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Introduction of a new Energy Recovery System—optimized for the combination with renewable energy

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Abstract

The ENERCON Desalination Department has developed a new energy recovery system for RO desalination plants, optimized for the combination with wind energy converters.

The main problem for the combination of desalination processes and wind energy is the fluctuation of power supply generated through renewable energies. Conventional desalination plants (and the belonging energy recovery systems) work at a fixed operation point or in a very small range.

ENERCON developed a system that can adjust the operation in a range of 12,5 - 100% energy availability - in a very energy efficient way!

The energy recovery system consists of a low pressure pump (20bar) and three combined pistons (there is no need for a second/booster pump). This "piston type accumulator" is able to transfer the pressure up to 70 bar, needed for the desalination process.

As a side effect we can also avoid the use of chemicals for the antiscaling and antifouling problem. We managed to avoid additives by a low recovery rate. In the combination with the very efficient energy recovery system we experienced an energy consumption within the RO unit between 2-2,8 kWh/m^3 for sea water and between 0,8-1,3 for brackish water with our prototype plants in the Mediterranean sea.

The ENERCON design enables a reduction of operation costs through low energy consumption and the avoidance of chemicals. Furthermore it is also a benefit for the environment.

Our goal: A reliable, sustainable drinking water production of finest water quality!

Keywords: Wind energy; Energy recovery system; RO desalination; Operation costs; Energy efficient; Energy efficiency; Low energy consumption; Sustainable solution for drinking water production

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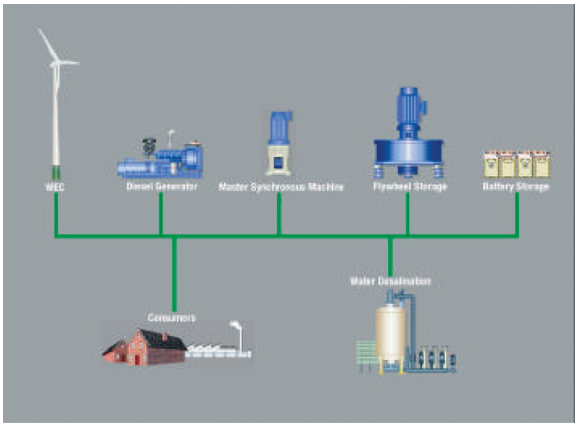
1. Introduction

The two most important topics in desalination nowadays are cost reductions and sustainable treatment of the natural resources such as water and energy. This article will show a way how sustainability and low costs can be achieved. Since ENERCON is one of the world's leading manufacturer of wind energy converters (WEC) it was obvious to think about the WEC as a renewable energy source in combination with desalination plants. Especially the decreasing prospects of fossil fuels and therefore increasing prices for any fossil energy will make renewable energies very competitive with regards to cost reduction in the near future. For islands and remote areas it is already worth calculating if a complete autonomous renewable energy and water supply system saves costs compared to conventional technology, especially for smaller plants (SWRO 300–1500 m^3/d).

An autonomous renewable energy supply system can basically be divided in two parts. The first part consists of the autonomous energy supply system where the main power supply is generated by a wind turbine and stable electricity supply is guaranteed despite fluctuating winds. The fluctuating power of the WEC is smoothened and offered to a consumer. The second part contains a desalination plant with (1) the ability to adapt to the fluctuating power offered with the autonomous renewable energy supply system and (2) a very low specific energy consumption. Due to the requirement of low specific energy consumption the RO—process was chosen. An energy recovery was developed to meet the special requirement of variable production to adapt to the available power. Therefore the desalination process needs to be controlled completely automatic, including not only the standard operation also basic cleaning processes.



2. Renewable energies and electrical power supply

Currently, for some remote regions or islands, the only possibility to provide the inhabitants with energy is diesel power stations. However, this method not only involves costly long-distance fuel transportation, but also pollutes the environment. ENERCON has taken a detailed look at this question and has developed an autonomous energy supply system where the main power supply is generated by a wind turbine, while constant and stable electricity supply is guaranteed despite fluctuating winds.

The so-called 'ENERCON Stand alone System' is currently in its application phase on the Norwegian Island of Utsira (see Windblatt05/03).

The system which was installed in 2004 is the first of its kind functioning in real conditions worldwide. The system combines several different components to form a highly efficient sophisticated system. The main energy supplier is an ENERCON *wind turbine*, which, due to its adjustment concept (variable speed, variable blade control), is easily combined with other components.