THE DEVELOPMENT OF INVESTMENT PROJECTS BASED ON COGENERATION, BY USING ALTERNATIVE SOURCES OF ENERGY

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Abstract: *In today's global economic development, energy is imposing itself as an essential factor in relationships between states, regions, blocks of interest, as a vital resource for socio - economic progress and having an economic, social, political and strategic value. The whole evolution of human society was and is related to energy derived mainly from coal, oil, natural gas and wood, due to negative environmental consequences and that these energy resources are going to consume in this century or in the next one, require energy diversification options in the future. Promotion of investment projects in the field of new energy technologies will have a crucial role in exploiting renewable energy, limiting vulnerability to fossil fuels, and to ensure sufficient clean and safe energy, at a satisfactory price.*

Keywords: energy, investments, projects, renewable energy, sustainable development

1. Introduction

Romania's location in a geographical area of temperate-continental climate with excessive shades, causes that approximately 40% of primary energy consumed in the country to be used as heat for heating homes and public spaces and individual hot water production for consumption. The average heating period varies between 160 and 232 days / year with an annual average number of degree-days between 3000-5000. These data lead to a characterization of the vital necessity of heating in Romania, with strong social impact.

In the same time, Romania has an important exploitable potential of renewable energy resources, distributed in different parts of the country's resources such as hydro resources, wind, solar thermal energy, solar energy for photovoltaic applications, biomass, geothermal energy.

Although, so far, making use of such renewable resources is not significant, their use should be based on three important premises: accessibility, availability and acceptability.

Given that the Romanian economy is characterized by a primary energy intensity and final high compared to the EU, to achieve the target of reducing energy intensity by 40% by 2015 compared with 2001, investments must be made in new capacity to produce electricity and heat as well as in the existing ones.

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2. General basic principles in taking the decision to modernize with equipment of cogeneration of low / medium power

In this context, economic agents with an annual consumption of energy more than 1000 TOE, and the public authorities of municipalities with more than 20,000 people have the obligation to submit their own programs of energy efficiency aimed at the whole energy chain (production - transport -- distribution - use) to reduce energy consumption for heating and air conditioning, lighting, transport and economic activities.

Restoration of production capacity for electricity and heat should be taken into consideration, if it is effective in terms of investment cost, since most of the equipment in service have exceeded the normal life span, high consumption of energy and as a consequence a low level of energy efficiency.

The construction of new capacities to produce electricity and heat, taking into account that the duration of their life is significantly longer than for the rehabilitation of energy groups, will help to cover demand for electricity and heat in the country.

Due to significant fuel savings and reduced CO2 emissions, resulting in combined heat and power production, investments in the construction of new groups in cogeneration are imposed.

Combined heat and power production(cogeneration) is consistent with the new trends of using clean fuels, and the construction of new cogeneration capacities in accordance with the EC Directive nr.8/2004, constitute a tool for increased energy efficiency (by primary energy savings) to reduce pollutant emissions, and coverage the energy demands in isolated areas or energy demands in residential, commercial and industrial areas, in the context of economic and environment conditions of these specific areas.

Supporting the investments in building new capabilities for the production of electricity and thermal, retechnologisation, upgrading and rehabilitation of the factories or cogeneration groups, involves the development of investment projects, in whose structure there are three main parts, as follows:

- the functional level regards the technical level of construction, sewage systems, systems of energy supply, industrial devices, the pipes and electric lines that are designed, level that imposes the economic efficiency of the investment;
- the technological part solves the solutions regarding the production organization, choosing the appropriate technological tool, mechanization and automatisation of the workings so that it can ensure the most advanced technology;
- the construction and installation part solves the plan solutions, volume and construction solutions of construction objects – assembly, sizing the main

dimensions of the overall construction, location, openings, etc., the choice of materials, degree of prefabrication, site selection, etc.. All these elements must be reflected in technical-economic indicators of background for the economic efficiency of the investment made.

To implement an investment project is required to achieve first **the feasibility study** which shows the specific elements and factors that have to be considered for evaluating technical and economic viability of the fueling system with thermal power centralized produced by small / medium power cogeneration, compared with other possible options.

The options have to be compared by using a range of economic principles, which will provide the certainty that the costs over the life span of the system were used.

The main **directions of orientation of the feasibility study** refer to:

- **assessing the demand of heat and electricity** (the evaluation of heat, electricity and a potential new market for air conditioning / cooling), aiming at:
  - ♦ identifying the potential partners - authorities, large hospitals, schools, associations of owners and all who can contribute to the formation of a basic task for the supply of heat produced centrally. This is necessary for any new system, but also for the reassessment of the existing system to be upgraded;
  - ♦ that all measures of cost-effective energy savings to consumers have been made before, or at least taken into consideration before determining the demand for heat, so as to avoid installing additional capacity unjustified;
  - ♦ obtaining the necessary dates from the archives of the existing buildings, or by techniques for modeling energy for new buildings in line with the development strategy of the urban area concerned, provided by the municipality;
  - ♦ the evaluation of variations of heat demand by direct measurements made with devices installed in buildings;
  - ♦ taking into consideration of the effect in the future of different factors on the demand profile, such as the introduction of contorisation and new tariffs, the liberalization of electricity market which will facilitate the sale of electricity directly to people connected to the system, and increasing demand for air conditioning / cooling systems in the summer;

- **the evaluation of heating systems in buildings**, include the following aspects:
  - ♦ for buildings already connected should be reconsidered the temperature and pressure of work, to ensure current and future needs;
  - ♦ the need of a program that works to increase the flexibility of the current system and to adapt it to the new solution of rehabilitation adopted;
  - ♦ the existence of a multitude of ways to produce hot water in the housekeeping system. The most efficient scheme in terms of energy involves

taking into account the advantage of low temperature water supply, so that the return water temperature into the system to be reduced to a value as close to that temperature;

- **in the assessment of heat centrals** must be taken into account the following aspects:
  - ♦ fuel choice, flexibility of the contract and security of supply;
  - ♦ cooperation in providing fuel, electricity supply (to CET) and heat in the systems;
  - ♦ capacities in reserve;
  - ♦ the costs of operating and maintenance;
  - ♦ heat accumulation and water pumping so that the CHP should have greater flexibility;
  - ♦ level of penetration of new technologies: preisolated pipes, condensing boilers, etc..

- **distribution system evaluation** refers to the identification of major routes restrictions (examining the design of other services of utilities to avoid damages) and the importance of using a specific software.

Optimization phase is the most complex phase of the feasibility study, where various options available for the rehabilitation of fueling system thermal power produced centrally, should be compared on the basis of maximizing net income, and the internal rate of return, such as:. Some possible optimization problems are:

- **operating temperature**: a higher temperature will cause a lower flow of water and thus a lower diameter of the pipelines, but there is necessary buildings connecting systems more expensive, and a higher cost of heat production;
- **operating pressure**: the costs of pumping should be taken into consideration especially for large systems, where a higher pressure reduces the need for auxiliary pumps;
- **metering:** meters installation will result in a reduction of energy used in buildings, and consequently a lower cost of operation. But the most important impact of the use of meters could be reaching the market acceptability of households and of those who develop projects;
- **the heating system in buildings**: the rehabilitation or replacement of parts from the heating installation of buildings will involve some additional costs, but could be justified by the positive impact on the rest of the system, or by increasing sales of heat (the deposition of lead pipes or radiators increase the required pumping power and to lower the heat transfer inside the building);
- **insolation and sealing** the building could create a financial advantage by reducing heat demand at peak load and thus the thermal power capacity (usually a boiler) and a distribution system. Marginal cost of energy should be taken into consideration in this assessment.

The incomings from sale of electricity and heat can be assessed only after a correct understanding of current and future costs for individual heating of potential customers, and also an estimate of the level's non-incomings.

In case of cogeneration is vital to obtain maximum incoming from generation of electricity because from the general estimates, an increase of 10% of sales of electricity will improve the internal rate of rentability (IRR) of investment by 2%, while an increase in sales of all the heat by 10% will improve this indicator by only 1%.

Specific options after liberalization of the electricity market for the sale of electricity produced in cogeneration refers to the wholesale to local public supplier of electricity to another supplier of electricity to sell directly to customers as a secondary supplier, in line with electricity market regulations, the sale under the regulations on renewable energy (only for waste used as fuel) and sales as autoproducers to other customers located on the same site.

The result of the analysis of these options can be used in the sensitivity analysis. For a good feasibility is recommended to provide customers heat and power together in a district heating scheme for the benefit of joint arrangements of metering and billing. In this situation additional arrangements are required: If the self production of energy is lower or higher than the client's demand, payments for use / installation of new cables, etc..

The development program is a result of the feasibility study and allows an advanced planning of the future stages of the project following the investment, containing mainly information on future needs for investigations (ground conditions, structures inspection, etc..), on the planning operations, on the implementation of local and national regulations on the bidding and tendering, construction companies, energy development, operation, evaluation of tenders and final negotiations of contracts and supervision during the implementation phase, rehabilitation, implementation, testing , operation and maintenance.

Regarding the **economic assessment**, it has to be considered the economic calculation (the cash flow, annual capital expenditures, annual operating costs and maintenance, annual income) and comparing alternatives using simple repayment period, net income updated (NPV), internal rate of rentability (IRR). In selecting appropriate alternative it is indicated to opt for the version with the highest NPV and IRR greater than the minimum required by the project developers (investor), taking into account his risk.

It is also recommended to make a financial assessment to calculate the implications of taxes and rates to cover the debt.

Specific investment in cogeneration is relatively high, therefore it is imposed the careful sizing of the capacity of the cogeneration equipment relative to the thermal peak need. Seasonal peak load is usually covered from another source (boiler classic). On the other hand, relatively specific investment leads to greater need for the search of financial incentives for a solution that will ensure competitiveness.

Maximizing the benefits of cogeneration applications in the heating is achieved by sizing the system depending on heat necessary and not on electricity. In this case, experience shows that an acceptable feasibility of projects is essential to ensure a permanent outlet for electricity – usually generated over consumers need of heat. Regulating access to the electric system and the contractual conditions based on which it is provided the electricity to the network are proved to be major barriers in cogeneration development.

Promoting an investment in this area should be based on advanced studies, based on real characteristics of the analyzed area. Studies will highlight what solutions can a local community allow it self to tackle the centralized heating problem using cogeneration and when the conditions are met for starting the investment.

In determining the solutions that will efficientisate the heat supply of urban consumers it will have to start from market economic principles. Any solution will be to ensure the operation of heating system so that the investment made could me returned, to recover the operating expenses and to achieve profit.

It is very important that the market is not artificially influenced, as was the case in Romania. It is accredited among investors the idea that the financing of centralized heat systems is not desirable. Therefore, these investments should be made where there are opportunities and economic conditions. To solve the heating needs of an area, only the feasibility study may show whether the cogeneration solution is applicable, or it is needed to implement alternative solutions.

3. Use of renewable resources in cogeneration factories

Cogeneration plants are a large step for alternative energy, to ensure energy independence in the future for Romania, limiting from an economic and financial point of view the dependence on the resources of oil and gas imported from other countries.

In Romania there is the possibility to power the electric and thermal plants (cogeneration system)with biomass represented mainly by the tree bark and other non use full parts resulted from the technological process of obtaining timber and woodworking, which in our days is mainly left to decompose .

The biggest electro – thermic cogeneration plant fueled by biomass from Romania, was made in Radauti, following an investment of 20 million Euros and will produce 22 MW, of which 17 MW of heat and 5 MW of electricity . Heat will be used for heating 7,000 homes in the municipality Radauti and for drying of timber "Schweighofer", factory and electricity will be delivered in the national energy system.

Using the potential of biomass in Romania can cover about 70% of the national commitments of the proportion of renewable energy in total energy consumption. Reaching an equivalent consumption of the biomass of approximately 8 TOE by 2010 can be achieved by installing new units or cogeneration plants based on biomass.

Conclusions

The main aim of promoting investment projects in cogeneration facilities is primarily to enhance the use of energy from renewable resources, so that the reducing dependence on imported primary energy resources (primarily fossil fuels).

Diverse valuing of renewable energy resources is necessary, taking into account that there are different types of renewable resources available and the fact that the production of these resources varies in different periods of the year, depending on weather conditions. In this way, it can be achieved the national target of 33% for the share of electricity produced from renewable sources in gross consumption of electricity in the year 2010.

Also, investments in exploiting renewable energy resources can promote entry into the economic system of remote areas, providing a basis for developing economic activities, for developing the economic and social environment in different areas of Romania, and will help reduce dependence on imports of energy, while contributing to technological progress and the creation of new jobs for local labor market.

Also, after the economic analysis of investment described above, we can draw the following conclusions:

√ most feasible variants from an economic point of view are the ones of producing centralized energy using CHP plants;

√ both at an European and national level, biomass is a renewable source of energy whose use is stimulated, in particular due to neutral impact on the environment pollution;

√ biomass potential existing in our country is quite high, so the forest biomass and the agricultural biomass.

R E F E R E N C E S

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