The registration of new solar parks in The Netherlands

Martin Tillema and Sara Bugera, the Netherlands

Key words: Solar parks, Cadaster, data, spatial planning

SUMMARY

The Dutch Land Registry documents solar parks as part of the Key Register Topography (Basisregistratie Topografie). By collecting these so-called functional areas annually as geodata, it becomes possible to monitor the realization of new solar parks. Through subsequently combining this data with other spatial datasets, more insight is gained into which land is used and which locations are being developed.

At the end of 2022, the Netherlands had 562 solar parks of at least 1,000 square meters with a total area of more than 3,621 hectares. The largest area of solar parks is currently in the northern part of the Netherlands. More than 60% of the land that is now used for solar parks was still agricultural land 5 years ago. We also see that almost 1 in 5 solar parks have been realized within built-up areas. In line with government incentives, we also see that many solar parks are being realized along roads and railways. It is striking that solar parks are only realized to a limited extent in combination with wind farms. Although this would be beneficial for the stability of the electricity grid, we rarely see this in practice.

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1. Introduction

Much like many other countries, The Netherlands are working hard to enlarge the capacity of sustainable energy production. One of the results is that additional solar parks are being developed. The Cadaster monitors this development by mapping the parks via aerial photography.

The registration of solar parks offers the opportunity to determine whether the ambition to realize more solar parks is being achieved. By combining this data with other spatial datasets, insight can also be gained about previous landuse and a number of location-specific characteristics. The primary research questions therefore are:

• How to best provide an overview of solar parks and the spatial distribution of solar parks in The Netherlands?
• How do we transform the registration data into clear, useful insights about the state of development of solar parks?

2. Cadaster: registrations

The Dutch Land Registry has the legal task of maintaining the Key-Register Topography. In addition to land use, roads and water, so-called functional areas are also registered. For example, sports complexes, industrial estates and recreational areas are registered. Since 2020 solar parks have also been registered. All solar parks of at least 1000 square meters that are visible (under construction) from the aerial photo are recorded here. To identify the solar parks, in addition to aerial photographs, a number of external sources are used that function as a 'trigger'.

Solar panels on roofs or other objects (such as parking spaces) are not part of this dataset. The Dutch Land Registry does provide insight into this through image recognition techniques, but it is not part of this registration.

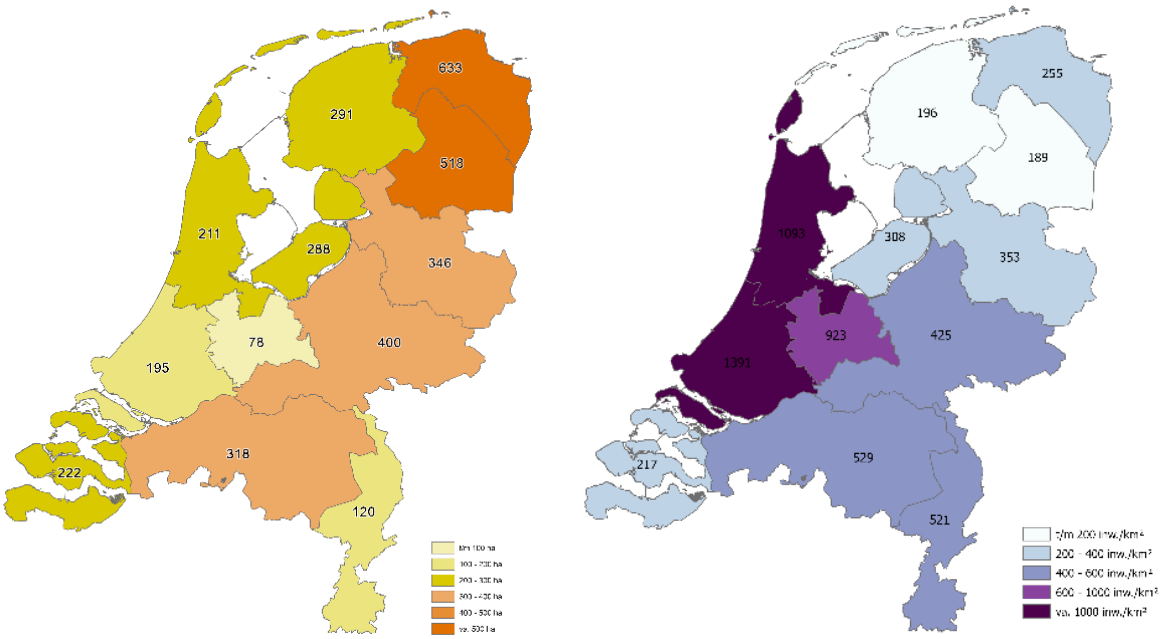
Because this geographical dataset is updated annually, it is possible to monitor the progress of the development of solar parks and also to conduct spatial research into the locations of these solar parks. Where in the Netherlands are solar parks being built? How was the land used before? Are solar parks realized at planned locations? Etc.

To answer these research questions, we combined the data from solar parks with agricultural plots from 2018 and 2013 (source: RVO) to determine which part was previously used as agricultural land. In addition, spatial analyses have been carried out to investigate the distance to built-up areas, infrastructure (roads and railways), industrial estates and wind farms.

3. Geographic distribution of solar parks and population density in the Netherlands

The data sourced from Cadaster has facilitated a comprehensive exploration of solar parks in the Netherlands, allowing us to map both the distribution of these parks and the corresponding surface areas. At the end of 2022, there were 562 solar parks with a total area of 3,621 hectares in the Netherlands.

Below, on the left side, the map illustrates the distribution of solar parks per province in the Netherlands. Notably, the northern provinces (i.e., Groningen and Drenthe) have the largest land area allocated to solar parks, exceeding 500 hectares. In contrast, the western regions of the Netherlands exhibit notably smaller surface areas designated for solar parks. These western areas are characterized by the highest population density, as illustrated in the second figure portraying population density per province. The prevailing population density patterns suggest that a significant proportion of solar parks in the Netherlands are situated in regions where the population density is relatively low. However, the distribution of solar parks in the Netherlands does not solely correlate with areas of lower population density per square meter. Both the presence of land and the suitability of land are important indicators. Therefore, this research includes an examination of land-use transformations to identify what type of land is being used for solar parks.



4. Planning objectives regarding solar parks

Given the fact that space is scarce in the Netherlands, every square meter of land is a subject of discussion and contestation. Therefore, the Dutch government has outlined several planning objectives specifically for solar parks. One noteworthy recommendation put forth by *The National Strategy on Spatial Planning and the Environment* (Nationale Omgevingsvisie - NOVI), is an 'order of preference' framework for siting solar parks in the Netherlands.

This order of preference is as follows:

1. Solar panels on roofs and facades of buildings*:*
2. Unused areas of land within the built environment.
3. Rural areas: preference is given to land with a primary function *other* than agriculture or nature;
    a. Looking for smart function combinations
    b. Areas managed by the government including where possibly shoulders of railways and motorways.

While this research primarily focuses on solar parks (excluding rooftop installations), it recognizes the planning preferences delineated in the 'order of preference' framework.

First, we have investigated the extent to which solar parks are situated within built environments. Among the 562 solar parks in the Netherlands, 107 are entirely located within built-up areas, comprising approximately 19% of the total. Nevertheless, these 107 solar parks collectively occupy just 4% of the overall solar park area. This observation aligns with expectations, indicating that solar parks within built-up areas tend to be smaller in scale.

Secondly, we identified multi-functional areas including solar parks. Although combining solar and wind farms is preferable for energy provision, this combination remains relatively rare in practice. Only 13% of the total solar park surface area in the Netherlands is situated on or near (within 100 meters) of a wind turbine park, encompassing 44 solar parks. Conversely, the co-location of solar parks and industrial sites is more prevalent. Nearly 40% of the total solar park area in the Netherlands positioned within a maximum proximity of 100 meters from industrial estates; 203 solar parks in total.

Thirdly, we have identified that 44% of the number of solar parks are located along roads and railways. That aligns similarly with the objectives of the Generating Energy on State Land (OER) program.

Finally, the planning priority for solar parks is to minimize the utilization of agricultural or natural land. We examinate the previous usage of the land that is now designated for solar parks. Most of the land (60%) that is now used for solar parks was used for agricultural

purposes in 2017/2018. This concerns 2,176 of the total 3,621 hectares of solar parks. However, only a limited portion of the total agricultural land in the Netherlands is still used for solar parks. Of the more than 1.8 million hectares of agricultural land in the Netherlands, 2,176 hectares are currently used for solar parks. This amounts to 0.12% of the agricultural area. Hence, only a very limited surface of agriculture land is now being used for solar parks.

5. Climate Agreements: Monitoring Policy Programs Using Cadaster Data

In response to the UN Paris Climate Agreement, the Dutch national government established its own national climate agreement, setting the ambitious target that, by 2030, seventy percent of the country's electricity must be sourced from renewable energy. To achieve this objective, the Dutch government has devised 30 Regional Energy Strategies (RES), each tailored to specific regions with distinct implementations. Nevertheless, the overarching goal of these RES is to collectively generate 35 terawatt-hours (TWh) of sustainable energy on land by the year 2030. Within this context, solar parks emerge as instrumental contributors to realizing this target.

While Cadaster’s data does not provide insights into the specific energy output of individual solar parks, it plays a crucial role in shaping planning objectives and determining suitable locations for solar parks. Ultimately, Cadaster’s data can be used by the implementation of the RES, supporting policymakers and stakeholders with essential information to make informed decisions in advancing renewable energy goals and to encourage a public debate.

BIOGRAPHICAL NOTES

CONTACTS

Martin Tillema and Sara Bugera

Kadaster
Hofstraat 110
7311 KZ Apeldoorn
The Netherlands

Email: martin.tillema@kadaster.nl and sara.bugera@kadaster.nl

Website: www.kadaster.nl and www.kadaster.nl/onderzoeken