Sea Water Desalination with Renewable Energy

1 Starting Position

As the global demand for drinking water is increasing steadily, the desalination of sea water is becoming more important. Naturally, there is in areas with high solar radiation, a particularly large need for drinking water. In these regions, the use of renewable energy (e.g., solar or wind) for desalination of sea water could be used, which would achieve a significant contribution for the sustainable supply of drinking water.

- The countries in the Mediterranean region, Middle East and Africa, and the islands are suffering in recent years with the supply of drinking water.
- Due to low rainfall during the summer months in these regions, it comes to increased shortages in water supply.
- Not only the residents in respective settlement areas, but also agriculture suffers from the low amount of available water.
- In recent years, water pumps were installed to bridge the drought. But it was only a help in the short term, in the medium term it caused new issues due to lowering groundwater level.
- Since these countries are surrounded by sea and each has sufficient sunlight, a desalination plant, which would operate with a photovoltaic system, would generate a valuable contribution to the recovery of additional drinking water.

1.1 Aspects to Consider

- In the countries concerned, a large demand of water supply is actual, but the prices for sea water desalination are yet to high, or there are "still enough" groundwater available (e.g. as in rural areas).
- Thus, the realizable sale price of drinking water in coastal regions should be derived, where heavy water shortage and not existing groundwater exploitation opportunities are present.
- The problem here is that the buyer – cities and municipalities, water economic communities or farmers – are seen not as bankable counter parties and they can hardly invest. The required electricity for water pumping is seen as an extreme cost factor.
- In regions with a large need of water by agriculture, where the water cannot be easily transported, our concept could be further combined with wind turbines to generate enough power for decentral pump stations.

2 Technology – Combination

For the operation of the desalination plant a renewable energy system supplies the power. With a battery storage module, which is delivering the required power constantly the production process of desalination can be performed. With this smart combination, it is possible to operate a sea water desalination plant with a high percentage with renewable energy.

2.1 Photovoltaic

The solar technology plays in the field of renewable energies a significant role. Due to high daily sunlight in these regions excellent natural conditions are in place.

The corresponding solar cell modules and the producer will be evaluated according to project specifications.

2.2 Wind

A combination with wind technology can improve the efficiency of the plant itself. In addition, it can reduce the required area for the solar panels.

2.3 Sea water Desalination – Reverse Osmosis

Through desalination the production of drinking water from sea water is possible by reduction of the salt content. Desalination can be based on various processes that remove salts and minerals from the water. In addition, during the process usable by-products such as saline are resulting.

Reverse osmosis is a physical process for the concentration of substances dissolved in liquids, wherein the pressure is reversed with the natural osmosis process.

2.4 Battery Storage

There are various battery technology methods which have their strengths and weaknesses. The module and implementation costs have to be taken into account and the operating costs have to be kept as low as possible.

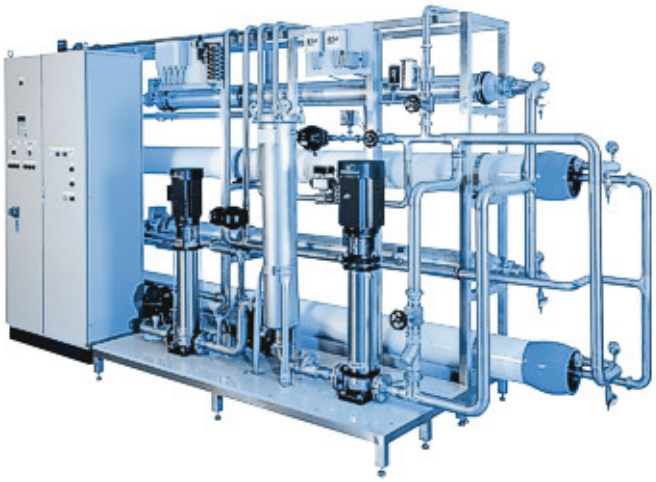
3 Sea water Desalination – Reverse Osmosis

Reverse osmosis (RO) is a water purification technology that uses a semipermeable membrane. This membrane technology is not properly a filtration method. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, a colligative property, that is driven by chemical potential, a thermodynamic parameter.

Reverse osmosis can remove many types of molecules and ions from solutions and is used in both industrial processes and the production of potable water. The result is that the solute is retained on the pressurized side of the membrane and the pure solvent is allowed to pass to the other side. To be "selective", this membrane should not allow large molecules or ions through the pores (holes) but should allow smaller components of the solution (such as the solvent) to pass freely.

The osmotic pressure increases with increasing salt concentration, the process would thus eventually stop. To counteract this, the concentrate is discharged. Since the crystallization of the salt or minerals (precipitation) in the membranes must be prevented, the use of reverse osmosis is only to a certain maximum concentration of the reflux possible. Depending on the salt concentration and due to high pressure, an energy expenditure of 2-4 kWh per cubic meter of drinking water is required.

The drinking water treatment plants can be equipped with additional pre-filters depending on the type of water pollution. Coarse material particle size till 20 micrometers can be separated. An additional active carbon filter separates organic substances such as pesticides. Further security level against microbes can be achieved by using UV irradiation.



4 Conclusion

The intelligent combination of different technologies in the regenerative area for producing potable water from sea water offers all participants a real added value.

The financing of the entire plant will be managed by Finomics Sustainable Umbrella Fund, within the compartment Renewable Energy and Debt Infrastructure.

Thus, the income from produced potable water and electricity is low, profits to be realized are in the lower band. Therefore, relevant European and global funding agencies (EBRD, World Bank Group, etc.) must be addressed, which are in the position to help in financing a such valuable project.