

## Technical and business economic study of photovoltaic systems

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**Abstract.** Renewable energy becomes more and more important in our power supply. The aim of this study is to perform a business economic evaluation of an investment in photovoltaic (PV) energy. Different cases of PV projects have been analyzed. In order to have a correct evaluation model, both economic parameters and technical influences have to be taken into account. This paper gives an overview and a sensitivity analysis of the influencing parameters, as well as an analysis of a practical case. A calculation tool is developed to allow private persons and companies to determine the feasibility of an investment in photovoltaic panels. It can be concluded that not only economic parameters such as discount rate but also technical parameters have a major impact on the feasibility of an investment in photovoltaic energy.

### 1. Results

The yield of a solar panel can be calculated by (1).

$$E_L = H_i \cdot A_{\text{panel}} \cdot \eta_{\text{module}} \cdot \eta_{\text{inv}} \cdot \eta_{\text{inclination}} \cdot (1 - \eta_{\text{cable}}) \cdot (1 - \eta_{\text{mismatch}}) \cdot (1 - \eta_{\text{temp}}) \cdot (1 - \eta_{\text{pollution}}) \cdot (1 + \eta_{\text{trac}}) \quad (1)$$

where  $E_L$  represents the solar panel yield [kWh/kW<sub>p</sub>],  $H_i$  the global irradiation [kWh/m<sup>2</sup>],  $A_{\text{panel}}$  the panel area for 1 kW<sub>p</sub> [m<sup>2</sup>],  $\eta_{\text{module}}$  the module efficiency,  $\eta_{\text{inv}}$  the inverter efficiency,  $\eta_{\text{inclination}}$  the inclination efficiency,  $\eta_{\text{cable}}$  the cable losses,  $\eta_{\text{temp}}$  the temperature losses,  $\eta_{\text{pollution}}$  the shadow and pollution losses,  $\eta_{\text{mismatch}}$  the mismatch losses and  $\eta_{\text{trac}}$  the tracker efficiency (increased efficiency compared to fixed position).

For the economic evaluation free cash flow (FCF) calculations are performed, taking into account the discount rate (for companies weighted average cost of capital (WACC)), electricity yield, investment and maintenance costs, subsidies,...

Figure 1 shows the influence of several technical and economical parameters on the payback time of a PV system.

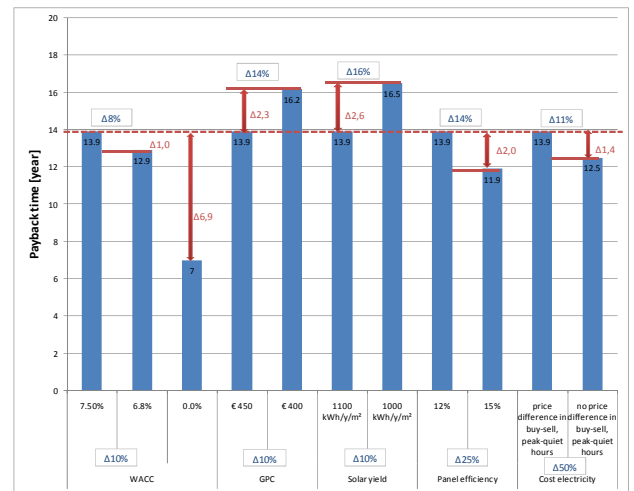


Figure 1: Influence of several technical and economical parameters on the payback time of a PV system

### 2. Conclusion

This study gives the decision maker a tool to perform a profound economic-technical analysis of a possible investment in PV installations. Many installers state that photovoltaic solar energy is profitable in the short term. However, this has to be treated cautiously since a lot of influencing parameters must be taken into account. Where installers indicate payback times of 6 to 7 years, in reality it almost will be twice. It can be concluded that not only economic parameters such as discount rate but also technical parameters have a major impact on the feasibility of an investment in photovoltaic energy. Consequently, all parameters should be taken into account for a correct evaluation.