

Optimization of the operation of water supply system

Joinville, Santa Catarina – Brazil

1. Objective

The main objective of this innovation pilot is to use Artificial Intelligence (AI), Machine Learning (ML) and Advanced metering infrastructure (AMI) to find solutions for system adjustments for optimization of Águas de Joinville's operations. This includes the use of Internet of Things to create communications from smart sensor devices and transmit water production and distribution data to Cloud Computing servers for a variety of functions, such as automatic opening or closing of registers, and pressure valve regulation, among others. The use of unique identifiers (UIDs) allows for a fully automated system, with no need for human intervention in this process. The immense volume of data generated enables big data analytics. The use of operational optimization actions using smart technologies is essential to guarantee the economic, environmental and social sustainability of the corporation.

2. The water supply system

Companhia Águas de Joinville operates as a concessionary for water treatment/supply and sewage collection/treatment in the municipality of Joinville, Santa Catarina - Brazil, serving a population of 600,000 people. Water coverage is almost 100%, while sewage coverage is only 39% of the population. The two key challenges for the company are the universalization of sewage and the optimization of the water supply process. Águas de Joinville manages 13 sewage treatment plants (ETEs), 13 reservoirs, 2,252 km of water networks, 553.7 km of sewage networks, 108 pumping stations, 5 service units, 1 warehouse and 1 administrative headquarters. The total number of connections in the system is 156,339. The energy consumption required to produce 1m³ of drinking water is around 0.6 to 0.7 kWh. The billing losses are in the order of 38% and the loss rate per connection is around 500 l/connection/day. One of the challenges for the managers who work in the supply operation is the need to know about the existing technologies and methodologies, with their respective potentials and limitations, allowing to adapt and use all available resources to achieve efficiency objectives. The government has gradually been reducing subsidies on electricity tariffs, which has resulted in a considerable increase in energy operating costs for the concessionaire.

3. The Challenge

The deficient water supply in Joinville is causing countless losses to Companhia Águas de Joinville, as well as considerable environmental and economic impacts, including waste of chemical products, reduced availability of water resources, energy losses, sub-optimal use of human resources, and high water tariffs for end users. The physical and commercial losses found in such inefficient systems directly translate into unnecessary expenses and financial losses, as well as increasing production and

distribution costs. The use of IoT technologies would optimize supply processes, in line with the modern precepts of innovative technologies, where capturing and processing of data allows the optimal operation of production and distribution of water to all users.

4. Pilot Project General Structure

Aguas de Joinville is looking to develop a comprehensive optimization program for their system, which should include, among others:

- Demonstration pilot with sensors installed in the water supply system to collect data and send to servers that use advance processing systems (i.e. Complex Event Processing – CEP, others), to process data in real-time, identifying recurring patterns of water loss, changes in water pressure, or other.
- Use a web interface that would allow water operators to monitor and control the water system and ensure adequate distribution throughout the network.
- Provide operational modules to allow the optimization of functions and real-time data analytics for specific objectives, such as pressure management, monitoring water quality, leak detection, alerts, etc.
- Establish a data management/geographic information system to process, display and communicate data at various levels (among operators, with water users/clients, etc.).
- Establish lessons learned with results from the pilot
- Establish a company-wide platform that will allow Aguas de Joinville to complete the optimization program throughout their systems.
- Design and test training modules among company operators for a full-fledged optimization program

5. Relevant Company/program information.

Sustainability Report, Aguas de Joinville:

<http://comunidad.socialab.com///uploads/16014669205f74722845209.pdf>