Solar-driven Desalination – An Environmentally Sound Technology

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Introduction

Desalination plants have a high energy demand. If this energy demand is covered by conventional energy sources, it implies a remarkable environmental impact. An alternative is the usage of solar power. This combination makes sense, since the demand for desalination plants is high in arid climate zones with high solar radiation.

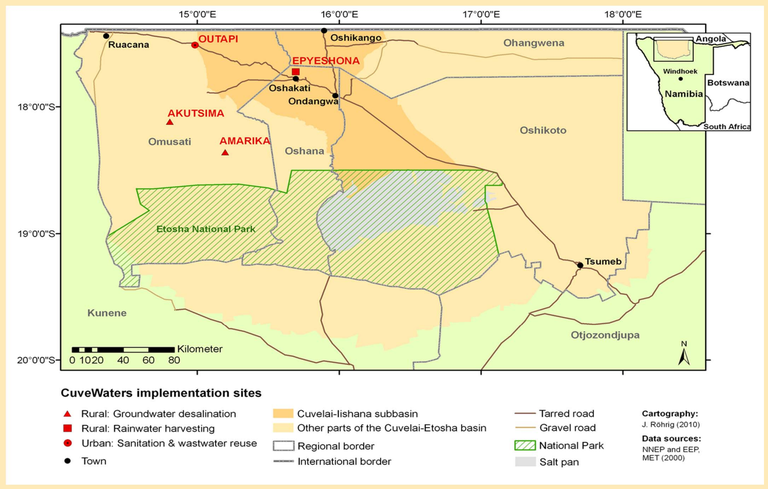

Figure 1: Desalination demonstration plants in Amarika and Akutsima

A very good example is central northern Namibia. With its solar radiation of more than 6 kWh/(m²d) the area has one of the highest values in the world. Precipitation is about 470 mm/a and potential evaporation is about 2,700 mm/a. Due to the climate conditions the groundwater near the Etosha salt pan is saline and not suitable for human consumption.

Implemented Desalination Technologies

Within the CuveWaters project, which is sponsored by the German Federal Ministry of Education and Research, the villages Amarika and Akutsima were selected as pilot sites. In every village two small scale groundwater desalination demonstration plants were implemented in 2010. Four different technologies were chosen:

- Chemical-free reverse osmosis (pro|aqua GmbH & Co.KG)
- Membrane distillation (Fraunhofer ISE)
- Terrawater evaporation with bypass technology (Terrawater GmbH)
- Multi stage distillation without electricity (Solar-Institute Jülich & IBEU)

	Unit	Amarika		Akutsima	
		pro|aqua	Fraunhofer ISE	Terrawater	Solar-Institute Jülich/IBEU
Salinity Raw Water at Sites	µS/cm	26,000	26,000	7,500	7,500
Max. treatable Salinity	µS/cm	70,000	150,000	280,000	280,000
Salinity Product Water	µS/cm	500-1,000	50-100	8	50-100
Daily Water Production	m³/d	3.7	3.5	1.6	0.6
Research Objective		Electro-chemical pretreatment without additional chemicals	Solar-thermal membrane-distillation	Plastic heat exchanger, solar system and chemical-free operation	Plastic-metall composite construction, chemical-free operation

Table 1: Operation data from desalination plants

Operation and Maintenance

The main challenge for desalination plants in remote areas is the organization of operation and maintenance. The concept includes a local caretaker and a professional service provider. The local caretaker are selected from the community, are trained and get paid. They look after the plant every day, conduct small maintenance tasks (cleaning, check for malfunctions etc.) and inform the service provider in case of malfunctions.

The service provider (Aqua Services & Engineering) is located in the capital Windhoek and checks the plants once per month on site to conduct repairs, maintenance tasks, water analysis, etc. In emergency cases he visits the plants additionally.
Local guards selected from the community protect the plant against theft and vandalism, which did not occur since start of operation.

Figure 2: Desalination plants in Amarika (top) and in Akutsima (below)

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