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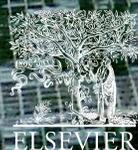
Power generation:

High altitude hydroelectric plant refurbishment



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Power generation

Pumping station gets high-altitude overhaul

When the existing pumping systems of a hydroelectric plant sited at high-altitude required upgrading, it presented considerable logistical problems, not least because the plant can only be reached by foot or helicopter. The challenge was given to Termomeccanica Pompe which supplied the new-look plant, and its work was designed to optimise the efficiency of the machines in order to reduce costs and to simplify operations.



The Di Truzzo Lake is 2,000m above sea level.

The hydroelectric plant pumping station is part of the Mese group of hydroelectric power stations owned by Edipower, and is located under the Lake Truzzo dam (Valchiavenna - province of Sondrio - Northern Italy) at 2,000m above sea level.

Termomeccanica Pompe's Service Division developed an integrated service system providing the client with on-going assistance throughout each stage of the delicate open

heart surgery' involved with the upgrading of the existing pumping systems. This assistance ranged from precision work to replacing the equipment's strategic components (such as modifying the hydraulic design), to the complete revamp of the whole pumping station.

The pumping station is the facility that introduces the flows from the Sancia and Val Servizio tributaries into the bottom of the

reservoir. Hence, maximising the efficiency of the pumping system was a key requirement in exploiting to the full the pumped water that, after a 1,000 m drop, is used to generate electricity by means of the turbines installed in the San Bernardo Power Station (which is 1,000 m above sea level).

The plant, set into a steep hillside, can only be reached either on foot via a spectacular scenic track, or by helicopter, since there are no roads or cable cars to carry people or goods. Compounding the existing logistical hurdles were the difficulties posed by the weather since operational requirements meant work had to be carried out during the January-March period, leaving personnel to contend with low temperatures and deep snow. Lastly, the pumping station is actually located inside a cave and can only be reached via a roughly 60-metre long sloping shaft fitted with rails.

The contract involved removing the four existing pumps and related accessories and replacing them with two high-efficiency enhanced pumping units, each comprising a pump-motor-inverter-transformer train. Another part of the job involved replacing the inclined shaft gear (winch and wagon) and tracked external handling systems so that they would be able to take the new weight of the equipment, weighing approximately three tons. To complete the job, pipe-work, wiring, bases and supporting structures were altered to the client's specifications.

The contract was awarded in late May 2012 and manufacturing activities concluded on

that year on 23 December with the factory testing of the first train. TMP worked in a joint venture with ABB Italia regarding the manufacturing of the machinery so as to provide the end user with fast turnaround, combined with quality and savings.

Actual on-site work started on 3 January 2013, with the airlifting of personnel to the site. The work team comprised eight specialist engineers from Termomeccanica Servizi Integrati, a controlled company specialised in on-site work on rotary units and systems. The team stayed at the plant's guest quarters, located at an altitude of 2,000m, practically for the entire duration of the job.

Materials were airlifted up from the valley in several stages, using a local transport company (Elitellina) for loads under a ton and a Swiss company (Heliswiss International) to carry heavier loads. The latter is a global leader in heavy lift helicopter transport, with world-first references such as the heli-transportation of the America's Cup Alinghi sailing boat from Switzerland to the sea.

reservoir's draining that was completed in May 2013.

Replacement pumps

Before the revamp

The existing plant was composed by two couples of horizontal axially split pumps.

The first pump couple was used for low pressure service in case of low level in the dam (up to 35m of head).

The second couple of pumps were used for medium pressure service in case of medium level in the dam (up to 55m of head)

For the high pressure service, with the dam at highest levels, the hydraulic circuit could be combined to put the first couple of pumps in series with the second, reaching the desired values of pressure (up to 70m).

The characteristics of the pumps were as listed below:

Characteristics	Low pressure pumps	High pressure pumps
Q [m ³ /sec]	0.9	0.8
H [m]	27	50
Eta	<80%	<80%
RPM	990	990

In spite of all the challenges that had to be faced, Termomeccanica Pompe delivered the new station on time, and it was put into service during April 2013, after it successfully passed on-site testing, confirming the high efficiency of the equipment trains during the

Characteristics	Design speed (maximum)	Minimum speed
Q [m ³ /sec]	0.95	0.5
H [m]	80	7
Eta	86.5%	85.5%
RPM	1470	570



A helicopter arriving at the base; the plant could only be reached by foot or helicopter.

After the revamp

The new plant supplied was designed to optimise the efficiency of the machines in order to reduce the cost of pumped water in the dam and to simplify operations.

The new configuration is composed by only two pumps which are able to cover all the pressure services with a VFD. This, combined with the high efficiency of the supplied pumps, has granted a high return of investment for the plant, allowing it to absorb the investment costs in just a few years of operation.

The characteristics of the new supplied pumps are listed below:



Guest quarters and helicopter base – the team stayed at the plant's guest quarters for the duration of the project.

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