A unique **expertise** and **innovation** centre

CESAME is a technical division of CNR whose ambition is to guarantee, in terms of safety and longevity, an optimal level of operational expertise in measuring and analysing the behaviour of flows and hydropower structures. Its main aim is to satisfy the requirements of safety and performance of CNR's assets from their design to their operation.

Its teams participate in controlling hydraulic safety, the safety of navigation, and technical risks. CESAME advises and supports the operational staff to manage the Rhône's flows. Backed by its high level of expertise gained from managing the river for 90 years, it works to improve the performance of the CNR's hydropower plants and innovates to prepare for the future.

Physical and hybrid modelling

Abrasion test on a concrete sample

A **multi-disciplinary** team with advanced resources

CESAME relies on a highly experienced team whose skills are in total synergy. It is installed on 6 sites in order to be as close as possible to CNR's different territorial operating centres.

100 SPECIALISTS COVERING 7 AREAS OF EXPERTISE

- **Hydrometry** (water and solid flows)
- **Hydraulic modelling** (physical, numerical and hybrid)
- **Measuring hydraulic performance** (river structures and hydropower turbines)
- **Measuring for civil engineering surveillance** (monitoring, topography, and bathymetry)
- **Materials engineering** (soils, concretes, rock-fill and sediment deposits)
- **Inspecting and monitoring hydropower plants** (plants, dams, and dikes)
- **Sediment management** (diagnostics and inspections)

2 TEST LABORATORIES

- **Physical hydraulic modelling**
- **Materials of structures and erosion**

What is CNR?

France's leading producer of 100% renewable electricity, with an installed capacity of over 4,000 MW, CNR transforms the energy of sun, wind and the water of the Rhône, a river of which it has held the concession for 90 years. This energy production activity allows it to finance its other missions: developing navigation and port sites, and irrigation for farmland. CNR manages these three natural resources of Water-Wind-Sun as common goods over which it shares the governance and the value generated with the territories and its subsidiaries in France.

The only joint stock company in the general interest in France, its capital is mostly public (183 local authorities, the Caisse des Dépôts Group). ENGIE is its leading industrial shareholder.

INDUSTRIAL ASSETS

20 hydropower plants
19 dams
17 SHP and MHP
19 locks including 5 for leisure craft
400 km of dikes
330 km of wide gauge navigable waterway

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Energy is our future, save it!

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CESAME

Expertise and Monitoring Center for Hydraulic Flows and Structures

Taking the river's pulse!

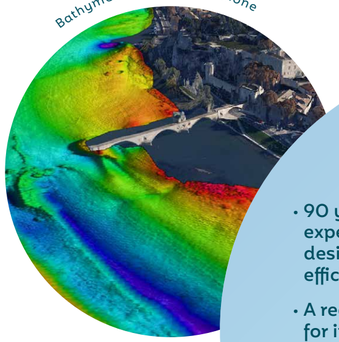
Essential missions for **safety** and **performance**

CESAME PERFORMS A WIDE RANGE OF MISSIONS

- **Monitoring** the hydropower plants operated by CNR, and the riverbeds of the Rhône and its tributaries.
- **Controlling** and **guaranteeing** that the water flows, beds, and structures behave well in normal and flood situations.
- **Producing reliable discharge data** to optimise hydroelectricity production and the operation of the hydropower plants in every situation.
- **Optimising the performance** of CNR's hydropower plants with advanced measurement and test equipment deployed in the framework of studies carried out on site and in the laboratory.

Carrying out bathymetric surveys

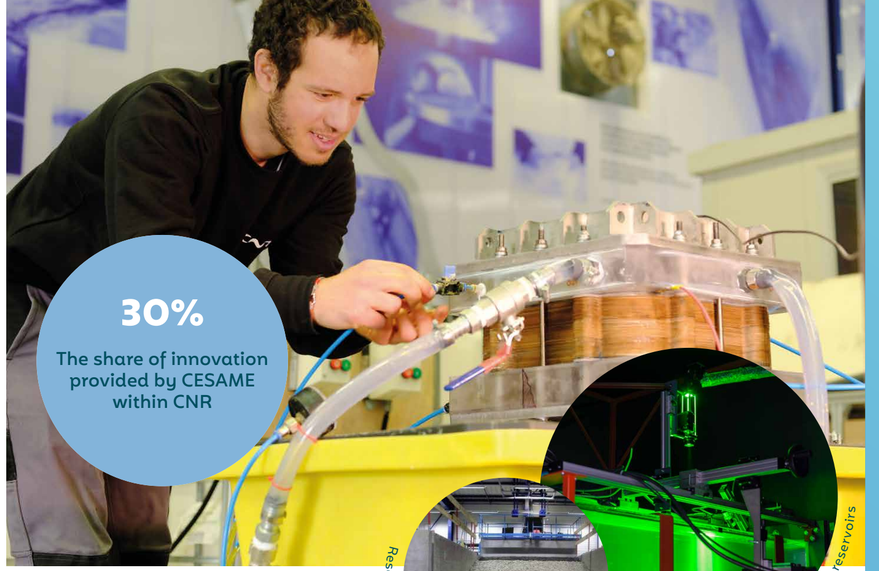
Operation on a hydropower turbine



Bathymetric map of the Rhône

Our assets

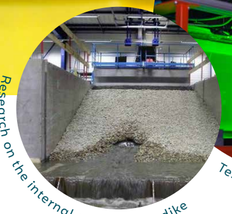
- 90 years of experience in designing safe and efficient structures.
- A requirement for impartiality and reactivity.
- Measurement and test resources that provide a unique capacity of expertise.
- Strong links with the scientific community and higher education.



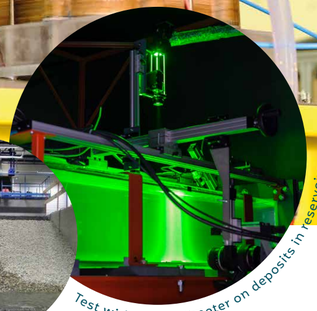
30%

The share of innovation provided by CESAME within CNR

Experiments with osmotic energy



Research on the internal erosion of a dike



Test with an erodimeter on deposits in reservoirs

An approach of **innovative collaboration**

CESAME implements an approach of permanent innovation to satisfy CNR's requirements regarding hydraulic safety and navigation, and its commitments to energy transition and the climate. Vital for CNR's performance, innovation lies at the heart of CESAME's activities. These developments emerge from the creativity of the operational teams and collaborations with different national and international partners: laboratories, research centres, expert committees, engineering offices, etc.

Its approach combines know-how and innovation by privileging experience sharing and the integration of new technologies from the earliest stages of their maturity.

OUR ACHIEVEMENTS INCLUDE

- Test bench for assessing the erodibility of sediment deposits in dam reservoirs.
- Modelling processes of internal erosion and erosion by overflows of earthfill dikes.
- Reinforcing earthfill dikes using bacteria (BOREAL).
- Physical modelling of torrential bedload and debris flows.
- Gauging discharges using video cameras.
- Osmotic energy demonstrator project.

OUR PARTNERS INCLUDE

- INRAE, CNRS...
- INSA, ECL, ENTPE...
- Universities of Stuttgart and Madrid
- EDF-R&D
- French Forestry Commission
- Sweetch energy

Know-how recognized in **France** and **internationally**

CESAME contributes its expertise to the major engineering projects carried out by CNR and by French and international project owners. These internal and external projects enrich its know-how and experience through the deployment of new methods and innovative techniques, resulting from diverse geographical, technical, and sociocultural contexts.

OUR SUCCESSES INCLUDE

- Physical model of the Manival torrent sediment **retention basin** (ONF – RTM and SYMBHI).
- Works to restore the **sediment balance** of the Loire River bed (VNF).
- Design of the new locks of the **Panama Canal** and the optimization of their operation (ACP).
- Dimensioning of the **new flood spillway** of Boukhroufa dam (VINCI).
- Urban **wastewater pre-treatment** plant of Clichy (SIAAP).

Physical model of the Loire (VNF)

New locks of the Panama Canal (ACP)

Physical model of the Manival torrent (ONF-RTM)