

Reverse osmosis and osmotic power generation with isobaric energy recovery

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ABSTRACT

Current state-of-the-art seawater reverse osmosis processes require isobaric energy recovery devices to minimize energy consumption and total operating costs. These “pressure-equalizing” devices efficiently recover pressure energy from the reject concentrate stream of the reverse osmosis process. The use of isobaric energy recovery devices in SWRO processes provides a great deal of flexibility in the design and operation of the plant. In a properly designed application, membrane flux and recovery can be dynamically changed without a significant total process energy efficiency penalty. The high efficiency and flexibility of isobaric energy recovery devices makes them logical solutions for other membrane processes such as brackish RO systems and pressure retarded osmosis. Pressure retarded osmosis, sometimes referred to as osmotic power, is a membrane process for generating energy from the osmotic potential between two feed streams such as seawater and fresh water. The process, invented by Sidney Loeb in 1973, will see its first full-scale prototype within 2009. Isobaric ERDs play a pivotal roll in making the pressure retarded osmosis process economically viable. This paper will illustrate how isobaric energy recovery devices work and chart the technological advances they have made through the years. The application of the isobaric ERDs, and specifically the ERI PX device, to reverse osmosis and pressure retarded osmosis processes will be discussed in detail.

Keywords: Reverse osmosis; Osmotic power; Energy recovery devices; Forward osmosis; Pressure retarded osmosis

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