

Water Flow Measurement in the Alqueva Project

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Summary

- The Alqueva Multipurpose Project
- The Iberian Peninsula and the transboundary Guadiana Watershed
- Flow meters in Alqueva (upstream and downstream):
- Other meters in the water lines
- Losses measurement
- Water balances in the context of climate change
- Hydraulic / energy efficiency
- Major measurements problems











Empresa de Desenvolvimento EDIA e Infra-estruturas do Alqueva, S.A.







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Annual rainfall - Beja (1941-2018)





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Flow Meters	
Electromagnetic	43
Pressure	7
Ultrasonic	43







ARDILA SUBSYSTEM







ARDILA SUBSYSTEM

FLOW METERS





Flow Meters	
Electromagnetic	15
Pressure	-
Ultrasonic	27









PEDROGÃO SUBSYSTEM







PEDROGÃO SUBSYSTEM

FLOW METERS



Flow Meters	
Electromagnetic	11
Pressure	2
Ultrasonic	14



PEDROGÃO SUBSYSTEM



















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CURRENT GSM TELEMETRY









TELEMETRY DATA - 2017







TELEMETRY DATA - 2018







TELEMETRY DATA - 2019







FUTURE LORA TELEMETRY















ALL DATE NO.

RESERVOIR INTAKE FLOW METER











NETWORK FLOW METER







Annual Irrigated Areas







Annual distributed volume







Irrigated Crops



Olival

- Frutos Secos
- Milho
- Vinha
- Forrageiras
- Oleaginosas
- Hortícolas
- Cereais
- Outras Ocupações
- Frutícolas
- Aromáticas e Medicinais
- Proteaginosas
- Flores e Plantas ornamentais
- Florestais





Average water consumption per hectare











Sérvia, May 2011

Middle Bottom Spillways









Hydraulic Model













Pedrógão Dam Hydraulic Model





ZNR





Flood (2010)





HYDROMETRIC STATIONS







Ecological Flow – Guadiana River at Pomarão















Final remarks #1

Climate Change and Water Resources Balance

Alqueva Project is located in a region that is particularly sensitive to climate change. It is a priority to have reliable and timely global and sectorial water use balance sheets and to move towards a sustainable approach and high hydraulic/energy efficiency use of this limited resource- essential to life. This can only be made with field meters adequately selected, installed and properly maintained.

Luso - Spanish Treaties of Water

Guadiana is a cross-border river managed according to the Portuguese-Spanish agreements for water use. The Alqueva Project is downstream from one of the river flow control sections but is also upstream of a control section for the delivery of flows to Spain - so the values of tributaries and effluents, validated by meters in sections of the tributaries, upstream and downstream from the Project, are of great importance.

Operation Algorithms

From the hydraulic-operational point of view, concerning the safety, the economy and sustainability of the Project, the data flow and water levels are indispensable inputs in the algorithms that govern the operation of the great hydraulic infrastructures of the Project





Final remarks #2

Alqueva Project Numbers

The Project will use 620 hm3 of water in cruise year, to benefit an area of 10,000 km2, through a multiplicity and diversity of infrastructures, namely 2000 km of piping and channel adduction and distribution network, 69 dams and reservoirs, 2 large reversible hydroelectric power stations, 47 pumping stations and 6 mini-hydroelectric plants.

Mobilized Water Resources

Alqueva Project and its infrastructures need to have the control of all the water resources mobilized, namely: the inflow, abstractions, storage, regularization, elevation, adduction and distribution (irrigation, raw water for public and industrial supply), turbine / pumped hydroelectricity / reversibility), ecological flows, losses (evaporation, percolation leakages). All these flows must respect the Portuguese-Spanish commitment to water and effluents.

Flow Meters

EDIA has already installed a large number of flow meters that support the management, but taking into account the diversity of measurement situations, the equipment and infrastructures implemented contain a great variability of solutions.





Final remarks #3

Second Phase of Alqueva Project

With the second phase about to begin, flow measurement and remote management issues are particularly important, within a logic of sustainable management of water resources- being essential to have a robust network with some redundancy. Some subjects in flow metering need to be addressed:

- i. large range of variation of constrains related to a) natural and ruled sections, b) free surface and pressure, and c) geometry and flows in presence;
- ii. temperature, solid transport and algae;
- iii. telecommunications and management;
- iv. redundancy to detect losses and validate measurements;
- v. maintenance procedures optimization.

Operation Control and Water Resources Planning

EDIA already has a tele-management system and information systems that enables it to have the necessary controls and dashboards that are fundamental to its technical and socio-economic activity and to the macro management of water resources but needs to be aware of new developments upgrades and innovations that can give greater accuracy and quality to huge data volume









