WP4.4

Astico MCA alternatives description

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Summary

SHORT DESCRIPTION
This document contains the description of the HP plant that will be the object of the MCA analysis on the Astico pilot case study river basin. On the basis of the current plant configuration and management, four different alternatives have been proposed and will be discussed.

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Introduction

The river Astico is one of the main rivers of the Vicenza's Province. This part of the Veneto Region is densely populated and several industrial activities are also present. These are some of the reasons of the intense water exploitation within the Astico river basin. Water is therefore withdrawn for drinking, industrial and hydroelectric production.
Hydropower plants on the river Astico are mostly of the run-of-the-river kind, and do not require therefore the presence of a reservoir. The only exception is the hydroelectric plant of Bessé, in the Municipality of Chiuppano (VI), which is served by a little reservoir, created with the construction of a concrete dam.
This plant will be the object of the Multi Criteria Analysis application to the Astico river basin pilot case study.

The hydropower plant

The plant of Bessé, in the Municipality of Chiuppano, is the only is the only power plant on the Astico River, which is served by a little reservoir. This reservoir is located in the Municipality of Piovene Rocchette, and has been created with the construction of concrete dam, named Leda's dam, in the neighborhood of a little town named Meda.
This power plant is property of the Eusebio Energia S. p. A. company, one of the most important Italian energy companies, specialized in the energy production from renewable energy sources such as water and wind.

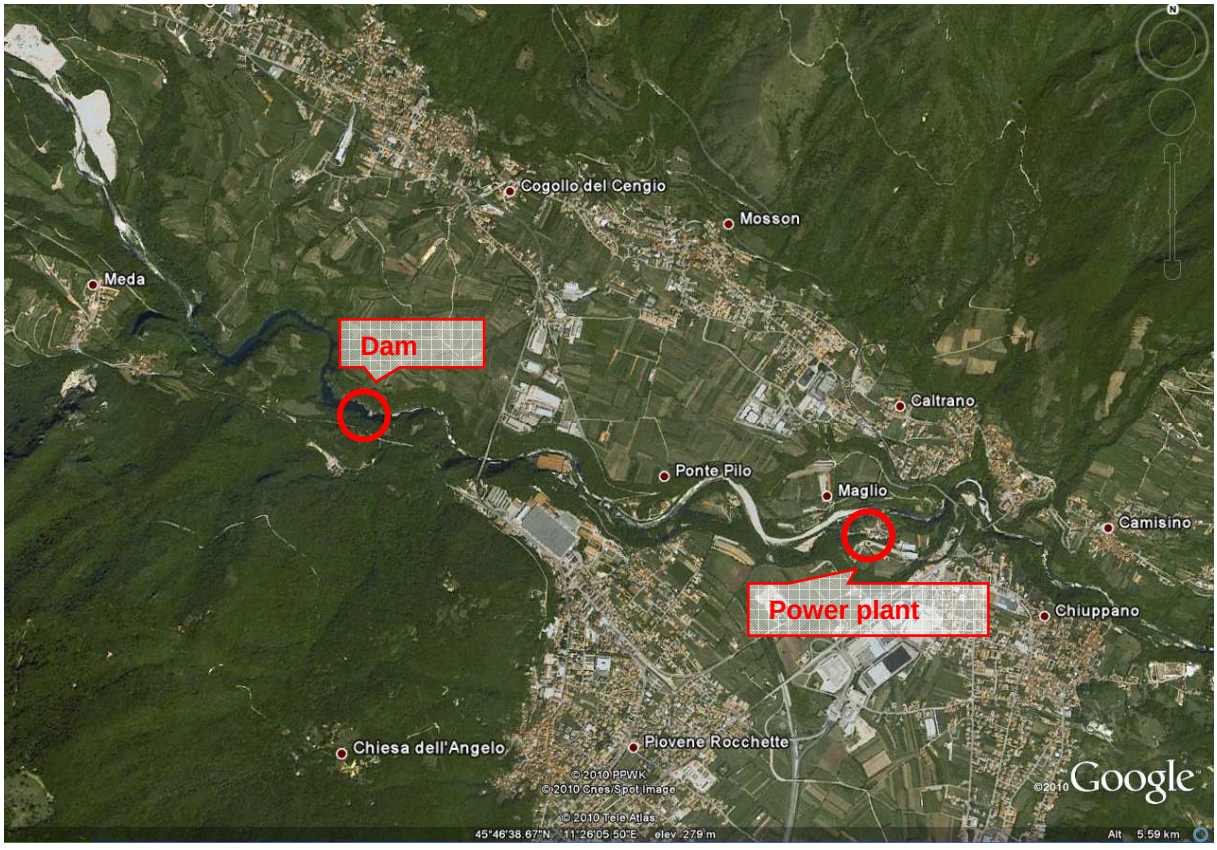

Figure 1: Aerial view of the Astico reach concerned by the Bessé power plant

The dam is 18 m high and the weir surface is 12 m long. The upstream basin is about 338'000 m^3. The minimum working water surface elevation 227 m a.s.l., while the maximum is 231.5 m a.s.l.. The minimum elevation corresponds to the altitude of the intake facility, while the maximum is 1.5 m higher then the weir top height, that is 230 m a.s.l.. The emptying of the reservoir is possible by means of two sliding gates (discharge 190 m^3/s each) and by a radial gate (200 m^3/s). The total discharge allowed

by the gates is therefore about 600 m^3/s, near to the value of the maximum historical discharge of 1966, estimated to be about 700 m^3/s. The Italian Dam Register has however imposed to the dam manager the complete reservoir emptying when the discharge flow exceeds 100 m^3/s. The dam is subject to periodic checks and is in operation since 1958.
Despite the presence of a reservoir, the plant effectively works as a run-of-the-river plant. This is due to the reduced possibility of water level regulation. The difference in height between the intake facility (227 m a.s.l) and the weir top (230 m a.s.l.) is in fact only 3 m. An old project planned the possibility of increasing the dam height in order to achieve a better regulation capacity and a larger reservoir volume, but it has never been enacted because of safety issues.

Figure 2: Leda's dam.

The power plant of Bessé is located about 3.5 km downstream. The energy is produced by two Francis turbines of an output of 1100 kW?? and 1880 kW ?? Respectively, the plant can be therefore included in the small hydropower category. The total annual production is about 12 millions kWh. The mean working discharge is 5.9 m^3/s, while the maximum is 10 m^3/s.
The MIF that has to be released downstream the dam has been estimated to be 1 m^3/s, on the basis of the river basin surface upstream the dam that is around 300 km^2. The MIF is released by means of the radial gate. The amount of the released water is not directly measured by appropriate instruments, but it is estimated accounting for the opening degree of the radial gate on the left of the dam.
Approximately in the middle of the Astico reach concerned by this power plant, at Ponte Pilo, a level measuring station has been provided by the company Eusebio Energia. In the corresponding cross section, a rating curve has been developed. Nevertheless, this relation cannot be used to measure the MIF released for two reasons. First, this monitoring station has been installed for hydraulic risk prevention: the measured data are in fact used to regulate the gate opening during floods. The rating curve has been therefore calibrated paying particular attention to fitting of high discharge values, since the gates opening sequence starts around 100 m^3/s. Secondly, in this reach the river Astico has dispersive features, and a noticeable amount of the flowing discharge infiltrates into the riverbed. Particularly in presence of low water flow, the discharge released immediately downstream the dam is higher than the discharge flowing at Ponte Pilo.

Figure 3: Bessé's power plant.

Figure 4: Measuring station at Ponte Pilo.

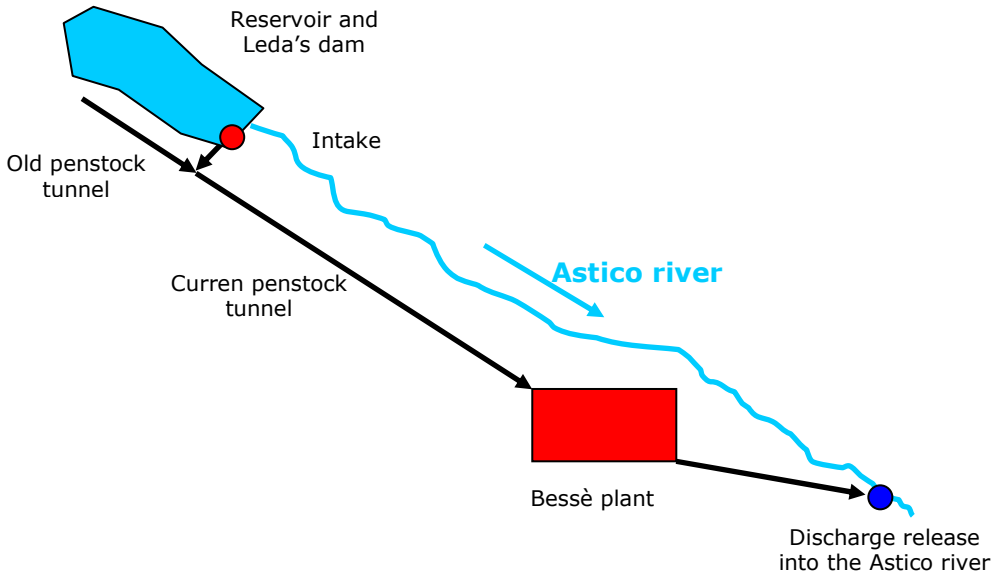

Figure 5: Power plant scheme.

Alternatives description

The alternatives that will be examined with the MCA concern the amount of MIF release. This is in fact the main problem affecting the Astico river reach downstream the Leda's dam, since, because of the strong infiltration phenomena, the current MIF release is not always enough to ensure the presence of flowing water on the entire reach from the dam to the power plant outlet channel. The mean dispersed discharge in this reach is in fact about 0.7-0.8 m^3/s.
Four Alternatives will be considered:

1. ALTERNATIVE 0 (HISTORICAL MANAGEMENT UNTIL 2008): until 2008 not MIF released.
2. ALTERNATIVE 1 Hydrological MIF release
3. ALTERNATIVE 2 Increase of the released water up to 150% of the hydrological MIF release
4. ALTERNATIVE 3 Increase of the released water up to 200% of the hydrological MIF release

It must be pointed out that Alternative 0 is no longer practicable, since the MIF release is, at now, mandatory. It has been inserted among the alternatives list as a reference condition, and to quantify the environmental advantages and the economic drawbacks consequent to MIF regulation.
The Alternative 1 is the current management solution. The hydrological MIF has been determined on the basis of the river basin area upstream the catchment. Therefore, it doesn't take into account, directly, the biological and morphological aspects. Alternatives 2 and 3 have in fact the role to investigate the effects of an increase in MIF, in order to understand if the hydrologically defined MIF is suitable also for river fauna, vegetation and functionality.