

THE EVALUATION OF THE BENEFITS GENERATED BY THE INVESTMENTS IN WIND ENERGY

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Abstract

Starting from the economic effects of investments in wind energy, the authors search to answer the questions: What is the global energy balance determined by the investments in renewable energy? What are the economic, social and environmental effects? The answer to these questions has as starting point the cost - benefit analysis and the comparative analysis of the situation in the European energy market. The investment in wind energy production are, generally, generators of present benefits. If their recognition presents no obstacle, their quantification for the inclusion in the investor's business plan presents real difficulties. Sustainable development of economy and society requires also the focused action of all economic actors in solving current problems related to energy.

Regarding this, the paper highlights the need for public support for the investment in wind energy projects, considering the generated benefits. Through benefits we understand the positive effects due to an investment, in economic, social and environmental area.

Key words: investment, wind power, benefits, sustainable development

The assessment of economic returns generated by investments in wind energy has as objective to obtain information that allows the interested entrepreneurs to base their investment decisions in a field with a high degree of novelty. The degree of novelty is due to the fact that the renewable energy market is in forming both in Romania and the EU, there are no accumulated experiences or standards generally accepted to evaluate the internal and external effects generated by investments in the field.

MATERIAL AND METHOD

The evaluation of benefits generated through investments in wind power has used methods that have as starting point the cost - benefit analysis.

The material used for the calculation of indicators is based on a case study made over 8 companies with investments in wind energy. It was studied an investment option in which the enterprises receive grants accounting 50% of total investment. The grants come from European Programs that implement energy policies (Sectoral Operational Programme for Energy and Environment Fund).

RESULTS AND DISCUSSIONS

Romania has the highest potential in South-Eastern Europe in wind energy, the southeastern of

Dobrogea having the second place in the entire continent. Romania has a wind energy potential of 14,000 MW, equivalent to an annual production of about 23 TWh. The number of licensed producers of RES-E (renewable energy source) consist (in 2010) of 65 producers, in which 32 use hydro energy, 28 use wind energy, 3 use biomass and one use photovoltaic energy. According to a study made by TPA Horwath, at the end of 2010 the wind power station capacity amounted to 462 MW, a 33-fold increase since the end of 2009, when Romania had an installed wind capacity of just 14 MW. At the end of the first half of 2011, they were operational about 570 MW and is expected that by the end of 2011, the wind energy power to reach 1,000 MW.

The country's most dominant region in terms of generating wind capacity is Dobrogea, on the Black Sea coast. This incredibly dynamic regarding the installed wind farm capacity is allowing Romania to make progress compared to many European countries.

The favourable environmental conditions, the grown number of permits and projects already underway ensure this market will continue to develop at a fast rhythm during the coming years. On a European level, by the end of 2010 the combined installed wind power capacity throughout Europe had reached 84,278 MW. The European Wind Energy Association (EWEA) estimated the value of investment in wind farms in

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2010 at 12,7 billion euro, which corresponds to a 10% increase in capacity compared with the previous year. For the purposes of comparison, the total capacity of wind farms worldwide amounts to 197 GW.

To evaluate the benefits generated by the investments in wind energy, we have considered the following:

- the analysis horizon is set at 20 years;
- the discount rate is 5%;
- on the considered time horizon, there were taken into account only cash flows, that the real value of cash paid or received for the project. Monetary flows, such as depreciation and reserve funds are not included in the financial analysis.
- the total investment value is 21,292,457 lei, consisting of:
 - eligible value = 15,469,077 lei, of which: wind turbine 14,679,699 lei, connecting SEN 742,406 lei, ground sockets 46,972 lei;
 - not eligible value = 5,823,380 lei, of which: access road 149,292 lei, technical design 305,000 lei, site organization 1,266,639 lei, VAT 4,102,449 lei.
- grant aid amount is 50% of eligible costs = 7,734,538 lei;
- the value of own contribution: 50% of eligible expenses 7,734,539 + ineligible costs 5,823,380 lei lei;
- residual value is considered in the financial analysis of 7,097,486 lei and it was calculated through linear depreciation method.

Revenue evaluation

Based on the price of a MWh practiced so far in the region and on the average price of green certificates for renewable energy, there were projected the annual revenues.

It was considered that the price at producer of electricity will be 60 Euro/MWh. This price is for continues supply contracts, to provide the electricity instantly and discontinuous the price drops by 50% and for the supply contracts pending in emergency situations, the price increase by over 50%. Green Certificates (GC) are stimulatory measures for renewable energy producers. Until 2017, for each megawatt hour produced, the wind renewable energy producers receive two green certificates and after 2017 the producer receives one certificate for each megawatt hour produced. These certificates are traded on the open market, with current prices between 27 and 54 Euro on certificate. In Romania the number of green energy

producers is low and the trading price of the GC is high, respectively 45 Euro/certificate.

The exchange rate used in the analysis is 4.3013 lei/EUR and total annual wind energy production is 5,123 MWh. The production is related to a plant of 2 MW, installed in the south of Bacau county, where wind studies indicate a potential wind between 5,123 and 5,187 MWh/turbine of 2 MW.

Table 1

Revenue evaluation

Contract type	Value (lei)
Sales of electricity	1322143
Revenue from the sale of green certificates till 2017 (2 certificates/ MWh)	1983113
Revenue from the sale of green certificates after 2017 (1 certificate/ MWh)	991556

Costs evaluation

In the forecast of costs it was taken into account the fact that wind plant operation will be provided through a service and maintenance contract estimated at 1 Eurocent/kWh or 10 Euro/MWh. These rates are seen as variable costs, they increased in direct proportion with the production, respectively with the energy produced.

The service charges cover the following types of costs:

- workforce - about 40% of the expenditure;
- specific consumables (gearbox oil plant, cooling system oil, cooling liquid, etc.) - about 40% of the expenditure;
- spare parts in case of emergency (sensors, fuses etc.) - about 20% of the expenditure.

The annual evolution of costs has been indexed with the index of prices variation, forecast by the National Council of Forecasting.

Table 2

Evaluation of maintenance expenditure

Cost type	Annual production capacity (Mwh)	Annual value (lei)
Maintenance expenditure	5,123	216,703

The company recourses to a bank loan worth of 14,200,000 lei, on a 10 years period, with a current effective interest of 12% (ROBOR 6.7% + risk margin 4.5% + commission 0.75% + management commission approx. 0.1%).

This appropriation is intended to cover the funding sources of investment, amounting to 13,557,919 lei, to provide a working capital of 642,081 lei for the start of work and to ensure the financial costs, service and maintenance costs until the cashing of the first income from the sale of energy and green certificates.

Sustainability and profitability evaluation

To calculate the financial return on investment, the financial return on equity and the financial net present value corresponding to the investment and to the own invested capital, there were used the project cash flow forecasts.

Table 3

Financial sustainability

Year	Cash inputs from its own activity	Cash outputs for operating	Net annual cash flow
1	21934538	21292458	642081
2	3305334	3266256	39078
3	3387967	3102026	325020
4	3472667	2937289	860398
5	3559483	2785020	1634861
6	2553929	2608243	1580547
7	2617777	2443942	1754383
8	2683222	2279793	2157812
9	2750302	2115800	2792314
10	2819060	1977143	3634231
11	2889536	1856592	1032944
12	2961775	609693	2352082
13	3035819	634009	2401811
14	3111715	659244	2452471
15	3189508	685437	2504071
16	3269245	712629	2556616
17	3350976	740861	2610115
18	3434751	770178	2664572
19	3520620	860026	2719993
20	3608635	832253	2776382
Average	3133754	1677707	1455047

*investment

From table 3 it follows that the investment supports its operating costs, there are not negative cash flows, respectively the project is sustainable.

Table 4

Financial internal rate of return

Year	Operating revenues	Investment total expenditures	Net cash flow
1	0	21292458	-21292458
2	3305334	3266256	39078
3	3387967	3102026	285942
4	3472667	2937289	535378
5	3559483	2785020	774463
6	2553929	2608243	-54314
7	2617777	2443942	173836
8	2683222	2279793	403429
9	2750302	2115800	634502
10	2819060	1977143	841917
11	2889536	1856592	1032944
12	2961775	609693	2352082
13	3035819	634009	2401811
14	3111715	659244	2452471
15	3189508	685437	2504071
16	3269245	712629	2556616
17	3350976	740861	2610115
18	3434751	770178	2664572
19	3520620	860026	2719993
20	3608635	-626523**	9873868

* investment; ** = 832253 lei (operating expenditure) - 7097486 lei (residual value)

Financial internal rate of return on investment = 3.45%.

Financial net present value = - 3.821.371,19 lei.

Negative financial net present value of the project and the low financial internal rate of return (RIRF / C < 5%), indicate that the project should be supported from grants.

Also, it is found that the net present financial value of the investment minus non-refundable contribution is negative, then the project should be co-financed through EU grants.

Table 5

Financial internal rate of return on capital

Year	Operating revenues	Investment total expenditures	Net cash flow
1	0	14124150	-21292458
2	3305334	3266256	39078
3	3387967	3102026	285942
4	3472667	2937289	535378
5	3559483	2785020	774463
6	2553929	2608243	-54314
7	2617777	2443942	173836
8	2683222	2279793	403429
9	2750302	2115800	634502
10	2819060	1977143	841917
11	2889536	1856592	1032944
12	2961775	609693	2352082
13	3035819	634009	2401811
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16	3269245	712629	2556616
17	3350976	740861	2610115
18	3434751	770178	2664572
19	3520620	860026	2719993
20	3608635	-6265233	9873868

Financial internal rate of return on capital = 6.56%

Financial net present value = 3,005,588,8 lei (reveals the profitability of national public and private capital used for investment).

Financial internal rate of return of 6.56% is less than 5%, respectively it falls in the average return for European projects.

Benefits evaluation

The evaluation of the benefits generated through investments in wind power was achieved through the obtained effects.

The effects are: economic, social and environmental.

- Economic effects: the profits earned by the company, the taxes collected by the state, the training effect on horizontal and vertical of wind equipment suppliers development, the increase of energy security and autonomy of the region;

- Social effects: the use of local labor in the construction and exploitation of wind power plant, the labor costs for investment and exploitation phase are 568,000 lei/year, the decrease of unemployment through the employment of local labor, by growing the income.
- Environmental effects: the reduction of pollution through not using non-renewable resources (obtaining 5,123 MWh of fossil fuel by using traditional methods generates pollution. The production of 5,123 MWh of renewable energy reduces consumption of natural resources with 120,000 lei/year).

CONCLUSIONS

The evaluation of the benefits generated through investments in wind power was achieved through economic analysis based on a case study which included 8 companies operating in the field.

Benefits are expressed through the effects of investment in wind energy. The effects are economic, social and environmental.

The economic effects were expressed quantitatively by assessing the revenues, the costs and annual net financial flows and qualitative using synthetic judgments in fonction of calculated values of indicators. For example, a 2 MW wind power plant produces an medium annual income of 3,132,754 lei at an medium annual cost of 1,677,707 lei. The result is a net flow of 1,455,047 lei. The economic effect influences positively the

general economy through the investment multiplier coefficient and the taxes generated and, also, the enterprise which is benefiting from receiving the profits.

The social effects are training the revenue growth for the local population and reduce the unemployment.

The environmental effects materialized in reducing pollution and saving non-renewable resources.

Currently, due to high costs of wind equipment, the investment return is directly linked to the financing structure. The grants, such as the European funds, make the investment profitable and recoverable within 7-8 years. If there are no subsidies, the investments in the renewable energy field are flat and have very high recovery time of over 14 years.

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