field. This experience has showed that there are considerable synergies for the solar thermal community by working together to improve and promote the solar thermal desalination technology.

SolarPACES is an international initiative managed under the umbrella of the International Energy Agency, bringing together teams of national experts from around the world to focus on the development and marketing of concentrating solar thermal power systems. In May 2007 the task, solar water & energy processes and applications, was established in order to identify and promote research projects and demonstration installations. The activities of the task for the first 5 years are focused on the development of the specific following topics:

- combined power and desalination plants powered by concentrated solar energy
- medium-scale solar thermal water desalination (range: 100–2,000 m³/d)
- stand-alone small solar desalination systems (below 100 m³/d)

In February 2006 an advanced research workshop on Solar Desalination for the 21st Century was organised in Tunisia, financed by the NATO Security through Science Programme [3]. The workshop attracted 42 relevant scientists from 20 countries in order to present the state of the art, highlighting the main barriers and indicating the potentials for further developments. The main conclusion was the identification of the need for common action and coordination of research activities. The technical and scientific knowledge on the topic has to be transferred to the local level in areas affected by water scarcity with availability of seawater and RE resources.

The ADIRA project [4] demonstrates RE desalination systems that provide drinking water to populations in remote and isolated areas. In total, 10 systems have been installed, six in Morocco, two in Turkey, one in Jordan and one in Cyprus. In addition, a handbook was produced that covers practical issues regarding the selection, design, installation and operation of such systems.

3. Objectives

ProDes will build on the results of these projects and work together with the initiatives presented above. It will support the use of renewable energy for powering desalination systems by addressing the non-technical barriers that the technology is currently facing, such as:

- There are important research efforts all over Europe for technological advancements that will bring down the costs and improve the reliability of the technology.

However, there is no coordination on the European level that will make use of the potential synergies.

- There is no formal training of any kind resulting in a lack of specialised personnel.
- SMEs in remote areas specialised in energy or desalination products and services are not up-to-date with the technological developments, resulting in slow deployment of the technology.
- The last stages of R&D before commercialisation require funding which is not always easily available. Mainstream financial institutions are not familiar with the RE desalination field and therefore it is difficult for them to evaluate the risks involved.
- The legislation and regulatory framework has been developed without taking into account RE desalination, resulting in complicated procedures for licensing and operation that do not protect properly the consumers and the environment.
- Various programmes and initiatives support RE, but they focus on grid-connected systems. For example, the feed-in tariff does not encourage stand-alone systems powering directly a desalination plant.
- Although there are several technically viable RE desalination systems, the general public and specific stakeholder groups are not aware of this option.

The overall aim of the project is to work on improving these issues and develop ideal conditions in the southern European countries and other target markets for increased use of RE to power desalination, especially in isolated areas. The aim will be achieved by realising the following list of specific objectives:

1. Develop a coherent market development strategy that will set clear targets and indicate the way for fast and effective achievement of them on a European level. The strategy will reflect the wishes of the industry and will represent a wide consensus. In particular the research needs of the industry for developing competitive products for the market and the know-how pools that can deliver these services will be identified.

2. Communicate effectively the main elements of the strategy to all relevant stakeholders.

3. Build the basis of a higher education course for engineers and scientists to gain expertise in RE-powered desalination so that it can be used by different interested parties for adapting a course to their own specific needs.

4. Provide formal training to students and professionals in desalination powered by RE, both through a training course and an e-learning option.

5. Facilitate collaborations between RE desalination technology providers with SMEs that have the potential to promote the technology on the local level.

6. Bring closer the RE desalination people to the investment community and support their mutual communication and understanding.

7. Set specific targets and provide the tools for improvement of the legislative and institutional conditions.

8. Clearly and effectively communicate these recommendations to key stakeholders on a European level and in the target countries and lobby for their implementation.

9. Reach out to the general public and specific target groups, especially in locations suitable for the implementation of the technology and communicate the message about the opportunities and benefits of the technology.

When these objectives are realised, the conditions will be much more accommodating for the increased use of RE-powered desalination systems. Trained personnel and specialists will be available while SMEs will actively promote the technology. The suppliers will further develop their products and work together with local actors and investors for concrete project implementation. At the same time awareness among the general public and key stakeholders will be growing and the reputation of the technology will be slowly established. More importantly, through ProDes, a long-lasting strategic cooperation between stakeholders from different backgrounds will be achieved, for promoting their common interests.

4. Project partners and target groups

ProDes has brought together a team of 14 companies, research institutes and associations that will work together towards achieving the project objectives. The overview of the partners is given in Table 1.

Table 1
Overview of the partners

Participant name	Country
WIP Renewable Energies	Germany
Centre for Renewable Energy Sources (CRES)	Greece
University of Palermo	Italy
Instituto Nacional de Engenharia, Tecnologia e Inovação (INETI)	Portugal
Ao Sol, Energias Renováveis	Portugal
Fraunhofer Gesellschaft – Institute for Solar Energy	Germany
Befesa Construcción y Tecnología Ambiental	Spain
AquaMarine Power	UK
Hellas Energy	Greece
European Desalination Society (EDS)	Italy
Technology, Environment and Energy Research Centre (CIEMAT)	Spain
Tinox	Germany
Instituto Tecnológico De Canarias (ITC)	Spain
Capital Connect	Greece

This core team will reach out to various groups and include them in the project activities in order to maximise the impact and realise as many of the objectives as possible. Here are described the main target groups that will be addressed:

1. Academic community and education system: The academic community will benefit from the coordination activities of the project. The road-map that will be produced will allow them to better plan their research activities and develop useful collaborations with other institutes or industrial partners. The education system will have as input from the project concrete plans and practical experience for a new course on RE desalination. At the moment almost no kind of formal training is in place and the demand is expected to be high. Young scientists and engineers will become experts in a specialty with bright prospects and low competition.

2. Industry: Industries will be the main beneficiaries of the project. ProDes is designed to support them promote their products and increase their share of the market. They will have the opportunity for targeted networking with SMEs that can sell their products to the end-users on the local level. The local SMEs, installers and distributors that will react to the opportunity ProDes will offer them the benefit of international contacts and can offer innovative products that will give them a competitive advantage in the local market.

3. Investors: Investors will gain information about a new fast-growing market, which will allow them to develop a good overview of the main market players. ProDes will be a unique opportunity for them to understand better the market and the involved risks and evaluate the investment opportunities in new companies and concrete projects.

4. Public authorities and policy makers: The public authorities and policy makers will receive concrete recommendations for action from the project. A concept for a subsidy scheme will be developed and presented to them and it can be used as a basis for a new support programme. Possible improvements in the legislation and the administrative structures will be suggested and explained to the policy makers. As a result, the public authorities will have a comprehensive plan for action that has the back-up of the academic world and the industry and promotes an objective that is fully in line with the EC policy objectives and the wishes of the civil society.

5. Civilian society: Civilian society will benefit from the project because the implementation of RE desalination will provide the necessary water for the development of the local communities without any impact on the environment. The civilian society will be informed about the project results through media announcements, the internet and local awareness raising work.

5. Work programme

The work programme has been carefully designed to realise the objectives of the project and address all target groups. The core of the project includes four phases that address different target groups. Below is a brief explanation of the four phases named after the target group they address.

5.1. Phase 1: Education system and academic community

The first phase of the project deals with the inter-European coordination of activities in the field of RE-powered desalination systems and higher education. All relevant stakeholders will be involved in a major effort to link the research community with the needs of the industry and the market on a European level. A working group will be formed and incorporated to the EDS that will sustain these efforts after the end of the project. After a comprehensive consultation process a road-map on RE desalination will be formed that will lay the foundation for the functions of the working group.

The next step will be dedicated to the introduction of RE desalination in the higher education system of participating countries. This aims to fill the gap in knowledge and help produce the missing experts that will bring forward the research in the field or work with entrepreneurs that will take advantage of the fast emerging market. The course will be implemented twice in each involved country within the framework of the project and it is planned to establish and extend it at a later stage. It will be also offered as an e-learning course, which will reach a much wider audience. A separate course dedicated to professionals will be developed and implemented in each of the target countries, aiming at faster results, targeting the people that are already active in the water and energy markets.

5.2. Phase 2: Industry—Investors

The second phase of the project is aimed at the industry and investors. The strategy is focused on networking that should fill the existing gap in information flow between entities that have products close to commercialisation with actors that can take these products and introduce them to the markets where the suitable end users are. Main part of this strategy will be facilitating collaboration with suitable SMEs and entrepreneurs already active in the water and RE markets in the relevant countries. Also support will be provided to the entities that hold the know-how to reach the capital they need for further product development or for concrete project implementation. Direct contacts with representatives from the investor community will provide valuable insight to

the requirements they have for providing the funding needed. Finally, market analysis will be performed to provide an additional tool to the actors who want to plan their long-term strategies in the field.

5.3. Phase 3: Public authorities and policy makers

The framework conditions in the target countries and on European level will be analysed and it will be defined how they can affect the implementation of RE desalination. As a result, concrete recommendations for improvements will be developed and communicated to key decision-makers through a dedicated event in each country. Realistic targets will be set for the future regarding the share of water produced by RE desalination on the overall desalinated water. Concrete suggestions will be made for local, regional or national schemes that will promote the more efficient use of current public spending in the form of subsidies in order to support sustainable solutions in line with the social and environmental policies.

5.4. Phase 4: General public

The last phase of the project is dedicated to dissemination activities targeted to the general public. The work will create awareness about the benefits of the technology, especially in the participating countries and the local populations in the areas with RE desalination potential. The main tools used will be the internet and the local, regional and national media, especially exploiting the occasion of the various project events.

The success of each step and of the project as a whole depends mainly on the motivation of the critical mass of stakeholders in order to raise awareness and bring the technology to the market. The involvement of key partners and associations from strategic countries and the European level ensures that the necessary critical mass will be reached.

6. Expected results

The major outputs of the project are listed below.

6.1. Phase 1

- A database with stakeholders that are interested and relevant to shape the future direction of the research fields and market development of RE-desalination.
- A road-map reflecting the needs of the industry and the views of the research community for the direction of research in RE-desalination, including specific targets and the resources needed to achieve them.

- General awareness about the contents of the road map among all key stakeholders.
- A strategy session will be implemented to present the road map and a working group will be formed as part of EDS that will function independently from the project and will keep the RE desalination road map up to date.
- Programme outline of a higher education course covering a wide spectrum of RE desalination elements; available on the website as a basis for the adaptation of a training course to the specific needs of any target audience.
- Training material like presentations and notes and a detailed programme of a training course for each involved country.
- 8×40-h training courses implemented with 25–30 students each.
- 4×8-h training courses implemented with 15–20 professionals each
- An e-learning platform based on the training course programme and material.

6.2. Phase 2

- Survey identifying the most suitable small and medium enterprises in each involved country for promoting RE desalination products.
- Comprehensive collection of information on all European RE desalination technology providers.
- Four national networking workshops promoting collaboration of RE technology providers with local suppliers.
- Collaboration agreements between technology providers and local stakeholders.
- A clear picture of the funds needed by RE desalination companies to improve their products and compete equally in the market with conventional water supply solutions; guidelines on the strategy to raise the required funds.
- At least four concrete project development opportunities—one per country—will be identified and promoted to relevant stakeholders. The selection will be made in a clear and transparent manner in close cooperation with the local authorities and the public water utilities of the area.
- Analysis of the main export markets for the different technologies.

6.3. Phase 3

- Study on the framework conditions that affect the implementation of RE-desalination in each country
- Concrete recommendations on improving the framework conditions and outline of a plan for subsidising RE-desalination.

- Four seminars for policy makers where the results will be presented and the specific recommendations discussed and promoted.

6.4. Phase 4

- Project website that will become the main hub for information on RE desalination also after the end of the project.
- Representation of the project in all relevant international scientific and industry events.
- Promotional material and media coverage that will raise awareness about the technology.

References

- [1] C. Epp and M. Papapetrou, Co-ordination action for autonomous desalination units based on renewable energy systems — ADU-RES, *Desalination*, 168 (2004) 89–93.
- [2] M. Papapetrou, C. Epp and E. Tzen, Autonomous desalination units based on renewable energy systems—a review of representative installations worldwide, *Solar Desalination for the 21st Century*, Springer, Netherlands, 2007, pp. 343–353.
- [3] L. Rizzuti, H.M. Ettouney and A. Cipollina, eds., *Solar Desalination for the 21st Century*, Springer, Netherlands, 2007.
- [4] MEDA water project, ADIRA, contract no. ME8/AIDCO/ 2001/0515/59610), G. Papadakis, Coordinator, Agricultural University of Athens, www.adira.info.