

DIGITAL TRANSITION OF INTEGRATED WATER CYCLE. INVESTEMENTS IN A CASE STUDY

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Abstract: Aigües de Manresa is a public company that operates in 17 municipalities, a Regional Council, and a Commonwealth of Municipalities, all located in the regions of Bages and Moianès. The company has been awarded by the Ministerio para la Transición Ecológica y el Reto Demográfico of a Project to improve the efficiency of the urban water cycle (PERTE digitalización del ciclo del agua). The main objectives of the project are to take the definitive step towards the digital transition using new technologies and innovation, to implement work by exception, to increase the energy efficiency of infrastructures and reduce the volume of leaks, to implement Edge computing, and to enhance transparency with the creation of a Territorial Water Observatory.

Keywords: Digitalization, PERTE, open hard, open source, edge computing, work by exception and GISWATER

1. Introduction

The digitalization of the companies operating the integrated water service is one of the fundamental objectives to optimize the management of the networks, the purification of water and its purification. Digitalization must provide the necessary tools to reduce leaks, improve the quality of the water supplied, improve purification processes, and minimize the pollutant load discharged into the environment during rainy episodes.

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The project Sustainability in the water cycle. A project to digitize and transform the territory covers the entire integral water cycle: collection, storage, treatment, conduction, distribution, evacuation, sewerage, purification, and discharge into the environment. In addition, this project is linked to the Horizon 2025 Strategic Plan that the company presented in 2020, and through which it will be able to advance in the proposed digitalization objectives.

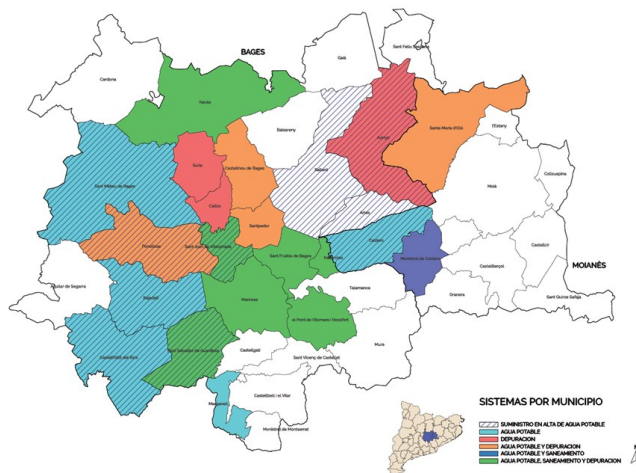


Figure 1. Territorial scope of the project.

The total estimated population involved in the supply is around 131,886 people and the number of subscribers, with data from 2022, is 67,480. The population involved in sanitation is around 140,799 people. The project has an amount of 10,628,086.08 euros and the aid granted amounts to 6,028,016.67 euros. In 2022, Aigües de Manresa had a turnover of 21,713,519.79 euros. The execution of the project began on January 1, 2024, and is expected to be completed by the end of 2025 or mid-2026.

2. Objective of the project

The main objectives of the project are to take the definitive step towards the digital transition of Aigües de Manresa using new technologies and innovation, to implement work by exception, to increase the energy efficiency of infrastructures and reduce the volume of leaks, to implement Edge computing, and to promote transparency with the creation of a Territorial Water Observatory.

The project presented is characterized by using open source and open hard, so all the results will be published on the GitHub platform [4], and by being executed within the company.

The project is structured in 12 general objectives with the aim of providing solutions to the problems and needs detected:

- Take the definitive step towards the digital transition of Aigües de Manresa, using new technologies and innovation.
- Contribute to better planning, management, and governance around Aigües de Manresa with the creation of a comprehensive water management plan, which includes the Supramunicipal Master Plan for the Integral Water Cycle and other derived plans. Special treatment will be given to areas with more extensive networks and smaller populations.
- Start working by exception, to optimize the operating costs of the services. Currently, work is being done since the inspection and analysis of the information received. With the improvement of the knowledge of the services operated, through their sensorization, communications and data processing systems, it is primarily intended to act in those cases in which the system detects unusual or dangerous behavior.
- Increase the energy efficiency of infrastructures linked to the integral water cycle with a reduction in external consumption by 12.59%. The project aims to reduce energy costs through the generation of renewable energy.
- Reduce the number of leaks in the different networks by an average of 5%, considering the particularities of each of them.

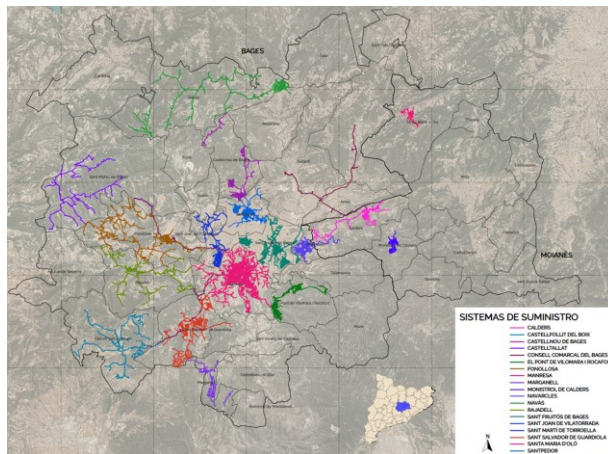


Figure 2. Water supply networks included in the project.

- Increase the data processing capacity and control over the services operated, through complex algorithms executed peripherally, through Edge Computing, in remote control.
- Have governance over the systems and data produced, through the majority use of open hard (Raspberry Pi, ESP32 and others) and open-source programs.
- Equip itself with the necessary tools to face the requirements derived from the new Royal Decree 3/2023 (with 68 catchments, mostly wells, and with only 6 conventional DWTPs) and at the same time manage 304 discharge points into the environment.
- Adapt the infrastructures of the integral water cycle to future drought or flood scenarios caused by the effects of climate change, increasing their resilience.
- Raise even greater awareness of the integral water cycle among the population by increasing their knowledge, enhancing transparency and their social linkage of an essential element such as water, through the creation of a Territorial Water Observatory.
- Train the staff of Aigües de Manresa with the development of new professional profiles, the creation of specialized jobs in the digital environment and automation.
- Share our experience with other operators with similar problems and challenges through mentoring.

3. Project Governance

The main objective of the project is the digitalization of the company, so that the management and decision-making of the project, execution and control will be internal. For the execution of the project, a work team has been created made up of a Project Leader and four Project Managers, Sensors, GIS, Computer Applications and Remote Control. Between the four of them, they will execute 80% of the project's budget, and other six working groups have been created that share the remaining 20%, Planning, Information Systems, Renewable Energies, Communication, Environment and Administrative Digitalization.

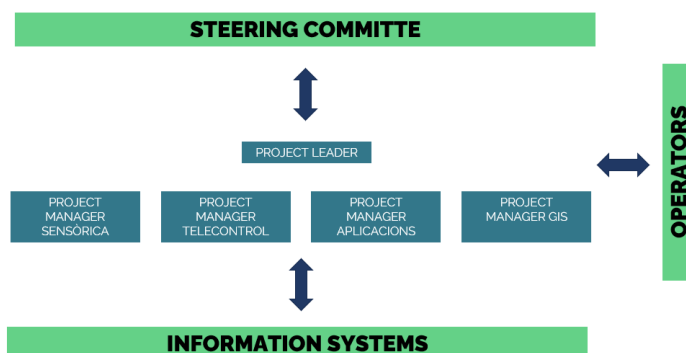


Figure 3. Structure of management the project.

The Project Managers' work teams have been grouped into a department created expressly for the execution of the project and which will eventually have 24 workers. About 15 workers, mostly technicians, are being hired, and a total of about 45 workers from the organization will participate in the project. The project depends on the Operations Directorate and for its governance a Steering Committee has been created with the participation of the members of the company's management.

4. Data processing and hydraulic modelling

The project focuses on data processing. The project foresees the installation of more than 1,500 sensors, the renovation of the 204 points of the remote control system using open hard, the use of open source and the widespread implementation of LoRa communications [6], the creation of new open source applications, corporate database and front end, and the improvement of the open source GIS system used, GISWATER module [3] of QGIS, with the introduction of web applications using QWC2 [5] and the systematization of the use of hydraulic modelling tools, with the joint use of open-source applications, EPNAET, SWMM and IBER.

5. Conclusions

The execution of this project in Aigües de Manresa will be the company's definitive step towards the digital transition. The grant received will allow the renewal of equipment and applications related to network sensorization, communications, data processing and hydraulic modeling in an open hard and open-source environment.

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