



cadagua



Global Partnerships for SWRO & Energy Recovery Devices

**Al Ghubrah – P3 (50.4 MGD) &
Valdelentisco (36.3 MGD)
Case studies**



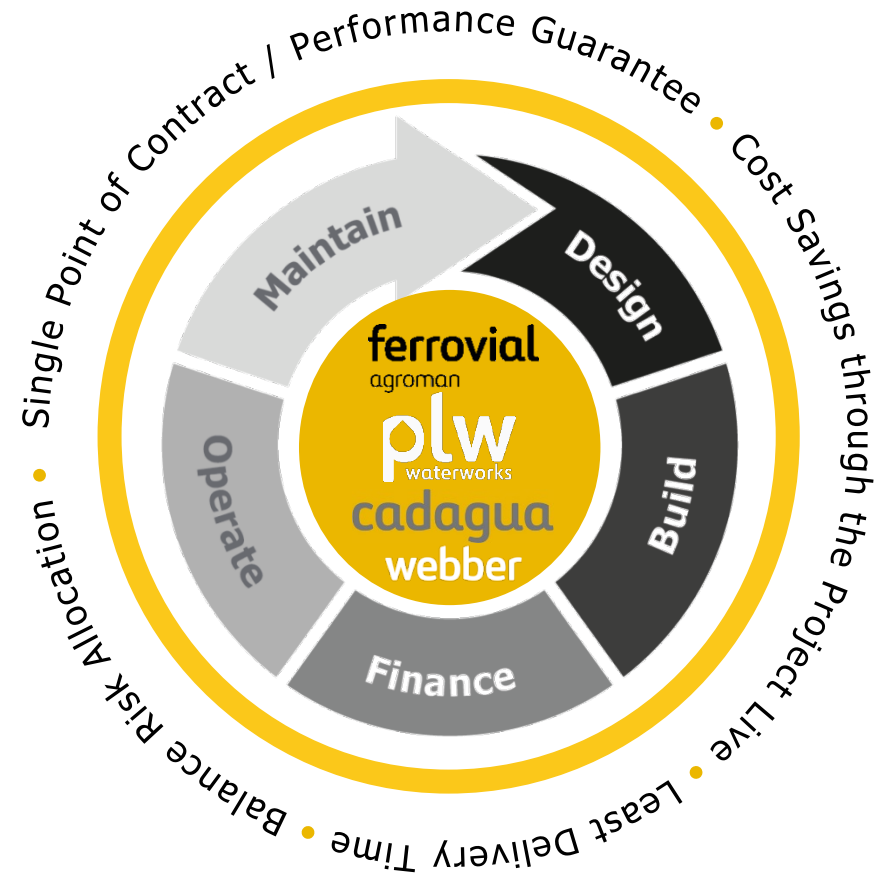
Javier Arrieta – Director of Engineering Cadagua

COMPANIES OF **ferrovial** GROUP

GROUP

ferrovial

- Since 1952
- Infrastructure leader (Services, Toll Roads, Construction, Airports, Water)
- 96,000 employees
- 15 countries
- Dow Jones Sustainability Index and FTSE4Good
- Revenue in 2016- 10,759M€



Customized and fully integrated service to guarantee our Client's satisfaction.



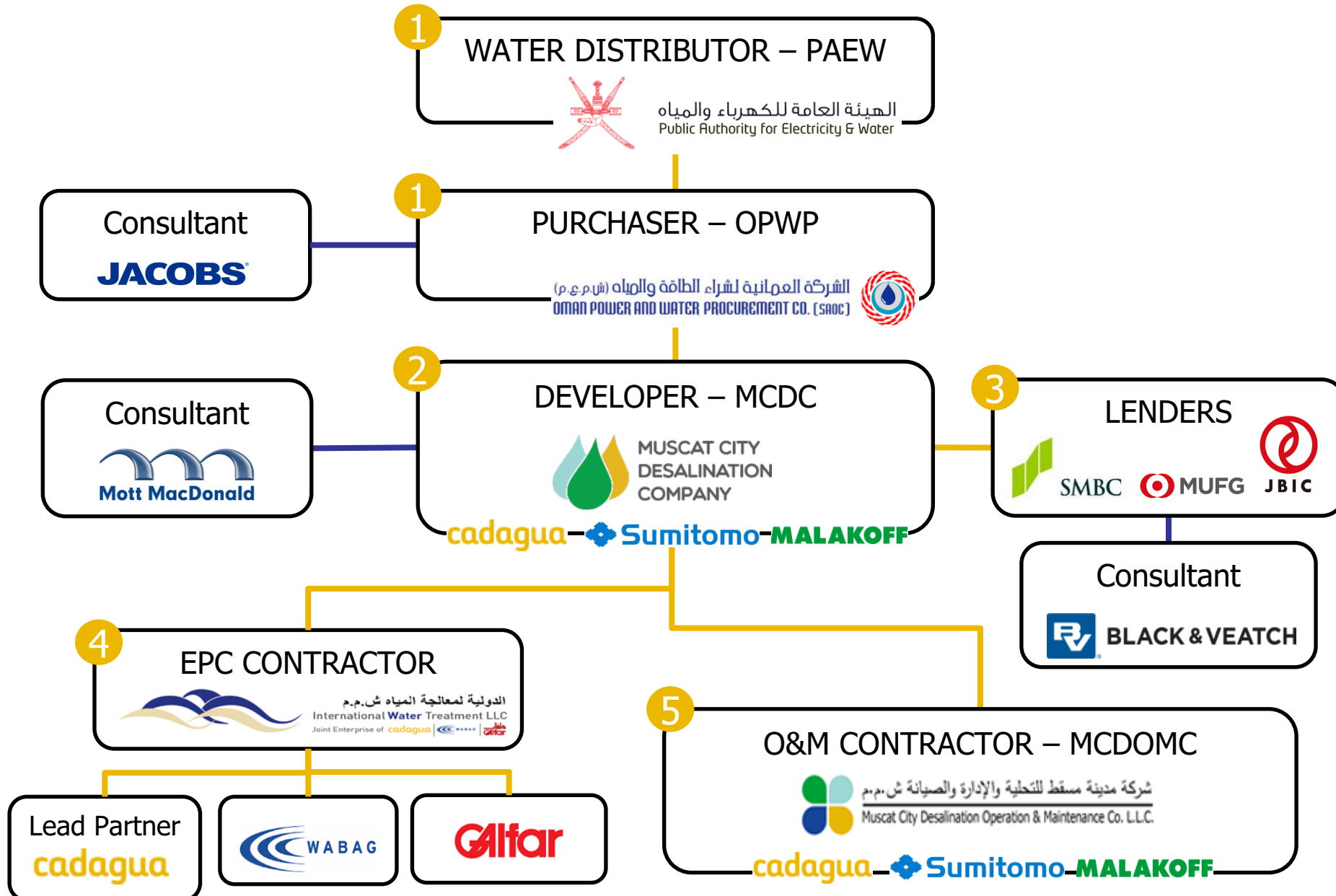


We produce 6.5 million m³/day of drinking water and we treat 9 million m³/day of sewage.

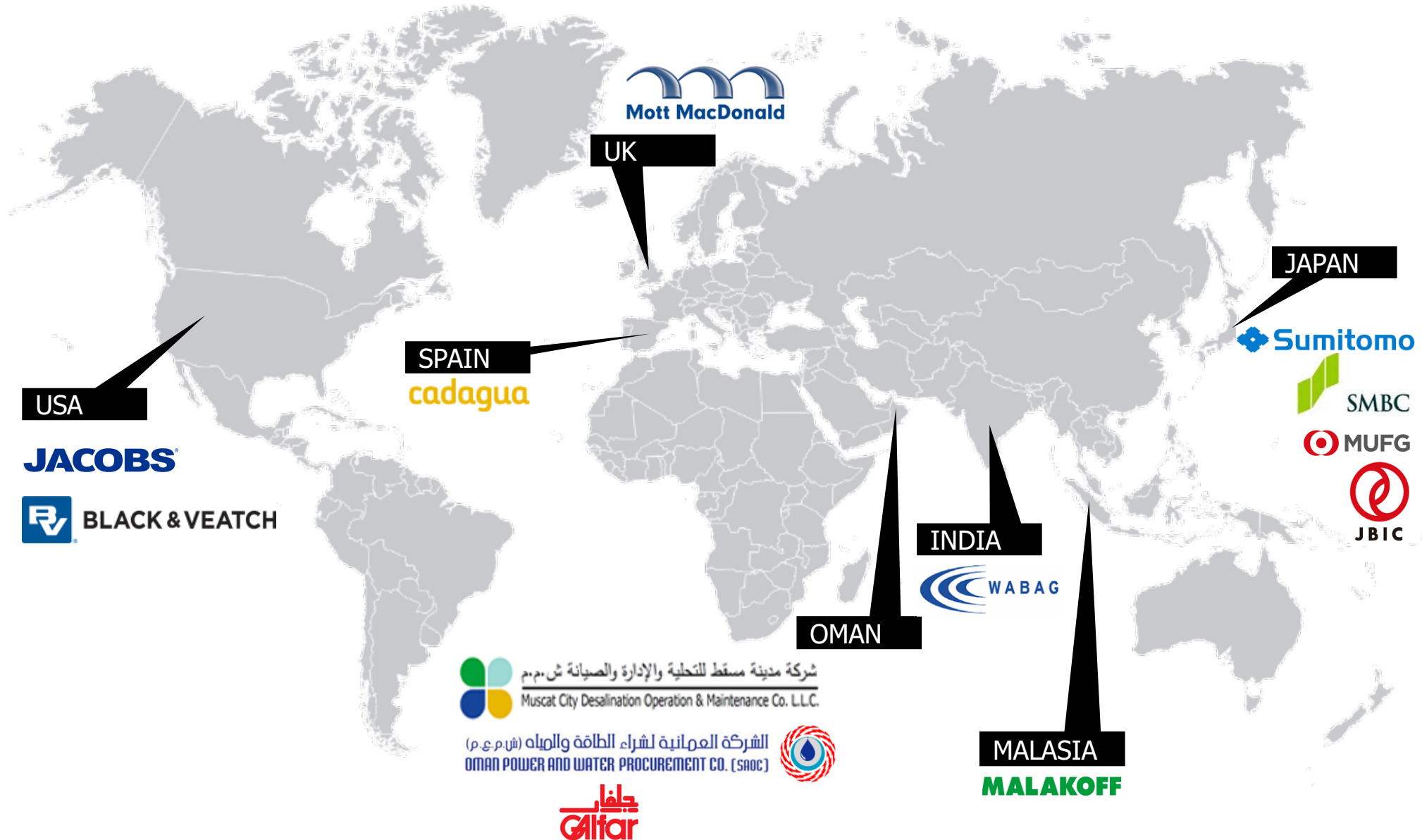
An aerial photograph of the Al Ghubrah industrial facility, showing various buildings, storage tanks, and piping. A semi-transparent blue trapezoidal shape is overlaid in the center, containing the text 'AL GHUBRAH' and '50 MGD' in white. The background shows the facility's proximity to a body of water and some surrounding urban areas.

AL GHUBRAH

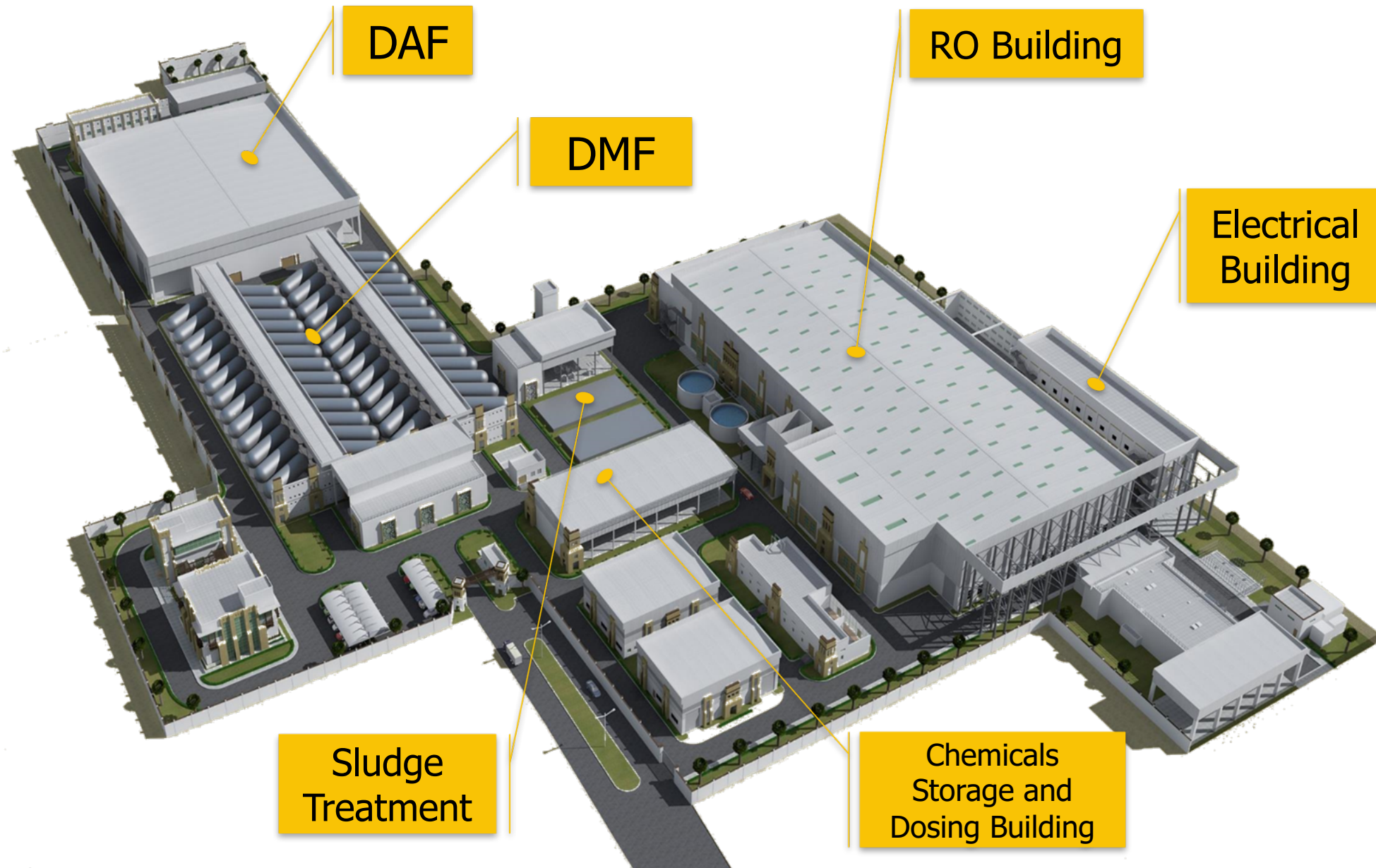
50 MGD



AL GHUBRAH IWP – A MULTINATIONAL, MULTICULTURAL SUCCESSFUL EXPERIENCE



AL GHUBRAH 50 MGD - MAIN PROCESSES



AL GHUBRAH 50 MGD - TIME AND SITE CONSTRAINTS



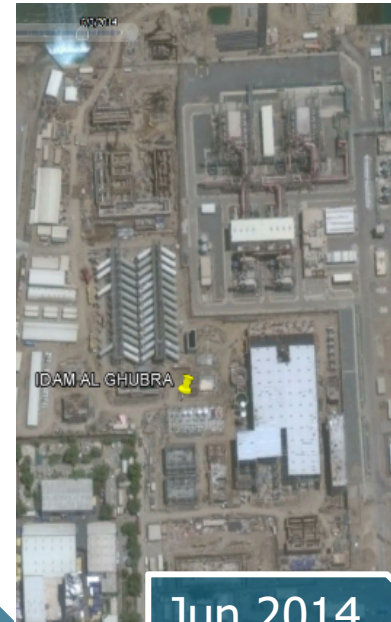
May 2013



Nov 2013



Feb 2014



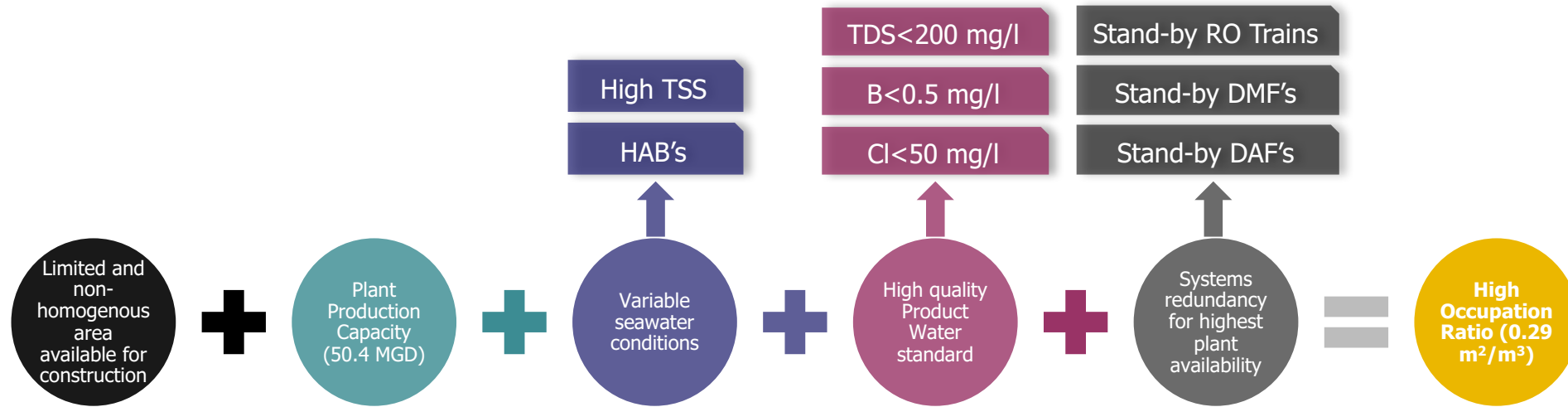
Jun 2014



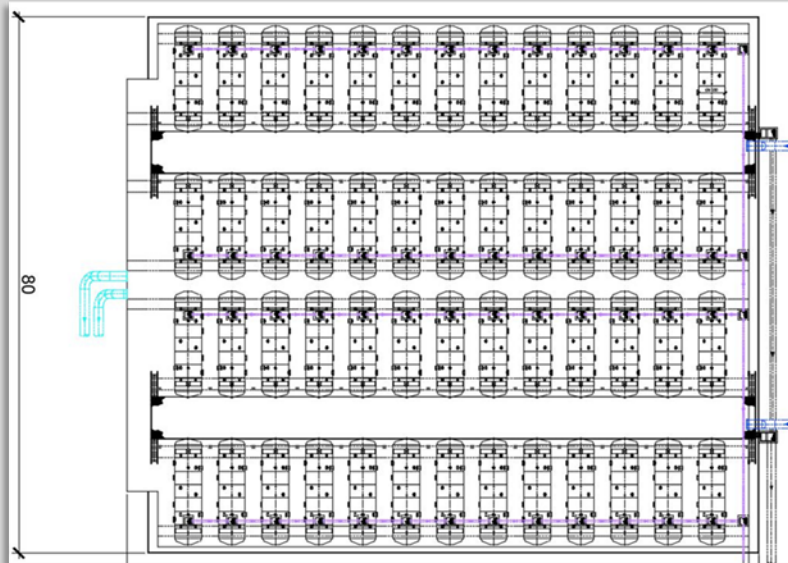
Dec 2014

Main Challenges

- Desert Climate
- Lack of skilled manpower
- Lack of qualified local suppliers and workshops
- Complex Lay-Out
- Other large ongoing infrastructure works (i.e. airport)

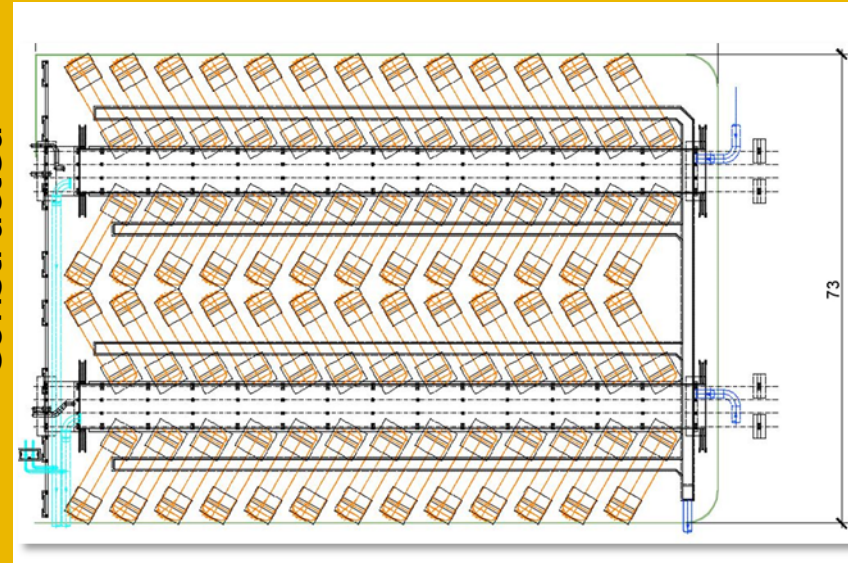


BIDDING STAGE



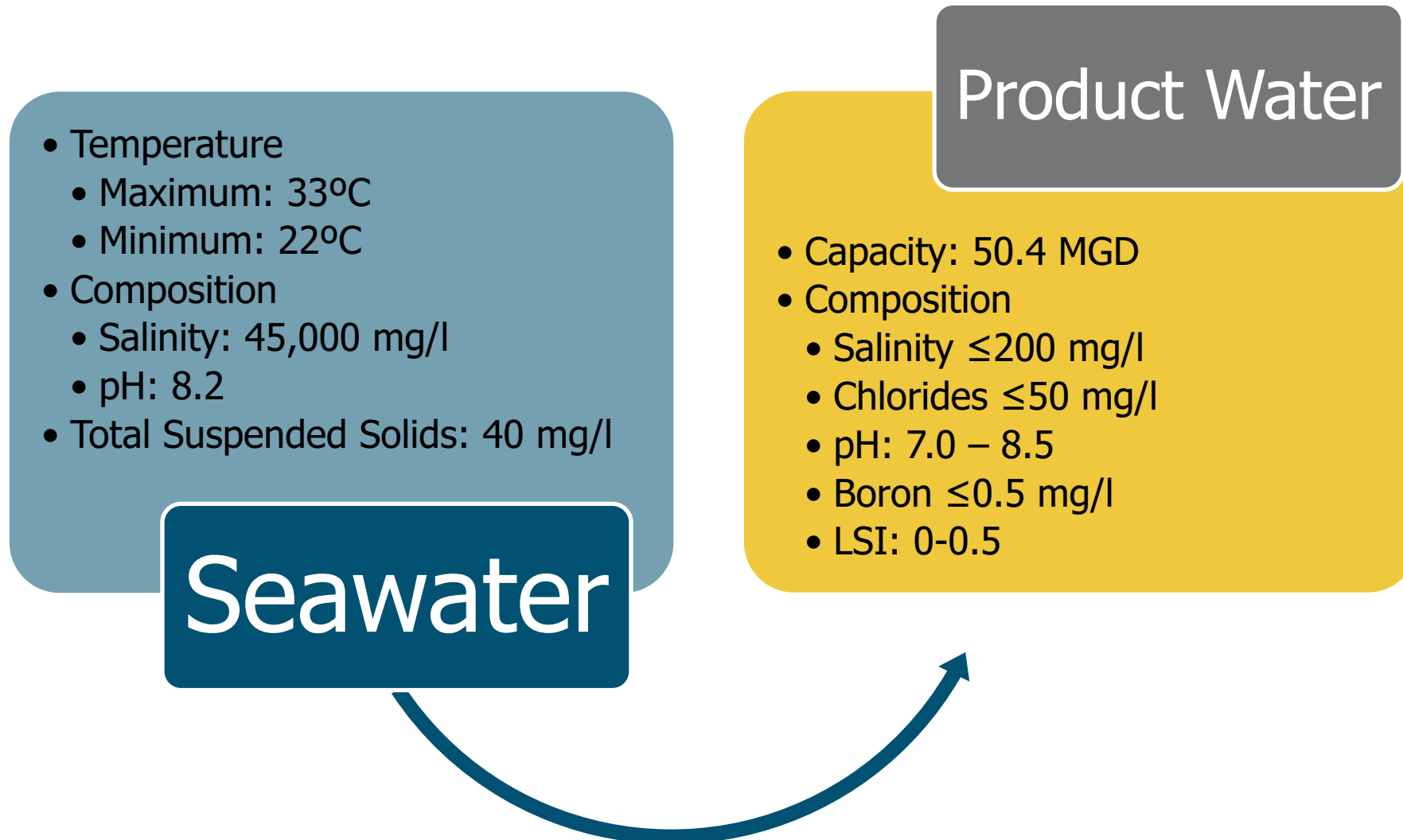
FINAL DESIGN

Constructed



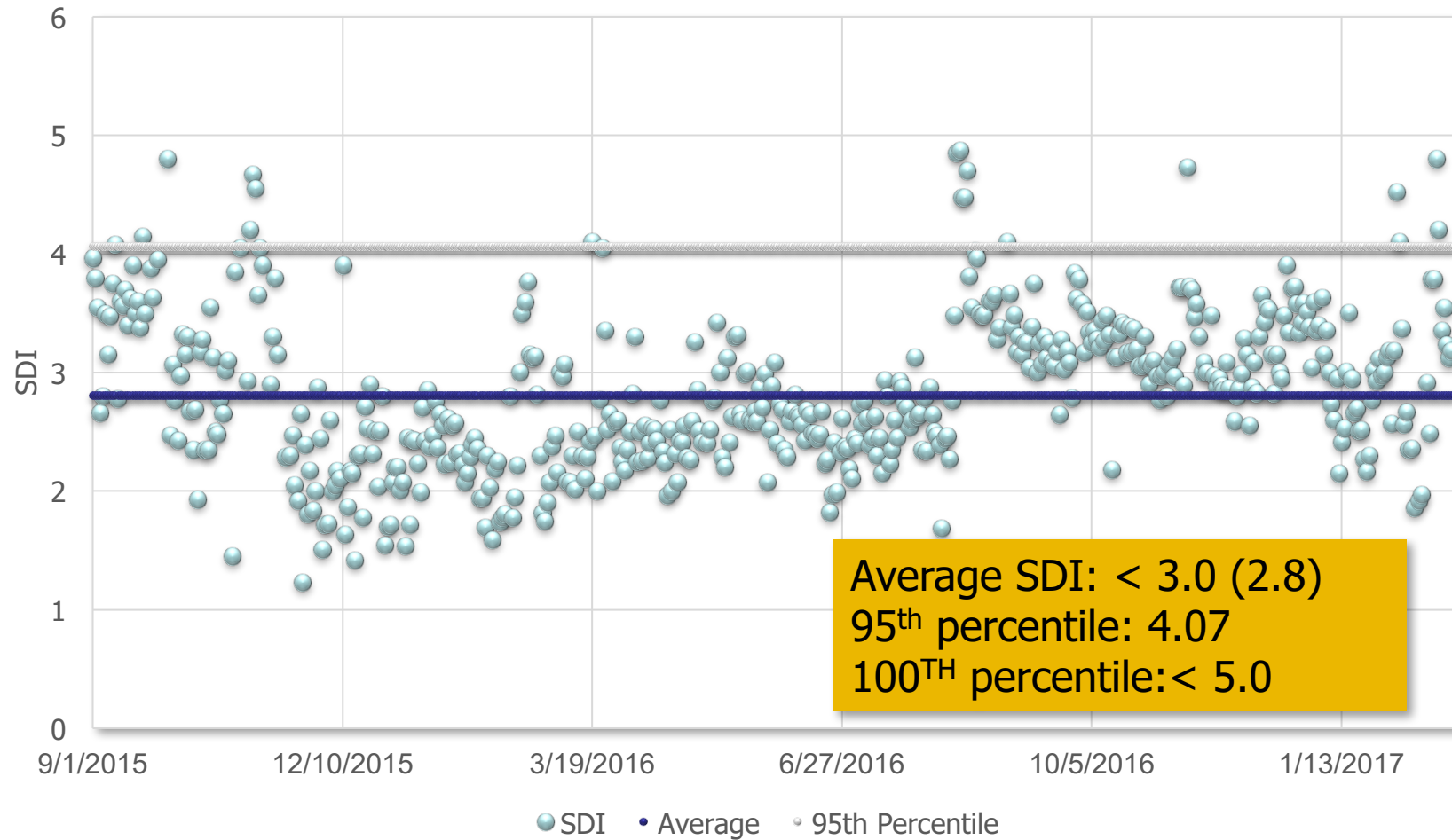
AL GHUBRAH 50 MGD



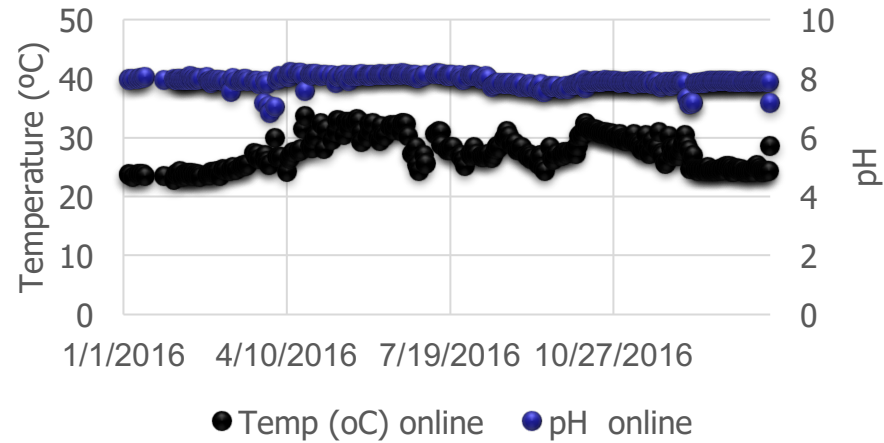


AL GHUBRAH 50 MGD 1st YEAR OF OPERATION

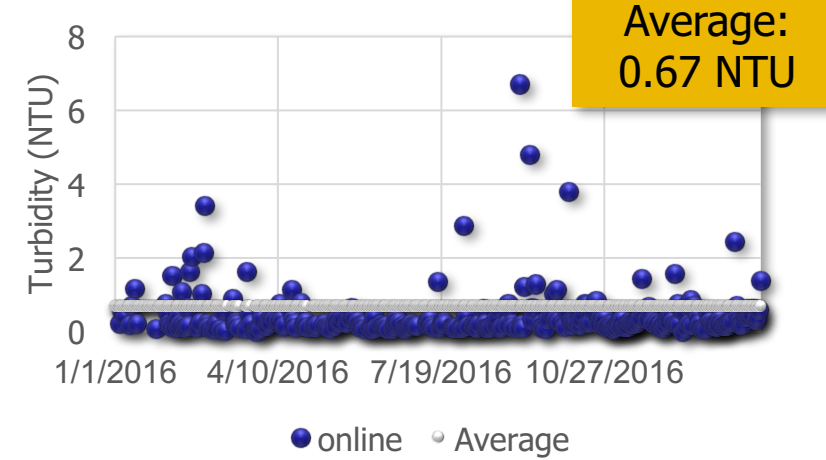
SDI - DMF Outlet



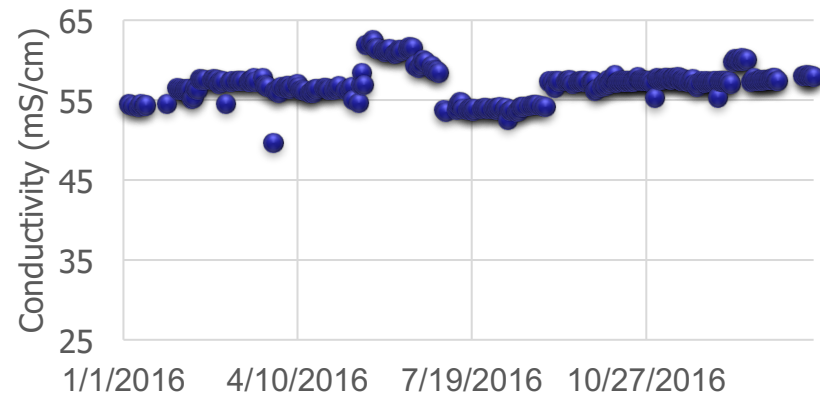
pH & Temperature



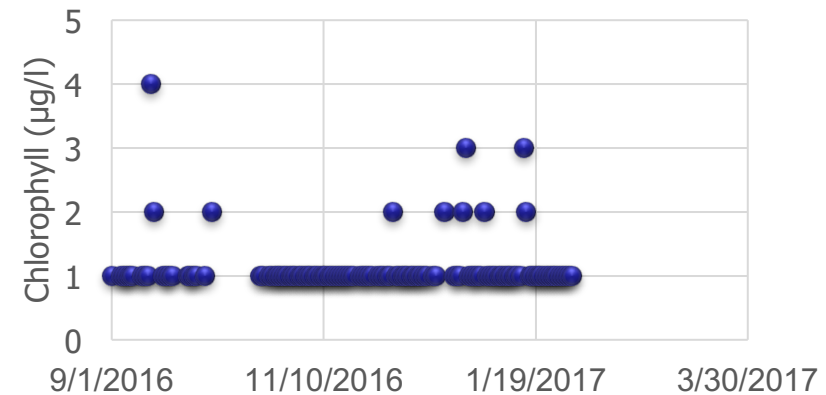
Turbidity



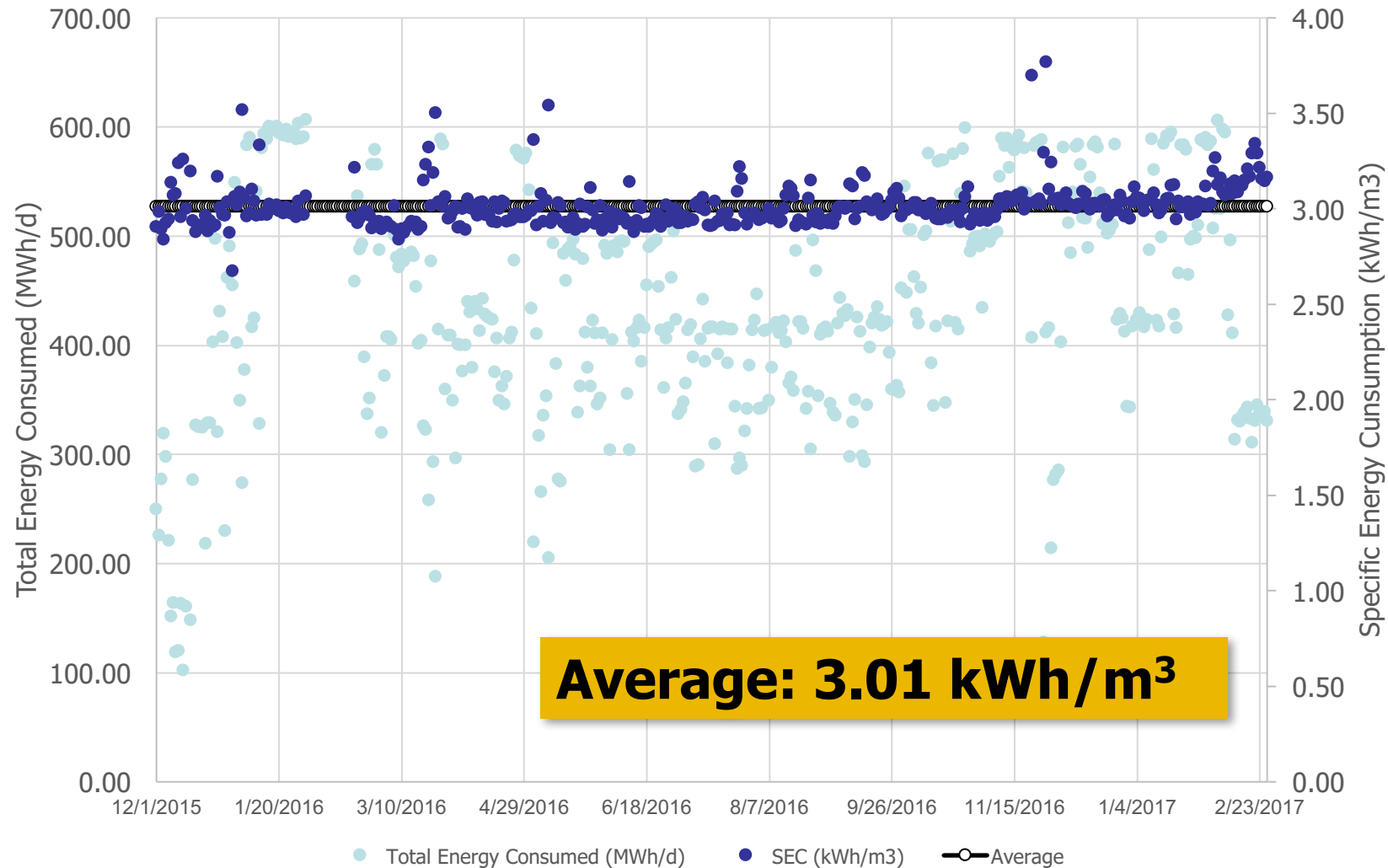
Conductivity



Chlorophyll



Specific Energy Consumption





16 t

VALDELENTISCO

36,3 MGD SWRO

VALDELENTISCO 36,3 MGD SWRO

Location: Cartagena. Murcia (Spain)

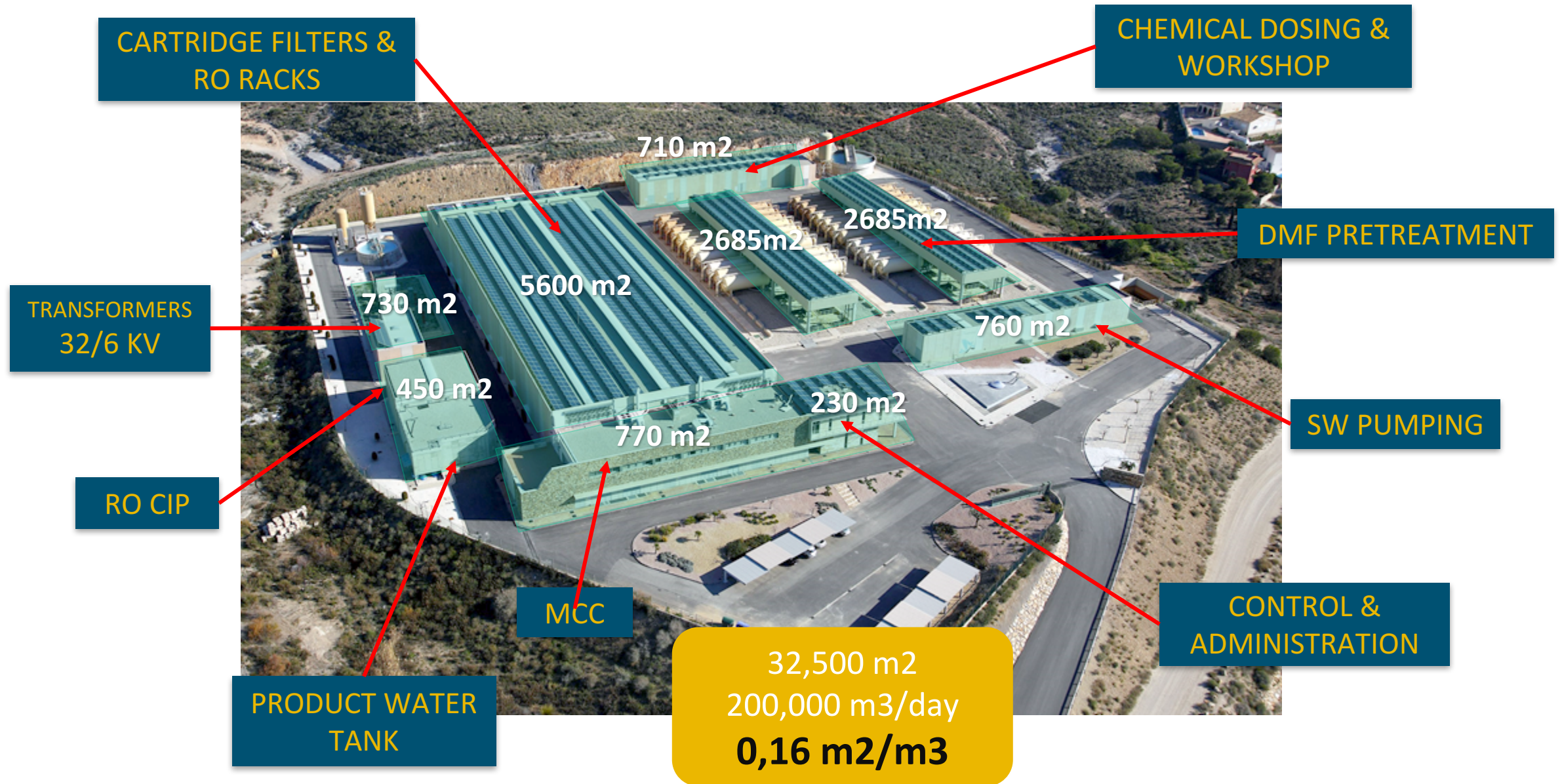
Type of contract: D&B + O&M

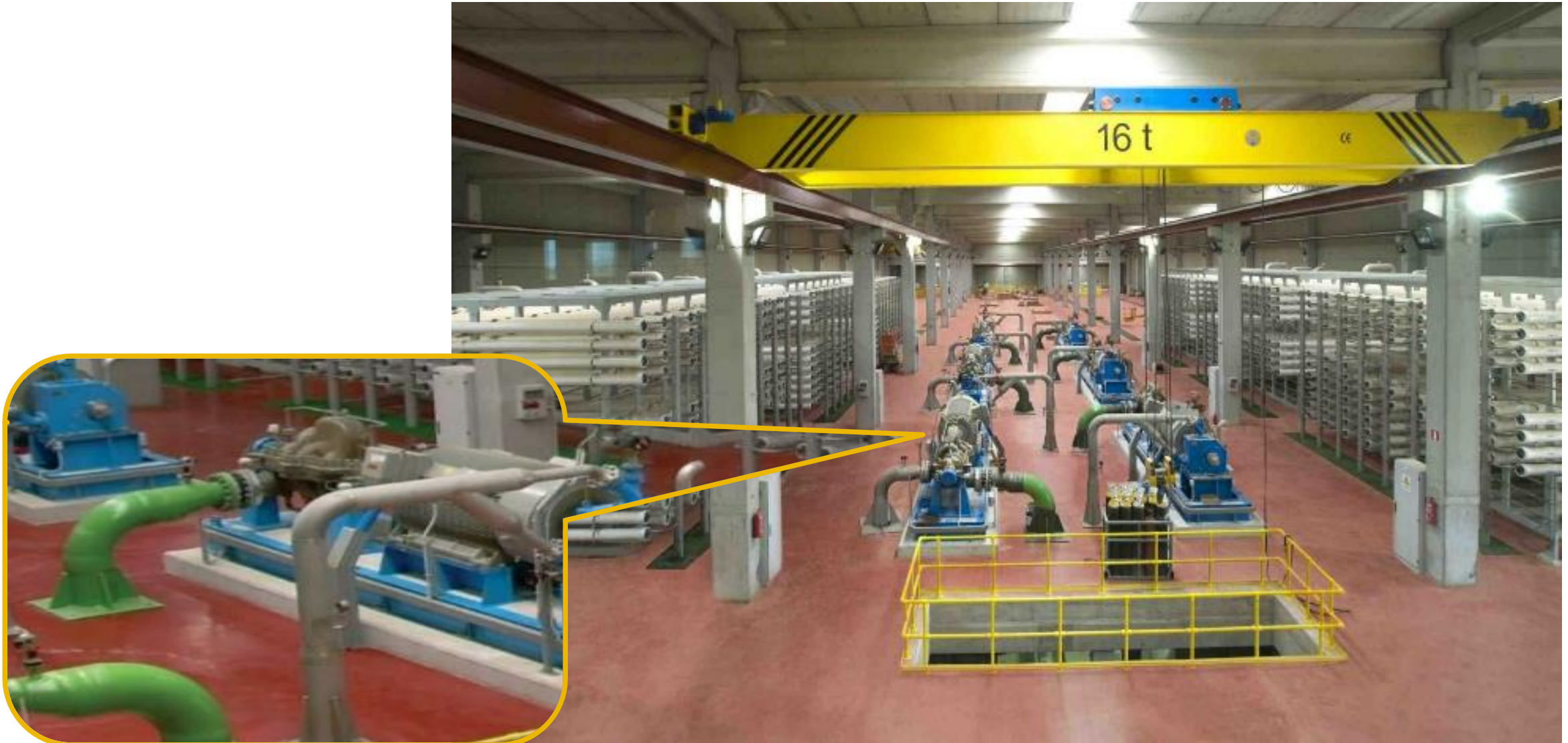
Capacity: Ultimate 200.000 m³/day (52,8MGD)

- Stage 1 (2007): 19,8 MGD
- Stage 2 (2009): 36,3 MGD
- Future: 52,83 MGD

Purpose: Drinking water and irrigation









Seawater pumping: 7+1R submersible pumps, 1,800 m³/h @ 45m, P Motor 355 kW.

SEAWATER RATIO: 0.37 kWh/m³ product water



Pretreatment Pumping: 11 centrifugal pumps with VFD, 1,030 m³/h, P Motor 250 kW.

PRETREATMENT RATIO: 0.35kWh/m³ product water



Reverse Osmosis: 11 Racks with 2stages, Recovery 50%. HP Pumps+PELTON 1,420 kW+Booster 315 kW. Production 515 m³/h

RO RATIO: 3.15 kWh/m³



Product water pumping: 4 pumps, 1,650 m³/h, P Motor 1,800 kW

PRODUCT WATER PUMPING RATIO: 1.01 kWh/m³



AUXILIARY SERVICES AND CHEMICAL DOSSING: 0.03 kWh/m³

VALDELENTISCO 36,3 MGD SWRO - TYPES OF ERD AVAILABLE



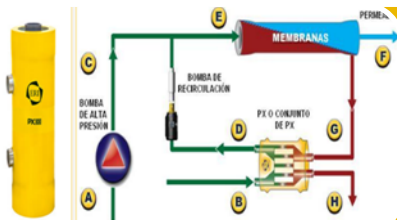
PELTON Turbines: Transform the RO reject pressure into kinetic energy by rotating the turbine blades, which are coupled to the HP pump and motor



Turbochargers: The brine enters the side of the turbine and rotates the turbine - booster pump shaft. The feed water receives the pressure transmitted by the shaft.



PISTON Type: DWEEER-Calder. It exchanges potential energy (pressure) with discs that move inside cylinders with the help of a set of valves which switches the currents in the cylinders.



ROTARY TYPE: PX-ERI. It exchanges the pressure in a rotor that rotates inside a cylinder, putting the two currents in contact (brine and sea water), without having any separating element nor piston between both currents.

VALDELENTISCO 36,3 MGD SWRO CHANGE PELTON BY ISOBARIC CHAMBERS

SWRO Plant High Operational Cost

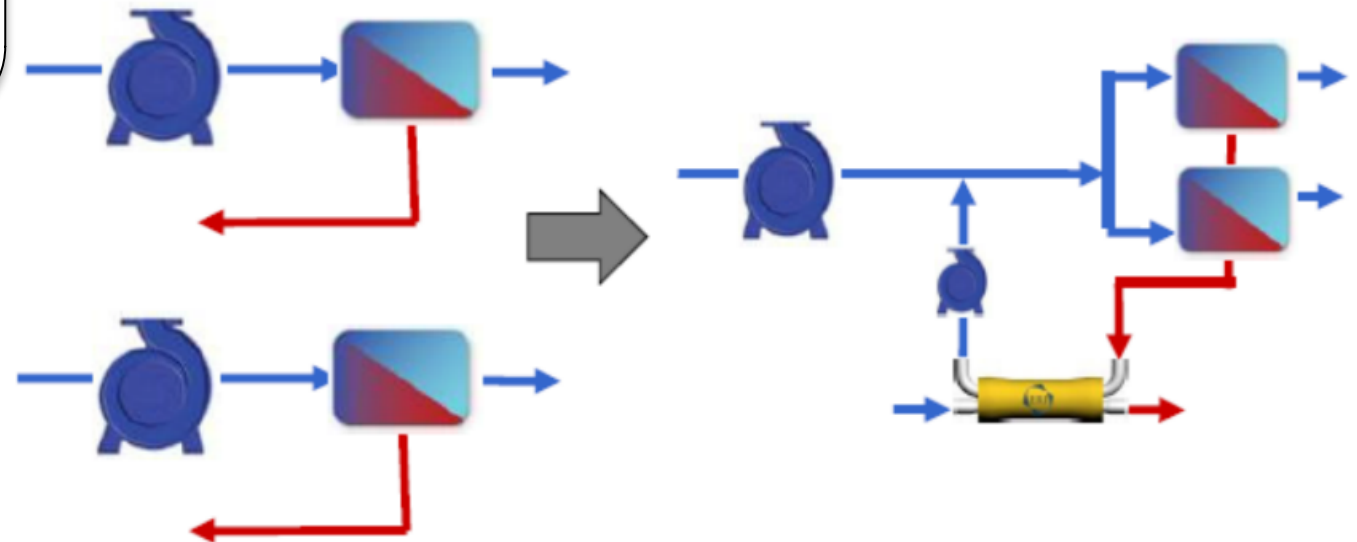
ENERGY



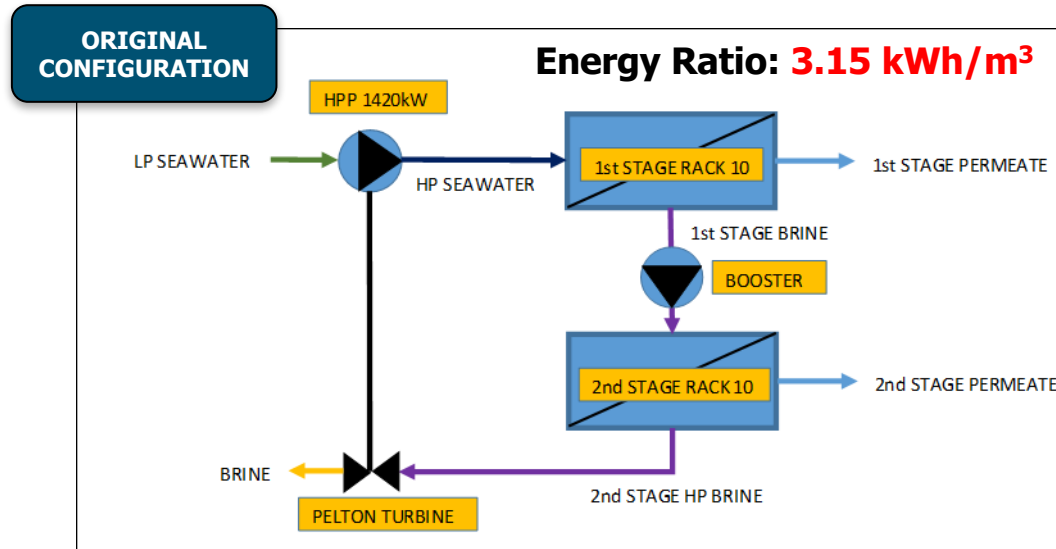
CLIENT

IMPROVEMENT

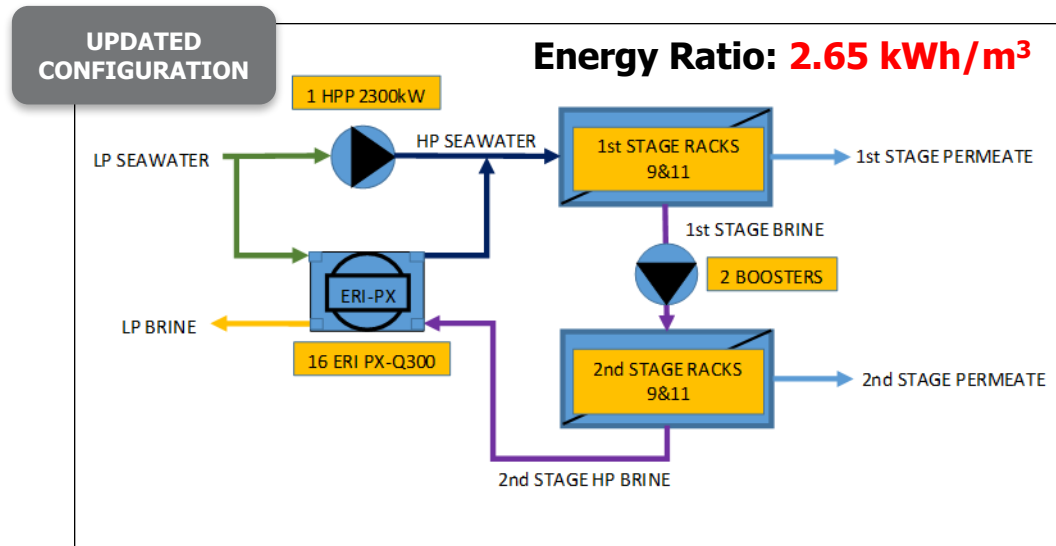
During our O&M contract 2012-2016 we proposed to our client the Replacement **without cost for our client** of 2 RO Racks with Pelton turbines by 1 single Rack with ERD from ERI.



VALDELENTISCO 36,3 MGD SWRO CHANGE PELTON TURBINE BY ISOBARIC CHAMBERS



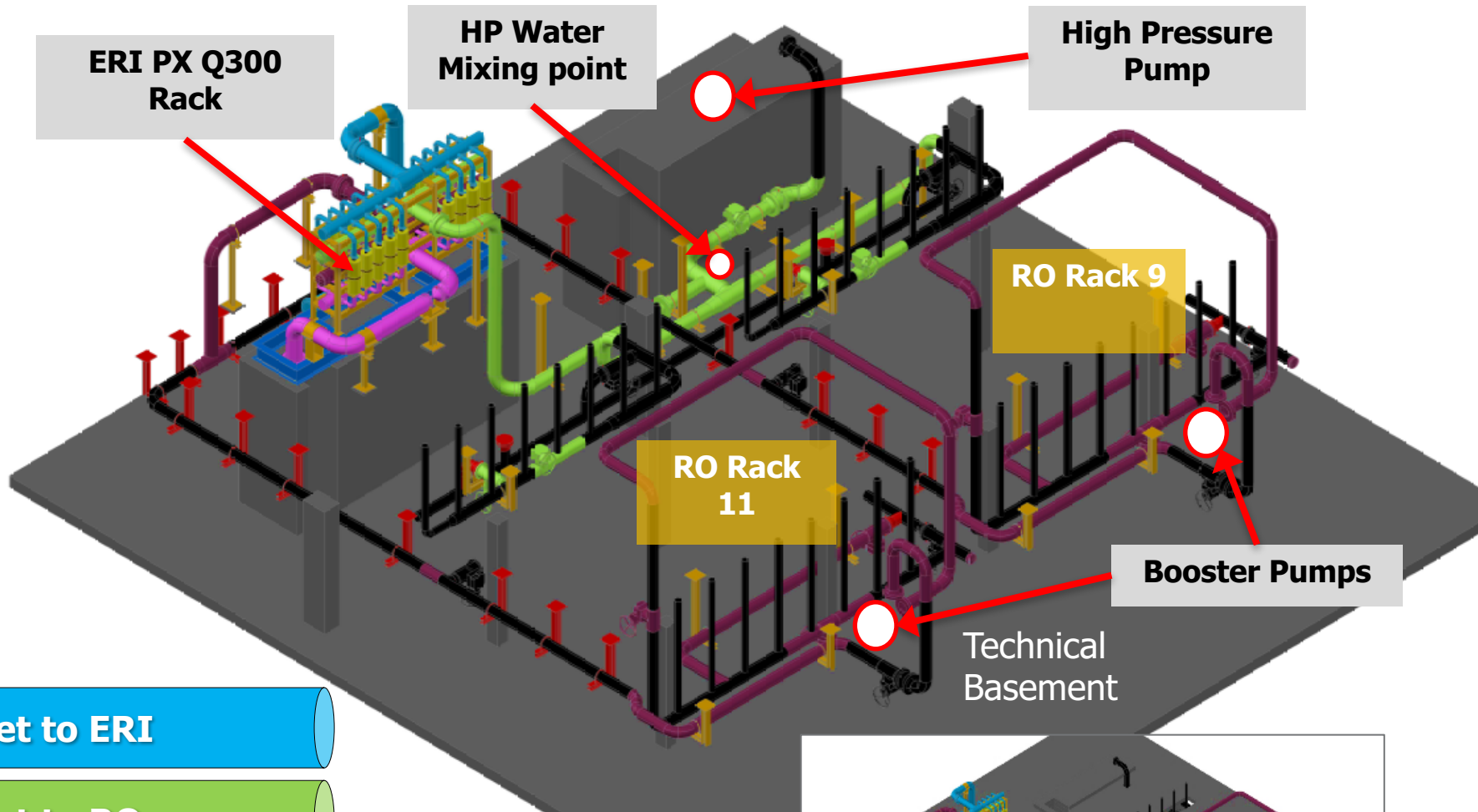
**HPP + Pelton
Turbine 1st Stage**



HPP1st Stage



ERIs 1st Stage

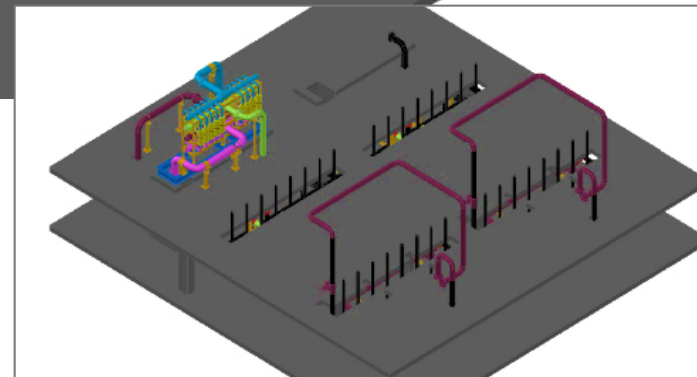


Seawater inlet to ERI

Seawater inlet to RO

Brine at HP

Brine at LP



VALDELENTISCO 36,3 MGD SWRO CHANGE PELTON TURBINE BY ISOBARIC CHAMBERS

Results and pay-back of the investment:

- SCENARIO 1: 11 Racks with Pelton.
- SCENARIO 2: 9 Racks with Pelton and 2 Racks with ERI

< 3 years

REAL DATA			SCENARIO 1		SCENARIO 2 (actual)	
	Production	Operation	Consumption		Consumption	
year	(m ³ /year)	(days)	(kWh/h)	(kWh/year)	(kWh/h)	(kWh/year)
2014	23,477,512	355	10,719	91,325.880	10,343	88,122,360
2015	28,964,242	333	14,098	112,671,216	13,704	109,522,368

**0.08
€/Kwh**

SAVINGS		
year	kWh/year	€
2014	3.203.520	256.282 €
2015	3.148.848	251.908 €
TOTAL	6.352.368	508.189 €

Why not do
it for the
complete
plant?



VALDELENTISCO 36,3 MGD SWRO CHANGE PELTON TURBINE BY ISOBARIC CHAMBERS

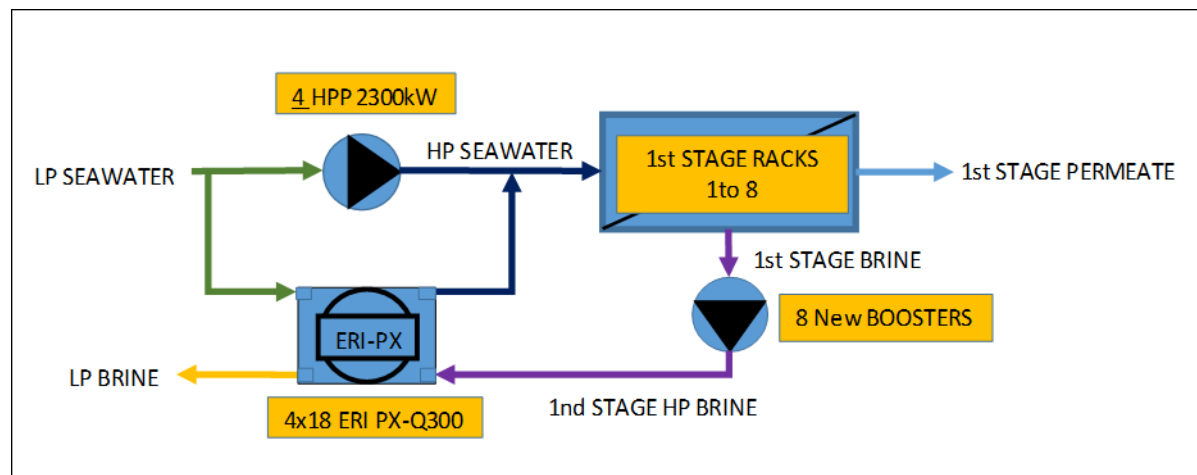
EXPECTED RESULTS AFTER THE UPGRADING

Each train:

- Two racks with 1 Stage configuration
- 1 HPP 950 m³/h, 650 mca and 2,300 kW
- 18 ERIs PX-Q300, 1,110 m³/h
- 2 booster pumps with VFDs 550 m³/h, 132 kW

		Consumption Savings	
Production		Per Rack	Tot.Acum.
year	(Hm ³)	(€/year)	(€/year)
2016	26,0	292.175	1.193.324
2017	28,0	320.175	2.498.648
2018	30,0	348.175	3.899.697
2019	32,0	375.787	5.372.745
2020	34,0	393.787	6.917.793
2021	36,0	411.787	8.534.842
2022	38,0	446.914	10.169.269

Final RO energy Ratio: 2.39 kWh/m³



**< 3.5
years**

Cadagua + Webber + Pepper Lawson = PLW Waterworks

An excellent blending of local and international knowledge to undertake any DB or PPP Desalination water project.

AL GHUBRAH SWRO

A successful example of a mega project performed in a multicultural and demanding environment.

VALDELENTISCO SWRO

An example of the added value we can bring as Plant Operators by implementing improvements aimed at maximizing energy efficiency.

THANK YOU



cadagua