CURRENT AND FUTURE PERSPECTIVES ON SUSTAINABLE WATER REUSE PRACTICES IN THE ARAB REGION

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Drivers for the reuse

1. Environmental sustainability – reduction of emission of pollutants and their discharge into receiving water bodies, and the improvement of the quantitative and qualitative status of those water bodies (surface-water, groundwater and coastal waters) and the soils.

2. Economic efficiency – alleviating scarcity by promoting water efficiency, improving conservation, reducing wastage and balancing long term water demand and water supply.

3. For some countries, contribution to food security – growing more food and reducing the need for chemical fertilizers through treated wastewater reuse.

The Water-Energy-Food Nexus
### Total water withdrawal, raw and treated wastewater in the different Arab countries

**Wastewater production, treatment and reuse in the Arab countries**

<table>
<thead>
<tr>
<th>Countries</th>
<th>Total wastewater produced</th>
<th>Volume of Treated Wastewater</th>
<th>Volume of Treated Wastewater Reused</th>
<th>Reused wastewater/Total withdrawal (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algeria</td>
<td>1200</td>
<td>700</td>
<td>51</td>
<td>0</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>730</td>
<td>652</td>
<td>166</td>
<td>51</td>
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<td>Bahrain</td>
<td>73</td>
<td>61.9</td>
<td>16.3</td>
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<tr>
<td>Comores</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Djibouti</td>
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<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Egypt</td>
<td>3760</td>
<td>2971</td>
<td>700</td>
<td>248</td>
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<tr>
<td>United Arab Emirates</td>
<td>500</td>
<td>454</td>
<td>248</td>
<td>700</td>
</tr>
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<td>50</td>
<td>98</td>
<td>5.5</td>
<td>40</td>
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<td>239</td>
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<td>74</td>
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<td>6</td>
<td>6</td>
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<td>Somalia</td>
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<td>Sudan</td>
<td>50</td>
<td>30</td>
<td>5.44</td>
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<tr>
<td>Palestine</td>
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<td>240</td>
<td>68</td>
<td>68</td>
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<tr>
<td>Tunisia</td>
<td>74</td>
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<td>6</td>
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<tr>
<td>Yemen</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>TOTAL</td>
<td>10880</td>
<td>6477.6</td>
<td>2184.59</td>
<td>2184.59</td>
</tr>
</tbody>
</table>

**The Wastewater Reuse Index (WRI*)**

\[ \text{WRI} = \frac{\text{Volume of Wastewater Reused}}{\text{Volume of Wastewater Produced}} \times 100 \]

* The Water-Energy-Food Nexus                   22-24 April 2012, Doha - Qatar
The annual volume of wastewater discharged in untreated form in Arab countries is 4.4 km³, which is 40% of the total wastewater produced in the region.

60% of the wastewater generated in MENA region is treated, which is higher than Asia (35%), Latin American/Caribbean (14%) and Africa (1%) (WHO/UNICEF 2000)

83% of treated wastewater used in agriculture,

most of the partly treated, diluted or untreated wastewater is used by urban and peri-urban farmers to grow a range of crops.
Main Challenges and constraints

- Lack of Urban Water Demand Management
- Institutional and Legal Constraints
- Unclear policies on wastewater reuse
- Environmental risks (soil salinization, excess of nitrogen)
- Inefficient monitoring of WW reuse system
- Limited Private Sector Role
- Social acceptance, reluctance (lack of awareness)
Questions?

1. Given the scarcity of water, why have many governments been slow to promote wastewater reuse?

2. How should policymakers adapt the wastewater management agenda to their country’s economic context?
PARADOX OF WATER-SCARCITY AND LOW REUSE OF WW IN THE ARAB REGION IS MULTI-FACETED

- Environment protection not a major concern
- Unclear policies on wastewater reuse
- Technology: adaptation and technical capacity
- O&M costs and management problems
- Legal aspects: restrictions on TWW use; use of raw WW
- Institutional conflicts; unclear mandates
- Lack of awareness programme
Factors Impeding the Implementation of Water Reuse Strategies In Arab Region

1. Insufficiency of economic analysis
2. Relatively high cost of wastewater treatment and conveyance, coupled with pricing of irrigation water that does not adequately reflect its scarcity value
3. Technical and social issues affecting the demand for reclaimed water
4. Difficulty in creating financial incentives for safe and efficient water reuse.
• Public health risks when irrigating with inadequately treated WW (e.g. gastro-intestinal infections, heavy metals, trace pollutants)

• Environmental risks (mainly soil clogging, soil salinization, excess of nitrogen, GW & SW contamination)

• Inefficient monitoring of WW reuse system: lack of trained personnel; lack of monitoring equipment; too high monitoring costs
WEAKNESSES IN CURRENT WASTEWATER MANAGEMENT PRACTICES

• Many treatment plants are plagued by poor operation and maintenance (O&M) and are operated well beyond their design capacity.

• These conditions are resulting in degraded treatment reliability and diminished reuse possibilities.
Arab countries have adopted several standards and guidelines that differ from one country to another even at the regional level.

While most of the Gulf countries have established low risk guidelines or standards based on a high technology/high-cost approach, many Low income countries have adopted an approach based on WHO guidelines that refer to low-cost technologies and focus on health risks.
<table>
<thead>
<tr>
<th>Country</th>
<th>E. Coli Or Fecal Coli /100ml</th>
<th>Nematode Eggs/l</th>
<th>Other Parameters</th>
<th>Crops Eaten Uncooked is Allowed</th>
<th>Code of Practice</th>
</tr>
</thead>
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<tr>
<td>WHO</td>
<td>1000</td>
<td>&lt;1</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<td>Jordan</td>
<td>100</td>
<td>&lt;=1</td>
<td>Yes</td>
<td>No</td>
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<tr>
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<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<td>No</td>
<td>Yes</td>
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<tr>
<td>Syria</td>
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<td>Yes</td>
<td>No</td>
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<tr>
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<td>No</td>
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<tr>
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<td>Egypt</td>
<td>Decree 44/2000, but no specific standard</td>
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</tbody>
</table>

1. BOD5, COD, NO₂⁻, TSS, EC

Source: Xanthoulis, 2010
TECHNOLOGIES FOR TREATING WASTEWATER

High Tech Technologies and Energy Consuming

Sulaibiyah STP

Abu Dhabi Mafraq WWTP
activ. - sludge + denitrif. + chlor.
(300,000 m³/d.)
TECHNOLOGIES FOR TREATING WASTEWATER

Extensive Technologies Applied to Medium & Small Communities

The Water-Energy-Food Nexus 22-24 April 2012, Doha - Qatar
Direct reuse being introduced at Aqaba, Wadi Musa, Irbid in Jordan
BEST PRACTICES FOR THE REUSE IN THE ARAB REGION

REUSE OF RECLAIMED WATER IN TUNISIA

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BEST PRACTICES FOR THE REUSE IN THE ARAB REGION

MUNICIPAL LANDSCAPING IN ABU DHABI

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WATER REUSE IN KUWAIT
BEST PRACTICES FOR THE REUSE IN THE ARAB REGION

FOREST DEVELOPMENT IN EGYPT El-Alaky, Aswan
Castor. Khava. Jatropha, Gogopa  1650 Feddan

The Water-Energy-Food Nexus

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Jatropha: haute rendement par l'utilisation des eaux usées

Ca. 12 tonnes de noix par hectare = à 4.000 litres d’huile et 8 t de matière résiduel
SPREADING BASINS
Learning from experiences overseas

Cyprus: 85% of the treated effluent is being reused.

California: Wastewater reuse has been practiced since 1890. Historically, agricultural reuse has been practiced (vegetables, fruit trees, forage, in urban areas and groundwater recharge).

Singapore: New Water.

Microfiltration / Ultrafiltration
Reverse Osmosis
Ultraviolet Disinfection

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Way Forward for Water Reuse Solutions in the Arab Region by 2020

- Move from restricted treated wastewater to non restricted wastewater Reuse by Implementing policies and regulation that encourage the treatment and the reuse of wastewaters;
- Help mobilize financial resources for adequate wastewater treatment and encourage public-private partnerships in wastewater treatment and reuse;
- Most Arab countries has developed the Regulation frameworks, but need to implement these Regulations, to enforce their application by Enhancing stakeholder’s participation and awareness for the reuse of treated wastewater.

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Way Forward for Water Reuse Solutions in the Arab Region by 2020

- Enhancing the Monitoring system and implementation of standards and guidelines
- Developing skilled human resources and supportive institutions by developing training programs and clarifying the organizational aspect
- Encourage a regional cooperation and exchange of information and establish a platform of dissemination of the lessons learned from existing facilities in the Arab region
- Commitment to wastewater reuse should be part of the proclaimed water policy and strategy in all countries of the Arab region. Arab countries should develop a comprehensive plan of action for reusing treated wastewater, with clearly assigned roles.
“Give water a second chance... re-cycle it!”

Thank You..