PITAGORAS

Sustainable urban planning with innovative and low energy thermal and power generation from residual and renewable sources

D5.9: Energy Service Company Portfolio and know-how related to solar thermal plants

Manual for Excel Calculation Tool for Assessing Customer's Profitability of Investment with ESCO Companies

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Content

1. INTRODUCTION

The purpose of this tool is to give some preliminary information to the customer (end user) who is considering changing, for instance, heating system or make energy saving investments in co-ordinations with an ESCO company. Moreover, the tool can be used for profitability calculations by ESCO companies as well as the customer although it is limited in description for a large ESCO company purpose. It should be noted that the tool is a simplified version, so decision makers can work out of the "big picture" of the investment decision rather than the exact results. This manual is written from the point of view of customers.

It aims to make the starting point of investment decisions as clear as possible. First, the customer (e.g., manager) needs to know if the investments will be profitable at all. There are two alternatives that must be compared with each other: 1) current system and 2) new system. Therefore, if the investment of new systems are profitable, customers can go ahead and proceed to the project planning phase, otherwise not. So, in theory, ESCO companies cannot itself make the investment profitable if it is not profitably designed by installation companies. Second, the customer does not want to make direct investments, but wants to retain the ownership of the investment (i.e. customers pay to ESCO companies a fee for some years and after that customers own, e.g., the heating plant). Therefore, the customer has to know the feasible payback period and the fee for ESCO company services that makes the investment profitable for both parties.

Consequently, based on the excel calculation tool of this manual, customers can estimate what the total payment will be (so-called risk-premium) that he/she would pay to an ESCO company.

2. VARIABLES OF PROFITABILITY CALCULATIONS

Let assume that the current system includes several variables that are:

$$\text{Energy Used (MWh/annum)} = E_c$$
$$\text{Energy Cost (Euro/MWh)} = P_c$$
$$\text{Energy Cost Scenario (\% change/annum)} = s_c$$
$$\text{Operation Costs (Euro/annum)} = C_c.$$

Respectively, the variables of the new system are:

$$\text{Investment (Euro)} = I$$
$$\text{Grant Rate of Investment (e.g. 10 \% = 0.1)} = g_n$$
$$\text{Energy Used (MWh/annum)} = E_n$$
$$\text{Energy Cost (Euro/MWh)} = P_n$$
$$\text{Energy Cost Scenario (\% change/annum)} = s_n$$
$$\text{Operation Costs (Euro/annum)} = C_n$$
$$\text{Residual Value of Investment (Euro)} = RVI.$$

Other factors that affect calculations are:

$$\text{Time Period (Year)} = T, t = 1,...,T$$
$$\text{Discount Rate (e.g. 5 \% = 0.05)} = r.$$

We shortly introduce, what variables of the tool mean in practice. Investment is an estimation of the investment costs (e.g., the cost of new windows that decrease energy consumption). Grant rate is estimated public subsidy for the investment (e.g., state gives 10 % subsidy for renewable energy investment). Energy used is an estimation of consumption of energy (e.g.,the total MWh per annum after the investment). Energy cost is an estimation of the energy price per MWh that includes all costs of energy (e.g., the price of heating oil per produced MWh). Energy cost scenario is a prediction of change of energy costs as a percent per annum (e.g., we can predict that the price

of heating oil per produced MWh increases two percent per annum). Operation cost is an estimation of other costs per annum that includes employment costs, administration costs, service costs, and so on (e.g., heating system controls and reparations). Residual value of investment is an estimation of the money that be obtained from the investment after a time period (e.g., we can sell or re-use part of the heating system after the time period). Time period is the expected time how long the investment works or can be used (e.g., the heating system can be used for several years but not forever). Discount rate means the expected rate level for a loan, thus, it also includes expected rate of inflation.

Loosely speaking, discount rate can include also risk-premium, expected real rate profit and other subjective factors. Variables of the current system can be estimated, for instance, by using information from the past few years. Respectively, the variables of the new system must be approximated by using the market information, pilot cases etc. Discount rate and time period can be estimated by using market information as well. Note that all variables, except energy costs, are constant over time, so all calculations are based on several assumptions. However, the decision maker can test profitability of various options by changing the values of variables. So, the investor must know or estimate the above variables and type these into the tool. However, if you do not know, for instance, residual value, you can put it as a zero. Note also that necessary variables are energy used, energy cost, time period and discount rate. Without these variables, profitability calculations cannot be done appropriately.

3. PROFITABILITY CALCULATIONS

Next, we go through the calculations that are made with the tool. If you are not interested in tedious calculations, you can move on to examples in the next section. To simplify calculations, we construct auxiliary variables. These are:

$$\text{Net Investment} = (1-g_n)I = I_n$$
$$\text{Energy Cost of Current System} = P_c(1+s_c)^t = P_{ct}, t = 1,\ldots,T$$
$$\text{Energy Cost of New System} = P_n(1+s_n)^t = P_{nt}, t = 1,\ldots,T$$
$$\text{Net Revenues (Euros/annum)} = (E_{nt}P_{nt} + C_{nt}) - (E_{ct}P_{ct} + C_{ct}) = R_{nt}, t = 1,\ldots,T.$$

3.1. PRESENT VALUE

Present value of the new investment can be calculated by using the discount factor and the net revenues, thus, it can be written:

$$PV_n = \sum_{t=1}^{T} \frac{R_{nt}}{(1+r)^t} + RVI(1+r)^{-t}.$$

3.2. PROFITABILITY OF INVESTMENT WITHOUT THE INTEREST RATE

We consider profitability of investment without interest rate. Now, if the investment is profitable, revenues must be higher or equal than the net investment, formally, it is:

$$\sum_{t=1}^{T} R_{nt} + RVI \geq I_n$$

Second, we can calculate how many years it takes that the investment is profitable for the investor: it is simply when the revenues are equal to the investment cost:

$$\sum_{t=1}^{T} R_{nt} + RVI - I_n = 0$$

(gives result B15 in tool)

Where t is years when the revenues are equal to the investment. Moreover, the net profit of the investment is:

$$\pi_N = \sum_{t=1}^{T} R_{nt} + RVI - I_n$$

(gives result B16 in tool)

Where πN is the net profit. Recall that cost of the current system per annum is TCCt = ECt PCt + CCt, thus, the average cost of current system on the whole time period is

$$\sum_{t=1}^{T} TC_{ct} / T$$

(gives result B18 in tool)

Where $\sum_{t=1}^{T} TC_{ct}$ is the total costs. Similarly, the average cost of the new system in the whole time period is

$$\sum_{t=1}^{T} TC_{nt} / T$$

(gives result B20 in tool)

Where TCnt = EntPnt + Cnt is costs of new system per annum and $\sum_{t=1}^{T} TC_{nt}$ is the total costs.

ESCO Partnership and Profitability without the Interest Rate

Typically in ESCO company partnership or contract, ESCO company and the client agree the ESCO fee and payback period. Now, we can estimate our profit if we assume the constant ESCO fee per annum and payback period, thus,

$$\pi_{cus} = \sum_{t=1}^{T} R_{nt} + RVI - (kF - \sum_{k=1}^{K} TC_{nk})$$

(gives result D24 in tool)

where k is payback period, F is ESCO fee per annum,

$\sum_{k=1}^{K} TC_{nk}$ is the total costs of the new system and πcus is the profit of customer. So, ESCO customer can preliminarily estimate his profit by the different combinations of fee and payback period. Moreover, the customer's risk-premium is equal to ESCO company profit, thus

$$\pi_N - \pi_{cus} = \pi_{esco}$$

(gives result B25 in tool)

However, note that estimations are based on several assumptions of the current system, new system, interest rate, and so on.

3.3. PROFITABILITY OF INVESTMENT WITH INTEREST RATE

Next we consider calculations and the profitability of the investment with the interest rate. Procedure is similar than to the one above, but now the calculations are not so straightforward. However, if the investment is profitable, it is simply $PV_n \geq I_n$. Moreover, the investment is profitable after t years. This can be calculated by:

$$\sum_{t=1}^{T} \frac{R_{nt}}{(1+r)^t} + RVI(1+r)^{-t} - I_n = 0$$

(gives result B29 in tool)

Where we need to solve such t when the revenues are equal to the investment cost. The net profit of the investment in the present value form is

$$\Pi_N = PV_n - I_n$$

(gives result B30 in tool)

Total costs of current system and new system are similar to the ones above, thus:

$$\sum_{t=1}^{T} TC_{ct} / T$$

(gives result B32 in tool)

$$\sum_{t=1}^{T} TC_{nt} / T$$

(gives result B34 in tool)

Internal rate of return (IRR) is the discount rate, which equates the net profit of the cash flow to zero, thus:

$$\sum_{t=1}^{T} \frac{R_{nt}}{(1+IRR)^t} - I_N = 0$$

(gives result B35 in tool)

Where we have to solve IRR by using numerical methods. Note that the residual value, in this particular case, it is not included.

ESCO-partnership and Profitability with the Interest Rate:

Respectively, customers estimated profit can be written

$$\Pi_{cus} = PV_n - \sum_{k=1}^{K} \frac{F_k - TC_{nk}}{(1+r)^k}$$

(gives result D39 in tool)

Thus, the customer can estimate his profit opportunities in the present value form as well. Moreover, the customer's risk-premium or the payment in the present value form is

$$\Pi_N - \Pi_{cus} = \Pi_{esco}$$

(gives result B40 in tool)

4. ILLUSTRATIVE EXAMPLES

Example 1. Energy Saving Investment

Decision maker considers making an energy saving investment (e.g., heat recovery system) with ESCO Company. Current costs or variables are:

$$\text{Energy Used (MWh/annum)} = E_c = 1400$$
$$\text{Energy Cost (Euro/MWh)} = P_c = 19$$
$$\text{Energy Cost Scenario (\% change/annum)} = 0$$
$$\text{Operation Costs (Euro/annum)} = 0.$$

The only cost of the current system is the energy cost per annum and we assume that unit cost of energy is constant. Now, estimated costs of investment and other variables are:

$$\text{Investment (Euro)} = I_n = 57.000$$
$$\text{Grant Rate of Investment} = 0$$
$$\text{Energy Used (MWh/annum)} = E_n = 500$$
$$\text{Energy Cost (Euro/MWh)} = P_n = 19$$
$$\text{Energy Cost Scenario (\% change/annum)} = 0$$
$$\text{Operation Costs (Euro/annum)} = C_n = 0$$
$$\text{Residual Value of Investment (Euro)} = RVI_n = 0$$

New systems need investment, but there is no operational cost and the residual value also is zero as well. New system decreases energy consumption, but the unit cost of energy is the same than in the current system. We also assume that the time period is ten years and the interest rate is 5 %. We type these variables in tool. Results tell

us that the present value of investment is positive (euro), so there is a positive cash flow that may be enough to make investment profitable.

When we consider investment without the interest rate, the investment is profitable after 4 years. Net profit of the investment is 114.000 euro. The results also tell us that the cost of current system per annum is 26.600 euro, but the cost of new system per annum is 9.500 euro.

Now, let assume that ESCO company offers us a five year contract in which we pay the annual fee that it is equal with the annual cost of the current system. So, we type payback period (5 years) and annual fee (26.600 euro) in tool. As a result, our estimated profit of investment is 85.500 euro without interest rate. Customer's payment or risk-premium to ESCO company is 28.500 euro.

The results of this example are more or less equal if we make calculations with the interest rate, i.e., in the present value form. Thus, the investment is profitable after 4 years and the net profit is about 75.000 euro, so the investment is clearly profitable. Internal rate of return (IRR) is 27 %. Respectively, our profit with ESCO contract is about 58.000 euro and ESCO company's profit (our risk-premium or payment) is about 17.000 euro. So, we can say that the investment and the partnership with ESCO company is profitable for customer as well as ESCO company.

Example 2. Changing Heating System.

Customer considers reforming the heating system from the heat oil system to the woodchip system. Therefore, he wants to compare different alternatives: the current system (heating oil) or investing in a new and different one (woodchip). He also wants to keep investment costs as low as possible, but wants to retain the ownership of the investment. The estimated variables of both of the systems are below.

Current system:

$$\text{Energy Used (MWh/annum)} = E_c = 1750$$
$$\text{Energy Cost (Euro/MWh)} = P_c = 50$$
$$\text{Energy Cost Scenario (\% change/annum)} = 0.02$$
$$\text{Operation Costs (Euro/annum)} = C_c = 5.000$$

New system:

$$\text{Investment (Euro)} = I_n = 200.000$$
$$\text{Grant Rate of Investment} = 0.1$$
$$\text{Energy Used (MWh/annum)} = E_n = 1750$$
$$\text{Energy Cost (Euro/MWh)} = P_n = 14$$
$$\text{Energy Cost Scenario} = 0.01$$
$$\text{Operation Costs (Euro/annum)} = C_n = 25.000$$
$$\text{Residual Value of Investment (Euro)} = RVI_n = 15.000$$

Interest rate is 5 % and time period is assumed to be 15 years. Energy used is the same in both systems, but other variables are different. We assume that it is possible to get 10 % grant for the investment from government or some other authority. Moreover, our view is that the unit cost of heating oil will increase 2 % per annum and the unit cost of woodchip will increase 1 % per annum, respectively.

When we type these variables in tool, we find out that the investment is profitable after 4 years and the net profit is about 680.000 euro (without the interest rate). In addition, if we assume that we make a nine-year contract with ESCO company and also assume that the fee is equal with the annual cost of current system (107.896 euro), our estimated net profit is 345.880 euro and we pay 334.240 euro to ESCO company.

In the present value form, the investment is profitable after 4 years and the net profit (net present value) is about 395.000 euro. Internal rate of return is 27 %. Our estimated profit with the ESCO contract is about 169.000 euro and our payment or risk-premium to ESCO company is 226.715 euro.