



PROJEKTARBEIT

“Battery-free solar-based desalination”

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Battery-free solar-based desalination

Farzane Ahmandloo recently graduated from the Elite Graduate Program “Advanced Materials and Processes” of the Friedrich-Alexander-Universität (FAU) Erlangen-Nürnberg. Already during her studies, Farzane was involved in Grino Water Solutions GmbH, a cleantech university spin-off from FAU. Recently, Grino Water Solutions has received the HOCHSPRUNG Award for a battery-free solar-based desalination system that was developed by Ms Ahmandloo.

Research for people suffering from water scarcity

844 million people have no access to clean water. While water shortage influences all aspects of life, the scarcity of drinking water is becoming one of the most pressing global problems, especially in remote areas. 96 percent of global water is distributed within the oceans, it usually contains too much salt, and is not drinkable. The most utilized technologies for seawater desalination are membrane processes and thermal processes. Among all the current desalination technologies, reverse osmosis (RO), is both a reliable and simple solution.

During the reverse osmosis process, we need high pressures to force the water to flow in the reverse direction, which means from the contaminated to the clean water side. Although electricity and thermal energy from fossil fuels is the most commonly used energy sources for desalination systems, less than 15% of people in developing countries and sub-Saharan Africa have access to these energy sources. Alternatively, solar energy is a widely available renewable resource [1] [2].

The substantial challenge in Photo Voltaic Reverse Osmosis (PVRO) systems is the fluctuation of solar energy. The conventional systems currently available on the market require a battery. However, batteries are very expensive and have a short lifetime (3-5 years), which decreases quickly in humid and hot areas. The need for an exchangeable battery raises the production cost of water and maintenance costs. In addition to the mentioned costs, the usage of batteries requires many energy conversions, which increase the complexity of the system and leads to energy losses at each conversion step, which reduces the efficiency of the overall RO process.

Grino developed a completely battery-free desalination system using solar energy. The battery unit is replaced by an innovative variable frequency generator (VFG).

Standard RO units typically operate under constant conditions. Since the output power of photovoltaic (PV) modules vary during the day, dependent on the solar radiation fluctuations, the pump on a conventional RO system can only operate for a limited period at nominal power. In comparison to those systems on the market, the Grino system continues to operate at a variety of different solar insolation. Considering that photovoltaic modules are directly connected to the high-pressure pump, the speed of the pump has been adapted to adjust to the solar radiation fluctuations. In Grino, a new power management unit has been developed to regulate the pressure, which performs the important function of compensating for the fluctuations in solar energy output.

Therefore, Grino produces a larger amount of drinking water at a lower price, using a completely independent system.

Grino is planning to install a pilot project in Cape Coast (Ghana) in January 2020, and the goal is to provide clean water for two schools with about 200 students.

We aim to provide water for people suffering from water scarcity in the remote area.

[1] D. Professor Kammen and Oxfam America, „The energy challenge in sub-Saharan Africa,“ [Online]. Available: <https://www.oxfamamerica.org/static/media/files/brief-final-post-proof.pdf>.

[2] M. Labordena, „How sub-Saharan Africa can harness its big electricity opportunities,“ The Conversation, [Online]. Available: <https://theconversation.com/how-sub-saharan-africa-can-harness-its-big-electricity-opportunities-97391>.”

More information on „Advanced Materials and Processes“

🔗 <https://www.elitenetzwerk.bayern.de>

🔗 www.map.tf.fau.de

More on Grino Water Solutions GmbH

🔗 <https://grinowater.com/>