Global Water Industry Sector Initiative

Products and solutions for desalination
Enhanced plant performance, efficiency and reliability
A global challenge
Desalination is one of the key processes in the water industry and plays an essential role to fill the gap between the demand and the availability of the precious resource water. In many parts of world there is an increasing need for desalinated water for urban, industrial, agricultural purposes for which a number of technologies have been developed and continuously optimized to produce fresh water at optimal costs: RO (Reverse Osmosis), MSF (Multi Stage Flash), MED (Multi Effect Distillation) are the key technologies and are, in some cases, combined in hybrid schemes.

Desalination and energy
A key cost component of desalinated water is electricity that can represent - depending on the desalination technology used - more than 20% of the operational costs. Therefore, energy efficiency and life-cycle cost optimization are among the most important challenges for utilities and for developers, which are responsible to build and operate plants for a number of years and recover their investment selling water (or water and energy in case of combined power plants) at agreed prices.

Technology to reduce the cost of water
The ABB portfolio includes products and solutions covering the entire electrical and automation scope for desalination projects with the clear goal to maximize the plant efficiency and productivity levels: drives and motors, soft-starters, low, medium and high-voltage switchgears and components, transformers, instrumentation, control products and PLC’s (programmable logic controllers), DCS (Distributed Control Systems) as well as optimization tools.

- Complete and reliable portfolio
- System integration and optimization
- A presence in over 100 countries
From Products to Integrated Solutions

A leader for integrated solutions
ABB combines in-house technology with extensive process know-how to develop complete engineered packages such as eBoP (electrical Balance of Plant) and I&C (Instrumentation and Control) systems.

We serve developers to optimize the entire life-cycle energy costs, EPC contractors to provide one single source for all instrumentation, control and electrical systems and pump OEM's, by delivering efficient motors and state-of-the-art drives.

ABB is the ideal partner for medium to large desalination projects as well as for combined water and power plants (based on the vast experience in power generation) and can take the responsibility for building complete integrated automation and electrification solutions, including engineering, installation, commissioning and maintenance. By using ABB as a single interface for the project, costs can be reduced significantly.

Motors and drives: choices for increased efficiency
Motors and drives can drastically affect the long-term operational management of water and wastewater treatment plants. This is especially true, considering the fact that pumping and aeration require larger amounts of electrical energy with the electrical energy being a major component of operational expenditures.

ABB is a world leading supplier of highly energy efficient motors. We deliver a full range of high efficiency and a broad range of premium efficiency as well as super premium efficiency motors. Using our motors will substantially contribute to make your operation more energy efficient.

ABB variable speed drives (VSDs) are used to control the motor speed of pumps with a typical 30 to 60 percent savings in energy consumption. The use of drives also reduces mechanical and electrical stress on pumps and aeration equipment components.

VSD’s in combination with high efficiency motors does not only make water processes in all parts of the water cycle more efficient, but also help reduce maintenance costs.
**Electrical Balance of Plant (eBoP)**
Abb offers integrated electrical Balance of Plant (eBoP) solutions for desalination plants. We have the knowledge to assess the degree of customization required, and we have the electrical products and services to create a fully integrated application. Electrical balance of plant covers electrical equipment and systems from pumps to grid connection, ensuring that the plant runs efficiently, safely, and reliably: Abb eBoP solutions include high-voltage substations, grid connections, medium-voltage systems, low-voltage systems, emergency systems, and facility management. Abb is a single source for design, engineering, supply, installation, commissioning, testing, and maintenance, reducing the cost of ownership.

**Instrumentation and Control (I&C)**
Abb distributed control systems (DCS) and PLC platforms provide an innovative, consistent, and comprehensive information management platform for desalination plants. The DCS handles all plant operations as well as information management (historian functions, archiving, reporting, performance calculations) and optional added-value applications, such as performance monitoring & optimization for different desalination technologies, Pump Efficiency Monitoring System (PEMS) and vibration monitoring.

Abb’s instrumentation portfolio includes flow, pressure, and level measurement, recorders, and quality analyzers.

Field devices, instrumentation, and control systems can be easily integrated to deliver complete plant automation solutions.

- Measurement, monitoring and control
- Energy management
- Extended asset life
- Engineering, installation, commissioning and maintenance
Reverse Osmosis: Performance Monitoring and Optimization

Membrane-based technologies such as reverse osmosis (RO) are increasingly used in desalination, water and wastewater treatment applications. Improved membrane designs contribute to decreased operational costs and thus drive the use of membrane technology. In order to achieve optimal operation, membrane units have to operate at the highest efficiency point to keep productivity levels and performance at their maximum.

One of the key operating problems in membrane-based systems is fouling and other types of membrane blockage. Fouling and blockage lead to a reduction in productivity and performance and potentially increases energy consumption since pumps need to operate at higher speed - where applicable - to compensate the production loss. In order to improve energy efficient operation of RO systems and to ensure maximum productivity, ABB has developed an online tool that supports:

- online performance monitoring by estimating current membrane fouling status, by predicting future membrane fouling status and by displaying the due date for next membrane chemical cleaning or flushing with product water,
- optimization of RO process operation by not only displaying the current optimal process conditions (flow and pressure set-points) but also predicting future optimal process conditions,
- simulation of the RO process by running what-if scenarios, capturing the fouling phenomena; therefore, it uses optimizer results, forming a key element to achieve optimal operation of RO systems.

Hybrid Desalination: Performance Monitoring and Optimization

In combined water and power projects, hybrid desalination is a solution in which two or more different desalination technologies are used (e.g. MSF and RO) in the same plant, allowing multiple possibilities of optimization, especially in the area of fuel conservation and efficient use of thermal and electrical energy. The challenge lies in large range of operation possibilities, which exist in short term and long term operation planning. ABB solutions allow economical optimization and address load scheduling, hybrid optimization, MSF Optimization, process optimization, or work process optimization.

Pump Efficiency Monitoring System

The Pump Efficiency Monitoring System (PEMS) provides rapid and detailed real-time information on pump efficiency. Based on a thermodynamic measuring method using ABB patented components, this solution calculates pump efficiency by processing water temperatures, pressures, and the motor power associated with each pump. Customers are able to monitor the status of their assets and improve maintenance activities.

- Performance monitoring
- Performance optimization
- Water management
- Pump efficiency
From Challenge to Projects

**Algeria:**
the world’s largest RO seawater desalination plant
(500,000 m³/day)
The Magtaa reverse osmosis desalination plant is being constructed in the western Oran region of Algeria. It will have a designed capacity of 500,000 m³/day of drinking water to serve about 5 million people. As part of the contract, ABB will be responsible for the design, engineering, supply, installation, commissioning of the electrical plant system, including a 220 kV outdoor substation that will connect the facility to the Algerian power grid and ensure that the plant receives a reliable supply of electricity without impacting grid stability. The solution includes 33 medium voltage drives that will reduce plant electrical losses from the benchmark target of 5 percent to only 3 percent. In addition the drives will speed up the long plant startup process after maintenance or power-failure related shutdowns, reducing the length of plant downtime compared with the more traditional method of mechanical control.

**Australia:**
Gold Coast 125,000 m³/day RO desalination plant
The customer, GCD Alliance, selected the ABB solution for the Tugun desalination plant on the Queensland Gold Coast, the first large-scale desalination project along the entire Australian eastern seaboard. Tugun will provide 125,000 m³/day which represents more than 15 percent of the entire south-east’s current needs and is sufficient to meet the water needs of at least 400,000 people. ABB was awarded the contract to supply motors and drives and was selected for best compliance with a diverse and demanding range of specifications and requirements that included lowest operating costs and fastest delivery.
From Challenge to Projects

**United Arab Emirates:**
**Fujairah combined water and power plant**
Fujairah Water and Power Plant is located approximately 5 km South of Khor Fakkan and 20 km North of the city of Fujairah, in the Gulf of Oman and is a hybrid plant which consist of a power section based on 4 Gas Turbines (106 MW each) with associated HRSG's (Heat recovery steam generators) and 2 Steam Turbines (119 MW each) and of a water section based on 5 MSF (Multi-Stage Flash) modules (57,000 m$^3$/day) and 1 Reverse Osmosis Plant (2 stages, 170,000 m$^3$/day). In total, the plant has a capacity of about 660 MW gross and 450,000 m$^3$/day at 46°C ambient temperature. ABB was selected to deliver an advanced on-line performance monitoring and optimization system covering load scheduling, hybrid optimization, MSF optimization, process optimization, work process optimization. After the implementation of the solution, more than 4% of the total fuel consumption was saved. Additional savings were realized in work process optimization.

**Kingdom of Saudi Arabia:**
**Yanbu Desalination Unit No. R.O.-1**
The reverse osmosis desalination Plant No. R.O.-1 in Yanbu, consisting of 6 trains with high pressure pumps, has increased the installed desalination capacity in this area by 50,400 m$^3$/day to a total of approximately 146,000 m$^3$/day. The complete desalination plant was awarded by the Royal Commission of Jubail and Yanbu to the Saudi company SBG-PCM which subcontracted the electrical and control systems to ABB. The scope of supply included Medium and Low Voltage Switchgears, Motor control centers, Transformers, UPS, DC-System, Distributed Control System, Plant Operation Training Simulator.