Reduction of energy consumption in seawater reverse osmosis desalination pilot plant by using energy recovery devices

Youngmin Kim\textsuperscript{a}, Man Gon Kang\textsuperscript{b}, Sangho Lee\textsuperscript{c}, Sang Gyu Jeon\textsuperscript{b}, June-Seok Choi\textsuperscript{a,*}

\textsuperscript{a}Korea Institute of Construction Technology, Gyeonggi-Do 411-712, Republic of Korea
Tel. +82 31 910 0759; Fax: +82 31 910 0291; email: jschoi@kict.re.kr
\textsuperscript{b}Hyosung Goodsprings, Mapo-Gu, Seoul 121-804, Republic of Korea
\textsuperscript{c}Kookmin University, Seongbuk-Ku, Seoul 136-702, Republic of Korea

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ABSTRACT

Of paramount importance, seawater desalination plants using reverse osmosis (RO) is reducing the use of energy, which is mostly required for high pressure pumps. Accordingly, energy recovery devices (ERDs) are widely used for reusing hydraulic energy in RO concentrate stream. Nevertheless, few works have been done to investigate the operation characteristics of various EDR systems in actual desalination plants. In this context, we focused on the comparison of ERDs in a pilot plant with the capacity of 1,000 m\textsuperscript{3}/day. One centrifugal ERD (turbocharger) and two different types of isobaric ERDs (pressure exchanger \textit{[PX]} and pressure exchanger for energy recovery \textit{[PEER]}) were installed and tested under various conditions. Operation data in the pilot plant were analyzed to estimate specific energy consumption and energy transfer efficiency. The specific energy consumption analysis results showed that the isobaric ERDs have higher efficiency than the centrifugal ERD as also expected in theoretical estimation. The energy transfer efficiencies for PX and PEER were determined to be similar in short-term tests.

Keywords: Seawater desalination; Reverse osmosis; Energy recovery; Specific energy consumption