

# Case Study Paroşeni: from coal to black pellets

# Paroseni power plant – short history

- The oldest coal -based power plant in Romania, built in 1950
- A capacity of 150MW capacity in cogeneration
- It provided 200000 inhabitants of the four mining towns (Vulcani, Paroseni, Lupeni, Petrosani) in the area with hot water and hitting



- It was designed to operate with coal from Valea Jiului (with a low caloric value between 3300kcal/kg and 4510kcal/kg)
- Due to the reduction in the amount of coal extracted from the mines of the Jiului Valley, it was also operated with imported coal (with a higher caloric value up to 6000kcal/kg) mixed with Valea Jiului coal (80% local coal and only 20% imported coal), so as not to exceed the lower calorific value maximum design of the boiler combustion system

# The current situation at SE Paroseni

- 197 employees
- Small supply of the daily amount of coal from Valea Jiului (the necessary is at 2000t/day)
- Consequence: the supply of thermal energy in the centralized system was stopped (Winter 2019/2020)
- The lack of an energy strategy in the region, the low efficiency of its power stations and the higher prices for the CO<sub>2</sub> certificates brought Societatea Complexul Energetic Hunedoara (incl. Sucursala Electrocentrale Paroseni) into insolvency

- Disconnection of households from the centralized heating and hot water system and installing new heating systems based on wall gas boilers
- No usage of the distribution system, which was sold in order to pay a part of its debts

Consequence: Under these circumstances, Paroseni power station produce energy only occasionally (two days per week)

# Efficiency of the power station no.4 (2015)

Power station no.4	Boiler Efficiency	Turbine Efficiency	Total Efficiency
Condensation 115MW	90.7	55.58	34.75
Condensation 130MW	90.8	55.26	34.01
Condensation 150MW	88.45	55.75	31.86
Cogeneration 115MW+48.75Gcal/h	91.12	68.15	48.94
Cogeneration 130MW+48.75Gcal/h	92.78	66.78	48.25
Cogeneration 150MW+48.75Gcal/h	90.05	65.66	45.52

Source: Societatea Complexul Energetic Hunedoara, 26.04.2023

# SE Paroseni CO<sub>2</sub> emissions and the specificity of its supply process with coal

- The coal from Valea Jiului has the following physical-chemical characteristics: total humidity (11,2 - 6,0 % -(10,7 % guarantee value)-); ashes (46 - 33,7 % -(38,0 % guarantee value)-); caloric power (3300 - 4510 kcal/kg - (3916 % guarantee value)-) (Sava, 2023)
- The emissions (SO<sub>2</sub>, Nox, CO<sub>2</sub>, CO and dust) at SE Paroseni are measured at the source and the measuring system is supported by a dedicated soft program (Dumitrescu, 2023)
- The emissions are correlated with the amount of coal burned. The coal requirement for the power station 4 varies from a minimum of 1200t coal/day up to 2000t/day (coal with a low caloric value)
- The designed amount of coal consumed annually is 665000 t at an average calorific value of 3750 kcal/kg, humidity of 6.5% and ashes 43%
- For the planned production the power station uses also 55000 m<sup>3</sup> gas with an average caloric value of 8330 Kcal/Nmc

# Scenarios for Decarbonisation at SE Paroseni

- *Hypothesis A: Rehabilitation of the centralized thermal energy supply system in Paroseni area*
- *Hypothesis B: Paroseni power station will work only as an electrical power station.*



# *S1: New Retrofitting of SE Paroseni*

- Replacing the turbine, for example with one Alstom;
- Changing the burner to increase energy efficiency and reduce the NO<sub>x</sub> emissions;
- Replacing the mills system;
- Modernization of high and medium pressure blocks, including the admission system for turbine 4 type K 160-130;
- Modernization of high-pressure pre-heater (PIP) for the turbine;
- Replacing the basic ejectors and the sealing one of the turbine with high efficiency vacuum pumps;
- Modernization of the rotary preheater for air related to the boiler
- Modernization of the distribution control system (DCS) of the power station by performing the software and hardware upgrade to the latest existing version;
- Strengthening the walls of slag and ash deposits for landfills and raising them to reduce, until new investments, air and water pollution with residues from the coal burning process (Draghina, 2023)

**ATTENTION:** Due to the precarious financial situation and the status of the main company (Societatea Complexul Energetic Hunedoara SA) as an insolvent company, these investments cannot be made.

## *S2: Conversion from Coal to Gas*

- First option: to retire the coal-fired plant and replace it with a new [natural gas-fired combined-cycle](#) (NGCC) plant
- Second option: to convert the boiler of a coal-fired steam plant to burn other types of fuel, such as natural gas

**ATTENTION:** even if the emission of CO<sub>2</sub> are lower from the combustion of fossil gas than from coal, these cannot be neglected, the new fossil gas plants still produce over 300g CO<sub>2</sub>/kWh; the need for an evaluation of the impact of methane (CH<sub>4</sub>) emissions (for the whole process/activities on the chain)

Even more methane traps significant more heat than CO<sub>2</sub> (up to 86 times more than CO<sub>2</sub> for a 20 year period) and therefore is twice responsible for global heating (IEA, 2021).

# S3: Conversion from Coal to Black Pellets

- According to the estimations calculated by SINTEF the conversion from coal to black pellets there is a potential huge reduction of total CO2 emissions
- The weak points of this conversion are related to the reduced feedstock availability in Romania

Forest area, 2015 in kilo hectares (*European Bioenergy Outlook, 2019, A10*)

Total land area	Total area of forests and other wooded land	Forests	Forests available for wood supply	Other wooded land
23.907	6.951	6.861	4.627	90

# Conclusions

- The coal conversion strategy is a long term strategy
- Big players on the coal power plants market are planning on switching from coal to fossil gas and biomass for power generation from now until 2050
- The case study indicates that isolated measures are not a solution in order to save the bankruptcy of Paroseni power plant
- Only a good strategy which will integrate the whole supply chain for the power station and will be also financed and implemented by specialists can avoid the continuous degradation of this power station