GOV7

INSTALOVANÝ VÝKON NOVĚ NAINSTALOVANÝCH FOTOVOLTAICKÝCH PANELŮ NA OBYVATELE

Number	GOV7
Indicator name	Instalovaný výkon nově nainstalovaných fotovoltaických panelů na obyvatele
Area	G
Indicator definition	The total installed capacity of newly installed PV panels in a given year in the city (regardless of the operator)
Indicator unit	kWp/1000 obyv./rok
Key words	renewable energy sources (RES), photovoltaics, photothermics, solar energy, photovoltaic panels, photothermal panels, solar energy
Reason for tracking and usability	Each megawatt-hour of electricity saved means (depending on the national emission factor) a saving of more than 1 tonne of CO2. Photovoltaic (PV) panels obtain electricity from the energy of solar radiation. Photothermal panels (PT) use the energy obtained from solar radiation to heat water (which can be accumulated). With the optimal way of using the panels, it is possible to replace a significant part of the supplied electricity (in the case of heating water and other fuels), and thus reduce CO2 emissions. This saving can be calculated for the building, the city district and the city.

Completeness, representativeness, validity

The indicator is designed to include all installations of PV and PT panels in the city/city district/municipality. The methodology assumes a complete description of existing installations, including the distinction between PV and PT panels (they have different efficiencies). Ideally (occurring using a combination of multiple detection methods), the data are complete and representative. The validity of the data depends on the method of use and the condition of individual installations (which cannot be verified by observation).
The value of the indicator applies to the optimal operating mode of all installations.
If the orthophoto map analysis method is used to determine the indicator (see below), then there is a risk that for some areas aerial maps will not be up-to-date or not available at all.
It is difficult to distinguish between photovoltaic and photothermal panels. Only some photothermal panels differ markedly, others are similar in size to photovoltaic ones.
Windows can also resemble panels. By analysing the map, we cannot determine the inclination of the panels to the roof (on flat roofs it is about 45 degrees).
The position of the panels on taller buildings must therefore be determined by visual interpolation of the various positions so that they correspond as closely as possible to the vertical reality.
After 20 years, the output of the PV panel drops to approx. 80%. In the future, it will be necessary to adjust the methodology by the efficiency factors of the panels depending on their age.

Description of data processing

To determine the value of the indicator, it is necessary to obtain data on the number, total power calculated from the area and possibly the type of photovoltaic panels. This data can be obtained in one of 4 ways, or a combination of them: (1) obtaining data from the regulator of the RES market, (2) obtaining data from the building authority, (3) analysis of orthophoto maps and (4) local survey and targeted survey of solar panels operators.
In the case of procedure (1), we obtain accurate and up-to-date data for individual operators in a given administrative territory and only add up the individual values of the installed peak power. In the case of procedure (2), we obtain similar data, but probably only about part of the installations. In the case of procedure (3), we obtain the data on the area of the panels, which we convert to peak performance by conversion using a simple consensus factor. In the case of procedure (4), we obtain data from the technical documentation and again add up the peak performances.
Description of data processing by the method of orthophoto map analysis with additional field investigation:

In the first step, it is necessary to choose the best possible freely available map base with orthophoto map (it will vary in different countries, or you can use products containing maps of the world, such as Google Maps). The Google background layer (orthophoto) can be loaded into the GIS environment (ArcGIS, QGIS, etc.). It is appropriate to supplement and correct the primary orthophoto map with other map sources (ESRI, ZBGIS (SR) and others).
In the second step, it is necessary to perform a map analysis in a GIS environment and identify all objects that are probably photovoltaic panels.
The standardized size of the PV module will help with orientation. Photovoltaic panels in the power range from 270 Wp to 300 Wp have a height of 1650 mm and a width of 995 mm. We can simply say that solar panels for electricity production have a size of 1.65 x 1 meter.

In the third step, it is necessary to create polygon objects and create an attribute table in which structured data about each object will be inserted:
• Panel number
• Roof inclination
• Panel inclination
• Panel type
• Panel area
• Standardised panel performance
• Total panel performance
The analysis is complicated by uncertainty as to whether it is a PV panel. Photothermal panels (see limits and restrictions) and possibly some other elements will appear very similar on the map. Therefore, we introduce an item into the attribute table
• Certainty (0/1)
After field verification, doubts should be dispelled as to whether it is a photovoltaic panel and the variable should be set to 1. In some cases, Google StreetView can also be used for verification. The on-site investigation may be carried out by a volunteer or other representative of the processor. Individual installations can also be geodetically surveyed (find out exactly the actual area) and the parameters on the map correct retrospectively. The on-site investigation should be combined with the summoning of building owners with installations with an explanation and a request to send information about the installed capacity.
1 standard panel produces approx. 250 kWh per year, i.e. 1 m2 produces approx. 156 kWh per year.
The specific annual profit of one photovoltaic panel is 160 kWh. m-2 and the photothermal panel 370 kWh. m-2. The number of panels is multiplied by the specific annual profit according to

	the respective type. All panels that are not identified with certainty as photothermal will be considered photovoltaic.
Data source	Data of the national coordinating body for RES, building authorities, energy agencies, own analysis of map materials, GIS analysis, field investigation, questionnaire survey, technical documentation.
Tracking frequency	once in 3 years
Urban influence	The city/city district/municipality can directly influence the number of installations on its own buildings and on the buildings of budgetary and contributory organizations (e.g. primary schools). Larger installations on private buildings are hindered by several factors, especially legislative ones, which the city/city district/municipality does not affect. Hypothetically, the city/city district/municipality can financially support installations on selected buildings outside its property, ensure common services of an energy agency to citizens, more advantageous purchases of panels and achieve further economies of scale.
Presentation method	The results will be presented in a uniform Klimasken framework on a five-point scale according to the set intervals
Responsibility	Processor Klimasken, city/city district/municipality