Solutions for Water Scarcity

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## Water Scarcity

<table>
<thead>
<tr>
<th>Definition</th>
<th>Implications</th>
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<tr>
<td>The Demand for Freshwater that Exceeds The Sustainable Supply of Freshwater</td>
<td>Left unresolved Water Scarcity will:</td>
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<td>• Slow/Stop economic expansion</td>
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<td>• Reduce agricultural output and food independence</td>
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<td>• Degrade public health and quality of life</td>
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**Mandate** – Sufficient, safe, reliable freshwater delivered at the lowest total cost
Regions of Water Scarcity

In 2001 the UN identified 18 countries that have a critical water shortage:

- Mainly in the Middle East and North Africa
- And a few countries in Europe, Asia and the Caribbean

In the year 2025 it is projected the number of water stressed countries will increase to 29:

- Population in current water scarce regions is expected to almost double
- Increasing demands of industry for high quality process water to sustain the region’s economy
Global Water Stress is Spreading

Impact on Infrastructure of Industrial Growth is happening at a faster rate as Municipalities curtail scarce water for consumer use.
Components of an Integrated Strategy For Water scarcity

- Public Private Partnership
- Low Cost Finance
- Water conservation
- Education
- Water Re-use
- Distribution Integrity
- Environment
- Tariffs
- Desalination
- Emergency solutions
Desal Driving Forces as a supply solution

• Scarcity of water in both the developing and the developed world.
• Demographics stressing existing water sources.
• Industry follows population growth and creates additional demand.
• Technology is reducing treatment costs.
• Risk re-allocation via BOO/DBO models.
Desalination

Seawater - RO & Thermal

Brackish Water - RO

Municipal Reuse

Brackish Water – EDR

Industrial Reuse - Thermal, RO, UF
Technology Driving Attractive Economics

Desal cost per cubic meter
Lifecycle costs for alternative water sources

- **Seawater RO**
- **Reuse with MF/UF + BWRO**
- **Reuse with MF/UF**
- **Brackish RO**

The diagram shows the total water cost ($/m³) on the y-axis and plant size (production in m³/day) on the x-axis. The cost varies depending on the water source and production size.
Cost of the Desalinated water is gone down by 80% in last 20 years

Cost trend of Membranes modules
Sulaibiya Wastewater Treatment And Reclamation Plant
BOT Project - Kuwait
Sulaibiya Water Reclamation Drivers

Water Scarcity Challenges:

• Fresh water supplies limited and declining in Kuwait.

• A need to build a new wastewater treatment facility that would comply with the highest criteria for effluent discharge to the Gulf and away from residential Area

• To include an advanced Technology to meet the increasing demands of agriculture and other non-potable applications with a high quality reusable effluent

• Reduce the increasing demand on the existing and planned desalination plants in Kuwait for potable water

• Use Privatization “Public-Private-Partnership (PPP)” as a financial enabler and risk transfer vehicle to insure a predictable water tariff and project schedule

• It is reported that the above Water Management strategy will save the State of Kuwait some $11 billion over the project concession period
Development Steps

Initial Data:

• Product requirements (m3/day)
• Customer business structure preference, if known
• Term of contract (BOO, DBO, O&M)
• Guarantor
• Project Status
Structured Financed Projects Considerations

- **Project Definition** — Has the project been clearly defined with a bankable Water Sales Agreement?

- **Revenue Security** — Is the client providing a bankable “take-or-pay” feature in the contract with suitable sovereign guarantees?

- **Asset Security** — Is the credit rating of the client strong enough to assume the purchase of the project assets if required?

- **Tariff Adjustment** — Does the contract allow for fluctuations in economic indices?

- **Economic** — How strong is the economy of the host country, and what incentives (tax) exist between the host country and the country of the foreign investor.

- **Institutional** — How strong and proven are the relevant institutions (political, judicial, financial, etc.) in the host country.

- **Political** — How stable is the local politics and how strong is the government relationship between the host country and the foreign investor’s country.

- **Power guarantee**

- **Banking** — Is there sufficient demand in the payment currency of the contract to attract adequate competition for the debt financing.

- **Currency** — Ease of converting and transferring currency, hard currency on-shore bank accounts

- **Local Participation** — Consideration given to the need of local partner to participate in the equity and/or EPC construction.

- **Change in Law** — Allows tariff adjustment

- **Acceptable Site Lease**
Dedication Ceremony – March 8, 2005
1. Pre-qualification Phase
2. Tendering Phase Until Contract Signing
3. Development Period
4. Engineering, Procurement & Construction (EPC) Period
5. Operation & Maintenance Period
AROUND 300,000 MANHOURS IN TOTAL
The Concession Contract

Treat Raw Municipal Wastewater to Reclaimed Water Conforming to Quality Parameters

- 30 Year Concession

- Plant Capacity:
  - Initially: 375,000 M³/D
  - Expansion Capability: 600,000 M³/D

- Payment for Produced Effluent Rate Per M³

- Guaranteed Minimum Inflow

- Guaranteed Off-taking of all Effluent.
Major Features

➤ Strategic Asset:

  Handling 60% of Kuwait Domestic WW.\(> 375,00 \text{ M3/DAY}\)

➤ Government Guarantees Power Supply at Agreed Upon Rates.

➤ Protection of Concessionaire from Negative Effect of a New Law.

➤ Concessionaire Entitled to Claim Benefit from Any More Favorable New Law.

➤ Local Financing in KD
Sulaibiya Project Structure - Kuwait

Kharafi Group
Consortium of Kuwaiti Financial Institutions led by National Bank of Kuwait

Ministry of Finance

Kharafi Group

GEWPT/IONICS

15% Equity

UDC
85% Debt

Ministry of Public Works

Lead EPC - Kharafi Group
Construction - Phillip Holtzmann (Kharafi Group)
Membrane Technology - GEWPT

Payment Guarantee

27.5 year Service Contract (30 yr. Concessions)

O&M contract
PROJECT GENERAL DESCRIPTION

ARDIYA
PRELIMINARY TREATMENT
PUMPING
ARDIYA SULAIBIYA PIPELINES 25 KMS

SULAIBIYA
BIOLOGICAL TREATMENT
WATER RECLAMATION
FOR REUSE
Ardiya Operations

RAW WASTEWATER → SCREENS → GRIT & FOG REMOVAL → MAIN PUMPS → TO SULAIBIYA
Sulaibiya Operations

FROM ARDIYA

MIXING

AERATION BASINS

SECONDARY CLARIFIERS

TO SLUDGE TREATMENT

CHLORINE

BIOLOGICAL TREATMENT PLANT

CLEAR WELL

RECLAMATION PLANT

CHLORINE

REVERSE OSMOSIS

ULTRA-FILTRATION

TO OFF-TAKER

TO OFF-TAKER

CHLORINE
Sulaibiya Wastewater Treatment and Reclamation Plant

- Sludge Drying Beds
- Transfer Pipelines
- Pumps House
- Secondary Clarifiers
- Aeration Tanks
- UF Building
- Gravity Belt Thickeners
- RO Building
- Aerobic Digesters
- Permeate Basin
- Administration Building
- Reclaimed Water
- Workshop Building

تغزين الحماة
40,000 m²
Ardiya Preliminary Treatment and Pumping Station
SCADA System at Ardiya
Transfer Pipelines
Between Ardiya and Sulaibiya
Transfer Pipelines
Aeration Tanks

Sulaibiya
Secondary Clarifiers
Aerobic Digesters

Sulaibiya
Gravity Belt Thickeners
UF Skids and Piping

Sulaibiya
Pumps at UF Building
RO Skids and Piping
RO Building
Why is Sulaibiya A Ground Breaking Project?

➢ WORLDWIDE:
  • Largest Wastewater Treatment and Reclamation.
  • Largest RO Plant.

➢ IN THE ME:
  • First Major WWT BOT in the ME

➢ IN THE GULF:
  • First Major Infrastructure BOT
  • Fully Financed by Local National Banks.
THANK YOU

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