

SOLAR REPOWERING OF THE COAL-FIRED THERMAL POWER PLANT OF BITOLA

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Abstract

ELEM, JSC Macedonian Power Plants, has considered the development of a Concentrated Solar Power Plant (CSP) project near the Bitola Thermal Power Plant energetic complex. ELEM has assigned ARTELIA, a French leading engineering company, and CARBONIUM, a French consulting company dedicated to Clean Development Mechanism (CDM) and Renewable Energy projects, to carry out (2011-2012) the feasibility study of the project.

CSP plants concentrate the solar rays, by means of optical concentrating devices, to produce heat at medium or high temperature, and then convert this heat into work and electricity. This project aims at helping the government of Macedonia to reach its ambitious energy objectives: increasing the share of renewable energy in electricity generation from 13.8% in 2005 to 21% in 2020, while ensuring the high growth of energy consumption of the country.

A first phase (preliminary study consisting of a state-of-the-art review, a legal and institutional framework analysis, a prefeasibility study of several technical scenarios and a multifaceted analysis) concluded in the selection of the best scenario that meets the local needs and objectives: the solar repowering (hybrid CSP plant) of the existing coal-fired thermal plant of Bitola. Solar hybridization of fossil-fuelled plants provides a competitive option to introduce firm solar energy into the electricity production mix.

The second phase of this project consisted in the technical conceptual design of the hybrid solar power plant, with the determination of best solar heat integration within the conventional coal-fired power plant and the CSP plant design. The technical study concluded that the best hybridization option for the TPP of Bitola is the preheating of the feed water between the last high pressure feed water heater (HP FWH) and the boiler inlet. Solar-thermal energy is used in a heat exchanger to raise the feed water temperature from 250°C to 285°C. This aims at decreasing the thermal power of the boiler during the sunny hours and thus the coal consumption for the same electrical capacity of the thermal power plant. This solution avoids any modification on the operating parameters of the turbine, do not impact the boiler efficiency and ensure very high solar heat to electricity conversion efficiencies and thus minimum cost of the renewable solar electricity produced. This second phase has been completed by the Use of Clean Development Mechanism study, the Environmental Impact Assessment and the detailed financial analysis.

The main results and conclusions of this challenging project, first of its kind in the Balkan region, will be presented during the "Energetics 2012" Conference:

- General presentation of the project
- Technical study and conceptual design
- CDM aspects and detailed financial analysis
- Environmental study