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Volunteering for the future – Geospatial excellence for a better living

Geospatial Products in the Registration of Photovoltaic Installations and Their Parameters

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Research problem

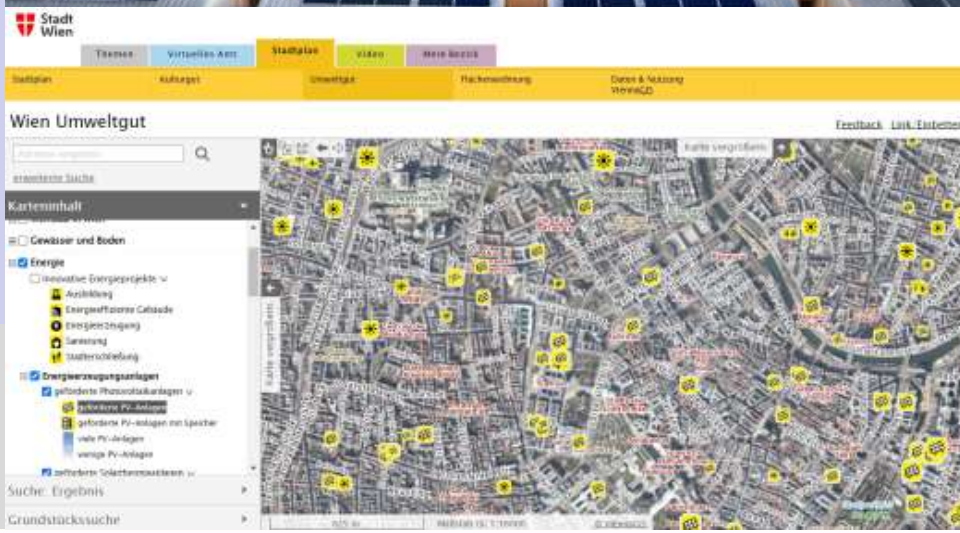
- The **global trends and activities** of individual countries **in the promotion of renewable energy sources**, as well as the development of GIS **bring demand for new opportunities in the field of creating databases related to their attributes**, including their spatial location;
- More and more often **data on already implemented photovoltaic installations are registered** and made available **in public registers or open access GIS tools**, **providing information on their location and productivity**;
- Modern **surveying and photogrammetry bring products to** quickly and efficiently **record the location of panels and to determine their parameters**;
- There is widespread recognition that **effective control over future photovoltaic installations requires proper knowledge about the remaining technical potential and the local demand to use the generated electricity**, as **extensive and uncontrolled installation** of photovoltaic plants **can lead to problems with the electricity grid**, including grid failures.

Research problem

- **There is increasing interest in photovoltaic installations worldwide**, both among individual households and in the public sector. **According to the International Energy Agency, the growth will continue** over the next few years, **reaching almost 740 GW by 2025;**
- **Many countries are developing strategies** at national scales **to largely implement solar energy**, **as** available **solar potential is enormous**. **The plans** concerning the implementation of solar energy and the reduction of the application of fossil energy **are very ambitious**.
- **The aim of the** following **research was to analyse the literature on the subject and global solutions - the content of selected public registers** concerning the existing photovoltaic installations, **in order to specify the model content and good practices in the field**. Moreover, **the usefulness of geospatial products**, gathered on the basis of modern surveying and photogrammetric methods, **in the process of the acquisition of the** aforementioned **data was analysed**.

Literature on the subject

- According to Stowell, Kelly, et al. (2020), **measuring and mapping the energy transition** at different levels and at various time scales **may provide insight into the current and future energy scenarios**, proving a helpful tool **in planning** climate resilient **energy systems**, **as well as short-term** solar PV **forecasting**.
- As emphasised by Mainzer, Fath, et al. (2014), **significant levels of photovoltaic capacity could lead to** major **disparities between supply and demand**, **especially in rural areas**. The authors claim that an **efficient** political **control over future installations depends on accessibility of knowledge about the remaining potentials** and the abilities to use the generated electricity locally.
- Mickrenska-Cherneva, Mladenov (2020) indicated that **the implementation of GIS resulted in the improvement of the quality of management**, significantly **reducing the time for analyses and decision-making.**



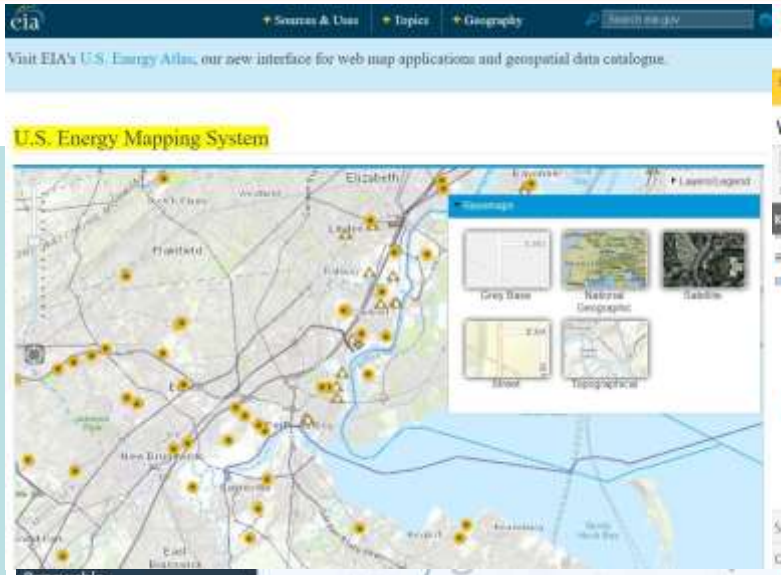
Methodology of the research

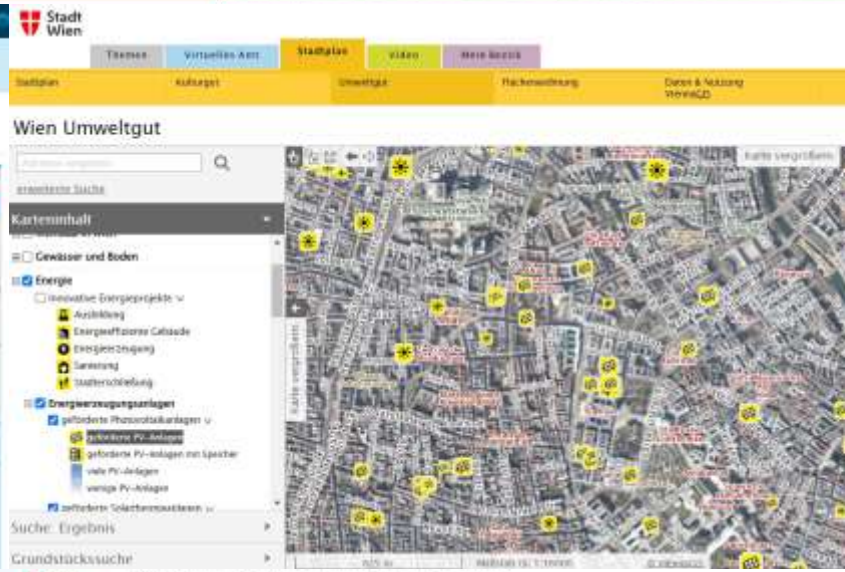
- **I step**

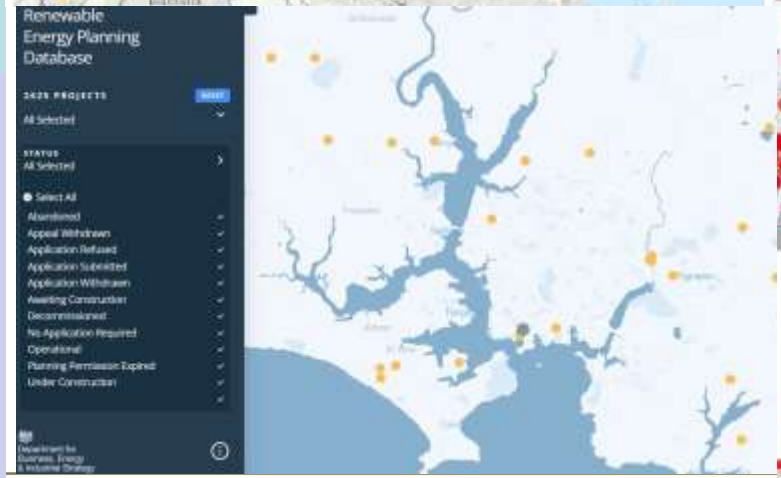
For the needs of the research **randomly selected registers / maps** of photovoltaic installations (available on-line) **were analysed for the needs of identification of model attributes that should be available** in such maps / portals**;**

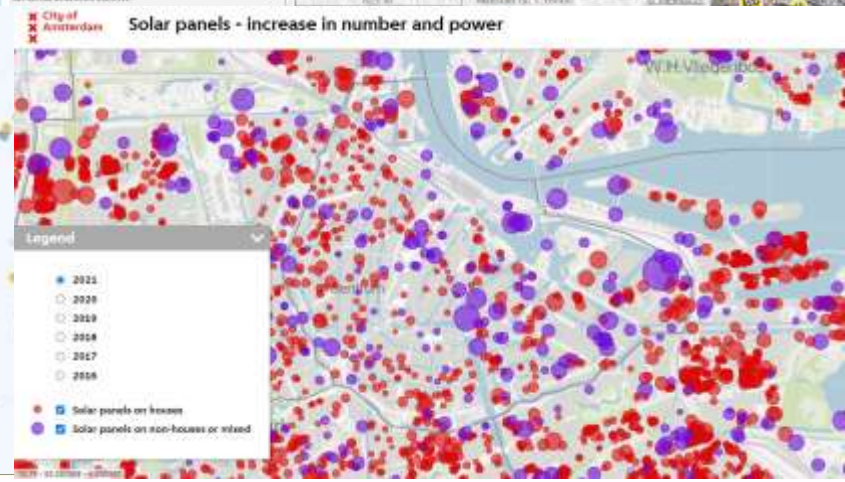
- **II step**

The second step involved **exploration of possibilities of** acquisition of data on the location of existing installations on the basis of UAV flights



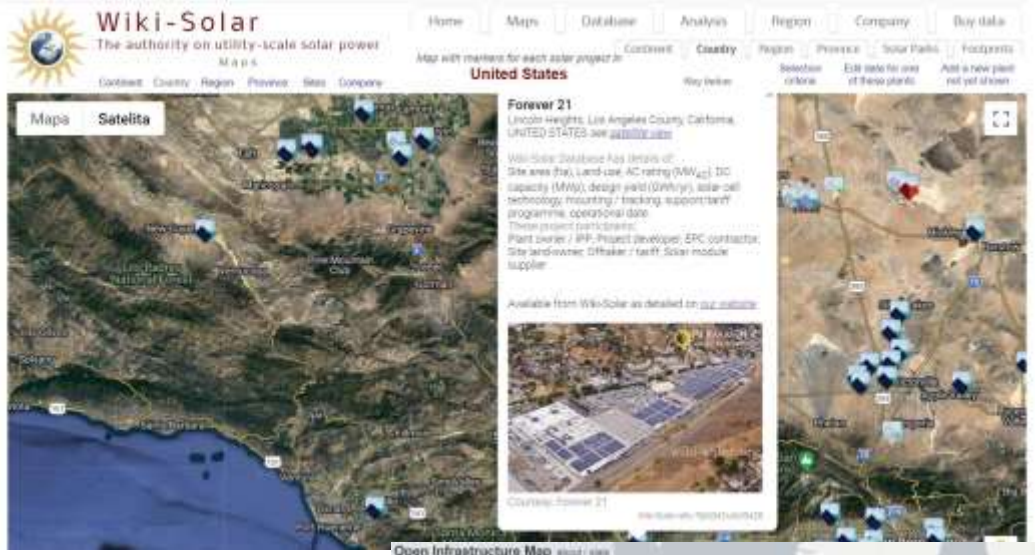






Results of the research

- Available databases **are realized at different levels of detail and advancement.** Some of them present data **for** the **selected areas of the world, countries**, whereas the others concern **cities, regions, or agglomerations**;



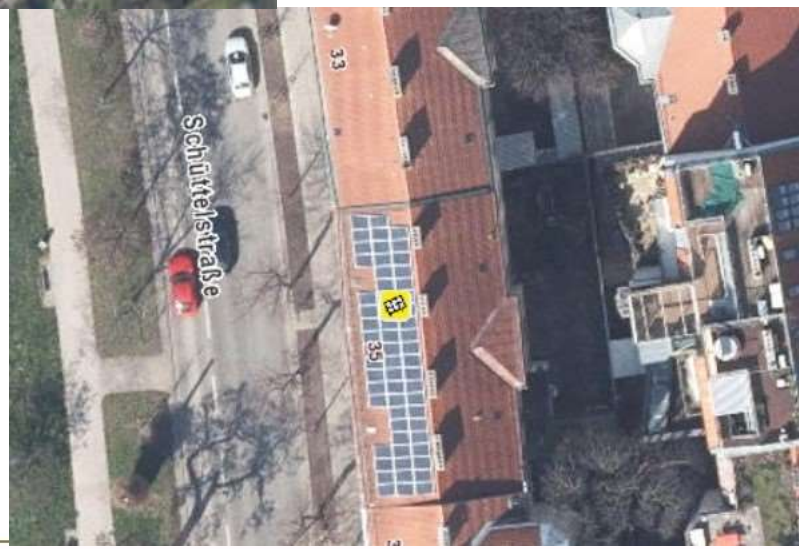
- **In some countries**, official **data** concerning PV installations **are registered for the needs of** securing their **planning permission,** in others for **subsidies or tax relief**, but **there are a lot of countries in which no official register** on such installations **has been implemented**;

Results of the research

Location	View of the site	Technological characteristics	Data on operational status/owner	Additional content /tools
• Precise, coordinate locations, • Approximate geolocation – via addresses and postcodes, • Mounting location (e.g. roof or ground), • Mounting type; fixed, offset, 1- or 2-axis tracker, rooftop, • Data on land use, • Site area (ha), • Mapping as polygons, • Mapping as simple points, • Information on generator orientation.	• Photographs of the site, • Indication on orthophotomaps/ Google Map, etc., • Hyperlink to site plan/ view on Google Maps / satellite view, etc.	• Installation capacity information (output), • AC rating (MW_{AC}), • Design yield (GWh/yr), • Equivalent power consumption expressed as number of homes, • Annual CO2 savings, • Equivalent carbon savings expressed as number of cars, • Solar cell technology, • Details of planning submittion (data, application reference, etc.). • Data on tilt, • Number of modules, • Surface area of the modules.	• Operational status of the installation, e.g. approved / under construction / operational, • Commissioning / Application date , • Data on the operator, owner, project developer, etc., • Solar module supplier, • Source of information, • Information on increase in number and power over years.	• Tool to add a new plant / installation, • Tool to edit a new plant / installation, • Url of internet page with details of the plant.

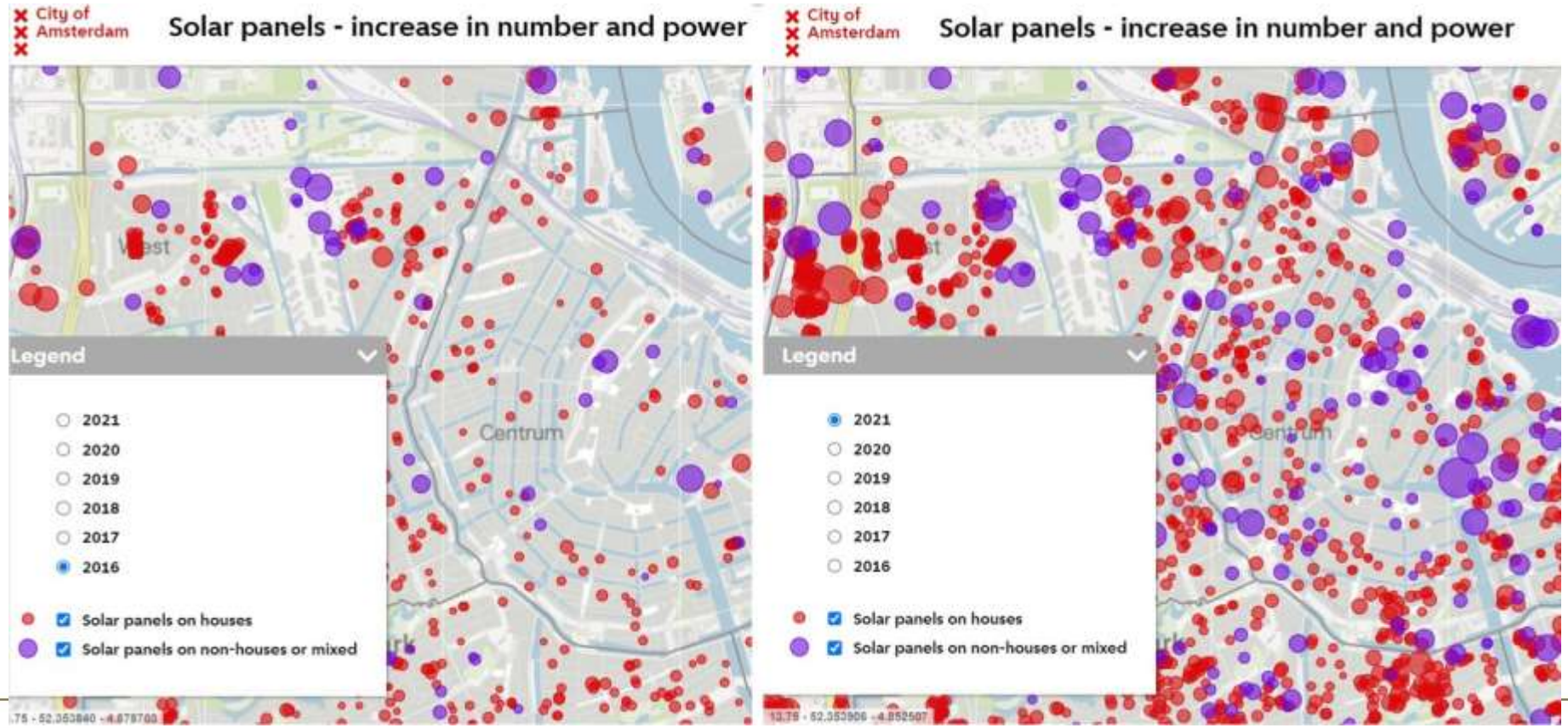
Results of the research

- **The most common attributes**, available in geographic information systems, that are collected for each PV installation **constitute**, among others, details such as **location, capacity, installation date, number of modules (or surface area), solar cell technology, operational status of the installation, etc**.
- **Solar technologies** are versatile and **can be installed in a wide range of locations and sizes**, so **existing registers can include information concerning installations mounted on roofs, on the ground and even floating** solar photovoltaic (FPV) installations.



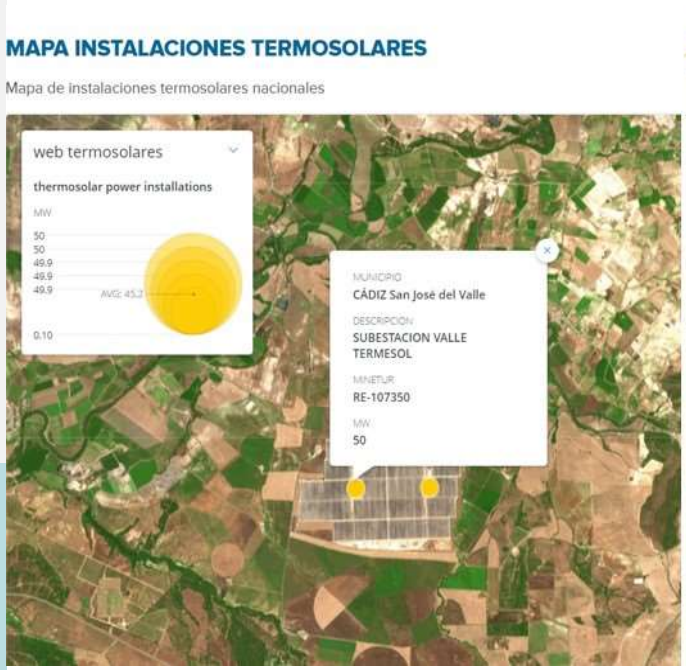
Results of the research

Some portals provide an **opportunity of comparison of number of panels between years**



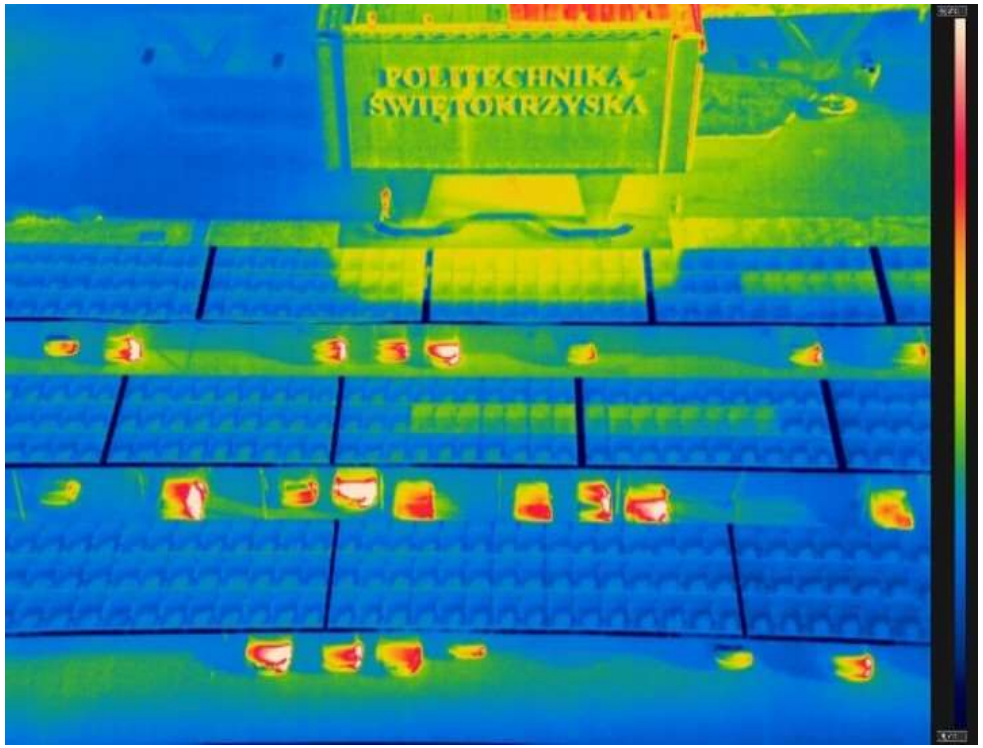
Results of the research

- **There are several attitudes towards the presentation of the objects**. Some portals offer the possibility of observation of **the location of the objects on the background of the orthophotomaps, Google Map, topographical map**, etc. In other cases **photographs of the object or hyperlinks to**, among others, **site plans or sattelite views are provided**.
- **Usually, approximate location is determined** on the basis of addresses and postcodes, so that **objects are represented by a single geolocation point**. Precise **coordinate locations may also be determined**, though the question is whether the knowledge of the precise location is necessary.



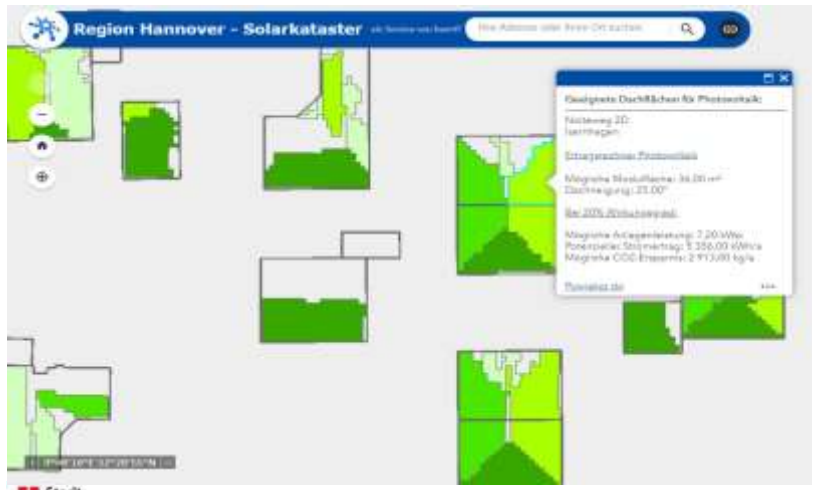
Results of the research - acquisition of data on the location of existing installations

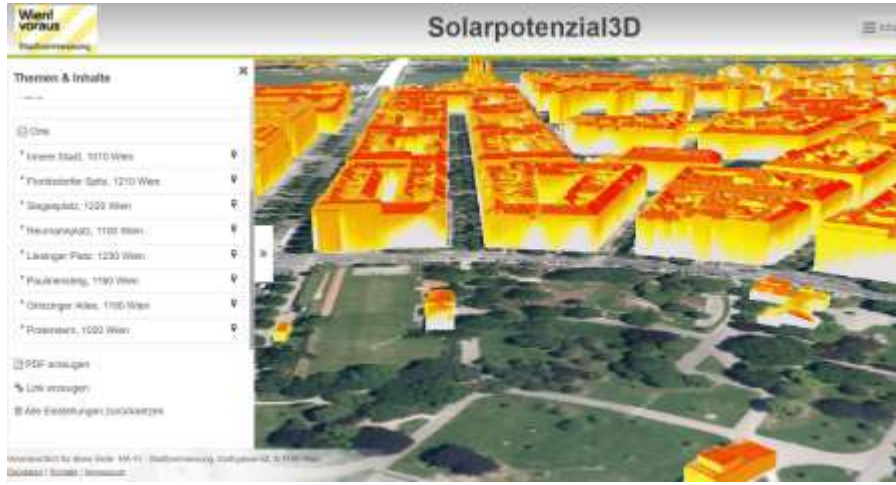
Thermograms acquired on the basis of UAV for the needs of inspection of photovoltaic panels for updating the projected solar register database

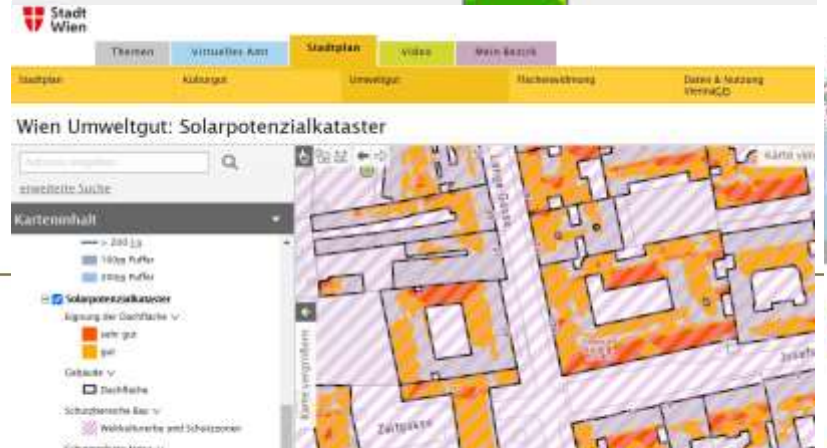


Results of the research

There are also other geoinformation portals **- solar maps and solar cadastres enabling to verify whether the investment in a solar installation in a selected location could be profitable and what savings it would bring.**







Results of the research

- **Reliable and complete data** on the location of photovoltaic installations **enable to monitor the remaining technical potential and the local demand to use the generated electricity**, as **extensive and uncontrolled installation** of photovoltaic plants **can lead to problems with the electricity grid.**
- **Available** databases – **registers** of PV installations **are realized at different level of detail and advancement and for various aims** (securing planning permission, subsidies or tax relief), but **there are a lot of countries in which no official register on such installations has been implemented**.
- There are **several attitudes towards the content of the registers and the presentation of data. The most common attributes**, available in geographic information systems, that are collected for each PV installation **are**, among others, details such as **capacity, installation date, location, number of modules (or surface area), solar cell technology, operational status of the installation**, etc.
- Modern **surveying and photogrammetry bring products to** quickly and efficiently **record the location of panels and to determine their parameters.** Moreover, **they enable repetitive inspections and can be helpful in detecting defects and ongoing maintenance of facilities.**