SUSTAINABILITY OF WATER & SANITATION SERVICES IN GREECE

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THE GREEK WATER INDUSTRY
An overview
Greece...

- **Area**: 131,957 km²
- **Population**: 11 million inhabitants
  - 84 inhabitants/km²
  - 1/3 of the Greek population concentrated along the coastline

**Topography**
- More than 40% of the land is over 500 m in altitude (peaks >2,000 m)
- Coastline: 14,000 km length
- ~ 3,000 islands

**Administrative divisions**
- 13 Regions
  - 9 on the mainland
  - 4 insular complexes
- 325 municipalities
- 14 River Basin Districts (RBDs)
Setting the scene

- Irrigated agriculture is the most significant water use (83% of the total) in most RBDs
- In Attica, urban water use is dominant
- The Metropolitan area of Athens is the country’s largest urban center (~ half of population of Greece)

<table>
<thead>
<tr>
<th>River Basins District</th>
<th>Agriculture (hm³/yr)</th>
<th>Domestic Water Supply (hm³/yr)</th>
<th>Industry (hm³/yr)</th>
<th>Other (hm³/yr)</th>
<th>Total (hm³/yr)</th>
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<tbody>
<tr>
<td>West Peloponnese</td>
<td>206.0</td>
<td>23.0</td>
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<td>20.0</td>
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<td>22.1</td>
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<tr>
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<td>375.5</td>
<td>22.4</td>
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<td>397.9</td>
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<tr>
<td>Epirus</td>
<td>163.8</td>
<td>33.9</td>
<td>4.3</td>
<td></td>
<td>202.0</td>
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<td>Attica</td>
<td>101.5</td>
<td>420.0</td>
<td>17.5</td>
<td></td>
<td>539.0</td>
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<td>East Sterea Ellada</td>
<td>783.6</td>
<td>41.6</td>
<td>12.6</td>
<td></td>
<td>837.8</td>
</tr>
<tr>
<td>Thessaly</td>
<td>1563.0</td>
<td>69.0</td>
<td></td>
<td></td>
<td>1632.0</td>
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<tr>
<td>West Macedonia</td>
<td>617.3</td>
<td>43.7</td>
<td>30.0</td>
<td>80.0</td>
<td>771.0</td>
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<td>535.6</td>
<td>99.8</td>
<td>80.0</td>
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<td>715.4</td>
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<td>632.8</td>
<td>32.0</td>
<td></td>
<td></td>
<td>664.8</td>
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<td>Thrace</td>
<td>832.3</td>
<td>27.9</td>
<td>11.0</td>
<td></td>
<td>871.2</td>
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<td>Crete</td>
<td>330.2</td>
<td>42.3</td>
<td></td>
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<td>372.5</td>
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<td>Aegean Islands</td>
<td>87.0</td>
<td>37.2</td>
<td></td>
<td></td>
<td>124.2</td>
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<tr>
<td><strong>Grand Total</strong></td>
<td><strong>6966.3</strong></td>
<td><strong>956.6</strong></td>
<td><strong>161.4</strong></td>
<td><strong>100.0</strong></td>
<td><strong>8184.3</strong></td>
</tr>
<tr>
<td><strong>Shares (%)</strong></td>
<td><strong>85.1</strong></td>
<td><strong>11.7</strong></td>
<td><strong>2.0</strong></td>
<td><strong>1.2</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Source: EEA, 2007
Urban water services in Greece (1/2)

- **EYDAP** (Act 1068/1980): Metropolitan area of Athens
  - Each divided in two entities
    - A public (“asset”) company “owning” the major water infrastructure (dams, conveyance networks)
    - A semi-private utility, owning and managing treatment plants & water distribution networks
  - Semi-private entities are members of the Athens Stock Exchange Market
    - EYDAP private shares: 39%
    - EYATH private shares: 10%

- **EYATH** (Act 2651/1998): Metropolitan area of Thessaloniki

- Other (smaller) cities
    - Enterprises operating under private law but owned and controlled by the municipalities
    - Assets remain a property of the municipality
    - DEYAs operate and maintain those assets
      - Financial costs recovered through water billing
      - Infrastructure enhancement financed by the municipality, the State or EU Structural Funds

- Other (smaller) cities
Urban water services in Greece (2/2)

- EYDAP ~ 4 million inhabitants
- EYATH ~ 1 million inhabitants
- All DEYAs ~ 4 million inhabitants
Urban Water Services in the Metropolitan Areas

Mornos Dam & Lake, Western Greece
[one of the main water supply sources of Athens]
Athens Metropolitan Area

Water supply sources & treatment infrastructure

- Raw water supply depends on surface water sources
  - 3 artificial reservoirs (dams) and one natural lake
  - Total water abstraction 451,417,000 m³/year
  - 105 boreholes [max. capacity of 800,000 m³/d] can be used for emergency water supply and under drought conditions
- Raw water is conveyed to EYDAP’s 4 WTP (combined capacity of 1.9 hm³/d)

<table>
<thead>
<tr>
<th>RESERVOIRS</th>
<th>Useful Capacity (hm³)</th>
<th>Average Annual Discharge (hm³/yr)</th>
<th>Reservoir Area (km²)</th>
<th>Maximum Capacity (hm³)</th>
<th>Spillway Level (m. a.s.l.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marathon (1931)</td>
<td>34</td>
<td>14</td>
<td>2.4</td>
<td>41</td>
<td>223</td>
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<tr>
<td>Yliki Lake (1958)</td>
<td>580</td>
<td>295</td>
<td>25</td>
<td>600</td>
<td>78.1</td>
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<tr>
<td>Mornos (1972)</td>
<td>560</td>
<td>235</td>
<td>18.5</td>
<td>780</td>
<td>435</td>
</tr>
<tr>
<td>Evinos (2001)</td>
<td>113</td>
<td>296</td>
<td>3.5</td>
<td>140</td>
<td>505</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,287</td>
<td>840</td>
<td>49.4</td>
<td>1,561</td>
<td>1,241.1</td>
</tr>
</tbody>
</table>

Source: EYDAP, 2004
Athens Metropolitan Area

Water distribution & sewerage infrastructure

- **Water distribution**
  - 1,160,000 m³/d average consumption
  - 55 water reservoirs of 885,000 m³ capacity
  - 9,500 km network length
  - 81 pumping stations
  - SCADA surveillance system
  - 2,026,000 water supply connections

- **Sewerage**
  - Separated network: 96%
  - 3 WWTPs (Psytalleia, Metamorphosis, Thriasio)
  - 6,000 km network length
  - 44 pumping stations
  - SCADA surveillance system
  - 400,000 sewerage connections

The Psytalleia WWTP
Athens Metropolitan Area

Infrastructure Management Framework

- The public “asset” company [EYDAP Fixed Assets] owns the water reservoirs & conveyance aqueducts

- The semi-private utility [EYDAP S.A.] operates the infrastructure of EYDAP Fixed Assets at no extra charge
  - In return, EYDAP S.A. is not charged by EYDAP Fixed Assets for raw water supply
Investments by EYDAP S.A.

- EYDAP S.A. private shares: 39%
- State participation in company’s capital is reported at 60%
- Improvement of currently provided services by using economies of scale
  - Reduction of operational costs
  - Improved management

Total Investment budget for 2011: 57M€

Source: EYDAP 2011
Thessaloniki Metropolitan Area

Water supply sources & treatment infrastructure

- Raw water supply depends on surface & groundwater
  - Surface water abstractions: Aliakmonas River
  - Aquifers of Paikos (Aravissos springs), Sindos, Aksios riverbed aquifer, Ag. Paraskeuh - Chortiatis springs, East Thessaloniki boreholes
- Main water treatment plant near Sindos (capacity of 150,000 m³/day)

Source: EYATH
Thessaloniki Metropolitan Area

Water distribution & sewerage infrastructure

- **Water Distribution Network**
  - 250,000 m³/day mean drinking water production
  - 2,200 km network length
  - 48 pumping stations
  - SCADA surveillance system
  - 510,000 water supply connections

- **Sewerage Network**
  - Separated network 20%
  - 1,700 km network length
  - 39 pumping stations
  - 3 WWTPs (Thessaloniki, Aineia)
  - SCADA surveillance system
  - 510,000 clients-consumers
Thessaloniki Metropolitan Area

Infrastructure Management Framework

- The public “asset” company [EYATH Fixed Assets] owns the infrastructure for water abstraction
  - Water intake works
  - External reservoir
  - Pumping stations & wells
  - Conveyance networks and water meters

- The semi-private utility [EYATH S.A.] manages water/wastewater treatment plants, distribution & sewerage networks
Thessaloniki Metropolitan Area Investments by EYDAP S.A.

- Shareholders
  - Private shareholders
    - Suez Environment: 5%
    - Other companies: 11%
    - Small shareholders: 9%
    - Other: 1%
  - State participation: 74%

Total investment budget for 2011: 21.3 M€

- Buildings: 54%
- Mechanical & electrical equipment: 17%
- Installation of water meters: 16%
- Other equipment: 3%
- Water distribution network: 4%
- Sewerage network & facilities: 2%
- Infrastructure maintenance: 3%
- R&D: 1%

Source: EYATH 2010
Problems: The Greek Financial Crisis

- Reduction of subsidies for infrastructure
- Infrastructure is going to remain under public control
- The Greek Government will try to attract private investors
  - Significant investments are required for rehabilitating infrastructure and ensuring efficient operation
- Hellenic Privatization Program
  - Government’s share to be reduced to 51%
  - Selling additional shares of EYDAP & EYATH in order to raise revenues
- Decline of cash revenues due to wage cuts, consumers cannot afford water bills
- Difficulty in increasing tariffs or enforcing the payment of arrears
Opportunities: Expanding towards new markets

- EYDAP S.A.
  - Energy, natural gas, consulting, commercial activities
  - Expansion to other areas in Greece
    - EYDAP Islands S.A.:
      - Administration and operation of water supply & sewerage systems of Greek islands
      - 20 year – contracts with local municipalities
  - Pursuit of contracts in other countries: Libya, Kazakhstan, Azerbaijan, M. East, Africa

- EYATH S.A.
  - Exploitation of sludge (Sindos WWTP) & biogas production
  - Development of an optical fiber network for expanding to telecommunications
Urban Water Services in the rest of Greece
Until 2010...

- 230 Municipal enterprises for water supply and sewerage - DEYAs
- Population served: 4.3 million
- Average consumption: 93 m³/year/cap
- Investments: 5.5 billion € spent since 1980 (current prices)

<table>
<thead>
<tr>
<th>Population served</th>
<th>Number of DEYAs (before 2010)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;100,000 inh.</td>
<td>3</td>
</tr>
<tr>
<td>50,000 – 100,000</td>
<td>16</td>
</tr>
<tr>
<td>20,000 – 50,000</td>
<td>25</td>
</tr>
<tr>
<td>10,000 – 20,000</td>
<td>62</td>
</tr>
<tr>
<td>&lt; 10,000</td>
<td>124</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>230</strong></td>
</tr>
</tbody>
</table>
The 2010 reform for the Re-organization of the Greek local administration (Kallikratis Law)

- **Main law features**
  - Abolishment of prefectures
  - Reduction in the number of municipalities
  - Larger powers vested in Regions & municipalities

- **Before the reform**
  - 910 municipalities
  - 124 communities
  - ~230 DEYA
  - 4.3 million inh. Served

- **After the reform**
  - 325 municipalities
  - 142 DEYA
  - 5.1 million inh. served (+ 20%)

Source: EDEYA, Safarikas N., 2010
Problems arising from the reform

- Formal decisions required for:
  - Merger or extension of existing enterprises
  - Personnel transfers
  - Asset transfers

- A lot of bureaucratic issues come up during these processes
  - Issues are still pending, 1 year after the law was effected
  - Proper coordination is often lacking

- Need for funding
Sustainability Challenges
Sustainability challenges

- Ensuring water conservation ~ Environmental sustainability
  - Wastewater treatment & reuse
  - More efficient technology – water saving

- Ensuring adequate funding for maintaining, enhancing & upgrading current water systems ~ Financial sustainability
  - Cost recovery
  - Efficient allocation of economic resources
  - Private investment

- Ensuring access & affordability, particularly for low-income groups ~ Social sustainability
  - Tariffs & cost allocation across different group
Environmental sustainability
Wastewater treatment
Wastewater reuse
Water saving
Progress in wastewater collection & treatment (1/2)

- EU Urban Waste Water Directive 91/271/EC
  - All wastewaters to be treated by 2005
  - This deadline has not been yet met; this is expected to happen by the end of 2013

- Much progress has been made in the development of sewerage systems
  - 1985-2008: 60% increase in the share of population connected to a WWTP (10% → 70%)
  - 1995-2008: 58% increase in the share of population connected to tertiary treatment (6.3% → 64.4%)
Progress in wastewater collection & treatment (2/2)

- Current number of municipal WWTPs = 290, considering also smaller plants
- Progress in % of national population (census 2001) connected to primary, secondary and tertiary treatment in Greece (GR – EEA CSI 024)

Source: EEA 2011
Wastewater collection & treatment - Issues

- Several WWTPs do not operate properly

- Further investments required
  - Compliance with the Urban Wastewater Treatment Directive
  - Rehabilitation of existing infrastructure
    - Improvement of sanitation coverage
    - Improvement of existing plants

- Design & planning seldom considered the possibility for water reuse
Wastewater Reclamation & Reuse – Legal Framework

- Potential uses for treated wastewater in Greece:
  - Crop irrigation
  - Irrigation of public parks and gardens
  - Aquifer recharge

- Provisions for water reuse set through a Common Ministerial Decision in March 2011
  - Quality parameters for different use purposes
  - Framework for the issue of permits, monitoring & control

- Applications remain limited
  - High cost of developing infrastructure
  - Very recent law – provisions to be tested
Wastewater Reclamation & Reuse
Plans & applications

- EYDAP & the Ministry of the Environment are planning the reuse of wastewater in Attica
  - Irrigation of public parks & peri-urban green areas
  - Annual water saving ~ max 6%
  - Around Psyt taleia WWTP: 50,000 ha
  - State funding: 30 M€

- EYATH is using treated wastewater for crop irrigation in the Chalastra-Kalochoriou valley (1,200 hectares)
  - Sludge of WWTP is also used as a soil fertilizer

- EDEYA, the union of Greek DEYAs has taken initiatives for promoting infrastructure for wastewater reuse
Reduction of losses (Physical losses & non-revenue water)

- One of the most significant problems of water services in Greece
  - Old infrastructure/damaged water meters
  - Network leakages

- Significant amounts of non-revenue water
  - Municipal buildings
  - Irrigation of public gardens-parks
  - Illegal connections

- Actions to be implemented
  - Conservation and replacement of damaged equipment
  - SCADA control
  - Continuous inspection of connections
  - Enforcement of tariffs to the public sector (Payment!)
  - Fines for illegal actions
Asset modernization can also be a profitable investment...

Benefit (€/m³) from reducing losses by 1%

Source: Safarikas et al., 2005
Financial sustainability
Pricing policies
Investment needs
Social considerations
Pricing policy and tariffs
Athens Metropolitan Area – EYDAP S.A.

- “Low cost” pricing policy (Law 2744/99)

- Increasing Block Tariffs
  - 8 tariff categories
  - Domestic users 74% of total revenues
  - Expenses of an average household 1.1% of its income

- Tariffs are renegotiated every 5 years with the Ministries of Finance and the Environment
  - Inflation
  - Costs of water service provision
  - Water Framework Directive requirements
Pricing policy and tariffs

Thessaloniki Metropolitan Area – EYATH S.A.

- The pricing policy is defined according to Law 2937/2001, based on
  - The operational cost of the company
  - The implementation of new infrastructure (Law 2937/2001)

- Increasing Block Tariffs
  - Domestic users: 70% of total revenue

- Tariffs are renegotiated every 5 years with the responsible Ministries
Pricing policy and tariffs

Municipal Enterprises for Water Supply & Sewerage - DEYAs

- Tariffs vary per enterprise (population, infrastructure etc.)
  - Principal aim: Recovery of O&M costs
  - Increasing Block Tariffs are applied in all enterprises

- According to EDEYA for 2008 (sample of 70 DEYA)
  - Average rate: 1.35 €/m³
  - Minimum rate (lower block): 0.23 €/m³
  - Maximum rate (higher block): 2.76 €/m³
Pricing policy & tariffs

Average expenditure for water services

Average expenditure/capita/yr (2007)

Source: Safarikas, 2008
Pricing policy & tariffs

An overall comparison

Price (USD) per m³ of water and wastewater services faced by a household consuming 15 m³/month in different OECD countries

Source: OECD, 2009
Challenges: The WFD implementation

- Environmental & resource costs are ignored although concepts are introduced in the WFD Transposition Law (3199/2003)

- In many RBDs, even financial costs (esp. capital costs) are not recovered
  - In 2005, 74 DEYAs recovered just 60% of their total financial cost
Challenges: Needs for new investments

- Greece will have to increase its water spending as share of GDP by ~ 10% in order to maintain WSS at current levels

<table>
<thead>
<tr>
<th>Country</th>
<th>GDP (USD billion)</th>
<th>GDP/cap (USD)</th>
<th>GDP growth %</th>
<th>Current expenditure on water infrastructure (USD billion)</th>
<th>Projected expenditure on water infrastructure as % of GDP</th>
<th>Average annual investment (USD billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>602</td>
<td>29,893</td>
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<td>4.515</td>
<td>0.75</td>
<td>6.86</td>
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<td>254</td>
<td>31,254</td>
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<td>1.905</td>
<td>0.75</td>
<td>2.59</td>
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<td>Belgium</td>
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<td>29,707</td>
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<td>2.318</td>
<td>0.75</td>
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<td>Canada</td>
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<td>32,921</td>
<td>2.3</td>
<td>7.875</td>
<td>0.75</td>
<td>10.27</td>
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<td>Czech Republic</td>
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<td>18,370</td>
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<td>3.553</td>
<td>1.90</td>
<td>3.12</td>
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<td>3,389</td>
<td>2.3</td>
<td>1.335</td>
<td>0.75</td>
<td>1.82</td>
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<td>Finland</td>
<td>152</td>
<td>29,305</td>
<td>2.3</td>
<td>1.140</td>
<td>0.75</td>
<td>1.35</td>
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<tr>
<td>France</td>
<td>1724</td>
<td>27,738</td>
<td>2.3</td>
<td>12.930</td>
<td>0.75</td>
<td>16.86</td>
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<td>Germany</td>
<td>2391</td>
<td>28,988</td>
<td>2.3</td>
<td>17.932</td>
<td>0.75</td>
<td>23.38</td>
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<tr>
<td><strong>Greece</strong></td>
<td><strong>224</strong></td>
<td><strong>20,362</strong></td>
<td><strong>2.3 (!)</strong></td>
<td><strong>1.680</strong></td>
<td><strong>0.75</strong></td>
<td><strong>2.17</strong></td>
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<td>Hungary</td>
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<td>15,546</td>
<td>2.3</td>
<td>1.140</td>
<td>0.75</td>
<td>2.02</td>
</tr>
</tbody>
</table>

Source: OECD, 2009
Challenges: Social considerations

- Difficulty of citizens to comprehend:
  - The need for a change of water prices
  - The concept of “true water cost”

- Economic crisis
  - Water-related charges must be affordable to all
  - What was affordable before, is not affordable anymore...
CONCLUDING REMARKS
Responding to current challenges
Responding to current challenges

- Reinforcement of EYDAP & EYATH’s efforts to expand their markets beyond the water sector
  - Profit enhancement can improve viability in view of the Greek economic crisis
  - Enhancement of the possibility to attract foreign capital

- Proper coordination and management at the level of DEYAs for the right implementation of the “Kallikratis” law

- Implementation of the WW reuse legislation
  - Enhancement of efforts for promoting reuse
  - Natural resources conservation, mitigation of water scarcity

- Asset modernization
  - Proper coordination & exploitation of funding tools & mechanisms (incl. EU structural funds)
Crisis = Opportunities?

- The economic crisis can be seen also as an opportunity
  - Reduction in consumption
  - Improvement of existing assets & investing in optimal management, instead of embarking on costly new water supply schemes
  - New partnerships & new investors
    - Optimal management
    - Proper allocation of revenues
    - Accountability of companies
    - Integrated design that will enhance sustainable development