FINANCE
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FINANCIAL ANALYSIS OF SETTING UP AN A SOLAR POWER PLANT

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Abstract: *In the present work we carried out the economic analysis of solar power plant set up by a town municipality. In order to realize the project besides own resources a considerable amount of European Union and various other kind of government funds were utilized by the municipality. The aim of this work was to find out whether such an investment would be economical without any funds, utilizing only own resources. Net present value (NPV), internal return rate (IRR), profitability index (PI) and discounted payback (DPB) were calculated. Every indicator was under the critical level. Thus, based on the results it could be concluded that the construction of the solar power plant would not be economical for the municipality without funds.*
Keywords: *investment, investment-economy calculations, municipality, solar power plant, NPV, IRR, PI, DPB*

1. INTRODUCTION

In accordance with the RED directive of the European Parliament and Council in Hungary the proportion of renewable energy sources should be at least 13% of the final energy consumption. In the Renewable Energy Utilization Action Plan of Hungary (2010-2020) the government drew up measures which would enable a higher 14.65% proportion thus facilitating more extensive usage of renewable energy sources which would enhance the development of green economy. In accordance with the domestic and European Union strategy within the framework of Environment and Energy Operative Programme the Ministry of National Development lodged a tender under the code: KEOP-2012-4.10.0/C in order to enhance the wide range usage of decentralized systems utilizing environmentally friendly energy sources.

Our aim was to reveal by taking into consideration economical points of view whether the construction of a solar power plant would enable the municipality to fulfil its obligation in case the given municipality would realise the investment without any funds. Taking into consideration the fact that for the realisation of the above mentioned tender construction financial resources are limited and not every tender can receive funds a given municipality can decide to realise the investment via utilizing own resources or taking out loans. We carried out the financial analyses of that.

2. MATERIAL AND METHOD

The most frequently asked question about investments utilizing green energy is return. With the economic analysis of investments involving renewable energy sources the following factor are ont taken into consideration because it is hard the express them in numbers (Horváth 2011):

- reduction of economic impact
- creation of liveable environment
- reduction of CO_2 emission
- at least partial energy-independence.

From the economic calculations of the investments net present value (NPV), internal return rate (IRR), profitability index (PI), payback time (PB) and discounted payback time (DPB) were applied.

The calculation of net present value is one of the basic tool of dynamic economic calculations (Illés 2009). Investment usually start with and initial investment than they require smaller or bigger further expenditures while the returns of the investments starts (Horváth 2002; Gál, Kmoskó 2008). Different expenditures and yields do not appear at the same time thus they cannot be summed (Kristóf 2008). Their discounted values are added, than the initial capital invest is subtracted. The result should be bigger than zero.

The internal return rate expresses that where net present value is zero, how much is the yield of the investment (Pálinkó, Szabó 2006). This should be bigger than yield expected by the investors.

Profitability index shows that for every invested HUF 1 how much yield can be expected. Necessarily this sum should be bigger than 1.

The criteria for calculating return time is that it should be less than asset's useful life.

3. RESULTS OF MY OWN RESEARCH

The municipality within the framework of the project built solar power plant of 499.5 kW power on a more than one hectare place in the outskirts of the town. The power plant consists of 1800 monocrystal solar panel facing south with 280W power each. The solar panels were built on a frame having stainless steel and aluminium parts leaning in a 30 degree angle. The solar panels provide 30V constant voltage at 8A. The direct current produced by solar panels utilizing sunshine is transformed into alternating current via 15 inverters with the capacity of 33.300W each. The low voltage electricity produced in this way is transformed into medium voltage by a 0.4/20 kV transformer with a concrete house placed on the property. Than it is transmitted to a nearby column switch where it connects to a 20kV system. The estimated operational cost can be seen in Table 1.

Table 1: Estimated operational costs

Costs	Amount (Thousand HUF/year)
Fee of remote management	140
Business administration	360
Maintenance	1.500
Maintenance of the area	500
Total	2.500

Source: from the given municipality (2017)

The yearly produced electricity is 611 MWh/year which in case of maximal capacity would result in 1220 hour. Apart from 10.000 kWh/year own usage the total amount of produced electricity will be sold. Based on the average of the past 30 years the number or sunny hours are 2102h, from which to the summer hemisphere there are 1522h thus according to the plans there will be 620.000 kWh produced, which will be sold and feed into the electrical system at HUF 19.951.600+VAT, or gross HUF 25.338.532.

The planned indicator of the project:

- 1 kW built in solar panel has a specific investment need of 695.95 thousand HUF/kW.
- The eligible cost of 1 ton yearly greenhouse gas emission reduction is 33 thousand HUF CO2eq/year.
- Increasing the utilisation of renewable energy sources 2201.47 GJ/year.
- Increasing the utilisation of renewable energy sources (electricity production) 0.61152 GWh/year.
- Reduction of greenhouse gas emission 566.7 t/year (Data: Municipality 2017).

Table 2 shows the main elements of the budget of the project.

Table 2: Budget of the project

Project activities		**Eligible cost (net HUF)**
Preparation	Project management Material expenses	4.500.000
	Other	1.000.000
	Studies and surveys	4.900.000
	Planning	1.900.000
Realisation 1 Other	Project management Personal expenses	6.220.000
	Other	1.000.000
	Planning (Realisation plan documentation)	1.000.000
	Engineering tasks	3.500.000
	Information and publicity	1.830.000
Realisation 2 System costs	Implementation of solar panel system	334.625.000
	Planning and realisation of connecting to energy providing system	13.000.000
Total		376.475.000

Source: based on municipality date (2017) own table

Fund 68.27%, net HUF 257.019.483
Unrecognizable own fund 31.73%, net HUF 119.455.517

- MND own fund (for public sector beneficiaries): net HUF 116.826.973
- Home Office own fund (remaining own fund up to50%): net HUF 1.314.272
- Effective own fund: net HUF 1.314.272

Based on the municipality data it is clear that by utilizing different forms of support (EU, MND, HO) compared to the total costs of investment the instalment of the solar power plant can be realised at a very low own cost (0.35%).

From the point of view of the investor it has a short return time, however in our study our aim was to answer the question whether it would be economic to realise the investment without any form of support. Thus during the calculation the non-refundable funds were not taken into consideration, apart from the landed costs of the investment.

It should be noted that in case the municipality choose to realise the project from own fund it does not have costs in connection with information providing and publicity. However, taking into consideration the fact that the actual completion of the project served as a patterned finished a year ago, it can be assumed that since than cost in connection with implementation and market prices in connection with realisation has increased at least as much as information providing costs in the project (net HUF 1.830.000).

In the model, amortisation, inflation and supplementary costs were not taken into consideration, neither were the advantages of utilizing renewable energy sources. When calculating the net present value the initial capital investment of HUF -346.475.000 and operational cash flow of HUF 19.951.600 were taken into consideration. The latter was understood as annuity, the expected yield by the investors as 5%. The useful life of the investment 20 years.

Based on the data the net present value of the investment HUF -97.838.160,8 Thus the investment cannot be regarded economic because it does not reach minimal requirement (zero).

The calculation of the internal return rate (IRR) was based on the cost level of the preparation year of the project. IRR calculation were carried by Microsoft Excel. With 20 years of useful life the internal return rate is only 1.38% which shows that it does not meet the yield requirements of the investor (5%).

The third type of calculation was profitability index (PI) which resulted in similar numbers as the previous one. PI was only 0.660 which does not meet the requirement of 1.

If only static PB would be taken into consideration with 17,366 yearly return time would seem economic for the investment, but dynamic payback time (DPB) shows that it would not return in 30 years. From these it is clear that static method should be treated carefully because it does not take into account the time value of money.

4. SUMMARY

Economic calculations were carried out in connection with a municipal investment of a solar powered system. Five types of calculations were carried based on the investment data in order to find out whether the investment is economic or not. Net present value (NPV) internal return rate (IRR), profitability index (PI), payback time (PB) and discounted payback time (DPB) were taken into consideration.

The net present value was HUF -97.838.160,8. IRR, internal return rate was 1.38%. Profitability index was 0.660. Payback time was 17,366 year, but the discounted payback time exceeded considerably the useful life. Thus it is clear that based on every dynamic indicator it investment should not be carried out because it is not viable. It is the interest of the municipality to utilize some form of fund.

However it should also be noted that it is purely a financial approach and analyses. The income of a solar power system is influenced by several other factors which can influence the present calculations. Such factors are for example the taxes, weather conditions influencing the productivity of the system and the difference between energy selling and buying prices (Horváth 2011).

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