Developing Effective Business Models for Water Reuse Projects
> Building the business case

> Designing effective business model in Saudi Arabia

> Veolia’s reuse capabilities
Current water demand is seven times higher than natural renewable water resources.

Total Annual Renewable Water Resource (TARWR) = 2.4 km³/year

Total Annual Withdrawals = 17.3 km³/year = 7.2 x TARWR

Total wastewater reuse = 0.8 km³/year

Total desalination = 0.8 km³/year

Annual water withdrawals by source of supply (million m³)

Current annual water demand is 17.3 km³. Estimated groundwater reserves (to 300m below ground surface) are 2,185 km³. Depletion of groundwater reserves will depend on future growth.
Reuse is part of the equation to meet future water demand because:

1. It increases the resources available (TSE)

2. It reduces over abstraction of groundwater for irrigation and therefore save potential high quality water for potable supply
Building the business case

Cost of potable water (1)

Cost comparison (USD/m³)

- Treatment cost of Reuse
- Economic cost
- Pipeline transmission cost
- Conventional WW treatment cost
- Reuse treatment cost (MF/UF)
- Reuse treatment cost (MF/UF+RO)

Source: Elie Elhadj – SOAS Water Research Group, 2004 / Veolia estimates for WW treatment
In Riyadh, water consumption can be estimated at 1,253 MLD.

Assuming that 10% of this potable water is consumed for non-potable usage and could be replaced by TSE, 45 million USD could be saved per year!

Cost estimates per year
Equivalent to 10% of water consumption

... 45 millions USD could be saved per year!

... Capital cost of a 90 MLD Ultrafiltration Plant
Treated Wastewater and Reuse Bylaw N° 42 (from 2000) provides a framework to develop Reuse projects.

Executive Rule for treated sewage water system and reuse (2002) provides quality standards for the definition of two levels of quality:

<table>
<thead>
<tr>
<th>Usage</th>
<th>BOD (mg/l)</th>
<th>TSS (mg/l)</th>
<th>CF (mg/l)</th>
<th>Usage Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restricted irrigation</td>
<td>40</td>
<td>40</td>
<td>1000 cells</td>
<td><strong>Agriculture needs</strong></td>
</tr>
<tr>
<td>(according to table 2)</td>
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<td><strong>Residential irrigation</strong></td>
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<td><strong>Municipal irrigation</strong></td>
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<td><strong>Commercial irrigation</strong></td>
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<tr>
<td>Unrestricted irrigation</td>
<td>10</td>
<td>10</td>
<td>2.2 MPN</td>
<td><strong>Agriculture needs</strong></td>
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<tr>
<td>(according to table 3)</td>
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<td></td>
<td><strong>Commercial irrigation</strong></td>
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<tr>
<td>Direct discharge (*)</td>
<td>40</td>
<td>40</td>
<td></td>
<td><strong>Discharge to Wadi</strong></td>
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<tr>
<td>(according to table 2)</td>
<td></td>
<td></td>
<td></td>
<td><strong>Environmental needs</strong></td>
</tr>
<tr>
<td>Direct discharge (*)</td>
<td>25</td>
<td>15</td>
<td>1000 cells</td>
<td><strong>Discharge to Wadi</strong></td>
</tr>
<tr>
<td>(according to GER std)</td>
<td></td>
<td></td>
<td></td>
<td><strong>Environmental needs</strong></td>
</tr>
<tr>
<td>Industrial needs (**) and</td>
<td>TBD</td>
<td>TBD</td>
<td></td>
<td><strong>Process</strong></td>
</tr>
<tr>
<td>aquifer recharge</td>
<td></td>
<td></td>
<td></td>
<td><strong>Cooling</strong></td>
</tr>
</tbody>
</table>
Existing reuse schemes have been mostly designed for irrigation applications.

Significant reuse projects with industrial applications are being developed.

Several key stakeholders are multiplying initiatives (MOWE, NWC etc.)

...only 18% of TSE is currently being reused in the Kingdom.
Building the business case  Wastewater coverage

Wastewater coverage is currently low and significant efforts are implemented to achieve a full coverage over the next coming years.

**Connection rate in Riyadh city**
- Not connected: 57%
- Connected: 43%

<table>
<thead>
<tr>
<th>0 - 4 years</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>New connections</td>
<td>↑ 176 000</td>
</tr>
<tr>
<td>Wastewater generated</td>
<td>↑ 470 000 m³/d</td>
</tr>
</tbody>
</table>

......TSE volume available will increase
Saudi Arabia cumulates several key drivers which built business case for Reuse

Building the business case

Conclusion

...however, so far, very few experiences or studies exists from which lessons could be drawn on how to develop effective business model
Designing effective business models in Saudi Arabia
Demand will increase

“Expressed demand” is higher than the supply (e.g. Riyadh)

The demand is segmented

Source: NWC, Veolia, Acwa Reuse study estimates 2009
Designing effective Business Model

The Reuse offer

- Wastewater treatment Plant
  - Quantity: High
  - Quality: Unrestricted
  - Distance: Low

- WATER RECLAMATION PLANT
  - Quantity: High
  - Quality: Unrestricted
  - Distance: High

- Quantity: Medium
  - Quality: Unrestricted
  - Distance: High

- Quantity: Low
  - Quality: Unrestricted
  - Distance: Low

- Quantity: Medium
  - Quality: Polished
  - Distance: High

- Quantity: Low
  - Quality: Polished
  - Distance: Low

- Quantity: Low
  - Quality: Unrestricted
  - Distance: High

- Quantity: High
  - Quality: Unrestricted
  - Distance: Medium
Designing effective Business Model

The Reuse offer

Wastewater treatment Plant

WATER RECLAMATION PLANT

TSE sale agreement

Quality
- Restricted
- Unrestricted
- Polished TSE

Quantity and Reliability
- Volume
- Seasonal variation

Delivery point
- Reclamation plant
- Customer premises

Quantity : High
Quality : Restricted
Distance : High

Quantity : High
Quality : Unrestricted
Distance : Medium

Quantity : Low
Quality : Polished
Distance : Low

Quantity : Medium
Quality : Polished
Distance : High

Quantity : Medium
Quality : Unrestricted
Distance : High

Quantity : High
Quality : Unrestricted
Distance : Low
Costs directly related to Reuse correspond to additional treatment to reuse quality + transportation / distribution to the customer.
Filtration is the key element of the TREATMENT COST component of Reuse

- Biological Treatment
- Sand Filtration
- Micro filtration
- Reverse Osmosis

- Restricted Irrigation
- Unrestricted Irrigation
- Unrestricted Irrigation?
- Industrial demand
  - Groundwater recharge
The TRANSPORTATION COST component is based on similar capital development program than a water utility

- Development of dedicated TSE transportation and distribution networks
- Reservoirs, pumping station
- SCADA
- Etc.
Similarly to the operation and maintenance of water system, a range of services needs to be develop to ensure international best practices in reuse development

- O&M services for treatment and TSE network infrastructures
- Quality control and monitoring tools and procedures upstream in the wastewater network especially industrial discharge
- Specific services in quality control and monitoring of usage (e.g. agriculture)
- Customer services
- Etc.

OPERATION AND MAINTENANCE COST component of Reuse
Ideally, such study should be conducted first at the scale of a city to determine better match between supply and demand and long term strategy........

.....however each project to be effective will have its own business model and risks allocation which will determine the nature of partnership
There is a clear business case for Reuse development for the country as a whole.

Regulation will be key in promoting reuse development.

Each opportunity or projects is likely to have different business model depending on the customer requirement.

Few business models have been developed so far in Saudi Arabia.

International best practices and technologies are needed to ensure financial viability and sustainability.
Veolia Water's reuse expertise is based on the technological expertise of its subsidiaries and on a large number of references.
Veolia Water has references in all reuse applications throughout the entire world.

<table>
<thead>
<tr>
<th>Application</th>
<th>Customer</th>
<th>Major cities</th>
<th>Coastal areas</th>
<th>Small towns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquifer recharge</td>
<td></td>
<td>Berlin (Germany)</td>
<td>Adelaide, Bolivar (Australia)</td>
<td>State College (USA)</td>
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<tr>
<td>Indirect drinking water production</td>
<td></td>
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<td>Kranji (Singapore)</td>
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<td>Industry</td>
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<td>La Rosita (Mexico)</td>
<td>Durban (South Africa)</td>
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<td></td>
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<td>Maubeuge (France)</td>
<td>Honouliuli (USA)</td>
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<td>Kranji (Singapore)</td>
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<tr>
<td>Irrigation</td>
<td></td>
<td>Cuernavaca (Mexico)</td>
<td>Almeria (Spain)</td>
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<td></td>
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<td>Limassol (Cyprus)</td>
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<td>Gerringong (Australia)</td>
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<td>Urban uses</td>
<td></td>
<td>WRAMS Olympics 2000</td>
<td>Mawson Lakes (Australia)</td>
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<tr>
<td></td>
<td></td>
<td>(Australia)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct drinking water production</td>
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<td>Windhoek (Namibia)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Veolia’s reuse capability

**STUDY**
- Business cases study
- Business model

**DESIGN & CONSTRUCT**
- Detailed design (treatment, networks)
- Construction of various treatment solutions and technologies

**OPERATE**
- Operate and Maintain the Facilities (treatment and network)
THANK YOU