GOOD PRACTICES IN SME

Photovoltaic installations

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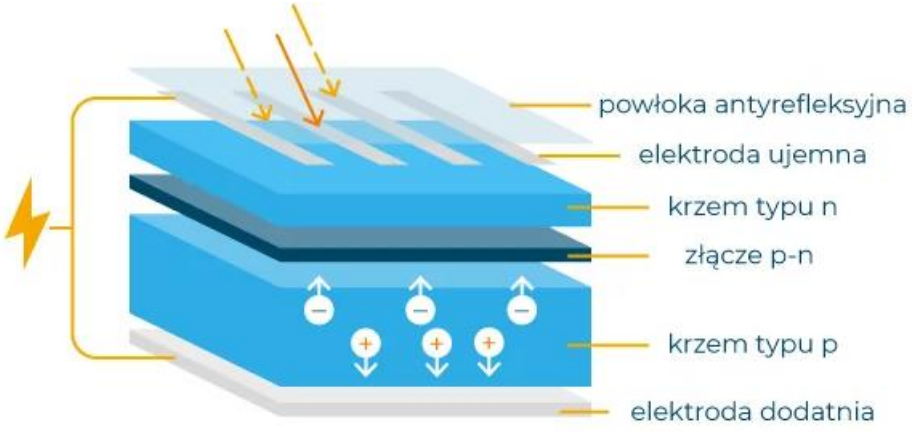
The following document was developed using European Union financing as part of the “Technical support for the promotion of energy audits and energy efficiency investments in small and medium-sized enterprises in Poland”. The opinions presented in this document should not be treated as the official stance of the European Union.

The project was financed by the European Union as part of Structural Reform Support Programme (SRSP) and realized by the Polish National Energy Conservation Agency (KAPE SA) in cooperation with the European Commission on behalf of the Ministry of Climate and Environment.

How do photovoltaic panels work?

Photovoltaic panels use the energy of solar radiation to generate electricity. Photons (light particles) hitting the panel excite silicon electrons – creating a direct current (DC) flow. As we use alternating current (AC) to power our appliances apart from the photovoltaic panels we need to use a power inverter which changes DC into AC.



Pic. 1 stiloenergy: photovoltaic panel diagram

Top left to bottom right: antireflexive layer, anode, n-type silicon, p-n junction, p-type silicon, cathode

What are the types of solar panels?

There are 3 main types of solar panels available on the market: polycrystalline panels, monocrystalline panels, and amorphous panels (sometimes called thin-film solar panels).

Cell type	Efficiency	Characteristics
Polycrystalline silicon	14-18%	The cells consist of multiple small silicon crystals. They are easy to produce and cheaper than monocrystalline cells.
Monocrystalline silicon	20-23 %	Created using a single silicon crystal, which enables achieving relatively high efficiency.
Amorphous silicon	6-10%	The cells are thin and elastic, which makes them suitable for installation on curved surfaces, however they have a low efficiency.

Pic. 2 powietrze.malopolska.pl: polycrystalline panels

Pic. 5 powietrze.malopolska.pl: monocrystalline panels

Pic. 4 powietrze.malopolska.pl: amorphous panels

Pic. 3 powietrze.malopolska.pl: inverter

Which panels are better – monocrystalline or polycrystalline?

Polycrystalline panels have a lower per-unit cost, which means that a photovoltaic installation of a given power made from polycrystalline panels will be cheaper than a monocrystalline panel installation. However, due to their higher efficiency, a monocrystalline panel installation of a given power will take up less space than a polycrystalline panel installation.

For this reason, it is worth choosing a monocrystalline installation when the space available for the photovoltaic installation is limited.

Where can photovoltaic panels be installed?

Photovoltaic panels can be installed on:

- building roofs – it is a good solution for large, durable roofs with a 15-45° inclination to the slope,
- building facade – this is a good solution when the roofing area is limited,
- as a ground installation – used in industrial installations and when an installation on the buildiun is impossible.

The panels should face southwards with a $\pm 15°$ accuracy at a 20°-40° inclination to the slope. It should be ensured, that the panels are not shaded by trees or other buildings.

What determines the electricity production of a photovoltaic installation?

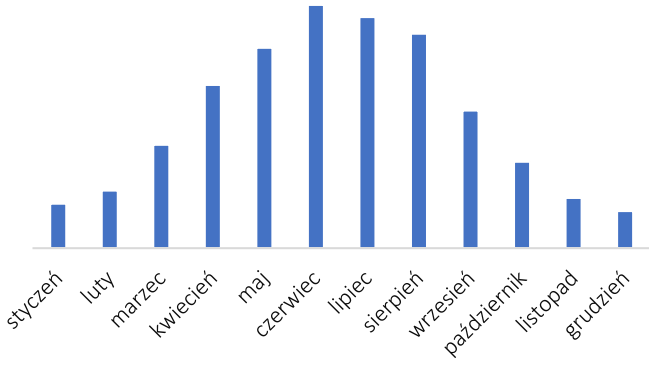
Electricity generation from photovoltaic panels will depend on the current availability of solar energy – determined by the time of day, season, and atmospheric conditions. The production of an installation also depends on the geographical latitude.

When excess energy is produced by the photovoltaic panels, the prosument feeds it back into the supply network which functions as energy storage:

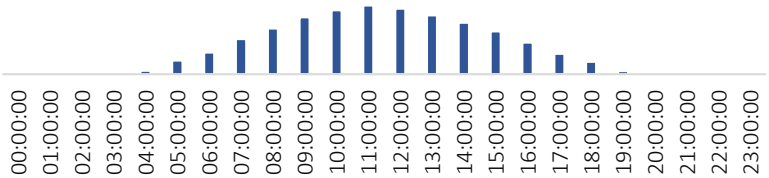
- with an installed power of 10kW, for each 1 kWh fed into the network, the prosument can draw 0,8kWh,
- with larger installations (10-50kW), for each 1 kWh fed into the network, the prosument can draw 0,7kWh.

A company can be considered a prosumer, if generating energy is not the main part of its business activities.

Annual yield profile of photovoltaic panels



Daily yield profile of photovoltaic panels



Left bar graph: January, February, March, April, May, June, July, August, September, October, November, December

How quickly can a photovoltaic installation pay for itself? - Example

Let us consider the purchase and installation of a photovoltaic installation with 5,25 kW of power, at a cost of 25 000 PLN, where the total of the generated energy will be consumed. For simplicity's sake, let us assume that each 1 kW of installed power produces 1 000 kWh of electricity annually. The average cost of electricity is 0,55 PLN/kWh.

Annual electricity generation:

$$5{,}25\ kW \cdot \frac{1\ 000\ kWh}{kW} = 5\ 250\ kWh$$

Annual electricity savings:

$$5\ 250\ kWh \cdot 0{,}55 \frac{PLN}{kWh} = 2\ 887{,}5\ PLN$$

Simple payback time:

$$SPBT = \frac{25\ 000\ PLN}{2\ 887{,}5\ PLN/year} = 8{,}7\ years$$

Source: KAPE