Operating model and innovative technologies for the sustainable future of the desalination industry: Designing Water & Resource Recovery From Brine

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SAWACO Water-Desalination

- SAWACO -Water Desalination is among the first private water utilities in K.S.A. License granted in 1999.
- SAWACO operates and maintains its own and third party desalination plants in addition to its water transportation fleet and pipelines
- Current production capacity exceeds 32,000 m³ /day distributed between 3 sites on the Red Sea- 5,000 m3 expansion to come on stream by May 2014.
- SAWACO produces and distribute different grades of water to a variety of industrial, commercial and domestic users.
- SAWACO returns around 64,000 m3/day of brine to the Red Sea (The Opportunity!)





The Need for a New Approach

- SAWACO started its business when water was scarce in Jeddah.-Saudi Arabia.
- Recently, Government water supplies improved drastically due to new plants and networks
- Industrial Clients held the key for survival
- The answer was in designing water for different industrial needs
- Something government extensive /complicated networks cannot possibly achieve
- Hence the concept "Designer Water" was created
- This concept can be applied when industrial clients are clustered anywhere in the world
- This is a concept that is infrastructureresistant and water abundance-resistant!!





More Needed to Be Achieved

- O&M capabilities + Good analytical skills + expertize in water treatment = customization of water
- That was the beginning of the "Designer Water "concept
- We created a niche market and sustainability was the next target
- Reduction of power consumption is the single most important driver of achieving sustainability
- Advanced power recovery equipment can achieve part of the target of energy efficiency
- Resource recovery from brine held the answer, but technical difficulties needed to be overcome

Three Pillars for Seawater Desalination SAWACO WAY

- Designing Water using traditional and Innovative Technologies for diverse applications
- Sustainability : lower power consumption and higher recovery,
- Resource
 Recovery from
 Brine :
 innovative
 technologies



1-Sustainability Drive

- Two major targets were set by SAWACO for a sustainable future :
- 1- Reduction of power consumed per m3 of desalinated water
- 2-Applying innovative techniques to increase recovery of the plant





1- Sustainability

- Energy recovery devices are common place in the RO industry and operators are spoilt for choices :
 - Turbo Chargers
 - Pelton Wheel
 - Pressure Exchangers etc.
- Low –energy high- surface membranes help too
- However, Power Consumption remains excessive
- Two third of filtered high -salinity water still go back to the sea
- Recovering part of this "wasted" water held the key to a novel overall power reduction











2- Resource Recovery from Brine

- Water, Salt and Bittern can be extracted theoretically from Brine
- Key considerations :
 - Lower energy consumption per m₃ of water recovered from Brine shall reduce the overall average power consumption (Kwhr /m₃)
 - 2. Economical recovery of Salt and Bittern
- The Benefits are quite attractive :
 - 1. Economically
 - 2. Environmentally
- Traditional technologies are :
 - 1. either energy intensive hence untenable
 - 2. or in need of large space
- The solution lies in a new innovative technology that requires reasonable space and is power-efficient









A Sustainable Green Opportunity !

- SAWACO could not recover water and salt from brine using existing technologies
- SAWACO requested a Japanese technology provider to research recovering water and salt through Nanomist technology.
- Saudi Arabia demand for salt is expected to increase due to industrial and population growth.
- Ideally, SAWACO would build a 5,000 t/d water and salt recovery plant using Nanomisting. Up to 350-400 t/d salt would be recovered in addition to 3720 m3/d of potable water !

The Solution



Salt Manufacturer (The JV) (Finance, Engineering, Construction, technology Management, Marketing & Maintenance)

SAWACO (Land, Feedstock, <u>**O&M Experience**</u>& Market)





Step 1. A 10 t/d Demo test plant : A 10 t/d demo plant will be built, operated and evaluated

Step 2. Transfer 10 t/d demo plant to SAWACO Plant: The

demo plant will be transferred to Jeddah, KSA. The reoperation and reevaluation will be carried out at SAWACO Plant

Step 3. Build a 1,000 t/d BOT plant in KSA.: The JV will build and operate for 10 years a 1,000 t/d plant in SAWACO Plant . Salt, bittern and Potable water will be produced.

Step. 4. Scale up to 5,000 t/d

The 1,000 t/d plant will be upgraded to 5,000t/d plant at an agreed depending on market conditions



The 1000 t/d Production Stream



*Technology Provider will be evaluating the use of Ultrasound (<u>3.0 KW/t)or</u> Electrostatic (<u>0.6 KW/t</u>). ** Magnesium Chloride



Bittern production to be exported to Asia

The 5,000 t/d Opportunity

OR

Current SAWACO Future SAWACO + TECH PROVIDER



+ Electricity o.6-3.0 KW/t

AWAC

5,000 t/d Brine water into Red Sea 5,000 t/d Salt & Water recovery plant





The Advantages

Environmental + Safety SAWACO will no longer dump brine water into Red Sea

Economical

SAWACO will recover valuable commodities that were usually wasted (Water + Salts) at LOW operating Cost

Competitive

By improving economics, and environmental friendly policy, SAWACO will attain a cutting edge in water desalination Sustainability and

Efficiency



Resource Recovery : Green + \$

- There is a technological solution to treat brine water, and produce valuable commodities.
- The economics reflect profitable returns due to: 1- zero value based feedstock, 2- high market pricing for production line, and 3- technological edge.
- Pursuing this opportunity by a desalination plant tremendously improves its returns, and competitiveness.

3-Design Water to Suit All Needs

- SAWACO uses its own O&M techniques to produce several grades of water
- Always searching for new technologies to assist
- ESD chosen as a new innovation to produce pure and possibly ultra pure water
- Currently piloting a 100 m3/day ESD (Capactive Deionization) manufactured in Canada



Why Capacitive Deionization?

Reduce TDS High removal efficiencies High water recovery No chemical additives Low maintenance Low energy consumption



O&M Capabilities: first ingredient



Pumps

Good Labs Facilities : second ingredient

واكو



Expertize In Water Treatment : third ingredient

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"Designer Water" : designs to suit all tastes!

SAWACO Produces 10 different types of Water

Water Type	TDS Value in ppm	PH
Туре І	280 <tds<350< td=""><td>7.0 <ph<7.8< td=""></ph<7.8<></td></tds<350<>	7.0 <ph<7.8< td=""></ph<7.8<>
Type II	200 <tds<250< td=""><td>6.8<ph<7.5< td=""></ph<7.5<></td></tds<250<>	6.8 <ph<7.5< td=""></ph<7.5<>
Type III	150 <tds<200< td=""><td>6.5<ph<7.5< td=""></ph<7.5<></td></tds<200<>	6.5 <ph<7.5< td=""></ph<7.5<>
Type IV	100 <tds<150< td=""><td>6.3<ph<7.5< td=""></ph<7.5<></td></tds<150<>	6.3 <ph<7.5< td=""></ph<7.5<>
Туре V	50 <tds<100< td=""><td>6.3<ph<7.2< td=""></ph<7.2<></td></tds<100<>	6.3 <ph<7.2< td=""></ph<7.2<>
Type VI	25 <tds<50< td=""><td>6.0 <ph<7.2< td=""></ph<7.2<></td></tds<50<>	6.0 <ph<7.2< td=""></ph<7.2<>
Type VII	TDS<10	6.0 <ph<6.5< td=""></ph<6.5<>
Type VIII	280 <tds<350< td=""><td>Zero Chlorine</td></tds<350<>	Zero Chlorine
Туре IX	280 <tds<350< td=""><td>8.0 <ph<9.2< td=""></ph<9.2<></td></tds<350<>	8.0 <ph<9.2< td=""></ph<9.2<>
Туре Х	280 <tds<350< td=""><td>High Chlorine - 1 ppm</td></tds<350<>	High Chlorine - 1 ppm



"Designer Water" : new designs keep rolling out.

SAWACO has launched in March 2012 Type XI: Low Boron Potable water :

- 0.3< BORON < 0.7 PPM
- 7.5<pH< 9.5
- TDS< 90ppm

Three new types of water are under development that cater for different industries .





Examples of Product Customization

- SAWACO tailors its water as per individual customer requirements.
- Some customers want water free from chlorine.
- Other customers may want water with low TDS (total dissolved solids) for boilers etc.
- Some industries look for high pH, others for Chlorine free water
- Things can get tricky : high alkalinity but pH not exceeding 7.5





PEPSI COLA

- Requirement : TDS below 200ppm and chloride not more than 90 ppm
- Solution: We assigned one skid intended only for them with post chemicals dosing.
- SAWACO uses a separate product tank to store water for PEPSI.



LUBEREF – ARAMCO

• Requirements: TDS below 10ppm



SI

BE REF

UNILEVER

• Requirements: TDS below 15ppm with high chlorine of around 3.5ppm with a pH of 7.5



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Thank you nizarkam@sawaco.com

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