Cyprus Experience with Desalination and Water Reuse

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Short description about Cyprus

Cyprus is an island in the Mediterranean Sea

- Area: 9250 Km²
- Population: 850,000 (under Government control)
- Type of Climate: Semi arid climate
- Cyprus is one of the “water poor” countries of Europe with limited water resources and frequent occurrence of droughts

Climate models predict rise in temperature and increase in the intensity and frequency of extreme drought events
The Republic of Cyprus, during the late sixties started the implementation of a Water Master Plan

- **Objective**: to satisfy in a sustainable way the different users of water and safeguard human & other life
- **Measures implemented**: to increase water availability and decrease water demand

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall</td>
<td>476 mm</td>
</tr>
<tr>
<td>Inflow into groundwater</td>
<td>201</td>
</tr>
<tr>
<td>Outflow to the sea</td>
<td>62</td>
</tr>
<tr>
<td>Groundwater Balance</td>
<td>139</td>
</tr>
<tr>
<td>Inflow into surface storage</td>
<td>82</td>
</tr>
<tr>
<td><strong>TOTAL Available (SW+ GW)</strong></td>
<td>221</td>
</tr>
<tr>
<td>SW Releases</td>
<td>60</td>
</tr>
<tr>
<td>GW extraction (Pumping)</td>
<td>146</td>
</tr>
<tr>
<td><strong>TOTAL Releases/ Extractions</strong></td>
<td>206</td>
</tr>
<tr>
<td><strong>DEMAND</strong></td>
<td>250</td>
</tr>
<tr>
<td><strong>DEFICIT</strong></td>
<td>- 44 (+33+8**)</td>
</tr>
</tbody>
</table>
Water Demand Management Measures

- Education and Awareness Campaigns
- Leakage Reduction in Distr. Networks
- Economic incentives
- Water saving devices
- Cropping patterns
- Improvement of Irrigation Efficiency
- Quota control
- Water Pricing and Metering
- Institutional changes

- Despite the significant measures, available water was not enough
- In August 2008 transportation of water from Athens to Limassol with tankers took place: 8 MCM were transferred with a cost of €56 M
Desalination Plants – (PPP) Projects

- In Cyprus desalination plants operate under Built, Own – Operate, Transfer (BOOT) Contracts, where private companies using their own funds, undertake the design, construction and operation of the Plants over a fixed period.
- The Government has the obligation to buy a minimum quantity of desalinated water each year over that fixed period.
- The Contractor produces desalinated water of a specified quality and quantity and delivers it to the Water Development Department’s storage reservoirs.

Pricing of Water Purchased

- **The Unit Price** is made up of four components:
  - C: Capital Expenditure
  - OM: Operation and Maintenance
  - E: Energy
  - SOM: Standby Operation and Maintenance

- **Different Unit Prices** are applied:
  - Unit Price for operation: C + OM + E
  - Unit Price for Stand-by: C + SOM
  - Unit Price for additional quantities: OM + E
# Desalination Plants 2017

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>DHEKELIA EXTENSION</th>
<th>LARNACA REFURBISHMENT</th>
<th>LIMASSOL</th>
<th>VASSILIKOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONTRACT TYPE</td>
<td>BOOT</td>
<td>BOOT</td>
<td>BOOT</td>
<td>Purchase Contract</td>
</tr>
<tr>
<td>START OF PRODUCTION</td>
<td>18 July 2008</td>
<td>Summer 2014</td>
<td>1 July 2012</td>
<td>Summer 2013</td>
</tr>
<tr>
<td>PERIOD</td>
<td>20 Years</td>
<td>25 Years</td>
<td>20 Years</td>
<td>20 Years</td>
</tr>
<tr>
<td>CAPACITY</td>
<td>60,000 m³/day</td>
<td>60,000 m³/day</td>
<td>40,000 m³/day</td>
<td>60,000 m³/day</td>
</tr>
<tr>
<td>MINIMUM DAILY PRODUCTION</td>
<td>54,000 m³</td>
<td>54,000 m³</td>
<td>36,000 m³</td>
<td>54,000 m³</td>
</tr>
<tr>
<td>MINIMUM YEARLY PRODUCTION</td>
<td>19,710,000 m³</td>
<td>19,710,000 m³</td>
<td>13,140,000 m³</td>
<td>19,710,000 m³</td>
</tr>
<tr>
<td>PURCHASE PRICE OF WATER</td>
<td>€0.69/m³</td>
<td>€0.59/m³</td>
<td>€0.87/m³</td>
<td>€0.81/m³</td>
</tr>
<tr>
<td>ADJUSTED PRICE FOR 2016 (ELECTRICITY TARIFF AND LABOR INDEX)</td>
<td>€0.83/m³</td>
<td>€0.47/m³</td>
<td>€0.92/m³</td>
<td>€0.77/m³</td>
</tr>
</tbody>
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Conditions of Contracts for the *Wastewater Treatment Plants*

- **FIDIC Contract - Design Build Operate: Two phases Contracts**

  - **Phase 1:** Design - Build – Commissioning – Testing- One year operation as defects Liability period.
  - **Contracting Authority:** Urban Sewerage Board
  - **Requirements:** Only the quality of the treated effluent.
  - **Treatment Method:** the tenderer to select proven method.

- **Phase 2:** Operate for 9 years (all the costs i.e. chemicals/electricity are borne by the Contractor. The contractor could also use renewable energy resources at his own cost)
  - **Contracting Authority:** Urban Sewerage Board.

- **Financing:** The Urban Sewerage Board through taxation of the citizens. There are two types of taxes:
  - Sewerage fee: paid once a year based on the value of the house
  - Sewerage system use: paid every two months based on the drinking water consumption

- **Award Criterion:** Exclusively the lowest price (phase 1 and phase 2), provided that the tenderer fulfills the economical and technical qualifications specified in the tender documents.
Reuse of Treated Effluent

• In Cyprus the cost for the construction and the operation and maintenance of the tertiary treatment plant carried out by the Urban Sewerage Boards is undertaken by the Government through Water Development Department.
• The treated effluent is used for irrigation and recharge of aquifers.
• Aquifers are used as storage reservoirs mainly in winter. The water from the aquifers is extracted and used for irrigation.
• The treated effluent is suitable for the majority of the crops and Irrigation is done under the Code of Good Agricultural Practice
• The quality is under control and remains constant
• The farmers use less quantities of fertilisers because the treated effluent already contains nutrients such as Phosphorous and Nitrogen
Thank you

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From the photographic competition of Water Board of Larnaca 2015 - first prize