THE ADAPTABILITY OF USING A COGENERATION INSTALLATION WHEN ACTUATING AN ELEVATOR

Carmen Elisabeta Radu, *Student – Ph.D. Eng, University POLITEHNICA of Bucharest, Romania, e-mail: carmenradu23@gmail.com*
Edward Răşchitor , *Student – Ph.D. Eng, University POLITEHNICA of Bucharest, Romania, e-mail: edwardraschi@gmail.com*
Iosif Tempea, *Ph.D. Eng. Professor Emeritus, University POLITEHNICA of Bucharest, 313, Spl. Independentei, Bucharest, Romania, e-mail: iosiftempea@yahoo.com*

ABSTRACT: *The cogeneration installations have experienced a particular development due to the energetic crises and, as a result of the Kyoto Protocol, regarding the reduction of the emissions of greenhouse gas. Cogeneration advantages: energy efficiency, economic and ecological advantages.*

KEYWORDS: cogeneration, elevator, robotic actuation, parking lot

1. The necessity of using the power and heat in case of the hydraulic elevator

The operation of the hydraulic elevator with a robotic actuation used for the execution of parking lots with high capacity (fig. 1) implies a significant power consumption. The execution and exploitation of these parking lots implies the existence of state-of-the-art automatic, electronic and mechanical systems. The high capacity of the parking lots (hundreds of cars) and the possibility of using these parking lots for the power supply of the electric cars during their stationing implies the supply of electricity that is obtained as cheaply as possible and with the highest possible efficiency. Also the necessity of heating the building where that parking lot is found, during the cold season, must be considered. Cogeneration defines the simultaneous production with the same installation (heat engine – power generator, turbine, etc.) of thermal and electrical energy. The cogeneration installations are dimensioned in correlation with the heat demand, the electricity being a "secondary" product. [1] This is the difference between the modern cogeneration installations and the classical CETs (central heating and power plants).[2] The latter are dimensioned for the electricity demand, the thermal energy being in this case a "secondary" product. The liberalization of the electricity market associated with the obligations undertaken by the EU member states by the Kyoto protocol led to the introduction of support schemes for cogeneration.

The cogeneration installations have experienced a particular development in the last two decades due to the energetic crises and, as a result of the Kyoto Protocol, regarding the reduction of the emissions of greenhouse gas. [3]

This results in the possibility of using a cogeneration system for the supply of such a parking lot both with electricity and heat energy.

The factors leading to the possibility of using such a system are:

- Obtaining cheap electricity by using an accessible fuel for the actuation of the cogeneration system
- The possibility of adapting classical engines or turbines for the use of other fuels in case of the cogeneration system.
- The possibility of using the produced electricity and heat in several buildings in the area, thus achieving a high efficiency

Fig.1 The elevator with a robotic actuation used for the execution of parking lots with high capacity

2. Introduction. Cogeneration. Requirements.

In case of thermal energy systems with cogeneration, the heat produced by combustion in an internal combustion engine or external combustion engine (turbine or turbo-jet engine) is used simultaneously in order to obtain mechanical, electrical energy for technological or heating purposes as well as for the preparation of the hot water used for heating.

The electricity obtained in the heating stations with cogeneration is used for the actuation of the pumps for the recirculation of the heat carrier between the heating station and the external consumer and/or for the supply of electricity in the national power system. Such power units are very useful in the cellulose and papermaking industry, food industry, textile industry, etc. because they ensure both the heat necessary for the technological process as well as the electricity for the actuation of technological machines or lighting. This greatly reduces the energy expenses. The basic idea of the thermal energy installations with cogeneration consists in the fact that the combustion gases produced by fuels combustion reach high temperatures, therefore present a high transformability degree of the internal energy in mechanical energy, according to the first principle of thermodynamics. With a very high efficiency (approximately 90%) both heat and energy may be simultaneously produced by a cogeneration station that uses an internal combustion engine or adapted turbo-jet engine from a single primary power source (primary fuel – for example, biogas, natural gas) by the cogeneration procedure. Heat and electricity are simultaneously produced, being able to produce heat as

technological steam, hot water for central heating or domestic use or hot gas for drying different products. By the more efficient use of the fuel, cogeneration leads to the reduction of the production costs, increase of the products' competitiveness and the significant reduction of the emissions of pollutants in the atmosphere.

The cogeneration systems are increasingly being used in the northern and eastern European countries and lately in USA and Canada. In our country there are such installations in Cluj-Napoca and Botosani.

In case of the elevator with robotic actuation it is necessary to obtain electricity for the actuation of the lifting mechanism, lighting stations, supply stations for electrical vehicles and for the heating of the parking lots.

The use of the equipment proposed for the cogeneration installation in case of the elevator and top technologies shall lead to the efficiency increase of the research-development activity by:

- The reduction of the time period between the idea/project to the prototype;
- The reduction of the costs incurred in order to obtain the prototypes or small series of subassemblies which are used within the industrial applications;
- The provision of auxiliary modelling and simulation services that may indicate the validity of the solution proposed by the beneficiary/designer or optimize it, thus improving the product's performance;
- The use of non-polluting technologies, with a reduced power consumption.
- The use of power for own needs and the pumping of the surplus in the national power system, thus also becoming power producers, this leading to a more efficient investment

The mandatory requirements for the execution of qualitative systems which must be ensured and maintained throughout the entire existence period of the systems that use generators for cogeneration are:

- Maximum capacity,
- Exploitation resistance and safety;
- Environmental protection;
- Power saving;
- Protection against noise.

The implementation of the cogeneration system presents a series of advantages, of which the most important are:

- The practical application of the most modern energetic solutions;
- The rational use of the fuel
- Reduced production and exploitation costs, power use for own needs and the pumping of the surplus in the national power system.

Fig .2 Cogeneration installation (http://www.ratcj.ro/cogenerare

3. The drawing of a cogeneration plant

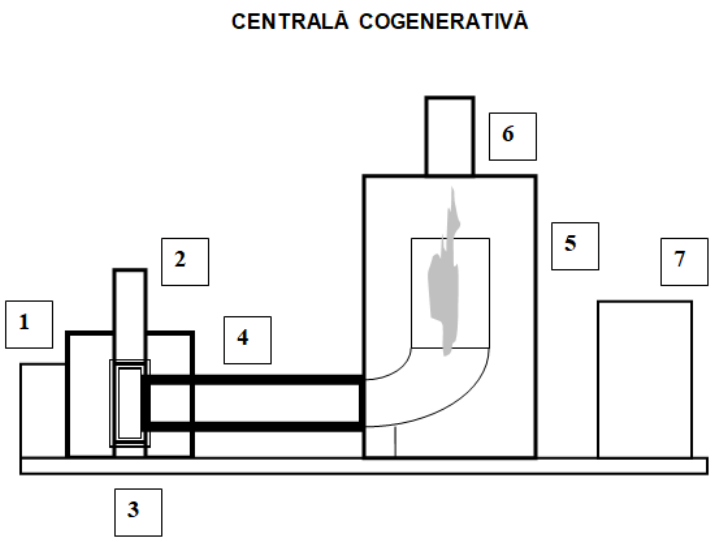

Fig.3 Cogeneration plant

1. Control room
2. Generator set room
3. Generator set
4. Motor adapted so as to operate with natural gas (internal combustion engine or turbine)
5. The room of the steam generator system and domestic hot water
6. Evacuation chimney for the non-polluting burned gas
7. The control room for the assembly's operation

The generator sets may use non-conventional fuels, resulting an electricity production at a lower price comparing to the production using classical fuels.

The necessity of a facile adaption of the engine and the provision of service is very important in case of using other non-conventional fuels comparing to the fuels which were used by the initial designs in the research centres and to industrial applications.

The field of use for the turbo-engines and derivative internal combustion engines is relatively new and there is an interest for it given the fact that these assemblies may use cheap non-conventional fuels, such as for example liquefied petroleum gas or biogas. The main requirement which is required for a modern energy installation that uses such an adapted engine is to obtain electricity at the lowest cost possible and with the minimum environment pollution.

The energy cost is imposed by the investment value and fuel consumption. In other words, the energy cost is even lower as the investment value is lower and the fuel consumption more reduced. The technical solution for the reduction of the fuel consumption is the capacity increase.

A particular importance is given to the matters related to environmental protection.

Generally, the combination of economic and ecological advantages is to be achieved, fact which is achievable in the cogeneration installations, where by the reduction of the conventional fuel consumption or use of non-conventional energies, the quantity of pollutants emitted in the environment is reduced (CO_2, CO, NO_x etc.).

4. The drawing of a cogeneration thermal plant provided with gas turbine

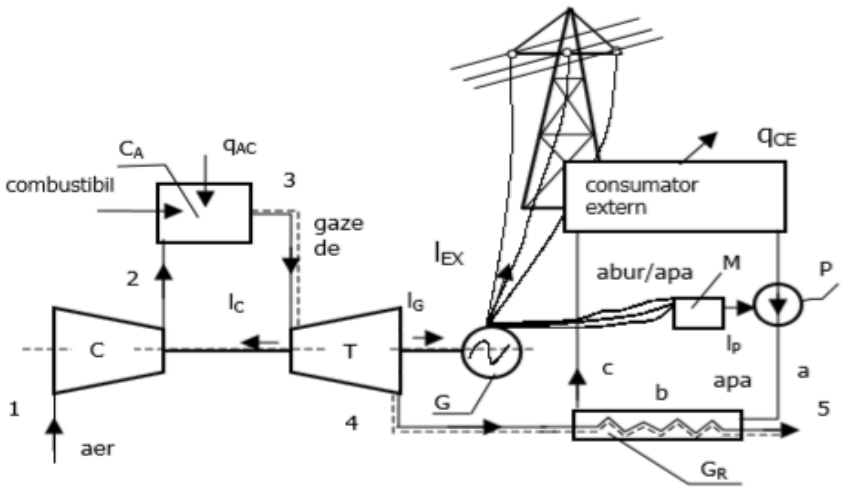

Fig.4 Cogeneration thermal plant provided with gas turbine

Figure 4 illustrates for exemplification the drawing of a cogeneration thermal plant which includes an installation with gas turbines (which in turn consists in the C compressor, combustion chamber CA, gas turbine T and power generator G) and a secondary circuit consisting in a steam/hot water generator, recovery type, with back-flashing, GR, recirculating pump P, actuated by the electrical engine M and an external consumer (in this case, the hydraulic elevator).

Romania adopted a series of supporting measures aiming the promotion of power production from renewable sources and in cogeneration with a high efficiency. The high efficiency cogeneration is supported in Romania based on a state aid scheme. [4]

5. The drawing of a cogeneration plant on biomass (140 kW)

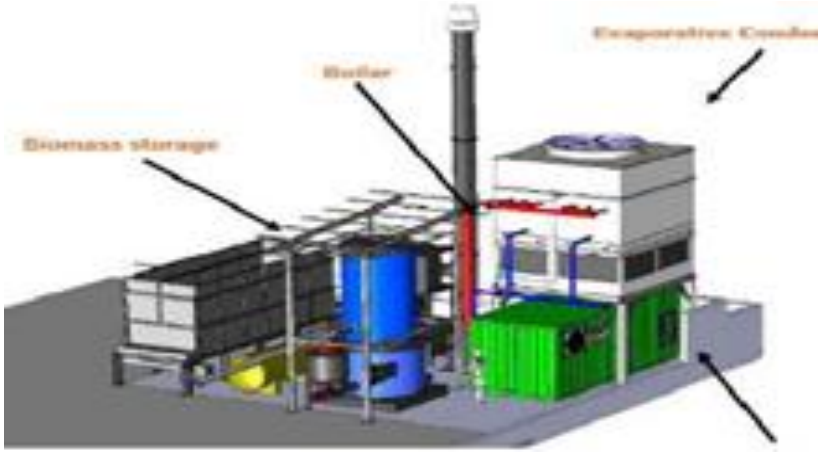

Fig. 5 Cogeneration plant on biomass (140 kW/h)

(http://www.kwg.ro/files/Salcia_Energetica_pentru_comunitatile_locale.pdf)

The objective of the Directive 2004/8/CE consists in the creation of an appropriate legal framework, necessary for the promotion of cogeneration, that contributes to the increase of the energy efficiency.[5] The lighting and heating of the parking lot may be executed by a cogeneration plant on biomass (renewable willow). Why renewable willow? Because the most profitable of the woody plants is the species – hybrid Salix viminalis, obtained in the Swedish laboratories.

The energetic willow is a plant which may be planted anywhere. The willow has a high caloric power of approximately 4900kcal/kg. The use of the energetic willow as a source of:

- biofuels – renewable energy - biomass;
- heat and electricity by direct combustion, combustion with coal and by gasification;[6]

CONCLUSIONS

Cogeneration refers to the combined production of the two types of energies, electricity and heat.

The correctly chosen cogeneration technology shall lead to the reduction of the energy cost for the user.

The introduction of low and average power cogeneration may represent an optimum solution for the modernization of the systems and reduction of the lighting and heating costs.

A professional management adapted to the market economy leads to the revitalization of the power production segment, in terms of efficiency and competitiveness on the electricity market.

Cogeneration constitutes a considerable potential for the efficiency increase and reduction of the impact on the environment.

REFERENCES

[1] http://www.ratcj.ro/cogenerare.html
[2] www.pulsmedia.com
[3]http://ec.europa.eu/energy/en/topics/energy-efficiency/energy efficiency/directive/national-energy-efficiency-action-plans.
[4] http://www.pelifilip.com
[5]http://www.kwg.ro/files/Salcia_Energetica_pentru_comunitatile_locale.pdf
[6] **Edward Răşchitor, Carmen Elisabeta Radu –** *The opportunity of planting energetic willows on Dambovita river margin,* SMART START-UP EDITION II, Politehnica University of Bucharest, November 2017