

CONSIDERATION ON THE DEVELOPMENT OF THE PUMPED STORAGE HYDROELECTRIC SYSTEM

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Abstract: The development of the energy sector is an area of strategic importance for the fact that it ensures and influences the economic competitiveness at a reasonable cost price, which represents the economic sustainability of a state.

In the energy strategy of Romania 2018-2030, it is stated: “The vision of the energy strategy of Romania is to increase the energy sector in sustainability. According to the latest data on climate change, for the storage of electricity, Romania is looking for solutions and aims to build hydroelectric power stations with pumping accumulation.

KEY WORDS: *energy, economic sustainability, hydroelectric power plant with pumping accumulation.*

1. INTRODUCTION

The role of the hydroelectric power plant with pumping accumulation is, it has a high maneuverability and thus it is capable of responding promptly to the load fluctuations. The operating period in the turbine mode depends on the duration of the peak period of pregnancy and the consumption during the day. The operating period in pumping mode depends on the duration of the pregnancy period during the night and in non -working days. The gap of this operating period (pump - turbine regime) determined the volume of the upper tank (10 million MC).

The flow of the hydro -aggregate is different in the turbine regime compared to the one in the pumping regime. To prevent hydraulic shocks in the pumping regime,

caused by some dysfunctions that may occur at the nuclear, thermal, wind power source, it is necessary that the turbine - pump hydro -aggregate be endowed with the ability to adjust the task absorbed. The evolution of the energy sector in Romania could be put in difficulty in the medium and long term due to the fact that the electricity market is deficient in terms of infrastructure, not having capacities for electricity storage, as has the natural gas market. Through the energy strategy of Romania 2018-2030, the realization of a hydroelectric power plant with pumping accumulation is one of the strategic investments of national interest, figure 1.[1.2.3.4.6]



Figure 1. Hydroelectric power plant with pumping accumulation[]

2. EXPERIMENTAL STUDIES ON DESIGNING A CHEAP

At present, the first condition of energy security is met, holding energy resources that ensure an energy mix this point. Judicious exploitation of these resources

ensure the security and stability of the National Electricity System (SEN), as well as going through critical moments, according to Table 1[6].

Tabel 1. . Production capacities at the level of 2022 – source Transelectrica

Nr. crt	Generation type	Power 2022	
		Installed power (MW)	Available power (MW)
1	Hydroelectric power plants	6731	6368
2	Nuclear power plants	1413	1413
3	Thermoelectric power plants	12059	10256
4	Wind power plants	3030	2944
5	Solar power plants	1375	1176
6	Biomass power plants	130	99
Total		24.738	22.256

In the future, there will be the prospect of developing other technologies for energy storage, such as batteries, but they do not have sufficient technological maturity to be implemented.

Therefore, it is mandatory to create a storage capacity with a power of about 1,000 MW in CHEAP that can intervene in balancing system for periods of 4-6 hours.

The role of a CHEAP on the electricity market involves the purchase at low electricity prices when energy demand electricity is low and therefore, the prices are low, (generally at night and in weekend), the storage of this electrical energy until the appropriate time and selling when electricity demand and prices are high, at the peak of pregnancy.

Permanent balancing of variable demand with continuity in generation, requires the existence and maintenance, with the related costs, of reserve in the system to permanently meet the demand, the fast reserve being also ensured by the existence of a pumping station.

Studies for the realization of a pumped storage hydroelectric power plants in Romania have been built starting with the 70s. At that time, the need for coverage

was taken into account peak load, continuous increase in energy demand and entry into operation units 1-5 of Cernavoda NPP, which did not have optimal coverage in consumption for the entire 24-hour operating period, at night consumption being lower, on average, by about 2500-3000 MW.[6]

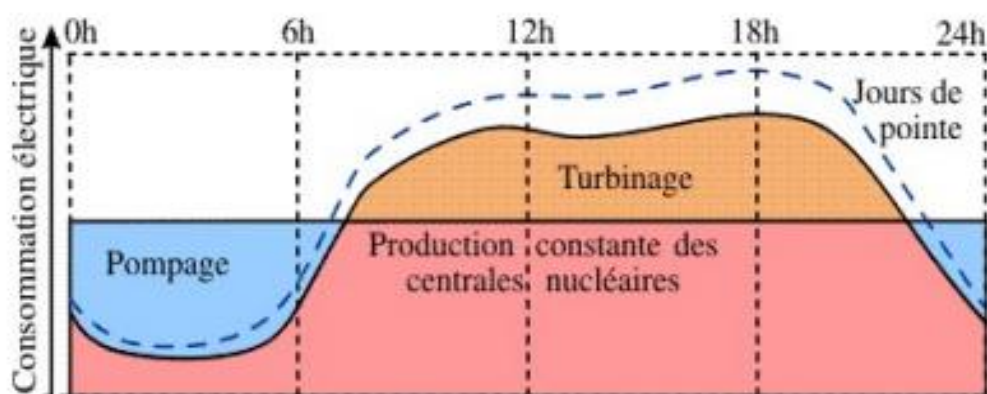


Figure 2. Energy distribution per day

The opportunity and necessity of building a hydroelectric power plant (CHEAP) is based on the following advantages and functions provided for the national energy system by a pumping:

increasing the safety of the SEN in the context of operation in the UCTE

- transfer of electricity from the load gap to the peak;
- arbitration of the electricity market;
- short-term emergency reserve;
- the secondary reserve and the tertiary reserve;
- frequency-power regulation and rotating reserve;
- supply of reactive reserve and voltage regulation in the SEN.

The existence of a power plant pumped storage and pumped hydroelectric plants (CHEAP) in the SEN will optimize the operation of thermal power plants and will allow for hydroelectric power plants that are currently used for in SEN, an optimal and constant operation, with reference mainly to CHE Gates of Iron I.

CHEAP are used for industrial storage of electricity and account for almost 99% of the world's storage capacity.

Pumped storage boilers are incredibly efficient. In the world of the future we want with renewable energy sources to 20%, 30%, or 50% of our electricity generation, we have need for pumped storage plants for electricity storage.

It's an incredible opportunity and it's actually the possibility of having clean energy at the lowest cost

I also increased bonding surface to the construction plate. The requested tests at

compressions at low temperatures from the material with 0, 8% carbon, FC 80 , presents the same constituents, protected and pearled with a non-homogenate

3.CONCLUSION

- Cost of operation of pumped storage hydroelectric power plant is low compared to other types of power plants and a CHEAP has a long lifespan of about 80-100 years. CHEAP can have an installed capacity 1000-3000 MW and a fast reaction time to the installed capacity, Seconds.

The efficiency is about 75-80%. Pumped storage plants are immune to the increase in the price of oil, gas or coal and do not require imports of fuel, for the maximum value of the test piece deforming force is transformed in slag.

- The development of CHEAP ensures the implementation of energy capacities wind turbines in the SEN in a ratio of 1 MW in pumped storage to 5-6 MW in wind turbines.

Thus, about 2000 MW of pumped capacity would be needed to ensure maximum development of Romania's wind potential. In addition, the more the fall is larger, the lower and upper bief are smaller in volume, thus reducing the impact on the environment.

- One disadvantage is the dependence of the design on the geology of the location. For the most part, geological constraints impose the cause of difficult constructions. Given the geological constraints, there is a limited perspective for pumped storage hydropower plants projects in Romania. The only viable project is for Tarnita.

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