



DESALINATION PROJECTS: LESSONS LEARNED AND EXPECTED PATH FORWARD - SAFBON

Shaleena Smith: Application Engineering Manager

Clovis Sarmento-Leite: LATAM Vice President, Sales & Marketing

ABOUT OUR PANELISTS

Shaleena Smith:



Shaleena Smith started her career in the water industry shortly after graduating from the Univerity of South Florida in 2006. She originally worked in research and development at Doosan Hydro Technology now SafBon Water Technology gaining hands on experience and working with pilot systems. During her time in R&D, she pursued her Master's degree in Civil and Environmental Engineering and graduated in 2011. She transitioned to a process engineering position in 2014 and was assigned the engineering manager for several water treatment related projects pertaining to seawater desalination, industrial wastewater as well as oil and gas applications. Ms. Smith is currently in charge of managing all aspects of the application engineering department since 2019. She currently focuses on industrial wastewater treatment - involving primarily polymeric filtration technologies including UF, BWRO, SWRO, MBR as well as ceramic membrane technologies. She has participated in the execution of projects / proposals for capacities ranging 0.5-40 MGD.



ABOUT OUR PANELISTS



Clovis Sarmento-Leite:



Clovis is a Chemical Engineer by UFRGS (Porto Alegre, Brazil), with Master's in Marketing by ESPM (Sao Paulo, Brazil) and an Executive MBA by Florida International University (Miami, FL). He is currently leading the expansion of an American based business, that belongs to a publicly traded Chinese organization in the field of water and wastewater treatment technologies. Leveraging strong process engineering capabilities based in the USA with Chinse procurement advantages and financing resources, the business is rapidly expanding on a global basis, mainly in Latin America and the so-called blue ocean markets. He has over 30 years of experience, having lived and worked in several countries, and his job resume includes functions with increased responsibilities in companies such as SUEZ, General Electric and Hercules. Clovis has held positions in Marketing, Business Development, Sales, Operations and General Management. Clovis spends most of his time traveling around the world to visit customers, partners and business associates. He is an active member of main organizations in his field of activities, namely the International Desalination Association (IDA), American Association of Membrane Technologies (AMTA) and ALADYR (Latin-American Association for Desalination and Water Reuse).

SAFBON GROUP (ORG STRUCTURE)







- Strong process engineering capabilities
- Global sourcing and manufacturing
- Continuous after sales services
- Financing arrangements available
- E&P / EPC / BOT models





SEAWATER DESALINATION FOOTPRINT





LESSONS LEARNED

- Innovation focused on reducing energy consumption
 - At what Capex could we drive Energy OpEx to <3.0 kwh/m3?
 - Energy recovery devices
 - From Pelton Wheel to Turbochargers to Pressure Exchangers
- Improving RO (reverse osmosis) membrane performance
 - Have we reached the optimal design?
 - Can we further reduce energy requirements and maintain permeate quality'
- Water scarcity has driven Desalination
 - Middle East
 - North Africa
 - Caribbean
 - South America: Chile, Peru, Mexico, Brazil, Central America...





TYPICAL DESAL PROCESS...TECHNOLOGY DRIVEN





DESALINATION TODAY...



- Practiced in over 150 countries
 - 300 million people rely on desalinated water, Expected CAGR = 7.8% (2018-2025)
- RO remains the dominant technology for desalination
 - Further improvements can drive water security and prosperity
- Increasing need for water: population growth and industrialization
 - Alternative water sources and its conservation, moving away from sea to inland brackish
 - Hydroponic agriculture driving adoption of desalination
 - Facing increased water temperature, salinity and contamination
- · Issues with political instability
 - Geopolitics becoming more relevant
 - Global volatility change is the only constant
 - How will affect long term contracts?



DIVING INTO LESSONS LEARNED....

ALADYR

CASE STUDY #1 CONTAINERIZED SYSTEMS







- Location: San Pedro , Ambergris Island, Belize
- Capacity: 310,000 GPD (430 GPM); 2 x 50% Trains
- Period: 2018-2019 | Startup: 2020
- Complete turn-key containerized design.
- Drinking water application

CASE STUDY #1 CONTAINERIZED SYSTEMS







CASE STUDY #1 LESSONS

• Engineering

- Weekly Client Meetings
- Managing sub-suppliers

Logistics

- Short delivery 7-8 months
- Customs clearance and client readiness
- Material availability Hydrotest pump, etc.
- Commissioning/Startup
 - End-user inexperience with RO
 - Water quality confirmation
 - Balance of Plant Equipment
 - COVID-19 impact
 - Remote startup/commissioning
 - Site challenges







CASE STUDY #2 SEAWATER DESALINATION





- **Owner:** Palestinian Water Authority (PWA)
- Location: Deir Al Balah,Gaza Strip (Palestinian Territory)
- Capacity: 0.94 MGD (3570 m3/d)
 - Periods: 2017 2019

Details:

Complete turn-key design and supply of all process equipment, piping etc. from beach wells to finished water storage tank.



Beach Wells and Raw water Pumps

CASE STUDY #2 SEAWATER DESALINATION





CASE STUDY #2 LESSONS



• Engineering

- Multiple Parties involved in approvals
- Procurement
 - Global sourcing restrictions
 - Specification compliance
- Logistics
 - Challenges and delay in delivery
 - Poor handling during shipment
 - Customs clearance









CASE STUDY #2 LESSONS



Commissioning/Startup

- Material Availability
- Water Availability
- Schedule Limitations
- Installation Issues
- Hydrotest Issues
- Process Design vs Operation





CASE STUDY #3 SEAWATER DESALINATION





- Owner/Client: Desalination Company of Trinidad and Tobago (Desalcott)
- Location: Point Lisas, Trinidad and Tobago

ALADYR



- Capacity:
 - One 1st pass two-stage SWRO train (G) 7.8MGD and Two 2nd pass two-stage
 - BWRO trains (G & H) 2x6 MGD)
 - One 1st pass two-stage SWRO train (H) 7.8MGD
 - One 2nd Pass 2-stage BWRO Train (I) 3 MGD
- RO Recovery: 60% SWRO | 94.5 % BWRO
- Periods: 2013 -2014 | 2015-2016 | 2020-2021
- Application: Drinking water

CASE STUDY #3 LESSONS



MODULAR SYSTEM

ALADYR



• SITE ASSEMBLY



CASE STUDY #3 LESSONS

- Engineering
 - Conventional Design
 - End-user Flexibility
- Procurement
 - Sub-supplier and sub-contractor management
 - End-user preferred suppliers
- Site Installation
 - Material Management and Storage
 - Some damage during shipment
 - Contractor experience with installation
 - Labor force available









CASE STUDY#4 MINING PROCESS WATER

- Location: Jahuay Beach, Peru (Minera Milpo)
- Capacity: Max cap 60 l/s (5180 m3/d) in total : [3 x 12l/s (Orig.); 1 x 12l/s (Exp.I); 1 x 12l/s (Exp.II)
- Period: 2006-2008 (Orig.) | 2011-2013 (Exp.I) | 2014-2016 (Exp.II)
- RO Recovery: 40%
- Application: Industrial WT for mining operations and potable water on site









CASE STUDY#4 MINING PROCESS WATER



- Phased Expansion
- Open Intake
- Algae Bloom events
- Turbidity 2-40 NTU
- Frequent cartridge replacements
- Frequent MMF BW cycles
- Alternative pretreatment options UF
- Containerized Option





CASE STUDY#5 LOW SULFATE WATER INJECTION

- Location: Saudi Arabia
- Capacity: 18.3 MGD
- Sulfate reduction: Inlet: 4400 ppm to Outlet: < 200 mg/L.
- Period: 2017 2020
- Application: Supply low sulfate water for injection into reservoir/wells.





SafBon Water Technology

CASE STUDY #5 LESSONS



- 2 MW HP Pump Skid design
- Factory pre-assembly



- High TDS Feed 54K mg/L
- High TDS Brine 100K mg/L
- High pressures > 1000 psi (~68 bar)
- Multiple operating/design parameters





CASE STUDY#5 LOW SULFATE WATER INJECTION





ALADYR



- Modular Design (120 MBD/5 MGD)
- Partial shop assembly

CASE STUDY #5 LESSONS



• Engineering

- Project Management vs. Operations
- Inexperienced Owner's Engineer
- Unconventional design criteria
- Material compatibility
- Engineering Management
- Procurement
 - Approved Vendors
 - Global Sourcing
 - Sub-supplier and sub-contractor management
- Logistics
 - Europe to Saudi Arabia Routes
 - Delivery to local shop/Partial Assembly

- Site Installation
 - Site Material Management and Storage
 - Contractor experience with water treatment equipment
 - Site limitations
- Commissioning/Startup
 - EPC coordination
 - Water availability
 - Operations vs Project Management
 - Water quality vs. Design Consideration
 - Site commissioning team
 - COVID-19 Working Remotely

CASE STUDY#6 WATER REUSE - REFINERY

Location: Karbala, Iraq Feed Flow: 12,672 m3/d Period: 2015 – Ongoing **Application:** Refinery WW Reuse



CASE STUDY #6 LESSONS



Engineering

- Joint Venture
- Engineering Management
- Scope coordination
- Delayed Approvals
- Procurement
 - Approved Vendors
 - Sub-supplier and sub-contractor management
 - Readiness for shipment
- Logistics
 - Delayed delivery

ALADYR

- Customs and required documentation

- Site Installation
 - Material Management and Storage
 - Site limitations
 - Multiple Packages
- Commissioning/Startup
 - Delayed commissioning
 - Warranty Expiration



LOOKING AT THE FUTURE.....

ALADYR

DESALINATION INDUSTRY TRENDS...

SafBon Water Technology

- Core RO Improvements
 - Lower membrane feed pressure while maintaining permeate quality
 - Fouling resistant membranes
 - Integration of precipitation and clarification with desalination
- Innovation on Reducing Energy Consumption
 - Use of renewable resources, lower power consumption
 - Advances in higher efficiency devices: HP-HEMI
- Combing Power Generation and Water Desalination
 - Cost and land optimization
 - Reduce reliance on conventional electricity sources
- Smart Systems

Digital technologies, predictive maintenance, IoT

DESALINATION BUSINESS TRENDS...

SalBon Water Technology

- Water scarcity still driving desalination
 - Day Zero is becoming reality in many areas...
- Contracting methodologies
 - From DBB (Capex) to D&B / BOT (OpEx) to TCO...
- Environmental concerns and implications...
 - Water intake, brine disposal, energy consumption...
 - Impact on permitting process, project delays...
 - Public perception...
- Expanding Market Value Chain M&A activities
 - Gradient Corp acquired Sigma Water (Malaysia)
 - Suez acquired Lanxess
 - Zhuhai Water investing in SafBon



WATER DESALINATION MARKET VALUE CHAIN





DESALINATION NEW FRONTIERS...



- DNA sequencing to identify biofouling microorganism agents...
- Optimization technologies via AI (Artificial Intelligence)...
- Cloud-based machine learning software platforms...
- Hybrid AI approaches to reduce OpEx...
- From dense polymeric membranes to sub-nanometer channels...
- Total offsetting of green gas emissions..



WATER SCARCITY...REDUCED OFFER



WATER STRESS BY COUNTRY

ratio of withdrawals to supply

Low stress (< 10%) Low to medium stress (10-20%) Medium to high stress (20-40%) High stress (40-80%)

Extremely high stress (> 80%)

This map shows the average exposure of water users in each country to water stress, the ratio of total withdrawals to total renewable supply in a given area. A higher percentage means more water users are competing for limited supplies. Source: WRI Aqueduct, Gassert et al. 2013

AQUEDUCT 🛲

₩ WORLD RESOURCES INSTITUTE

WATER FINALLY HITS WALL STREET..



mint



CME's contract, tied to the \$1.1 billion California water market, will launch late this year,

Wall Street is set to start trading in a new commodity: Water

3 min read . Updated: 18 Sep 2020, 10:35 AM IST Elizabeth Elkin , Bloomberg

 Almost two-thirds of the world's population is expected to face water shortages by 2025, according to the CME





Thank you!

SafBon Water Technology 9208 Palm River Road – Suite 302 Tampa, FL 33619 USA

Clovis E. Sarmento-Leite Commercial Director, Latin America +1-813-774-2152 <u>csarmento@safbonwater.com</u>