

Recent Development of Desalination Technology and its Application to Address Water Problems in Small Communities

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Many countries depend on seawater desalination technology to overcome shortages of natural fresh water. The seawater desalination technology can be divided into two commercially-major processes, such as thermal processes (MSF: multi-stage flash distillation, MED: multiple-effect distillation, etc) and membrane based processes (seawater reverse osmosis (SWRO) membrane, etc). In 1999, the MSF and SWRO plant accounted for about 78% and 10%, respectively, of the world's seawater desalination capacity. Today, over 50% is made up of the SWRO plant showing rapid expansion in world's seawater desalination market. It indicates that the SWRO technology is becoming a primary choice for desalination facilities. As compared to the thermal based desalination plant, the SWRO based desalination plant has several advantages as follows: relatively low energy, compact site for construction, and broad range of plant capacity. Although the SWRO process has dramatically improved during last years, there are still some challenges to reduce the capital cost by scaling-up total plant and unit train sizes and to prevent membrane fouling by developing optimized pre-treatment processes and by specializing in membrane manufacturing. In this presentation, a world's largest R&D program, (seaHERO: Seawater Engineering Architecture High Efficiency Reverse Osmosis) will be introduced as a main key of the remaining challenges for SWRO plant. The R&D program will provide technical criteria for the development of global-top-grade SWRO based desalination plant.

In 2006, Korean Ministry of Land, Transport and Maritime Affairs (MLTM) selected SWRO desalination technology as one of the Global Top 5 technologies and Value Creator (VC)-10 projects. The Center for Seawater Desalination Plant (CSDP) was established in December of 2006 with a final goal of the top SWRO plant technologies in the world. The CSDP launched seaHERO R&D program in August, 2007. During the 6 years from 2007 to 2012, this program is funded by MLTM of Korean government with 140 million USD. We expect capability and capacity to be the



top leading practical technology which needs to be available for the new discoveries and products. As a matter of fact, this program is a way for us to be a part of the world and to make a contribution to humanity as well. Core technology (CT) projects support seaHERO R&D program. There are four CT projects, including development of platform technologies for SWRO plant construction (CT 1: Platform technology), development of SWRO membranes and high pressure pump component manufacturing and system optimization technologies (CT 2: Plant units localization and system optimization), development of large scale SWRO plant design and construction technology (CT 3: Engineering-Procurement-Construction (EPC)), and development of innovative operation and maintenance (O&M) technology for large-scale SWRO plant (CT 4: O&M). Finally a test-bed, which is defined as a whole SWRO plant (total size= 10MIGD (45,460 m³/d)) including the unit train (>6MIGD (27,000 m³/d)) in the world up-to-date will be developed to integrate and verify the developed unit technologies.

In order to get improvement of seawater desalination technology and the economical efficiency of SWRO desalination plant, the technical objective of the seaHERO program are Large scale, Low energy, and Low fouling called 3L, of which specific targets are as follows. [1] Large scale: To design and construct the unit SWRO train (daily water production rate > 6 MIGD (=27,000 m³/d)). The daily production rate of the largest unit train at the moment is known as 5.2 MIGD and it is in Point Lisas SWRO plant, Trinidad and Tobago. [2] Low energy: To lower energy consumption of whole SWRO plant (including intake, pre-treatment, SWRO systems, and so on) less than 4 kWh/m³. [3] Low fouling: To reduce membrane fouling by 50% in terms of silt density index (SDI) and a new fouling index developed through CT 1 project.