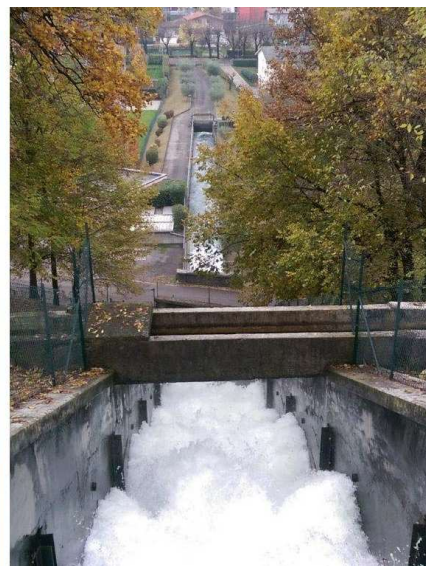




Esenta Hydroelectric Power Plant

Monzambano, february 2025



Premises

Since its foundation in 1921, the Reclamation Consortium “Alto Mantovano” has dedicated the “Jump of Esenta”, a section of the Arnò waterway near Esenta in the municipality of Lonato, to generate hydroelectric power.

Despite financial setbacks that postponed its construction, the project has finally taking place thanks to the 308/82 law that guaranties economic incentives provided by the Italian government.

Consequently the Reclamation Consortium “Alto Mantovano” —now known as “Garda-Chiese”—joined forces with the Consortium of “Chiese”—in charge of the waterway that runs through the Jump—to form the “Hydroelectric Consortium of Esenta” with the unique purpose of constructing the homonymous power plant.

Born officially in 1989, the Hydroelectric Consortium of Esenta is a collaboration between the two consortiums with the following quotas of participation:

- Reclamation Consortium of Garda/Chiese 60%
- Reclamation Consortium of Chiese 40%

The current chief administrative officer is Mr. Maurizio Bottoli, counsellor of the Reclamation Consortium of the North/Central section of the Plain of Mantova.

Main Features of the Plant

The derivation takes place near the cemetery of Esenta, where the Arnò waterway splits into two ramifications: the right branch continues its natural water course towards the unloader “a gradoni” (gradual steps), while the left directs the water to the plant via a conduit.

A spillway was built between the two branches of the canal to control the water level, therefore to avoid overflowing in the event of an excess flow or a sudden blockage of the power plant.



Intake Structure: on the right is the channel that feeds the Plant and the cleaning equipment for the grid that protects the conduit, centered is the Spillway and on the left is the Arnò waterway.

Before entering the conduit, which entrance is regulated by an hydraulic safe gate, the water is filtered through a vertical-bars griddle—with no more than 35mm gap from each bar.

The cleaning of the grid is ensured by an automatically operating device that conveys the intercepted material into an underground collection tank located on the left of the channel; from here the material is periodically collected with the aid of a fixed crane and transported to the landfill for disposal.

Access to the restricted area is possible thanks to a road adjacent to the cemetery.

The conduit, which is 57 meters long and completely under the ground, is a pipe entirely made of PRFV (a fiberglass-reinforced construction resin with helical shape) 25mm of thickness and with a constant section of 1600mm. The end of it is attached to a 10 meters long concrete-coated steel connector that runs under San Marco St and has a variable diameter between 1600mm and 1400mm.

The maximum water pressure in the pipe reaches 30m of head and it's comprehensive of the hydraulic ram that occurs when the turbine is not receiving water.

The choice of a plastic-like material for the conduit is due to its excellent hydraulic characteristics and its durability. It's in fact perfectly smooth on the inside and unlike pipes made of iron it's not subjected to oxidization.

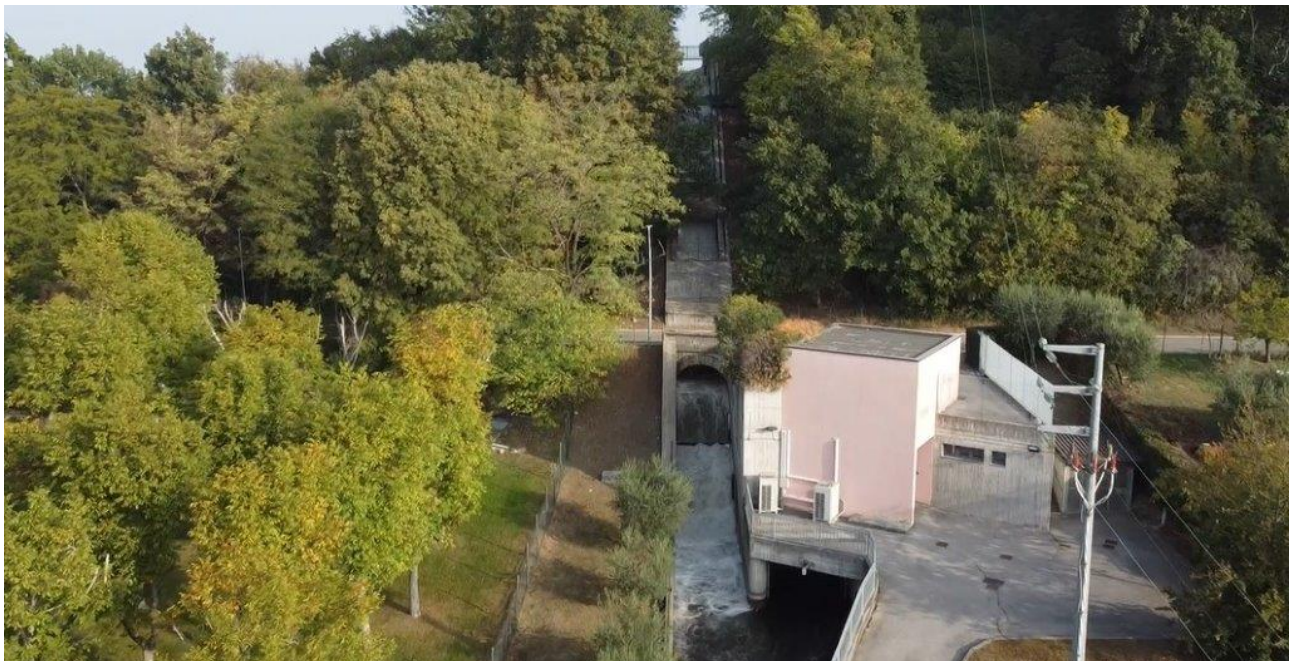
The pipework is connected to the plant via a "butterfly-like" horizontal valve that works autonomously thanks to its counterweight mechanism.

Next to the unloader is the power plant that hosts the main generator, the control panels and every electrical and hydraulic equipment necessary for the correct functioning of the entire system.

The plant is divided in three floors: the first floor is the deepest and where the main valve and all the hydraulic machinery are located.

In the mezzanine we find the engine room along with the control panels, the storage room and the restrooms. This floor is connected with the one below via an internal stairway. Properly separated from the other appliances are the batteries, the transformer for auxiliary services and the electrical group.

The top floor, accessible directly from the road to the cemetery, is solely dedicated to the ENEL power cabin. An external stairway, located along the main body of the plant, connects street level with the outdoor open space where both the control panels and the power transformer are located.





The Power Plant seen from valley

The “Kaplan” vertical-axis turbine consists into a horizontal spiral that converges radially the water to the wheel. Thanks to a fixed pre -distributor and a mobile-flaps distributor it’s possible to control the flow of the machine based on the flow of water of the canal between 0 and a maximum of 4.50 m³/sec.

The hydraulic wheel, which intakes water radically from the distributor and unloads it axially downward, is formed of 5 flaps of a peculiar shape and profile meant guarantee the turbine’s best performance. These flaps are capable of rotating on their own axis to best adapt to the position of the distributor vanes and the incoming flow rate, ensuring maximum efficiency in every hydraulic situation. This is a highly sophisticated machine that, however, allows for average efficiencies of around 90% in converting hydraulic energy into mechanical energy.

Coupled directly with the turbine is the power generator. With a medium efficiency of 98% circa, the generator transforms the mechanical energy transmitted by the turbine into 660 V at 50 Hz electrical power.

The generator is synchronized with a water cooling internal system that disperses excess heath through a device immersed into the water unloader of the turbine. It’s an unusual method to help the generator cooling more efficiently and to disperse excess noise.

The specifications of the generator are as follow:

- brand LDW
- apparent power of 1150 KVA
- Active power Cosfi 0.8 equal to 920 KW
- Number of revolutions 750 rpms

The plant is fully automated, therefore it doesn't require constant human supervision. Technicians are anyway scheduled to perform periodic controls. They also provide 24 hrs on-call availability in case of anomalies and are contacted via automated phone call and simultaneous radio transmission.

Compared to fossil fueled electricity, hydroelectric generated power has a considerably lower impact on the environment by the following emissions values:

- 58 ton/year of SO₂ avoided emission
- 4,290 ton/year of CO₂ avoided emission
- 13 ton/year of NO_x avoided emission
- 6 ton/year of avoided Particles in the air
- 7 ton/year of avoided Methane emission
- 1,075 TEP/year of unused fossil fuel

Esenta's power plant was inaugurated on May 6th 2002 by Doctor Viviana Beccalossi, then vice president of the Regional council and the secretary of Agriculture of Lombardy.



May 6th 2002: secretary Beccalossi and President Gavioli inaugurate the power plant

Comprehensive cost of the plant

The project was drafted by the "Frosio" Engineering Firm in Brescia and the realization of the plant has been assigned to 3 different companies as follows:

a) building and reclamation constructions:

Construction Company Zanardelli – Concesio (BS)

b) supply and installation of the hydroelectric group and accessories:

Voith Riva Hydro S.p.A. – Cinisello Balsamo (MI)

c) supply and installation of hydraulic components and accessories:

API S.p.A. – Milan

The comprehensive cost of the plant was € 1,842,000.00 as specified in the following notes:

A) CONSTRUCTIONS AND SUPPLIES

1- building and reclamation constructions	€ 483,183.83
2- supply and installation of hydroelectric group and accessories	€ 568,000.00
3- supply and installation of hydraulic components and accessories	€ 91,700.00

TOTAL	€ 1,142,883.83

B) SITE SAFETY AND SECURITY:

1- building and reclamation constructions	€ 24,500.00
2- supply and installation of hydroelectric group and accessories	€ 5,500.00
3- supply and installation of hydraulic components and accessories	€ 3,700.00

TOTAL	€ 33,700.00

C) FUNDS AT THE ADMINISTRATION'S DISPOSAL:

1- constructions not related to building and reclamation.	€ 71,760.22
2- technical measurements, analysis and verifications	€ 938.58
3- connections to the main lines	€ 57,659.66
4- unforeseen expenses and round ups	€ 38,587.25
5- acquisition of land and/or existing buildings	€ 21,684.89
6- expenses for technical draftsmanship, project management, coordinating according with the 494/96 during planning and execution	€ 158,478.72
7- application fees and various expenses	€ 7,755.02
8- testing and director of operations	€ 5,165.99
9- I.V.A. (Taxes) 20%.	€ 303,385.85

TOTAL	€ 665,416.17

The Comprehensive

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TOTAL € 1,842,000.00

The funds for the realization of the project came from different bank loans that we obtained by acting officially as proxy for the Consortiums of Reclamation "Alta/Media Pianura Mantovana" and "Media Cheese".

In addition to those funds and near to the completion of the plant's construction, the government of the Region of Lombardy granted € 231,890 as capital investment.

Technical management

The Reclamation Consortium of Esenta stipulated an official agreement with the company "Società Idroelettrica M.C.L. S.c.r.l. of Calcinato (BS) for the management of every functional aspects of the plant such as operating it, administrating it and providing the maintenance necessary. The company is already managing two hydroelectric plants within the reclamation Consortium of Chiese and it's professionally qualified thanks to a staff of trained technicians with many years of experience.

Nonetheless having one company qualified to run multiple infrastructures is not just a cost effective model but ultimately guarantees other advantages:

- o environmental (zero impact)
- o energetic (electricity produce via renewable sources therefor clean)
- o ecological (no CO2 emissions in the atmosphere)
- o productivity (income and jobs creation)

Monzambano (MN), February 2025

