



Agence d'Etudes et de Promotion de l'Isère

AEPI 2011

Grenoble isère-france

Grenoble-Isère The birthplace of hydroelectricity

- **Hydroelectricity was invented in Grenoble-Isère in 1869. Engineer Aristide Bergès was the first to harness the power of water for industry.**
- **Alstom Hydro Global Technology Centre: the world's largest hydroelectricity R&D center.**
- **Grenoble-Isère is home to three of France's ten largest hydropower plants.**
- **The largest hydroelectric project in France – EDF's €250 million rehabilitation of the Romanche-Gavet hydropower plants for potential capacity of 560 GWh/year – is in Grenoble-Isère.**
- **Grenoble Institute of Technology's ENSE³ provides specialized hydropower training to 150 engineers each year.**
- **Government-funded research in Grenoble-Isère covers all aspects of hydropower, from turbo machinery development (CREMHyG) to fluid mechanics (LEGI).**



While **hydroelectricity** has been used successfully for more than a century, as a clean, renewable – and competitive – source of energy it has a bright future ahead of it. Securing the future of hydropower will require new responses in terms of innovation, safety, and integration with the grid. And, Grenoble-Isère, offering a broad palette of expertise from turbine manufacturing to smart energy management, is poised to shape the hydropower of the future – and help rise to the global challenge of meeting increased demand for energy.

ADVANCED RESEARCH IN A DIVERSIFIED INDUSTRIAL ECONOMY



CREMHyG

Cooperation between research, higher education, and local industry
Research is a pillar of the Grenoble-Isère economy. Grenoble boasts 22,800 research jobs, placing it just behind Paris. And hydropower is a key research focus area.

GOVERNMENT-FUNDED RESEARCH WITH GLOBAL REACH

CREMHyG, Grenoble's center for hydraulic machine research and testing, is a key contributor to developing the technologies that underpin tomorrow's hydraulic machines, with high-level research in areas like space pump suction stages and turbine pumps for hydroelectric dams and the negative effects of cavitation on performance.

LEGI is a lab that studies geophysical and industrial fluid dynamics. The lab's 170-person team conducts targeted research on turbulent flow dynamics, geophysical fluid dynamics, and very-high-hydrodynamic flows.



LTHE looks at hydrological and environmental transfer phenomena. The lab's 120-person team leverages recognized expertise in instrumentation and experimentation to study the water cycle and its relationships to climate and the environment.

ALSTOM HYDRO, DRIVING PRIVATE-SECTOR RESEARCH

Alstom Hydro doubled the testing and research capacity of its R&D center in May 2008. Today the world's largest reduced-scale turbine testing lab, the center employs 142 people to test all of the mechanisms developed by Alstom Hydro and its European customers.



Alstom Hydro

CERG, an R&D center owned by EnvironneTech, specializes in fluid mechanics, providing applied research services to manufacturing and other industrial companies from the public and private sectors.

TECHNOLOGY TRANSFER CENTERS

The **HYDRO** technology transfer center is a joint initiative of Grenoble Institute of Technology and Alstom Hydro. The center's mission is to improve equipment efficiency and better monitor and control water resources. It develops for major foreign markets new machine concepts designed to meet the latest standards.

PREDIS is a center for innovation and training in the field of energy. It develops technologies for local, renewable power generation, smart grid management, and low-power systems. The center combines theoretical development work, digital modeling, and pilot implementation.



CERG fluid dynamics research



TENERDIS competitive cluster focuses solely on new energies, with a program targeting hydropower. To date, six R&D projects to improve hydroelectric system efficiency and promote innovation in hydropower have received funding via the cluster.

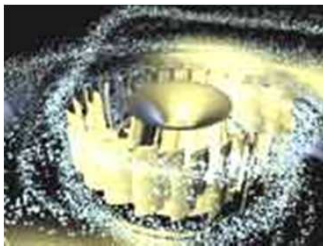
AN IMPRESSIVE CONCENTRATION OF GLOBAL LEADERS IN THE FIELDS OF HYDROELECTRICITY AND RENEWABLE ENERGIES



Grenoble-Isère offers a broad palette of hydroelectric and energy expertise that includes hydropower dam and plant design, turbine manufacturing, small-plant maintenance, uninterrupted power supply, and smart grid technologies.

The area is home to **more than 10,500 jobs in the hydroelectric and energy industries (including new energies)**, with leaders like Alstom, Atos Origin, Schneider Electric, Sogreah, and Gaz Electricité de Grenoble.

Grenoble-Isère also offers a dense network of subcontractors in metals, software, instrumentation, and mechanics.



Alstom Hydro

FROM SMES TO LEADING GLOBAL CORPORATIONS

ALSTOM Hydro France employs 480 people in Grenoble-Isère. The **global leader in hydroelectric equipment** supplies equipment to hydropower plants of all sizes and rehabilitates existing facilities.

SOGREAH - ARTELIA employs 370 people in Grenoble-Isère and nearly 1,200 people worldwide. A specialist in **water and the environment**, Sogreah provides infrastructure studies, design, and construction services.



ANDRITZ HYDRO employs 50 people in Grenoble-Isère. The hydroelectricity division of Austria-based technology company Andritz, Andritz Hydro operates worldwide, and is one of the leading global suppliers of **equipment for hydroelectric plants**.

EREMA Provides hydroelectric plant supervision and maintenance services and consulting services focusing on **automation and transmission systems**.

HYDROLOGIC has been **designing and manufacturing hydrological measurement equipment** for more than two decades, offering expertise in **bubble-to-bubble level measurement**.



Aqualienne® by H3E

H3E Industries designs and manufactures a **new generation of hydroelectric micro plant: Aqualienne**. The plant was co-designed with Grenoble Institute of Technology and CREMHYg and was certified and financed by competitive cluster Tenerrdis.

ELECTRICAL EQUIPMENT MANUFACTURERS

Schneider Electric employs 5,500 people in Grenoble-Isère and is a leading global specialist in energy management and automation systems. **APC by Schneider Electric** provides end-to-end solutions to ensure uninterrupted power supplies for calculation, network, and telecommunications applications.

ELECTRIC UTILITIES

EDF employs 2,200 people in Grenoble-Isère and recently implemented a strategy to increase the use of energy from renewable sources.

GEG (Gaz et Electricité de Grenoble) employs 420 people in Grenoble-Isère. A local energy producer and supplier, GEG owns and operates 12 hydroelectric plants.



GEG hydroelectric plant

HYDROELECTRIC DAMS IN GRENOBLE-ISERE



Grand'Maison



Monteynard

Hydroelectricity is France's second-leading source of electricity, at 15% of total production and average output of 70 TWh.

Grenoble-Isère is home to more than ten hydropower plants and three of France's ten largest plants:

- Grand'Maison : 1690 MW (France's highest-output plant)
- Le Cheylas: 490 MW
- Monteynard: 360 MW

Current and future projects

- The largest project currently in progress is EDF's rehabilitation of the Romanche-Gavet hydropower plants, which will offer potential capacity of 560 million KWh/year.
- Two concession licenses will be renewed in 2011 and 2012: Le Sautet with output of 110 MW and Lac Mort with 20 MW output.

A HIGH LOCAL CONCENTRATION OF HYDROPOWER REGULATORY BODIES

The regional agency in charge of regulating hydropower dams (DREAL's energy division) is located in Grenoble. The agency oversees some 70 dams. DREAL, the Water Agency, and all relevant divisions have offices in or near Grenoble.

Grenoble-Isère also boasts **400 highly-qualified legal experts in fields like public policy, the environment, and international law.**

HIGHER EDUCATION: GRENOBLE-ISÈRE IS HOME TO 65,250 STUDENTS



**Higher education
Key figures**

- 65,250 students
- 9,000 international students
- 4 universities
- 7 engineering schools
- 23 international Master's programs
- 13 doctoral schools



Grenoble-Isère is home to four universities; half of all students are enrolled in science programs:

- Sciences and Medicine (Université Joseph Fourier): **17,400 students**
- Grenoble Institute of Technology: **4,600 students**

High-quality academic programs in mathematics, IT, electronics, and process engineering have earned Grenoble-Isère a stellar international reputation in the sciences. The area's universities are attended by **9,000 international students.**

ACADEMIC PROGRAMS IN NEW ENERGY TECHNOLOGIES

The first public course in industrial electricity was offered in Grenoble in 1892, leading to the creation of the Electrotechnical Institute, which later grew into today's Grenoble Institute of Technology. Some 1,200 students per year enroll in courses in new energy technologies, and 750 degrees are granted, mainly by two schools specializing in new energy technologies:

Grenoble Institute of Technology ENSE³: Engineering for Energy, Water, and the Environment. Located on the university campus, the school offers three-year degree programs in engineering for water, energy, and the environment, which cover sustainable development as it applies to the design and industrialization of increasingly-complex hydraulic and mechanical systems.

Grenoble Institute of Technology Phelma: Engineering for Physics, Electronics, and Materials. The school also trains engineers to manage electrical systems.

AEPI, the Grenoble-Isère Economic Development Agency, provides businesses with the personalized support they need to move to Grenoble-Isère, all free of charge. Financed by the Isère General Council, the AEPI provides economic data and actively promotes Grenoble-Isère as a premier destination for new businesses.



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