

# Energy supply and decentralized drinking water treatment by Photovoltaic

## Design and conceptualization of a sustainable drinking water distribution system in rural South Africa

### Students



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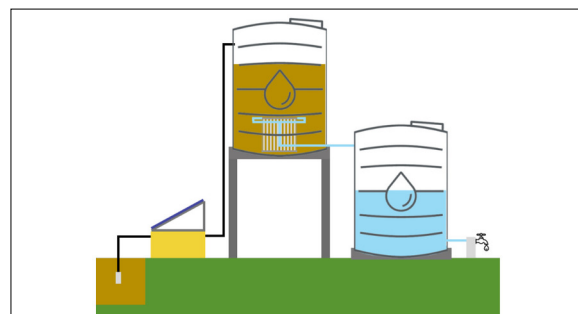
**Introduction:** Despite the efforts of the United Nations and their SDG 6 to provide all people with the basic human right to adequate drinking water, many people in rural areas do not have access to safe drinking water. Especially on the African continent, this problem is widespread. To combat this inequality, the Swiss Embassy in South Africa, together with the SPF and UMTEC institutes of the University of Applied Sciences of Eastern Switzerland, was given the opportunity to conduct a research project in a particularly affected region in the Eastern Cape in South Africa. The aim of the project is to supply the selected village of Fama with clean drinking water. The semester thesis is part of this project and has the task to investigate the conditions on site in cooperation with the South African Institute of Environmental Health (SAIEH) and to propose a feasible system to achieve the project goal. In a further step, the Project Steering Committee (PSC) will assess the proposed systems and decide on the final implementation of a system. In a joint effort between the SPF and UMTEC institutes and the local water provider with its authorities the selected system will be built.

**Definition of Task:** To ensure the character of the project as applied research, some boundary conditions were defined. It was requested that the gravity-driven membrane ultrafiltration (GDM-UF) technology developed in Switzerland be used for water treatment. Since the system was to be as sustainable as possible, it was required to operate without greenhouse gas emissions. Therefore, the project partner ENNOS AG, a spin-off of the Bern University of Applied Sciences, provided a solar-powered water pump to be used to pump the water. In this way, the system could be used in other communities with minimal adaptations.

**Result:** In a preparatory step, a profound understanding of what is required to realize such a system was created by reviewing the state of the art. On this basis, concepts were elaborated. During a visit, measurements were taken, and the feasibility of the different concepts was evaluated. As a result, a proposal with four different options was developed which will be presented to the PSC. The proposals include obtaining water from a spring water source near the village and using the ENNOS sunlight pump to transport the water to a suitable location where the GDM-UF is performed. The difference between the four options lies in the arrangement of the components - and thus the overall layout of the system - and in the way the water is collected at the source. During the assessment on site, it was determined that the existing water distribution system with boreholes had two deficiencies. To address these issues, two possible additions to the project were included on the proposal. The first addition consists of repairing a broken pipe that leads to the

water storage tank from one of the boreholes. The second addition was the proposal of a solar-powered pumping system for the other borehole because the pump for that borehole failed shortly after it was put into service. It was recommended to the PSC to select one of the four options and possibly the additions for the implementation of the project.

Schematic of a GDM-system powered by PV  
Own presentation



Water quality testing on site  
Own presentation



Pump demonstration workshop with local partners  
Own presentation



### Advisors

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### Subject Area

Electric solar  
technology, Water  
treatment, Plant design  
and project  
management

### Project Partner

Swiss Embassy in  
South Africa,  
Johannesburg,  
Gauteng, South Africa /  
ENNOS AG, Bienne,  
Berne