MINI HYDRO POWER

MEGÈVE (France)

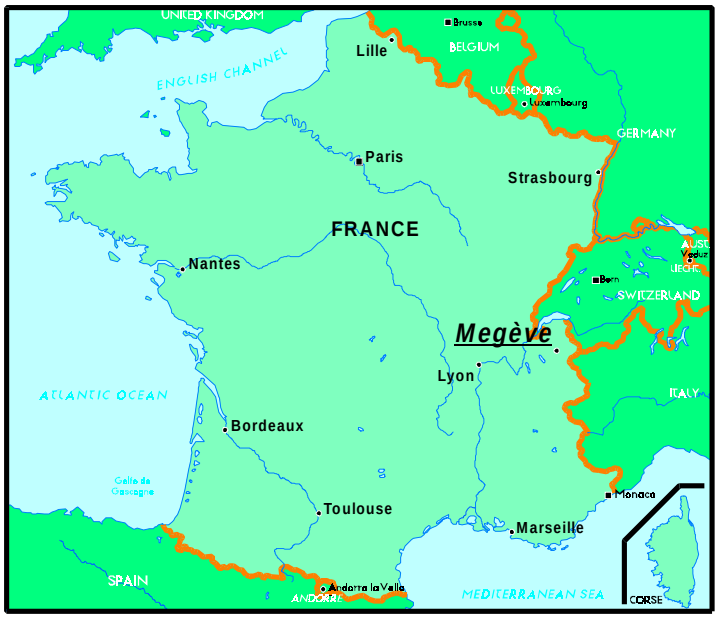
Among the renewable energy sources, hydropower is the one that is used the most. In some European countries, it covers more than 30% of the national electricity needs. New, big hydropower stations will – because of the damming up of rivers and the related environmental laws -–only very rarely be constructed. But there is a big potential for the mini-hydropower below 1MW. It can be very cheaply (re-)actived on those places where there are still the old exploitation rights and where old installations can be reactivated or at least the dams do exist. In the city of Megève, in the French Alps, one mini hydro power installation placed in the drinking water system has since 1968 supplied the municipal sports hall with electricity.

GENERAL ASPECTS

The town of Megève belongs to the region of Haute-Savoie, and is at an altitude of 1.113 metres at the foot of the Mount Arbois between the valley of Arly and the basin of Sallanches, with a number of inhabitants of 5,600, living on its important winter sports resort (300 km of marked out skiing pistes), which has become famous for the quality of its sports facilities, as well as those aimed at tourists.

Climatic data:

Degree days (basis 18 °C) : 4,000



CONTEXT

Hydropower on water system is hardly developed in France. In the absence of incentive policy on the matter, only a few facilities on the irrigation and on the drinking water systems have been carried out. Most of the time, those facilities have been developed as things came by people who got aware of the aspects linked to the energy promotion and to benefits and/or economies that may result from those different facilities.

It has been during the 60's that the idea of promoting drinking water collected and stocked in the reservoir of the Livraz, on plateau of the Mount Arbois, 300 m above Megève, had been made. Plan and carrying out follow.

When the Sports and Conference Centre opened in 1968, the hydro-electric plant (Pelton turbine and asynchronous generator of 300kW) works in a semiautomatic and discontinuous way, with a heavy human constraint.

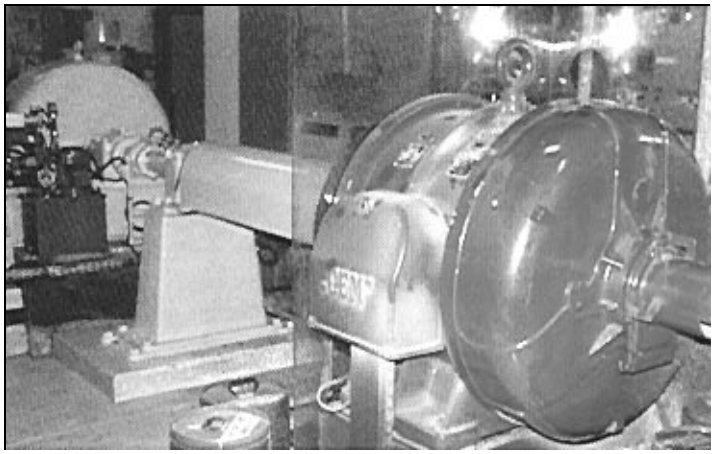
EXPERIENCE OF MEGÈVE

The hydroelectric microplant is located in the Sports and Conference Centre of Megève, which is a multifunctional and covered complex of 9.320 square metres (sports, pool, ice rink, shows, conferences). Built at the same time as the Sports Centre, it dates back to1968, and belongs, just like the latter, to the town of Megève.
In 1978, the annual consumption of fuel oil reached 540,000 litres. That's why the Municipality of Megève decided to undertake an important programme, in the long term, of energy economy to reduce this consumption and for a better use of the hydraulic energy available :

- Replacement of the 2 boilers of 1.850 kW by 2 boilers of 464 kW.
- Installation of a heat pump water-water of 70 kW driven by the turbine.
- Improvement of the recovery of calories from the turbo compressor producing ice for the ice rink and heating water for pools.
- In 84-85, increase of the capacity of the reservoir of the Livraz from 1,000 to 5,000 square metres, optimisation and automation of the working turbine, generator, heat pump, home consumption of the energy produced, sale of the surplus, and purchase of water if there is a lack of it, priority always being obviously given to public consumption.

The results are considerable, because the annual consumption of fuel oil has thus, on average, gone from 540,000 to180,000 litres a year since 1983 until today, and this despite the important expansions, such as a summer outside Olympic pool of 50 metres in 1981, gymnasium and covered tennis court of 2,500 square metres in 1984 heated by circulation in the ground of the water of pools (27°), the latter being heated by the turbo compressor of the ice rink etc. The electric consumption of the Centre is about 1,200 MWh/a. The volume of water gone through the turbine is, in average, of 1,500,000 sq.m./y.

Technical aspects



The microplant is located on the potable water network of the town. The excess of the potable water network is what goes through the turbine in the microplant, the sharing of water being made by a vacuum breaker ensuring to regulate the uphill/downhill pressure according to the request of the town as for water needs, but also according to the water level in the reservoir. The turbine can activate either the generator, or the heat pump, or both of them at the same time. In the same way, the generator may work as a motor and thus drive the heat pump. The turbine has a power of 282 kW and a 30 bars pressure. The Pelton wheel of the

installation has a diameter of about 600 mm and drives an asynchronous generator of 300kW and a heat pump of 70kW. The pipe is long (pipe of a diameter of 350 over 2,300 m, then a diameter of 300 for a length of 1,500 m), and the losses of charge are important, for the power reached is only 220kW in full charge, while the efficiency is about 70%. The whole is managed by programmable logic controls from information about the level of the principal drinking water reservoirs of the town, conveyed by transmission and centralised at the Sports Centre.

The energy produced is first consumed there and then, if there is still some available, sold to the French Electricity Company. At a time of low hydroelectricity and of high tourist crowds, thus of high public consumption (January and February), electric energy is bought from the French Electricity Company.

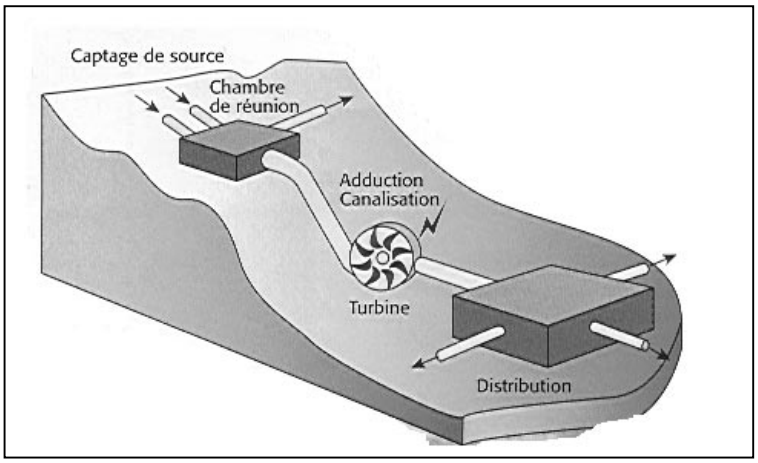
Financial aspects

The investment relative to the putting back of the turbine into service, and to its automation has approximately come to 234,000 Eur between 1981 and 1985, representing an investment of about 830 Eur/kW. The maintenance of the system is cheap, and carried out by the maintenance shifts of the sports Centre.

Now, the turbine works about 4,800 hours a year. Annual savings linked to the microplant are about 38,100 Eur/year in the field of the electricity self-consumed (pumps, turbo compressor, light...), and 7,620 Eur coming from the sales of the energy produced to the French Electricity Company.

Environmental and economic aspects

Compared with a classic hydroelectric plant, the energy generation upon potable water conveyance offers numerous advantages. The environmental impacts, related to this system and integrated in a project with multiple choices, are very slight : there is not any catchment, the forced pipe is not specific to the system, because it also feeds the potable water network of Megeve. Moreover, pipes are buried, and catchments are on the hill. There are no visual impacts because the system is located in the basements of the Sports Centre and, so, invisible. In the same way, no additional disruption of the aquatic ecosystem is engendered by the energy promotion of an existing water network. The sound impacts are maybe the most important, and are simply felt in a limited area inside the Sports Centre. They do not disrupt in any way the normal functioning of the Centre, except in case of concerts in the Conference room, where, most of the time, turbines are stopped.



At the level of the potable water quality, there is not any problem because water that has gone through turbines is not supplied in the water network, but drained off in the stream of the Arly. The reintroduction, in the network, of the water that has already gone through turbines, is possible, but not really economically interesting in the case of Megève, because it requires the functioning of pumps to bring water back to the working pressure, which is about 7 bars. Generally, there is no reason for not supplying in the potable water network the

water that has gone through turbines. In other plants, there is no major problem to report, except an increase of ventilation following the fact that water has gone through turbines. The hydroelectric system does not bring any chemical water pollution. Nevertheless, it is possible to take additional precautions, by using food fat in bearings and/or by putting in waterproof bearings on the turbines.

EVALUATION AND PERSPECTIVES

Indeed, thanks to energy savings and to benefits from the sale of electricity to the French Electricity Company, the town of Megève can ensure, for a low price, the annual functioning of the Sports and Conference Centre, and offer its inhabitants and tourists a cultural and sports facilities, with a competitive cost price.

The persons in charge of the system of the hydropower microplant of Megève are unanimous as for the quality of facilities : their profitability (due to the low cost of investment compared with a classic system) and their slight impacts over environment are just so many elements which should, in future, win over more and more other local authorities. All these are significant assets which add to the satisfaction of producing and using a clean and renewable energy, in prospect of a sustainable development, and of an harmonious town and country planning.

The short and medium-term prospects of the persons in charge are, in this field :

- to replace, over approximately 700 metres, the pipe of a diameter of 300 by a pipe of a diameter of 350, to reduce the losses of charge, and then increase the efficiency of the turbine.
- to use, on another site, an already existing cast-iron pipe for potable water conveyance, of a diameter of 200, and of a length of 1,000 metres, to settle a Francis turbine of 10 kW on it.
- to study, between May and October, the action of the turbines over important supplies of stand by water, recently created for the production of artificial snows (snow-blowers), and only used between November and April.

FOR FURTHER INFORMATION

Palais des Sports et des Congrès
Hubert TOURNEUR
F - 74120 MEGEVE
Tel: +33 4 50 21 15 71
Fax: + 33 4 50 21 59 22
E-mail: palaismegeve@dial.oleane.com

This case study was prepared by Energie-Cités in co-operation with the municipality of Megève and Rhônalpénergie-Environnement. It received funding from the ALTENER Programme of DG Energy and Transport of the European Commission.