COMMERCIAL AND NATIONAL PROFITABILITY OF COAL MINING AT GACKO COAL DEPOSIT

Vuković Boško[1]

[1]*Mine and Power Plant Gacko, Bosnia and Herzegovina, e.mail.* bosko.vukovic@ritegacki.ba

ABSTRACT

Coal resources, beside oil, gas and uranium as nonrenewable source of energy, represent the most significant part of energy potential of Republic of Srpska and energy source of strategic importance.Modern pace of technological and industrial development conditions constant increase of coal exploitation and consumption. Usage of this resource must be planed and utterly rational.Production of coal from Gacko deposit has great importance from socio - economical and national aspect. If taken into account that thermoenergey capacity of installed power of 300MW was built very close to Gacko coal deposit, to the greatest extent the problems of unemployment and purchasing power of locals and residents of neighboring municipalities are solved. In the former production of coal and electric energy from energy complex in Gacko the commercial profitability is realized, which represents direct financial benefit for Republic of Srpska energy sector. However, commercial profitability, which is practically determined by market economy and its principles can not give clear picture about contribution of coal and electric energy production to national economy of Republic of Srpska.

Key words: *coal, deposit, thermo- energy facility, national profitabilityand*

INTRODUCTION

There are numerous energy and mineral resources in the territory of Republika Srpska. Coal, petroleum, natural gas and uranium are all non-renewable resources whereas water is considered a renewable resource. Economy-wise, coal (non-renewable) and surface water (hydropower), which is a form of renewable energy, are among energy and mineral resources of particular interest for Republika Srpska [1]. Other above-mentioned energy and mineral resources are not utilized at all or are used minimally in Republika Srpska. However, the growing energy needs and the need to adjust to the energy, environmental and other standards in Europe and the world represent a motive to reexamine both non-renewable energy resources available and used in Republika Srpska and alternative non-renewable resources that can be utilized in the near or distant future.

In order to make the non-renewable energy resource of Gacko endure and develop in the actual environment, its purpose of existence has to be defined clearly. That purpose is primarily related to a multistage process of providing and using the non-renewable energy resource in conformity with the actual natural, economic and environmental potential in regard to the needs in the immediate or wide neighbourhood. The Gacko coal deposit contains a commercial type of coal - lignite/brown-lignite coal. It is almost exclusively used by the coal-fired thermal power plant in Gacko and is one of the

strategic raw materials in Republika Srpska. This coal that originates from the Gacko coal deposit is the non-renewable energy and mineral resource of vital importance for Republika Srpska economy.

COAL AS THERMAL ENERGY FUEL FOR PRESENT AND FUTURE POWER STATIONS

Gacko's geological coal reserves are 340 Mt [2]. According to the valid geological documentation the mineable reserve is ≈ 190 million tonnes, the average heating value is 9.9 MJ/kg and the energy potential is 545 TWh. According to the efficiency indices that have been processed so far, the mineable coal reserve is able to provide a long-term fuel supply for present and future thermal power plants, which is bolstered by favourable economic terms. Due to the overall amount of the ore reserve and its quality, the Gacko coal deposit is the most significant source of that raw material required by thermal power plants in Republika Srpska.

The average concentration of coal in the Gacko deposit is 9.36 t/m^2 in the main coal seam whereas at all three levels of the first lower coal seam it is 13.73 t/m^2. The second lower coal seam is distinguished by a steady development in the whole deposit and the average concentration is 13.46 t/m^2. The average concentration of coal in the contours of the mineable reserve in the upper coal zone is 7.12 t/m^2.

The Gacko coal deposit has 36. 1 Mt of coal classified as C_2 category mainly in the deepest parts of the East field. It practically means there is a real chance to find new mineable reserves in this area. If new reserves are found (there are favourable mineragentic preconditions), the lifetime of this coal-pit would be prolonged, so Gacko's coal mine would be an industrial facility that will have an important impact on the development of economy and public services in the municipality of Gacko over a longer period of time. So it is being appraised that the construction of the second unit of the thermal power plant as well as the third one in the foreseeable future is fully legitimate. To assess the possibility of energy development based on the use of coal from the Gacko deposit, it is necessary to know the actual coal reserve, mining and geological circumstances, hydrogeological conditions, geomechanical parameters of overburden sediment, quality and usability of coal, possibilities of cheaper surface mining, chances to use the latest state-of-the-art machinery in the surface mining, i.e. high-production mechanized complexes [3]. In principle, over a longer period of mining, it can be expected to see a more notable influence of various risks within which geological, mining and economic risks are dominant [4].

COMMERCIAL PROFITABILITY OF COAL MINING AT GACKO DEPOSIT

Commercial profitability analysis contains: investment profitability analysis and financial analysis. These two types of analyses are complementary and they are not substitutable. Both of them have to be carried out because they focus on different aspects of investment evaluation. Investment profitability analysis measures profitability of the resources put into a project, the direct return on the investment regardless of the form of financing sources. So investment profitability analysis assesses potential revenue of the resources involved in a project disregarding the financial transactions that have occurred during the project's lifespan. On the other hand, financial analysis takes into consideration financial aspects of a project to ensure that available finances will facilitate a smooth implementation and operation of the project in the future. The final assessment of commercial profitability of the coal production at the Gacko coal deposit has been done by analyzing economic benefits of the project (estimated coal deposit).

The following dynamic methods have been applied to evaluate the commercial profitability of the Gacko coal deposit: net present value, internal rate of return and discounted cash flow to determine the time horizon for recovering the investment. The analysis of the economic impact of the investment project (examined deposit) has been done by applying cost-benefit analysis using the following methods: NPV, IRR, DCFROI. Economic analysis encompasses uncertainty analysis, that is, sensitivity analysis of the Gacko coal deposit: static sensitivity analysis (determining the break-even

point and the break-even price of mineral raw materials per unit) and dynamic sensitivity analysis which looks at the results of the change in parameters (revenues, costs), investment and legal obligations against the change in the internal rate of return previously calculated.

Net Present Value (NPV)

Net present value is the difference between the present values of future cash inflows and outflows of the Gacko coal mine. It means that all the cash flows are discounted at a predetermined discount rate according to the formula [5]:

$$NPV = \sum_{t=0}^{n} (P - O) \; F_t \, ,$$

where:

NPV – net present value

$\sum_{t=0}^{n}$ - sum total for the whole lifespan of the project from year 0 to year n;

P – cash inflow in the year t (KM)

O – cash outflow in the year t (KM)

F_t – discount factor in the year t corresponding to the selected rate of discount (%)

The discount factor is calculated using the following formula:

$$F = \frac{1}{(1 + \frac{R}{100})^n} \, ,$$

where:

R – interest rate,

n – number of years.

The NPV calculation for a period of 21 years has been done on the basis of the following parameters: production, costs, revenues and investments at the Gacko coal mine. The revenue was projected on the basis of production capacity planning, a planned selling price per 1t of coal, and the outflow side, the operating costs were projected on the basis of past components of financial outflows and a forecast for the 21-year period (projected lifespan). The components for determining financial outflows are: standard costs, labour, maintenance and depreciation charges.

Based on the economic cash flow calculation it follows that the total net present value (NPV) of the Gacko coal deposit over 21 years is positive and it amounts to KM 405.356.000 at a discount rate of 12% [6].

Internal Return Rate

The internal return rate is a discount rate that reduces the net present value of the estimated coal deposit to zero and it is relied on the formula [5]:

$$0 = \sum_{t=0}^{n} (P - O) \; F_t \, ,$$

where:

$\sum_{t=0}^{n}$ - sum total for the project's whole lifespan from year 0 to year n

P – cash inflow in the year t (KM)

O – cash outflow in the year t (KM)

F_t – the discount factor in year t corresponding to the selected rate of rate (%)

If the net present value is positive, this rate is higher than the discount rate. The economic cash flow calculation shows that in the case of the Gacko coal mine, the NPV amounting to KM 405.356.000 at a discount rate of 12% generates the IRR of 33.43% [6].

Time Horizon of DCFROI

The time horizon of the return on investment for the Gacko coal mine is stated in years in which the annual discounted net inflows received from the investment will pay back the discounted value of the total investment. In the case of the Gacko coal mine this period is 7 years [6], which means that the implementation of the project will be justified because the pay-back period of the investment is shorter than the technological lifetime of the coal mine Gacko.

Cost – Benefit Analysis (CBA)

Cost-benefit analysis (CBA) is an analysis of the socio-economic justification for costs of an investment project. It is usually used to evaluate net social and economic impacts of the public sector investment projects. The analysis of the economic effects arising from the coal production at the Gacko deposit has been done by applying cost-benefit analysis. It contains: static sensitivity analysis (establishing the break-even point and the break-even price of mineral raw materials per unit) and dynamic sensitivity analysis that looks at the results of change in the parameters (revenues, costs, investments and legal obligations) against the change in the internal rate of return previously calculated. The static sensitivity analysis encompasses the calculation of the break-even point and the break-even price for mineral raw materials per unit.

The calculation of the break-even point is done as: BREAK-EVEN POINT (BEP) = [Total fixed costs/ (total revenues minus total variable costs)] x 100 [6]. At the break-even point revenues equate to expenses so there is no profit. Above this point a project produces profits and below it, losses. The break-even point for the Gacko coal mine with an average annual production volume of 4.400.000 t is 1.628.000 t. The break-even price for mineral raw materials per unit below which the sale of the planned quantity would generate a negative result is calculated using the formula [6]: (break-even production x sales price/average annual production). In the case of Gacko's coal mine it is t=18.24 KM/t [6]:

Dynamic sensitivity analysis looks at the results of the change in parameters against the change in the internal rate of return. The point of this analysis is to change parameters interactively from -5, -10, -20, -30, -40 to +5, +10, +15, +20, +30, +40 (or different ranges) and they are calculated for the relevant values of the internal rate of return. In the case of the Gacko coal deposit, the IRR is the most sensitive to the change in total revenue: if the revenue (prices) is increased by 10%, the internal rate of interest will be 43% and if we lower the prices (revenue) by 10%, the internal rate of return is 26% [6].

NATIONAL PROFITABILITY OF COAL MINING AT GACKO COAL DEPOSIT

National profitability analysis is similar to commercial profitability analysis since both of them try to identify the costs and benefits and when commeasured, they can assess the profitability of a proposed investment. Commercial profitability analysis is the first step towards national profitability analysis. An overall development strategy of a country usually requires fulfillment of several objectives. Namely, it is necessary to evaluate the social soundness of a project– its impact on the economy as a whole and the special aspects of the economic life in the context of which the project will be considered. Accordingly, besides the basic criterion – net value added as a tool for evaluating the main impact of a project on the economy – there are other additional indices that measure certain implications of an investment project such as: the effects on employment, foreign exchange inflow and international competitiveness. It is recommended to do qualitative analysis of non-quantifiable implications and consider their impact on the infrastructure, technical know-how and the environment. The final assessment of the national profitability of coal production at the Gacko coal deposit has been

carried out by analyzing the results of the basic criterion of national profitability – net value added and indirect influences of coal production in Gacko on the national economy of Republika Srpska.

In order to measure the contribution of the coal production at the Gacko coal deposit to the national economy of Republika Srpska, the net value added criterion is applied. The adjusted world market prices of coal are used to determine the net value added. The net value added criterion measures the contribution of coal production at the Gacko coal deposit to the increase in the national income. It is calculated as the difference between the revenues generated by the coal production and the expected value of material inputs, services and investments [7]:

$$NVA = O – (MI + I)$$

where:
NVA – net value added generated by coal production at the Gacko coal deposit (KM)
O – difference between the revenue received from the sale of coal at world market prices and the revenue received from the sale of coal at the prices set by coal mine Gacko (KM)
MI – expected value of material inputs and services (operating costs of coal mine Gacko), (KM)
I – total investments of coal mine Gacko (KM)

Based on these calculations, the net value added for the Gacko coal deposit is 2.644.363.840 KM [6]

When some additional criteria of the national profitability appraisal (employment effects, foreign exchange inflow and international competiveness) are considered along with the results of the net value added, we get a fuller picture of the national profitability of the coal production at the Gacko coal deposit and we comprehend the importance of this resource for Republika Srpska [8].

Impact on Employment

An additional implication of the national profitability of the investment project is expansion of coal and electricity production at the thermal power complex Gacko. It enables the creation of new jobs for skilled and highly skilled labour force.

Foreign Exchange Inflow

Rudnik i Termoelektrana Gacko a.d. company earns foreign exchange by exporting electricity to the neighbouring countries – Montenegro and Croatia.

International Competitiveness

International competitiveness reflects the capability of Rudnik i Termoelektrana Gacko company to engage in international trade successfully. At the same time it represents the capability of the energy sector in Republika Srpska to ensure that the products (coal and electricity) are in compliance with the international market standards and to maintain and increase the real income of the population in the long-run.

CONCLUSION

Based on the input parameters, that is, the input assessment (production, costs, investments) and the expected results (revenue, profit etc. over 21 years), the NPV and the IRR for the Gacko coal deposit were computed. The time of the return on investment was calculated by discounting economic cash flow. The break-even point, the break-even price for mineral raw materials per unit as well as the break-even capacity were calculated within the static sensitivity analysis resulting in the following values [6]:

- The level of ground water at a discount rate of 10% is KM 522.965.000
- The level of ground water at a discount of rate 12% is KM 405.356.000
- IRR is 33.43%
- Time horizon of ROI is 7 years
- Break-even point is 37%
- Break-even capacity for the annual coal production of 4.400.000 t is 1.628.000 t;
- Break-even price for mineral raw materials (coal) per unit is 18.24 KM/t;

The net value added (NVA) was applied in order to assess the national profitability and it was calculated on the basis of world market price of coal of 103 KM/t and it amounts to KM 2.644.363.840. Besides direct influences of coal production in Republika Srpska on the national economy (financial revenues and costs), some additional criteria were analyzed: the impact on employment, foreign exchange inflow and international competitiveness, that is, the cost-benefit analysis showed direct and indirect impacts of the coal production at the Gacko coal deposit on the national economy of Republika Srpska.

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