

# Fisia leading seawater desalination megaprojects

20 million people in the Middle East are served by Fisia's desalination plants

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*RO Building SHUAIBAH 3 EXPANSION II (Fisia Italimpianti & Abengoa)*

**F**isia Italimpianti is part of Webuild, formerly known as Salini Impregilo. Webuild Group is a global construction player specialized in building large works and complex infrastructure for the sustainable mobility, hydroelectric energy, water, green buildings and the tunneling sectors. Webuild Group is present in all 5 continents with 70,000 direct and indirect Employees. With three closely integrated business areas, Fisia Italimpianti is a leading EPC Contractor for water resource management projects, that helps provide clean, safe water to millions of people in regions with limited access to it. "Fisia Italimpianti is a leading EPC Contractor for water resource management projects, today part of Webuild,

formerly known as Salini Impregilo, a global construction player specialized in building large works and complex infrastructure globally for the sustainable mobility, hydroelectric energy, water, green buildings and the tunneling sectors

In particular for the Desalination business area 4,400,000 m<sup>3</sup>/day (1,000 MIGD) is the total desalination production capacity of plants built to date, mostly in the Middle East with 20,000,000 people served by our desalination plants.

Headquartered in Genoa, Fisia Italimpianti has operations and projects spanning across the Middle East, Europe, Africa and the Americas.

The table reports the Fisia Italimpianti acquisitions in desalination fields over the last seven years:

Plant name	Location	Field	Capacity	Developer / Owner	Commercial Ops Start date
<b>DAKHLA</b>	MOROCCO	Desalination RO	89.101/111.376 m <sup>3</sup> /d	Engie/Nareva	AWARDED IN 2021
<b>GHUBRAH 3 IWP</b>	OMAN	Desalination RO	300.000 m <sup>3</sup> /d	Oman Power & Water Procurement (OPWP)	ONGOING
<b>SALALAH</b>	OMAN	Desalination RO	113.500 m <sup>3</sup> /d	Dhofar Desalination Company SAOC	2021
<b>SHUAIBAH 3 EXPANSION II</b>	KSA	Desalination RO	250.000 m <sup>3</sup> /d	Shuaibah Two Water Development Project Company	2019
<b>MIRFA</b>	UAE	Remineralization Plant	235.000 m <sup>3</sup> /d	MIPCO	2017
<b>TAKREER</b>	UAE	Desalination MSF	16.800 m <sup>3</sup> /d	SAMSUNG	2015

We give a brief description and report the main technical details about two recent plants now in operation, after having terminated the commissioning and the warranty period: Shuaibah 3 Expansion II, and Salalah projects.

## Shuaibah Expansion II Project

Seawater reverse osmosis desalination plant with a capacity of 250,000 m<sup>3</sup>/d of potable water output, designed by the consortium between Abeima & Fisia for Shuaibah 2 Water Development Project Co. (STPC), located and constructed in Shuaibah, 120 Km to the South of Jeddah, inside existing SWCC premises.

The Seawater Reverse Osmosis plant includes the following main process facilities:

- Seawater intake;
- Effluent outfall;
- Pre-Treatment system;
- SWRO system;
- Post treatment system;
- Product water pumping station
- Waste water treatment system;
- Instrument and service air system;
- Fire protection and detection system;
- Ventilation and air conditioning;
- General buildings;
- Emergency Diesel Generator;
- Control system through plant DCS (Distributed Control System)

The desalination plant built by Abeima and Fisia has been designed in order to comply with the water output requirements and to ensure the required availability of potable water. The design of the plant and the related buildings have been developed focusing on the combination of operational suitability & plant availability, optimization of power consumption and energy efficiency in order to minimize the cost per cubic meter of desalted water, minimization of the environmental and visual impact, ensuring the maximum flexibility in operation by implementing optimal automation processes.

As brief summary of the processes and equipment included within the scope is listed hereinafter:

- Intake system, comprising the Intake Basin along with the screening channels and the seawater feed pumps, the raw water intake pipeline, the Intake risers (towers) and the chlorination injection system for treating the raw water at the intake risers.
- Pre-treatment system, comprising the multimedia gravity filters and the required coagulant dosing system.
- Intermediate system, comprising the filtered water tank, the intermediate pump station and the centralized chemical storage area for all chemicals used.
- SWRO system, comprising the cartridge filters, the RO membrane trains, the High-Pressure pumps, the Energy Recovery devices, along with the ERD Booster pumps and Sodium Hydroxide,



*North West side panorama of Desalination plant in Shuaibah, Saudi Arabia (Fisia Italmimpianti & Abengoa)*

Sodium metabisulphite, Anti-scalant (1st pass) and Anti-scalant (2nd pass) dosing systems.

- RO CIP and CIP neutralization system, comprising the CIP/Neutralization tanks, the Flushing tank, the CIP/flushing pumps, the Cartridge filters, the Chemical preparation tank & loading pumps, the Sodium hydroxide and the Sulfuric acid dosing systems.
- Post treatment system, comprising the CO<sub>2</sub> generation system, the Lime preparation and dosing system for re-mineralization, and the NaOH dosing system, for pH final adjustment.
- Product water pumping Facilities comprising the Remineralized water tanks, the product water pumps, the potable water connection pipeline and the disinfection dosing system.
- Waste water treatment systems, comprising the backwash waste water basin, the clarifier feed pumps, the coagulation/flocculation chambers along with the required mixing devices, the lamellar settling decanter, the sludge homogenization tank, the dewatering centrifuge decanters along with the feed and sludge pumps and chemical stations and the dewatered sludge storage silo.
- Effluent outfall collectors, comprising the outfall chamber and one pipe with diffusers until the off-shore waste discharge point.

Additionally, to the described processes and equipment, the following connections are part of the project scope: Firefighting system, Air conditioning and ventilation system, Ancillary systems.

## Salalah Project

With a Guaranteed Contracted Water Capacity (GCWC) of 113,650 m<sup>3</sup>/d, and Total Contracted Water Capacity (TCWC) of 120,000 m<sup>3</sup>/d potable water output, the Salalah IWP project is designed by the consortium between Abeima & Fisia for Dhofar Desalination Company SAOC (DDC), located and constructed in the south of Oman, at the Salalah area, approximately 40 km east from Salalah.

The proposed SWRO plant includes the following main facilities:

- Seawater intake
- Pre-treatment system
- SWRO system
- Post treatment system
- Waste water treatment system
- Effluent outfall
- Instrument and service air system
- Fire protection and detection system
- Ventilation and air conditioning
- Emergency Diesel Generator
- Control system through plant DCS (Distributed Control System)

Salalah desalination plant has been designed to comply with the water output requirements and to ensure the required availability of potable water. The design of the plant and the related buildings have been developed focusing on the combination of operational suitability & plant availability, optimization of power consumption and energy efficiency and minimization of the environmental and visual impact.

*Main Electrical room  
SALALAH IWP (Fisia  
Italimpianti &  
Abengoa)*





*RO rack arrangement  
SALALAH IWP  
(Fisia Italmimpianti &  
Abengoa)*

The seawater quality and the effluent discharge have been considered in the design and dimensioning of the desalination plant, with the aim of complying with the technical and operational expectations and requirements. In summary, the design criteria aim to achieve the following objectives:

- Ensure the guaranteed water capacity, availability and quality as required, maximizing the availability of the plant and its components.
- Optimize the energy consumption; in order to minimize the cost per cubic meter of desalted water.
- Design the plant in a comprehensive approach which considers the operation and maintenance period and the whole life of the project, minimizing operation and maintenance costs.
- Optimize the quality of the installed equipment with the best and most reliable suppliers and technologies, paying special attention in reducing the noise and vibrations levels.
- Optimize the layout of the plant to ensure a proper accessibility to equipment for a correct operation and maintenance, considering the topographical and geotechnical characteristics of the site and the logical sequence of the treatment
- Ensure the maximum flexibility in operation by implementing optimal automation processes;
- Minimize the environmental and visual impact during plant execution and operation in order to fully integrate them in the site.
- Maximize the safety of the plant operation.



The scope of the Project includes the engineering, procurement, construction and startup of a desalination facilities based on seawater reverse osmosis technology.

*Dissolved Air  
Flotation system  
SALALAH IWP  
(Fisia Italmimpianti &  
Abengoa)*

As brief summary of the processes and equipment included within the scope is listed hereinafter:

- Intake system, comprising the Intake basin along with the screening channels and the seawater feed pumps, the raw water intake pipeline, the Intake risers (towers) and the disinfection system for at the intake risers and the intake basin.
- Pre-treatment system, comprising the DAF system, the multimedia gravity filters, the multimedia pressurized filters and the required coagulant and flocculant dosing system.

- Intermediate system, comprising the filtered water tank, the intermediate pump station.
- SWRO system, comprising the cartridge filters, the RO membrane trains, the high Pressure pumps, the Energy recovery devices, along with the ERD Booster pumps and sodium metabisulphite and anti-scalant dosing systems.
- RO CIP comprising the CIP tanks, the Flushing tank, the CIP/flushing pumps, the Cartridge filter, the Chemical preparation tank & Transfer pumps.
- Post treatment system, comprising the CO<sub>2</sub> storage and dosing system and the Limestone filters for re-mineralization, and final chemical dosing with caustic soda for pH adjustment, sodium hypochlorite for disinfection and sodium fluoride.
- Waste water treatment systems, the backwash waste water basin, the clarifier feed pumps, the coagulation/flocculation chambers along with the required mixing devices and chemical dosings, the lamellar settling decanter, the sludge thickener, the sludge homogenization tank, the dewatering centrifuge decanters along with the feed pumps and chemical dosing.
- Effluent outfall collectors, the outfall chamber and two pipes with diffusers until the off-shore waste discharge point.

Again, additional facilities included in the project scope are: firefighting system, air conditioning and ventilation system and other ancillary systems.



## Alberto Zecchin

Alberto Zecchin has graduated in Chemical Engineering at the University of Padua in 2003. In 2005/2006 he attended the second level international Master course on "Innovative membrane technologies & conventional processes for waste and drinking water treatment" organized by the University of Genoa.

Following an earlier employment in various companies as water and industrial wastewater treatment plant designer and commissioning engineer, he entered Fisia Italimpianti S.p.A. in 2000 and he specialized in desalination technologies.

He worked for Saipem between 2012 and 2015 on Oil & Gas Front End Engineering and execution projects on water and wastewater treatment, and in 2016 he

supported the Qatari RasGas company (today Qatargas) as an independent technical advisor for the TIPW project.

Since his return in Fisia Italimpianti in 2017 he took part to the design phase of seawater reverse osmosis projects of Shuaibah III Expansion II and Salalah as Deputy Process Manager. He assumed the role of Commissioning advisor for Mirfa revamping project and of Deputy Commissioning manager for Shuaibah III Expansion II. From 2019 he is the Process Manager for the bidding and execution phase of Ghubrah III project. Since 2020 he has taken on the role of Process Coordinator for all the Reverse Osmosis projects in Fisia Italimpianti.