Online Pre-Conference
WATER, MEGACITIES AND GLOBAL CHANGE
7 – 11 December 2020

Technical And Technological Solutions
11 December 2020

Solutions That Leverage The Resilience Of Water Supply Systems – The Experience of EPAL
Ana Margarida Luís, Conceição Almeida, Francisco Serranito
Summary

1. About EPAL
2. Integrated Risk Framework
3. Smart Technologies As Barriers To Strategic Risks
4. Foresight Analysis
5. Conclusions
Summary

1. About EPAL
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1. About EPAL

EPAL is a profitable company founded in 1868, supplying drinking water to more than ¼ of the Portuguese population (2,9 M inhab). The supply system comprises assets whose value is aprox. 700 M€.

Since 2015 EPAL has been responsible to manage the concession of AdVT, a new water and wastewater company that resulted from merging 4 former companies, serving around 1,0 M inhab.
1. About EPAL
2. Integrated Risk Framework
3. Smart Technologies As Barriers To Strategic Risks
4. Foresight Analysis
5. Conclusions
2. Integrated Risk Framework

What are our current and future vulnerabilities?

Strategic objectives’ identification
Events/exposures/harms systemic model
“Side by side” risks comparison

Mega-trends characterization
Construction of future scenarios
“Side by side” risks (evolution) comparison

“Strategic Risk Management in Water Utilities: Development of a Holistic Approach linking Risks and Futures”

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2. Integrated Risk Framework

“Side by side” strategic risks comparison (in the present)
2. Integrated Risk Framework

CROSS-CONSISTENCY ANALYSIS – FUTURE SCENARIOS

<table>
<thead>
<tr>
<th>State of the economy</th>
<th>Energy prices</th>
<th>Consumption patterns &amp; environmental behaviour</th>
<th>Water quality</th>
<th>Water availability</th>
<th>Regulation and legislation</th>
<th>Infrastructure development</th>
<th>Technology development</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>Significant increase</td>
<td>Consumption slight decrease</td>
<td>Significant improvement</td>
<td>C. Bode reservoir level &gt; 121.5 m or Tagus &gt; +8 m</td>
<td>Compliance driven by EU</td>
<td>Resource scarcity: min. for maintenance and max. for Capex</td>
<td>Low degree of automation; no global vision of system</td>
</tr>
<tr>
<td>Stagnation</td>
<td>Slight increase or decrease</td>
<td>Consumption significant decrease</td>
<td>Slight improvement</td>
<td>C. Bode reservoir level &gt; 100 m or +4 m &lt; Tagus &lt; +6 m</td>
<td>Compliance driven by National Law</td>
<td>“Normal”: Increase maintenance and decrease Capex</td>
<td>Developed degree of automation; global view of system</td>
</tr>
<tr>
<td>Fluctuation</td>
<td>Remains the same</td>
<td>Consumption remains stable</td>
<td>Remains the same</td>
<td>C. Bode reservoir level &lt; 100 m or -1 m &lt; Tagus &lt; +4 m</td>
<td>Compliance driven by self-regulation</td>
<td>Resource abundance: Decrease maintenance and increase Capex</td>
<td>Best in class. Import / Develops and exports own tech.</td>
</tr>
<tr>
<td>Recession</td>
<td>Fluctuation</td>
<td>Consumption slight increase</td>
<td>Slight degradation</td>
<td>C. Bode reservoir level &lt; 89 m or Tagus &lt; -2 m</td>
<td>Compliance driven by lobby groups</td>
<td></td>
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</tr>
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2. Risk Framework

CROSS-CONSISTENCY ANALYSIS – FUTURE SCENARIOS

Reference scenario
As Portugal has just exited an economic recession, the state of the economy is becoming stagnant. Energy prices register slight positive or negative fluctuations, and consumption patterns evidence a slight decrease. Both water quality and water availability at source remain at good levels. Water supplied complies with national standards and economic regulation is becoming gradually stronger. Infrastructure developments return to their “normal” configuration, i.e., increasing maintenance and reducing capital investment, thus optimizing assets' life without compromising the agreed levels of service to the clients. The company maintains a developed degree of automation, allowing a global view of the system and its centralized operation.

Scenario 1 - Water scarcity
Downscaled climate change scenarios indicate that severe drought periods are expected to occur in the next 40 years. During these periods, that may extend over one year or more, there may be a fluctuation in the prices of energy, as energy production is also affected by droughts, as well as a fluctuation in the state of the economy. Consumptions will decrease due to restrictions imposed by EPAL and the regulator. Water quality at sources will also decrease, due to the reduction in flows in the water bodies, which augments the concentration of pollutants. This decrease of water quality may become significant if compliance with environmental standards is self-regulated and economic regulation is weak. In order to cope with the increased water treatment operational costs and the costs associated with the implementation of adaptation measures to water scarcity, along with the reduction in revenue due to a decrease in consumption, tariffs will be gradually increased. EPAL will decrease the regular investment costs, thus increasing maintenance expenditure, and will maintain a developed degree of automation, since having a global view of the system is shown to be crucial for its operation in this scenario.

Scenario 2 - Financial resources‘ scarcity
In a prolonged global economic recession context, water quality at sources gets worse, since industries and municipalities cannot afford adequate treatment of the water they or own hand. EPAL faces a significant decrease in consumption, which lowers annual revenue. Both capital and operational expenditures are constrained, and part of the installed automation system may begin to fail. EPAL moves from a preventive attitude in asset management towards a reactive one. Economic regulation is weak, since regulators know that water utilities have no financial resources either to put measures in place to accomplish the established levels of service or to pay any fines. Development of new solutions or technology may occur, due to the need to find cheaper ways to operate the water supply system.

Scenario 3 - Strong economic growth
Significant improvement in water quality happens in a context of strong economic growth. Although existing industries in the watershed increase their activity and new ones arise, they comply with EU water quality legislation and treat all the wastewater before it is discharged into the rivers or the sewage network. Farmers also use permitted pesticides only, complying with the Nitrates Directive. Municipalities' wastewater treatment is of secondary or tertiary levels. There is a slight increase in water consumption. This context of strong economic growth makes way to an increase in Capex, targeting trunk mains' rehabilitation because of their ageing process, and also enables the company to adopt or develop new technology, becoming “best in class”. For example, EPAL augments its own power generation capacity, through the production of solar, wind and micro-hydric energy. As a result of all these factors, EPAL faces a reduction in Operational Expenditure, due to reduced costs with energy and chemicals, as well as to an increase in the revenue from the clients.
2. Integrated Risk Framework

Evolution of Strategic Risks (in the future)

- Strategic objectives' identification
- Events/exposures/harms systemic model
- "Side by side" risks comparison
- Mega-trends characterization
- Construction of future scenarios
- "Side by side" risks (evolution) comparison
1. About EPAL
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3. Smart Technologies As Barriers To Strategic Risks
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Eg.#1: Asset Management

<table>
<thead>
<tr>
<th>Risco</th>
<th>80%</th>
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<tbody>
<tr>
<td>Ponto de Vista</td>
<td>Desempenho Esperado</td>
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<tr>
<td></td>
<td>Desempenho Real</td>
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</table>

Consequência

<table>
<thead>
<tr>
<th>Custo</th>
<th>20%</th>
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</thead>
<tbody>
<tr>
<td>Fatores Económicos</td>
<td>Custos de Renovação vs. Custos de Reparação</td>
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<td></td>
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LISBON DISTRIBUTION NETWORK RENEWAL – PRIORITY AREAS

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3. Smart Technologies As Barriers To Strategic Risks

Eg.#2: Smart Network Management

- **Remote supervision and operation of all drinking water production and transport processes**

- **Algorithm that identifies suspension zones with a low service quality level, based on a risk matrix criteria.**

- **Customer relation management application that integrates commercial and technical information, including mobility functions.**

- **Support energy management in water supply and waste water utilities, aiming energy operational and economic optimisation.**
3. Smart Technologies As Barriers To Strategic Risks

Eg.#3: Business Continuity

Drought Contingency Plans
- Definition of contingency plans for drought;
- Contact with security forces, health entities and NGO´s;
- Contacts with various official entities, including the regulator;
- Contacts with municipalities for support;
- Developing campaigns in the media;
- Strengthening the supply ducts, allowing redundancy;
- Preparation of alternative supply channels

Emergency Plans

<table>
<thead>
<tr>
<th>Location and Surrounding Area</th>
<th>Supply System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 1. – Planning for Prevention</td>
<td>Part 1. – Planning for Crisis</td>
</tr>
<tr>
<td>Part 2. – Planning for Emergency</td>
<td>Part 2. – Organising the Response to Crises</td>
</tr>
<tr>
<td></td>
<td>Part 3. – Contingency Plans</td>
</tr>
<tr>
<td></td>
<td>3.1. – Supply Systems</td>
</tr>
<tr>
<td></td>
<td>3.2. – Pandemics</td>
</tr>
</tbody>
</table>

General EPAL Emergency Plan
(Communicating and organising with the exterior)

Stakeholders

Civil Defence Emergency Plans
- National Civil Defence Plan
- District Civil Defence Plan
- Municipal Civil Defence Plan
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4. Foresight Analysis

**Scenario 1 - Water scarcity**

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**Scenario 2 - Financial resources’ scarcity**

In a prolonged global economic recession context, water quality at sources gets worse, since industries and municipalities cannot afford adequate treatment of the wastewater they produce and, on the other hand, farmers tend to use non-approved pesticides. EPAL faces a significant decrease in consumption, which lowers annual revenue. Both capital and operational expenditures are constrained, and part of the installed automation system may begin to fail. EPAL moves from a preventive attitude in asset management towards a reactive one. Economic regulation is weak, since regulators know that water utilities have no financial resources either to put measures in place to accomplish the established levels of service or to pay any fines. Development of new solutions or technology may occur, due to the need to find cheaper ways to operate the water supply system.

**Scenario 3 - Strong economic growth**

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4. Foresight Analysis

Current vulnerability = Low
(due to natural conditions + adaptation measures in the past)

Megatrend: Climate change
4. Foresight Analysis

Future vulnerability = Low to Medium

Megatrend: Climate change
4. Foresight Analysis

Flexible Adaptation Plan

climate change indicators

Megatrend: Climate change
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# Conclusions

## The Strategic Risk Management Approach

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<th>STRATEGIC RISKS’ ASSESSMENT, IN THE PRESENT</th>
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| i. represents the first approach combining risk and futures; |
| ii. allows the company to have an integrated view of its strategic risks, with an influence diagram; |
| iii. shows the role of smart technologies in securing the corporate strategic objectives; |
| iv. allows the company to anticipate how strategic risks might change in the mid- and long-term and to timely adopt adaptation measures; |
| v. provides the basis for the utility Master Plan [Chinese Proverb]. |
Conclusions

i. Both the Strategic Risk Management approach and the Adaptaclima project are successful examples of collaboration between industry and research.

ii. The approach followed by EPAL is aligned with the European Commission (EC) first strategic forward-looking report recently adopted, to identify emerging problems and opportunities in order to guide the necessary transitions in a sustainable way and adapted to the specificities of each city, keeping strategic risks at acceptable levels.

iii. We strongly believe this approach can be adopted by other entities with management roles in mega-cities, contributing to leverage their pathway towards resilience.
Thank you for your attention!

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