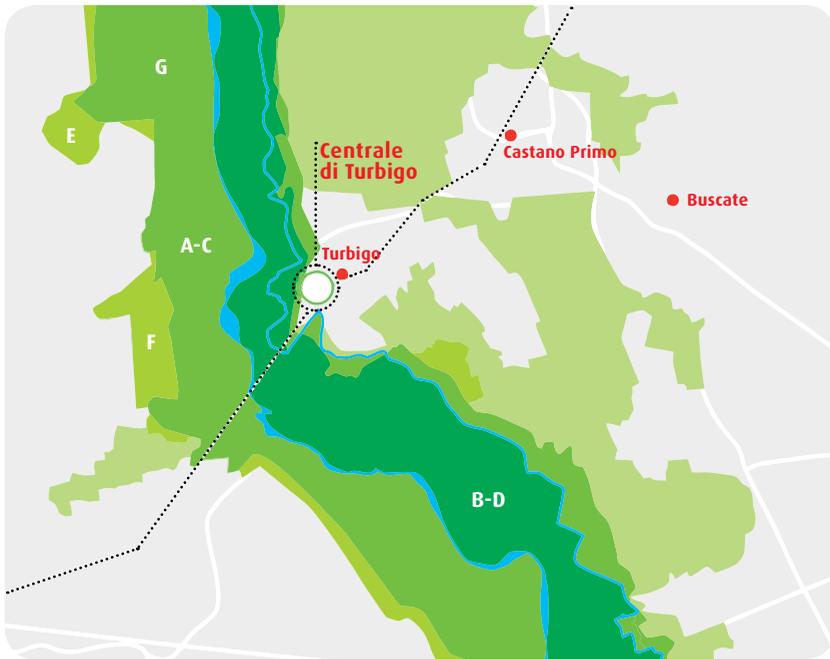




PLANT
TURBIGO



iren energia



- A - Ticino Valley
- B - Ticino woods
- C - Ticino Valley
- D - Turbigaccio, Boschi di Castelletto and Lanca di Bernate
- E - Ticino River
- F - Nature Park of the Ticino Valley
- G - Nature Park of the Ticino Valley in Lombardy



Iren Energia is the company in the Iren Group that operates in the fields of electricity production and distribution, heat production and distribution for district heating and technological services.

Iren Energia continuously pursues the values of quality, reliability, sustainable development, energy efficiency and relations with the areas in which it operates.

The Turbigo thermoelectric power plant, situated in the municipalities of Turbigo and Robecchetto, in the province of Milan, is made up of:

- three not-functioning conventional steam units with a total capacity of about 900 MW;
- a combined-cycle unit with post combustion made up of two gas turbines and one a steam turbine, for a total capacity of 855 MW.



The Combined-Cycle Unit

Unit 4 is a combined-cycle unit consisting of two gas turbines, each one coupled with a horizontal heat-recovery steam generator (HRSG) with three pressure and resuperheating levels plus with postcombustion.

The steam produced is transferred to the 330 MW four-cylinder steam turbine.



The Gas Turbines

The two single-shaft gas turbines (SGT5-4000F, with a nominal capacity of 287 MW at 50 Hz and a nominal air flow rate of 689 Kg/s) are each made up of:

- an air suction filter chamber, with: bag prefilter, anti-icing system (to prevent ice forming in the winter), eva-cooler system and droplet separator (to lower the temperature during operation in the summer) and final filters
- a 15-stage axial compressor, with an outlet pressure of 18 bars
- a ring combustion chamber equipped with 24 Low NOx burners, each pre-mix with pilot flame, fired with natural gas and with a nominal flow of 70,000 Nm³/h
- a 4-stage turbine section with an exhaust temperature of 577°C.

To increase the overall efficiency, the gas turbines are equipped with a hydraulic system for recovering the play between the rotor and the stator.

The blades on the first row at the inlet of the gas turbine compressor have an

adjustable angle so that the air flow can be modulated to the various operating conditions.

The heat recovery steam generators

The heat recovery steam generators supplied are of the horizontal type.

Each boiler has 3 sections with different pressures, HP/MP/LP (113, 33, 6.6 bars), each with an energy-saving, steam evaporation and superheating section.

The water and steam circulate inside the coils heated by the fumes naturally, that is, simply by the movement generated by the fluids due to the difference in density.

There is also a resuperheating section where the steam that has undergone an initial expansion in the HP body of the steam turbine (390°C, 33 bars), re-acquires heat before being returned to the HP body.



The boilers can increase the heat coming from the gas turbines using supplementary burners fired with natural gas (post combustion) situated in the inlet pipe turbines (each has a maximum capacity of 9,000 Nm³/h).

valves with an independent electrohydraulic control and into the MP body (540°C, 30 bars) through 2 similar valves. On entry to the LP body the steam produced by the LP sections of the boilers is added (240°C, 6.8 bars).

The steam turbine

The 330 MW four-cylinder turbine is made up of a high-pressure body with a single crossing (1 action stage and 15 reaction stages), a medium-pressure body with a double opposite flow (13 reaction stages) and a low-pressure body also with a double opposite flow (8 reaction stages).

The steam is let into the HP body (540°C, 100 bars) through 8 regulating

After the LP sections, a 370 MVA generator cooled with hydrogen and water is connected to the shaft of the turbine.

The condensation system

The steam flowing out of the LP section, which is at a low pressure and cool as it has transferred its energy to the turbine, is conveyed directly to the condenser situated immediately after

the turbine, where vacuum conditions are maintained (33°C, 0.05 bars).

The condensed water is collected so that it can be pumped and returned to the boilers and the thermal cycle can be repeated.

The condensation system uses water drawn from the Naviglio Grande canal for cooling (with a water temperature between 5 and 25°C).



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