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THE INFLUENCE OF BIOMASS PRICE OVER DISCOUNTED NET INCOME

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Through this paper is want to make an impact analysis on the biomass price over discounted net income. The analysis is made for a cogeneration plant with condensing steam turbine outlet adjustable using solid biomass as primary energy, destined to heat supply for urban consumers for medium areas of Romania. It wants to determine the maximum possible biomass price assuming zero net income updated.

Keywords: biomass, discounted net income, cogeneration

1. Introduction

In this paper we present two cases, CHP plant with steam turbine condenser and adjustable plug using both biomass in cogeneration installation and the installation of peak and also using biomass in cogeneration installation and CH4 in installation of peak. Using the analytical method provided updated net income zero, determines the maximum possible biomass price. Take account of new regulations, especially the law 220/2008, republished in the Official 577 of 13.August.2010, which encourages producers of electricity from renewable sources by giving them three green certificates for each 1MWh of electricity delivered to the network and also for high efficiency cogeneration are granted 4th certificate green, on duration of 15 years.

2. General aspects regarding the use renewable energy resources in systems of cogeneration under the form of biomass

The EU market for biomass for heating is low, but growing. The heating equipments with burning of solid biomass are currently the most common in areas where there aren't gas supply routes.

In some regions local authorities require developers to include renewable energy to provide heat for buildings that exceed certain dimensions. Heating by burning wood is one of the options that are used to meet this requirement. There is

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also a growing demand for housing with consumption of low-energy and low emissions of CO2.

The best known fuel for home heating systems on base of biomass is woody biomass resulting from local forests and forestry wastes or energy crops such as willow young forests. It also can use waste wood left over from cutting wood or other processing of this. The most convenient types of woody biomass used for heating are wood chips, pellets and logs.

Freshly cut wood has a moisture content of 40-60%. Useful energy available depends on the amount of moisture present. "Wood ideal" would be as dry as possible. Water contributes nothing to the energy contained in fuel and reduces energy useful of wood.

Energy content per unit mass or volume is known as calorific value. Calorific value is expressed by rule, the MJ(GJ)/kg or sometimes in kWh/kg. Net calorific value or calorific value is the method used in Europe and the quantity of heat produced by combustion complete of fuel with vapor formed during combustion in gaseous form. This means that the heat recovery by vapor condensation in the gas flow is not included. Because boilers with condensed wood are very rare this method is more realistic to measure the amount of useful energy. [1]

As shown in [2], calorific value and density of the volume for a range of fuels have the values listed below

Table 1

Calorific value and density of the volume for a range of fuels

Fuel	Energy per mass kWh/kg	Volume density kg/m^3	Energy per volume kWh/m^3
Wood (solid - dried in oven)	5-5.8	450-800	2300-4600
Peled of wood	5	600-700	3000-3500
Natural gas	15	0.7	10.8

Biomass price at forest road, not including transportation costs from forest road to the place of consumption is 130 RON/t with VAT for wood and 60 to 70 RON/t the fall of the VAT for grooming forest.

Natural gas price vary from one provider to another. In general, for natural gas from distribution network, the price ranges between 22 and 24 euro/MWt.

3. Laws and regulations on the use of renewable energy

The promotion, development and increased use of renewable energy sources is one of national commitments that Romania has assumed by ratifying the Kyoto Protocol to the Convention - framework of United Nations on climate change in view the reduce quantitative of reducing anthropogenic emissions of gases greenhouse and in the aim promote of a sustainable development. This objective is achieved through projects aimed at acquiring installations which respect the objectives clean technology, namely: technologies with low consumption of prime materials, reduced energy consumption and with production of a small amounts of pollutant emissions and waste, of installations which have as aim the capitalization and use of renewable energy resources (wind, solar, geothermal, wave, hydro, biomass, digester gas of waste, digester gas of sludge from installations of wastewater treatment and biogas).

Capitalizations of renewable energy is a major focus in framework of EU policy, enrolling in the context of the need of gradual abolition of the use of conventional fuels and obtain energy independence of Member States versus extern sources of energy.

This leads to improved security of supply with energy, ensuring a clean environment by reducing greenhouse gas emissions, promoting regional development. In addition, the capitalization of renewable energy contributes to satisfaction energy needs in remote rural areas.

Directive 2001/77/EC of the European Parliament and Council on the promotion of electricity produced from renewable energy sources in the internal market, was the first concrete action to achieve EU obligations to reduce emissions of greenhouse gases to which have undertaken by ratifying the Kyoto Protocol.

Need to use heat or power more efficient has determined since 2004 prompted the establishment of European-level of a legislation, Directive 2004/8/EC, which promote the potential of combined heat and power, in conditions high of efficiency under , ie CHP plants. This Directive was transposed into Romanian legislation by Government Decision no. 219/2007 on the promotion of cogeneration based on useful heat demand.

Directive 2009/28/EC of the European Parliament and the Council of 25 April 2009, the most recent and comprehensive document to the EC, promoted the use of energy from renewable resources.

According to Law 220/2008, republished in M.O. 577 of 13.August.2010, it encourage producers of electricity from renewable sources by giving them three green certificates for each 1 MWh of electricity delivered to the network and also for high efficiency cogeneration are granted 4th certificate green, on duration of 15 years.

Through the granting of the 4th certified green, energy production is fortify through the technologies of cogeneration by high efficiency of heat and power energy, these being considered new technologies, competitive, "clean", "mature" in terms of technological and economic having a high efficiency in fuels use.

The system of promotion applies to qualified producers of ANRE from date on which they begin to produce electricity and they receive green certificates if the putting in function or the refurbishment is done by the end of 2016.

4. Biomass price with implications in discounted net income

Due to the quantitative limited character of renewable energy resources useable and reducing to the maximum possible of transport distances until sources of heat production, the latter make part of the category decentralized production. If CHP plants, is generally by cogeneration plants of low power with total installed electrical power of order MW/GCC.

In these conditions, for CCG plant, energy efficiency of the production by power energy decreases significantly, due to the effect of scale, while global energy efficiency is reduced few relatively.

In the case of use in GCC of renewable energy resources under the form of biomass, production technology of the two forms of energy are based, in most cases, on the use of Rankine cycle with steam turbines, with condensing and plug adjustable at low pressure with maximum unit power of order MW/GCC.

This leads to a significant increase in specific investment, determined by the effect of scale and at a some reduction of efficiency of production heat and power energy, in conditions the increasing share of functioning in regime of cogeneration after electric chart (increased production of electricity in regime by the condensing).

All this leads to increased unit cost of producing of the two forms of energy.

Starting from [3], through analytical method, putting the condition as updated net income to be zero, it's determined the maximum possible price of biomass so that the project is still profitable.

Analysis is performed on the average climatic zones of Romania having the classed curve of heat demand for heating and hot water in [3].

As sizes regarding the technical performance of the equipment used:

- nominal cogeneration index, y_{cg}^{n} [kWhe/kWht], determined using the thermal adjustment chart varies between $y_{cg}^{n} \in [0.2 \div 0.35]$ [kWhe/kWht], but the annual average cogeneration index is determined using the load of cogeneration equipment and specific flow idle of energy equipment d=0.20, and it varies between $y_{cg}^{a\,n} \in [0.12 \div 0.34]$ [kWhe/kWht] according to [4. chapter 7.2.3.5.];

- overall efficiency of ICG for cogeneration production of heat (Qcg) and electricity (Ecg) $\eta_{gl}^{cg} = 82\%$ according to [4. chapter 7.2.5.];
- the yield of electricity production in ICG, in the non – cogeneration mode $\eta_{ICG}^{e,ncg} = 30\%$;
- the yield of thermal installations of peak to produce heat $\eta_{ITP} = 80\%$;
- $p_{pe}^{cg} = 40$ [€/MWhe], [5], unitary sale cost of electricity, from CHP, produced in cogeneration, and $p_{pe}^{ncg} = 73$ [€/MWhe] [6], unitary sale cost of electricity, from CHP, produced in non-cogeneration;
- $p_q = 50$ [€/MWht], unitary sale cost from CHP of the heat produced;
- specific investment in installation of cogeneration based on biomass, $i_{ICG} = 1300$ [€/kWe.i], [7] and specific investment in installation of peak based on biomass $i_{ITP} = 80$ [€/kWt.i], and specific investment in installation of peak based on CH4 $i_{ITP} = 60$ [€/kWt.i], [4];
- unit value of a green certificate $v_{GC} = 28$ [€/MWh] according to “the Order on the update values limit of green certificates trading and the counter value of a green certificate which has not been purchased, applicable for 2012”;
- total investment (I) is updated for the implementation of the investment (tr=1years) with the same updating rate (a=10%).

Analytical form of biomass price for the case biomass in installation of cogeneration and installation of peak will become then:

$$p_{bio} = \frac{\left(\frac{V-I}{(1+a)^1} + \sum_{i=2}^{20} \frac{V}{(1+a)^i}\right)}{\sum_{i=1}^{20} \frac{C}{(1+a)^i}}. \qquad (1)$$

and analytical form of biomass price for the case biomass in installation of cogeneration and CH4 in installation of peak will become

$$p_{bio} = \frac{\left(\frac{V-I}{(1+a)^1} + \sum_{i=2}^{20} \frac{V}{(1+a)^i}\right) - Q_{CHP} \cdot \frac{1+\gamma_{CF}}{\gamma_{CFuel}} \cdot p_{CH4} \cdot \frac{1-\alpha_{cg}^{an}}{\eta_{ITP}} \cdot \sum_{i=1}^{20} \frac{1}{(1+a)^i}}{\sum_{i=1}^{20} \frac{1}{(1+a)^i} \cdot \left[Q_{CHP} \cdot \frac{1+\gamma_{CF}}{\gamma_{CFuel}} \cdot \left(\alpha_{cg}^{an} \cdot \frac{y_{cg}+1}{\eta_{gl}^{cg}} + \frac{y_S - \alpha_{cg}^{an} \cdot y_{cg}}{\eta_{ICG}^{e,ncg}} \right) \right]} \quad (2)$$

where,

- V - CHP' s annual revenue from the sale of electricity, respectively heat, in [€/year];
- α_{cg}^{an} - cogeneration coefficient, from the thermal point of view, in annual value;
- $\gamma_{CFuel}, \gamma_{CF}$ - annual fuel cost share (with renewable energy resources) in the variable annual costs, respectively annual fixed costs in the CHP's total;
- QCHP, Qcg - The annual values of the quantities of heat produced respectively by the CHP in [kWht/year], respectively in ICG (in cogeneration);

5. Conclusions

The result is presented in the following graphs:

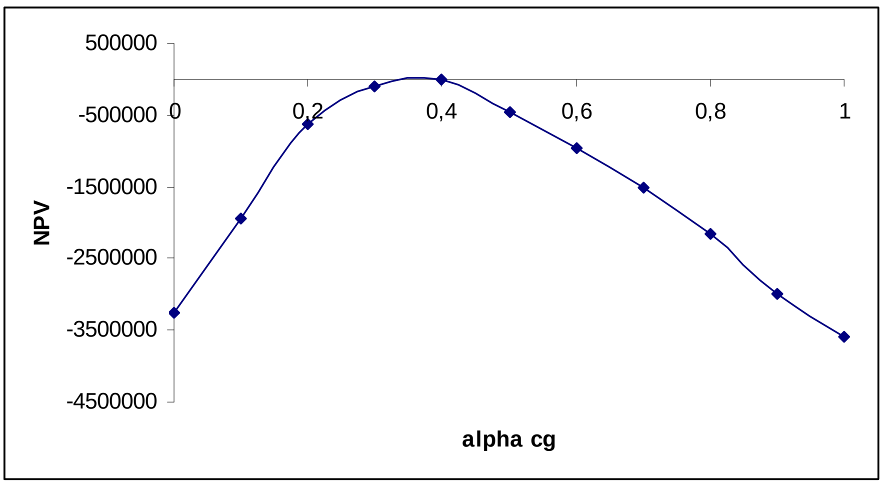

Fig. 1. Relative variation of the NPV in relation to the reference value (p_{bio} =16.77 €/MWh) (observation: biomass in ICG and ITP)

From the chart above (Fig. 1), we see that the maximum possible price of biomass is 16.77 €/MWh α_{cg}^{optim} is 0.4 which is that 40% of energy, produces in cogeneration installations and the rest of the peak.

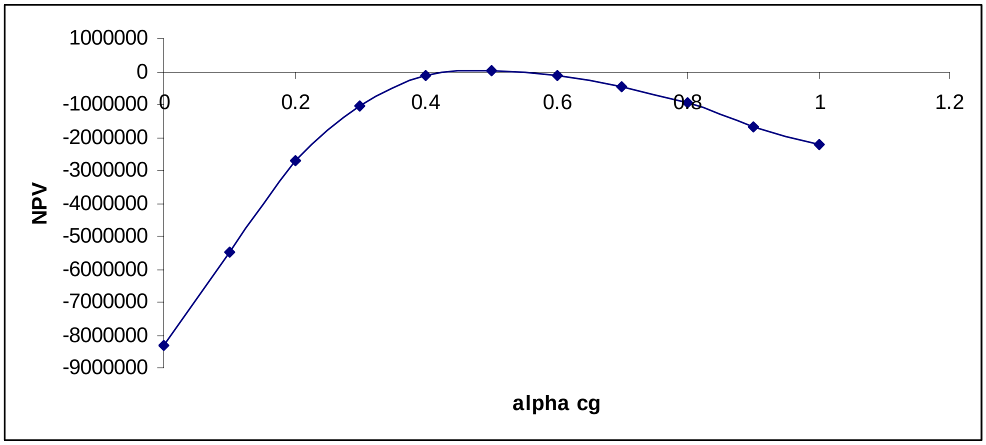

Fig. 2. Relative variation of the NPV in relation to the reference value (p_{bio}=15.93 €/MWh) (observation: biomass in ICG and CH4 in ITP)

From the chart above (Fig. 2), we see that the maximum possible price of biomass is 15.93 €/MWh α_{cg}^{optim} is 0.5 which is that 50% of energy, produces in cogeneration installations and the rest of the peak.

As a final conclusion, if we analyze which of the two projects is more feasible, we see that project with using biomass in installation of cogeneration and CH4 in installation of peak is more feasible than biomass in CHP plant, producing more energy on renewable energy resources upon which to receive green certificates.

R E F E R E N C E S

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