First calculation of the implementable solar photovoltaic potential in Somogy county and its impact on CO_2 emission reduction and job creation

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Abstract: Due to the current climate urgency, it is necessary to accelerate an energy transition towards renewable energies. To this end, the European Union has set ambitious energy targets. However, in member countries such as Hungary, nuclear energy and fossil fuels continue playing a major role in the energy mix. Nevertheless, this country has a large solar photovoltaic (PV) potential that is hardly exploited, especially in the southern counties, and its technical potential has been less analysed. With the aim to estimate the short-term implementable solar PV potential in Somogy county in southern Hungary, a multi-criteria spatial approach which integrates environmental, technical (with economic attributes), and geographical (with social-acceptability attributes) GIS-based constraints with existing local power plant considerations was employed. Results show that Somogy has a short-term implementable solar PV potential of 2.7 GW_P with an electricity generation capacity of 3.2 TWh/year This power potential is about 25 times more than the current installed capacity for generating electricity in Somogy and represents 45% of the national target by 2030 for installed solar PV capacity in Hungary. Furthermore, this potential could create almost 35,000 direct jobs and avoid the emissions of 1.16–2.65 $MtCO_2$ to the atmosphere. The findings and future studies suggested in this work are significant for both local and national levels and could contribute with insights on how to meet climate targets and accelerate energy independence with socio-economic benefits.

Introduction

To mitigate the effects of climate change the European Union (EU) has set a target of reducing greenhouse gas emissions by at least 55% by 2030 (European Parliament, 2022). This requires increasing the share of renewable energy (RE) up to 45% in the EU's final energy consumption (European Parliament 2022). Consequently, the European energy target mainly depends on the replacement of fossil fuel-based electricity generation by RE sources. However, this can vary from one country to another.

In the case of Hungary, further progress is needed in the decarbonisation of the economy and the integration of renewable energies into the national electricity generation structure due to the remaining weight of fossil fuels. Looking at the structure of electricity generation (Központi Statisztikai Hivatal 2021a), fossil fuels continue to play an important role, accounting for 35.38% of all electricity generated in the country, while renewable energy sources account for 20.36% of the total. Nuclear power stands as the most important energy source in the country (44.26%), however, although it is a low carbon alternative to fossil fuels, nuclear energy is not a renewable source and, according to Jacobson (2019) it is not the answer to solve climate change. At the same time, solar photovoltaic (PV) energy stands out as the main source of renewable electricity with a contribution of 10.65% of the total electricity generation in this country (Központi Statisztikai Hivatal 2021a). In any case, large interest in the ground-mounted systems segment and residential and commercial rooftop installations up to 50 kW have ranked Hungary among the top 10 EU member states with the highest annual PV capacity expansion, with 3 GW of installed solar PV capacity at the end of 2021 and an annual growth of 0.7 GW (SolarPower Europe 2021). Furthermore, the energy policy of the central government aims to support the energy transition through increased use of locally available RE sources. with solar PV being the RE technology that has grown the most in terms of installed capacity in Hungary (which has increased tenfold in the last five years), and which has a favourable projection for future development according to the Ministry of Technology and Industry (Bolcsó 2022).

Based on this data, it has been estimated that the installed capacity of solar PV could increase up to 5 GW by the end of 2023, which is very close to the target of 6 GW set for 2030 (Innovációs és Technológiai Minisztérium 2020, Major 2022).

However, the fulfilment of that objective is not fully guaranteed. First of all, the energy transition is a complex process linked to multiple institutional contexts that change over time and modulate the dynamics of REs development (Frolova et al. 2019, Rodríguez-Segura and Frolova 2021). In addition, an European trend associated with local social opposition against some RE projects has recently appeared (Segreto et al. 2020), and Hungary's citizens could join that trend. Therefore, the evaluation of and discussion on the short-term (meaning within a range of 3 years vs. long-term that means decades) implementable solar PV potential at the local level is needed to better identify barriers that can stop the deployment of this technology. This can also help to develop ways to mitigate social opposition of RE projects and identify benefits beyond the techno-economic ones. In this work we focus on Somogy county, which is located in the south of Hungary. This county has great solar conditions, but solar PV technology has hardly been exploited yet and its technical potential has been little analysed.

In fact, few studies have calculated the solar PV potential of Hungary, including Somogy county, and the majority of them have been executed at the national level. Most of those works (Pálfy et al. 2004; Dobi 2006; Mezősi 2017; Pintér et al. 2020; Atsu et al. 2021; Kumar et al. 2021) have calculated the average solar PV electricity that could be generated taking into account only technical aspects, or considering natural conditions such as climate, latitude and longitude or topography. Authors such as Szabó et al. (2017) and Munkácsy et al. (2011, 2014) calculated a theoretical potential for landfills and domestic rooftop systems, respectively, which have considered aspects such as the high land use/demand for ground-mounted installations and the valuable agricultural use of Hungarian land. Authors such as Lechtenböhmer et al. (2016) consider that it is needed to distribute the estimated potential between facades, roofs and ground after consideration of competing uses. Furthermore, very few works have attempted to calculate a solar PV potential on a sub-national scale. In fact, only two studies (Somogy Megyei Önkormányzat 2014a, Žnidarec et al. 2019) have calculated the solar PV potential for Somogy county, but together with other counties.

In summary, on the one hand, there are no studies applied to Hungary that have evaluated the solar PV potential at the county level. On the other hand, the implementable solar PV potential for Somogy has not been evaluated yet, and neither socio-economic nor environmental benefits of harnessing its solar PV potential have been reported for this county. Recognizing these gaps, the aim of this study is to make a first calculation of the photovoltaic potential of the Somogy region that could be implemented in the near future (short-term) considering those high-voltage lines that would facilitate the injection of generated electricity into the grid. In this case, given the limitations of access to information, only the highest voltage line (440 kV), which crosses the county transversally, was considered. In addition, the largest active solar photovoltaic power plant in the country is connected to it. Moreover, the direct creation of employment and the avoidance of CO_2 emissions into the atmosphere are estimated. This will contribute to understanding the impact that utilizing the county's RE potential could have, and provide useful information for accelerating the implementation of renewable electricity projects that help to meet climate targets and achieve greater energy independence al national level.

This paper is structured as follows. Section 2 provides an overview of the study area, highlighting its electricity status and the theoretical solar PV potential. Section 3 presents and describes the multi-criteria GIS-based approach applied to Somogy county. The results of this approach are presented in Section 4, whereas Section 5 discusses these results together with pointing out new research opportunities. Lastly, conclusions of this work are exposed in Section 6.

Material and method

Overview of the study area

Somogy county is one of the 19 administrative units in Hungary. It is located in southwestern part of the country (Figure 1) and its capital is Kaposvár. Somogy is the fifth largest county in Hungary, 6 065 km^2, which represents 6.5% of the country's territory (Központi Statisztikai Hivatal 2022a) but is one of the least populated counties with 298 786 inhabitants (Központi Statisztikai Hivatal 2022b). Geographically, Somogy is located in the basin of Lake Balaton. The landscape is dominated by a vast plain broken by the Transdanubian Hills: the Outer Somogy region in the northern half of the county, where the highest point in the county is located (Almán-tető hill at 316 m); the Inner Somogy region in the southwest and the Zselic Mountains in the southeast (Varga 2018; Csorba et al. 2018).

The economic structure of Somogy is primarily agricultural. Agriculture contributes more to the county in GDP generation and in employment than the national average, and is clearly the most important sector (Somogy Megyei Önkormányzat 2014b). Industry, mainly wood processing, sugar processing and canning of products, has hardly developed and a tourism sector is concentrated only around Lake Balaton (Somogy Megyei Önkormányzat 2014b). With regard to land use, about 60% of Somogy's territory is under agricultural use and 30% is forest land (CNIG, 2018).

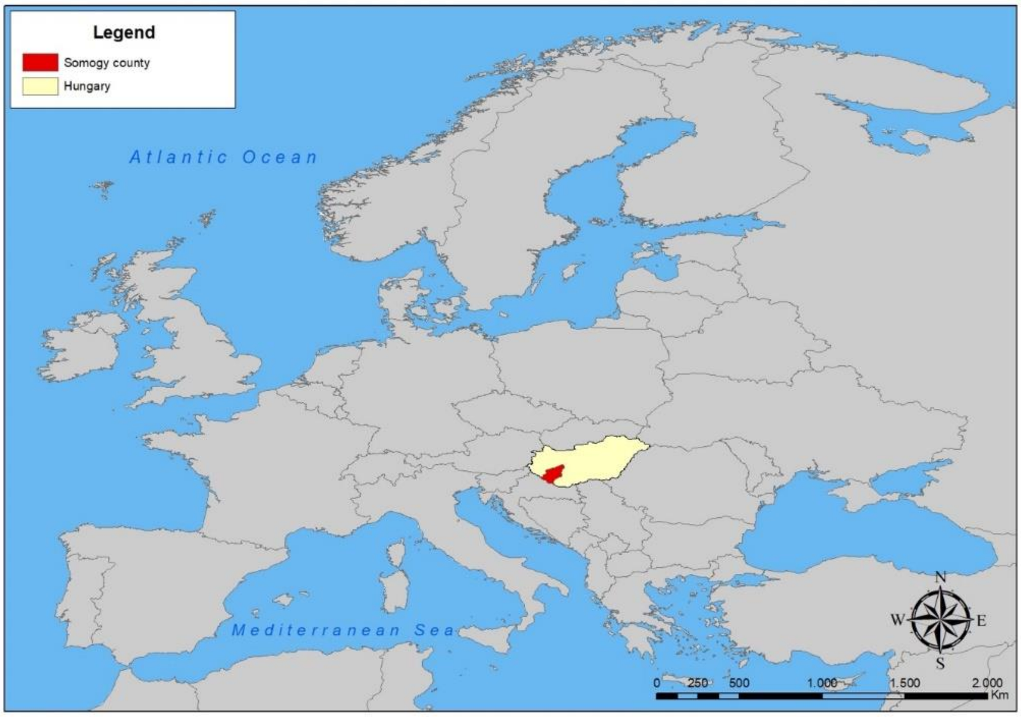

Figure 1. Geographical location of Somogy county in the European and Hungarian context

1. ábra. Somogy vármegye földrajzi elhelyezkedése Európában és Magyararországon

Electricity status in Somogy county

The electricity consumed in Somogy county was 887.67 GWh in 2020, which is only 1.58% of the annual electricity consumption in Hungary (Központi Statisztikai Hivatal 2020). About 40% of the electricity in this county is consumed by the residential sector, with a monthly average consumption of 152 KWh per home, while 28% is consumed by the industrial sector, reflecting an economic structure that is not very industrialized. The remaining 32% of electricity is distributed between agricultural purposes, lighting and tourism (Központi Statisztikai Hivatal 2021b).

In terms of electricity generation, there are only two solar PV power plants in Somogy. One of them has an installed capacity of 100 MW_P and another one 6.9 MW_P, and they generated about 135 GWh and 7.5 GWh of electricity per year, respectively (Magyar Energetikai és Közmű-szabályozási Hivatal 2022). This means that these local PV plants supply around 16% of the electricity consumed in the county and therefore about 84% of the electrical needs have to be met through imports from other counties.

Solar PV potential for generating renewable electricity in Somogy county

Despite the fact that photovoltaic electricity only meets about 16% of total electricity consumption in Somogy, this county has a significant solar PV potential (Somogy Megyei Önkormányzat 2020) and the high number of sunny hours which allow a rough estimate of an average of 1300 kWh/m^2 per day on a horizontal plane for the whole region (Žnidarec et al. 2019). This represents a total theoretical potential in the county of 788 TWh/year. However, not all of this solar potential can be technically exploited since not all of the county's surface area is available for it, and in fact, no previous studies have discussed it. Therefore, using a multi-criteria spatial approach explained in the next section, this paper focuses on the calculation of the implementable solar PV potential for the county.

Methodology

To estimate the short-term implementable solar PV potential in Somogy county, the multi-criteria spatial approach recently proposed by Osorio-Aravena et al. (2022) has been adopted. This multi-criteria approach is an integration of environmental, technical (with economic attributes), and geographical (with social-acceptability attributes) GIS-based constraints with existing local power plant considerations. All of that is needed in order to identify options for accelerating the decarbonization of the current energy mix in a given territory.

The process to estimate the RE technical potential is composed of three steps (Osorio-Aravena et al. 2022):

1. Detection of useful sites and areas for implementing RE-power plants around the highest voltage power lines, and which could therefore support the installation of various power plants in the near future. In this work was only considered the main electric power grid (440 kV) as it is on of the highest voltage power grid that crosses the study area, as well as due to the difficulty of accessing information on the lower voltage power grid.
2. Calculation of the technical potential of the specific RE technology based on a spatial approach, and a job creation estimation by technology and their corresponding CO_2 emission reduction.
3. Analysis of the pros and cons of the potential location based on local consideration, so a more realistic approximation of the installable RE potential in the selected territory is obtained.

The type of solar PV power plant considered in this work is a fixed-tilted ground-mounting installation. Here, we used data from existing local solar PV systems operating in Somogy for the adjustment of some parameters, such as capacity factor (defined as the ratio of the net electricity generated, for the time considered, to the energy that could have been generated at continuous full-power operation during the same period), power density (the amount of installed capacity of a power technology per unit of area) and full-load hours (the number of hours per year when a renewable energy asset produces electricity at its maximum capacity). Table 1 shows the GIS-based constraints by the criteria for this technology, following the order in which they were applied. A description of each criterion and constraint can be found in Osorio-Aravena et al. (2022).

Table 1. GIS-based constraints by criterion for solar PV power plants

1. táblázat. Térinformatikai alapú korlátozások kritériumok szerint napelemes PV erőművekhez

Criterion	GIS-based constraint
Environmental	Exclude natural parks and protected areas
Technical (with economic attributes)	Sites located not more than 1 km from the electric power grid
	Zones with a capacity factor equal to and greater than 12%
	Terrain with a slope less than or equal to 10%
Geographical (with social-acceptability attributes)	100 m from urban areas, towns and villages as a minimum
	100 m from buildings (industrial, military and cottages) as a minimum
	50 m from infrastructures (primary and secondary roads, railways and airfields) as a minimum[i]
	100 m from rivers and water bodies as a minimum[ii]
	Sites with a minimum of 0,02 ha[iii]

[i] Distance to airports has not been considered as no airports exist in Somogy; however, it is recommended to apply this same constraint to other infrastructures.
[ii] Distance to marine coast has not been considered as it does not exist in Somogy; however, it is recommended to apply this same constraint.
[iii] For a solar PV power plant of 10 kW or more.

After applying the multi-criteria GIS-based constraints, the solar PV potential calculation, in terms of installed capacity and electricity production, was carried out based on a spatial approach using equations (1) and (2). Solar PV power capacity potential was calculated as follows:

$$PP_{PV} = (DS_{PV} - OS_{PV}) \cdot PD_{PV} \tag{1}$$

where PP_{PV} is the solar PV power potential in MW_P, DS_{PV} is the detected surface for solar PV plants in hectares (ha), which it is a result of applying the multi-criteria GIS-based constraints; OS_{PV} is the occupied surface by existing solar PV plants in the range of 1 km from the main electric power grid in ha; and PD_{PV} is the power density of solar PV in MW_P/ha. In the case of Somogy, OS_{PV} is 213 ha and PD_{PV} is 0.5 MW_P/ha. The PD_{PV} was obtained based on the existing PV plants in Somogy via GIS. Then, using the obtained PP_{PV}, solar PV potential for producing electricity was estimated as follows:

$$EP_{PV} = PP_{PV} \cdot FLH_{PV} \tag{2}$$

where EP_{PV} is the solar PV electricity production potential in GWh and FLH_{PV} is the full-load hours for solar PV technology. In the case of Somogy, 1 193 h was assumed as FLH_{PV}, which is the mean value for the existing solar PV power plants operating in the county.

Subsequently, equations (3) and (4) were used to estimate the direct jobs creation potential for solar PV plants in the construction and installation (C&I) stage and for operation and maintenance (O&M) purposing, respectively:

$$JC_{PV,C\&I} = PP_{PV} \cdot EF_{PV,C\&I} \tag{3}$$

where $JC_{PV,C\&I}$ is the number of direct jobs created in the C&I stage for solar PV and $EF_{PV,C\&I}$ is the employment factor in the C&I stage for this technology: 13 jobs-year/MW_P according to Ram et al. (2022). And,

$$JC_{PV,O\&M} = PP_{PV} \cdot EF_{PV,O\&M} \tag{4}$$

where $JC_{PV,O\&M}$ is the number of direct jobs created for O&M purposing for solar PV and $EF_{PV,O\&M}$ is the employment factor for O&M purposing for this technology: 0.7 jobs/MW_P according to Ram et al. (2022).

Regarding CO_2 emissions reduction estimation, 0.364–0.826 ktCO_2/GWh was considered, which is the range of CO_2 emission factor relying on the specific fossil fuel-based electricity generation technology (Eggleston et al. 2006).

Results

Figure 2 shows the results associated with the sites detected for the solar PV power plants implementation in Somogy county, taking into account the multi-criteria GIS-based constraints. Some 36 sites were identified, accounting for 5 380 ha (0.87 % of the surface of Somogy) with a suitable condition for installing solar PV systems. The total detected surface can accommodate an installed solar PV capacity of 2.7 GW_P, which is about 25 times more than the current installed capacity in this county (only PV systems on ground), and could create about 34 974 direct jobs in the C&I stage considering that 13 direct jobs per year will be available for each MW_P, and, around 1 883 direct jobs for O&M purposing.

On the other hand, those 2.7 GW_P could generate 3.2 TWh of electricity per year, which is 9 times more than the total electricity consumed by the residential sector in Somogy in 2020, 3.6 times more than the total electricity consumed in this county, and 22 times more than the electricity generated by the solar PV power plants operating in Somogy in 2020. Furthermore, this solar PV potential for generated electricity would prevent the emission of 1.16–2.65 $MtCO_2$ per year to the atmosphere.

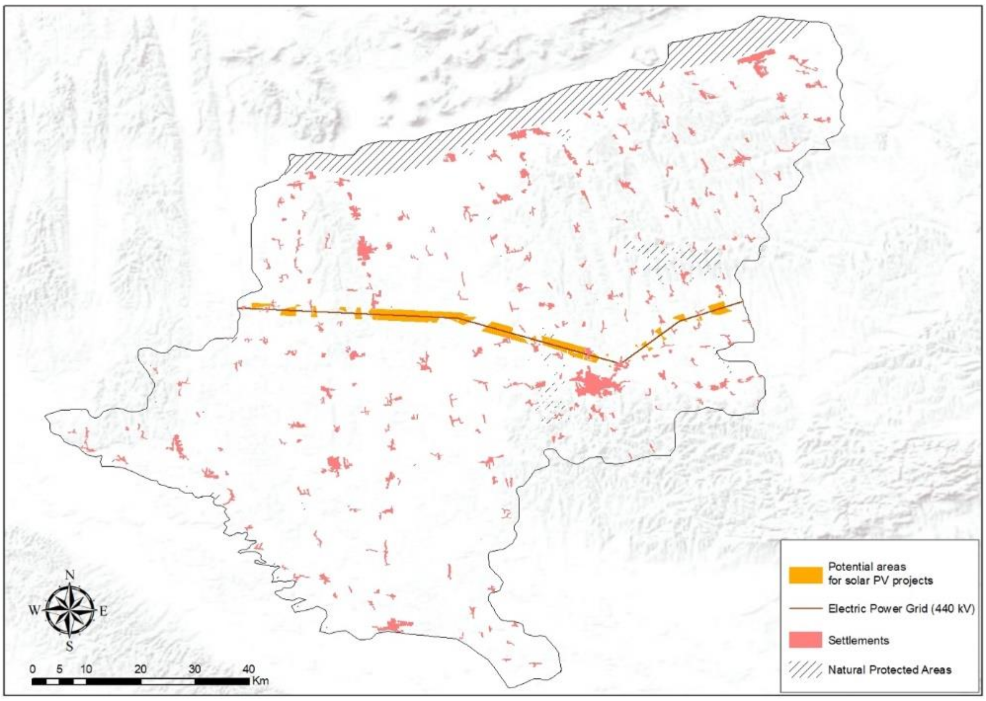

Figure 2. Identified sites for the installation of solar PV power plants in Somogy County

2. ábra. Az azonosított napelemes PV erőművek telepítési helyszínei Somogy vármegyében

Figure 3 shows the distribution of suitable sites based on installed capacity ranges as follows: 69% of the identified sites have a surface between 3.5 and 92 hectares, which could accommodate solar PV systems with an installed capacity in a range of 1.75–46 MW_P. These 25 sites correspond to 435 MW_P that would generate 519 GWh, representing 58.5% of the total electricity consumed in Somogy in 2020. The smallest identified site is 0.055 ha, which would allow the installation of 0.027 MW_P, while the largest identified site has 2,053 ha, which corresponds to a solar PV plant of 1,026 MW_P. Therefore, there is a wide range of installable power capacity in the county, but with a predominance of large surfaces due to the flat orography, which would allow the implementation of medium and large size of solar PV systems.

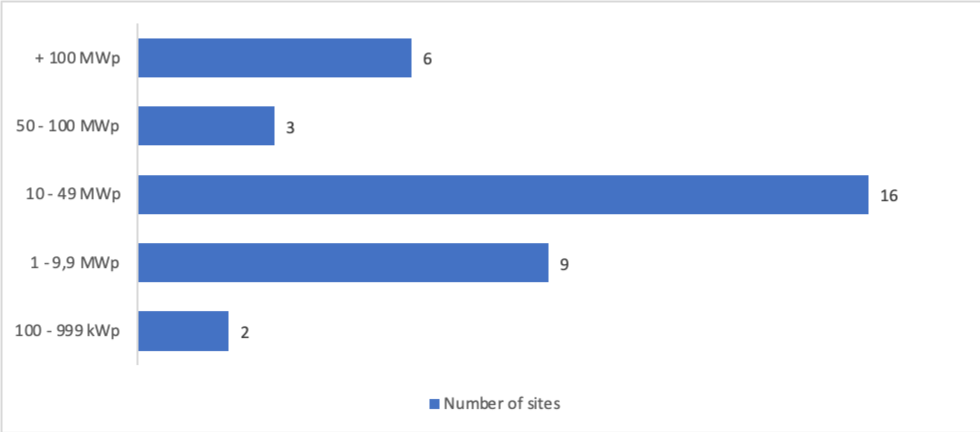

Figure 3. Distribution of sites for implementing solar PV systems according to different installed capacity ranges

3. ábra. Napelemes PV rendszerek kivitelezési helyszíneinek felosztása különböző beépített kapacitás-tartományok szerint

Finally, as Figure 4 shows, the 59.6% of the sites (3 205 ha, which represent 1.5% of the total agricultural surface in Somogy) are located in agricultural areas occupied by non-irrigated arable lands (2 935 ha), pastures (121 ha) and complex cultivation patterns (149 ha). The remaining 40.4% of the sites (2,175 ha, which represent 1.2% of the total forest and seminatural surfaces in Somogy) are located in forest and seminatural areas, covered by broad-leaved/coniferous/mixed forests (1 911 ha) and transitional woodland shrubs (262 ha).

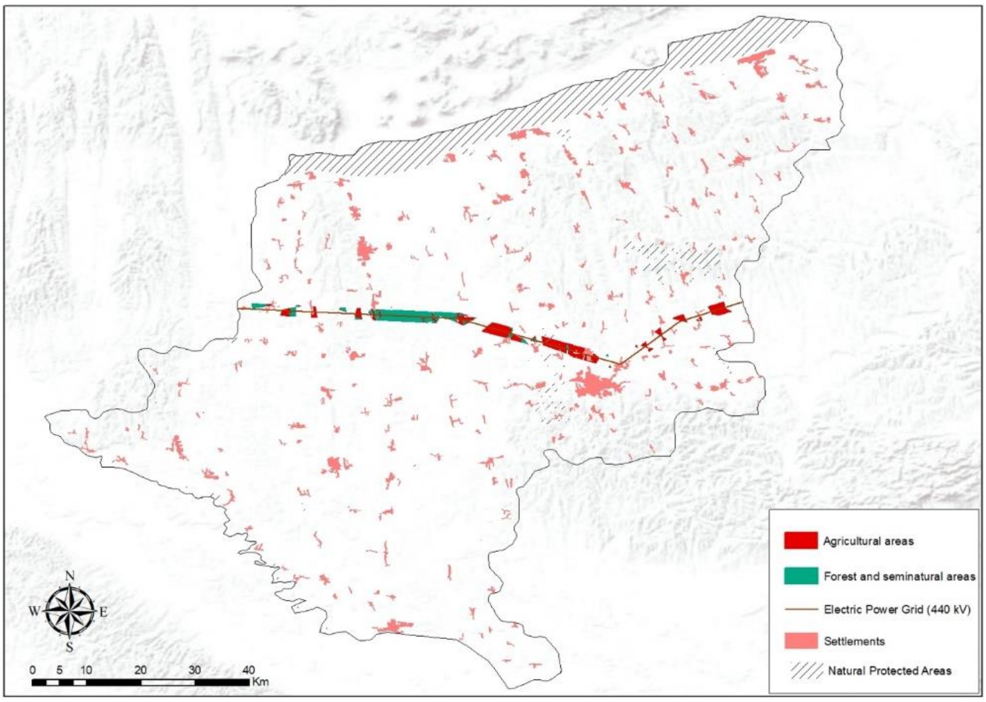

Figure 4. Identified sites for the installation of solar PV power plants in Somogy county classified by land cover

4. ábra. Azonosított napelemes erőművek telepítési helyszínei Somogy vármegyében felszínborítás szerint osztályozva

Discussion

The results of this work reveal that the implementable solar PV potential for electricity generation in Somogy is significant not only for the county, but also for Hungary. The total area identified can accommodate an installed solar PV capacity of 2.7 GW_P, which would occupy around 0.9% of the surface of Somogy and is about 19 times more than the installed capacity of ground-mounted PV systems currently operating in this county. This capacity could generate 3.2 TWh of electricity per year, which is 4.6 times more than the total electricity imported by Somogy from other counties. Furthermore, those 2.7 GW_P represent 45% of the Hungary national target for reaching an installed solar PV capacity of 6 GW by 2030 (Innovációs és Technológiai Minisztérium 2020). This finding suggests the possibility to contribute in the short-term to the electricity self-supply and energy independence at local and even national levels, which would also imply both socio-economic and environmental benefits: creating 34,974 direct jobs in the C&I stage (considering that 13 direct jobs per year will be available for each MW_P), around 1,883 direct jobs for O&M purposing, and preventing the emission of 1.16–2.65 $MtCO_2$ per year to the atmosphere, respectively.

Furthermore, the solar PV technical potential calculated in this work is the first of its kind for Somogy county, but also for Hungary. Previous works (Somogy Megyei Önkormányzat 2014a, Žnidarec et al. 2019) that estimated a solar PV potential for this county have only reported theoretical values with an average of about 1300 kWh/m^2

per day for the whole area. Therefore, in addition to the fact that we have used values based on local solar PV plants operating in Somogy, our results are the first that reported specific potential locations for the implementation of solar PV power systems. Moreover, none of those previous studies consider economic and social-acceptability attributes to identify suitable area for PV facilities. In addition, we report for the first time for Somogy county the direct jobs creation and CO_2 emissions that would be avoided by a solar PV technical potential.

If the results of this work are compared to those reported for the case the province of Jaén (Spain) where the same methodological approach was applied (Osorio-Aravena et al. 2022), a specific similarity can be found. The results of both studies reveal that the total identify area suitable for a short-term implementation of solar PV plants would occupy around 1% of the territory under analysis. This means a power density of 0.49 MW_P/km^2 in Jaén and 0.45 MW_P/km^2 in Somogy. However, the difference of the absolute installed capacity potential between those studies, 6.6 GW_P for Jaén and 2.7 GW_P for Somogy, can be attributed to the fact that in this work was only considered the main electric power grid (440 kV), while in the case of Jaén, electric power grids in a range of 60–400 kV were considered. This allows to infer two significant aspects. Firstly, the main limitation of this work is the consideration of just one type of the existing electric power grid in Somogy (due to the difficulty of accessing information). And, secondly, this suggest that the short-term implementable solar PV potential in this county is greater that the estimated in this study and need to be further investigated.

In any case, also similar to the case of Jaén, the short-term implementation of the solar PV potential reported in this work is not fully guaranteed. This mainly depend on factors, situations and criteria that influence the social acceptability of RE projects; one of them is land use. In the case of Somogy, land use becomes an important factor because 40.4% of the sites detected for the solar PV power plants implementation match with forested areas and transitional woodlands shrub, which would make it difficult to prepare the land for the installation of PV plants. In addition, in a parallel work to this article, a survey was conducted among the local population of Somogy to find out their degree of acceptance of RE and their possible locations, revealing that there is a preference for unused or environmentally degraded areas over natural areas (Rodríguez-Segura et al. 2023), compromising 1.09 GW of the total calculated potential.

In the same way, there is a preference for location in livestock farming areas as opposed to cultivated areas (Rodríguez-Segura et al. 2023). This is an aspect to be considered since more than half of the calculated potential is located on arable land (manly arable crops). However, according to the survey, respondents do not relate their acceptability of RE to the fact that it must involve a change in land use. This is also motivated by the energy transition model promoted in the county, focused on small-scale domestic/urban installations (Somogy Megyei Önkormányzat 2021). All of this suggests that medium-sized installations (< 50 MW) would be better accepted by the population. According to the results of this work, up to 27 PV plants of less than 50 MW_P

could be installed in the county, with a total capacity of 435 MW_P that would generate 520 GWh.

In any case, given that the potential areas located in forests are more complex to install solar PV projects in the short-term, new lines of research focused on land use compatibility should be explored, such as agrivoltaic systems, where the symbiosis between energy production and agriculture would allow farmers to obtain new sources of income without losing productivity or land ownership (Toledo & Scognamiglio 2021). Similarly, the results obtained in this research allow opening future lines of research towards studies of the annual profitability of cultivated area versus area occupied with energy installations. This will provide more objective information to key stakeholders (politicians, planners, landowners and companies in the solar PV sector), as well as complementing these results with studies of other sources of RE electricity generation (biogas or second-generation biomass) and secondary transmission lines.

Conclusions

In this work, a short-term implementable solar photovoltaic (PV) potential for electricity generation in Somogy has been calculated using a multi-criteria GIS-based approach that includes environmental, technical (with economic attributes) and geographical (with social-acceptability attributes) constraints, together with existing local solar PV power plants considerations. As far as the authors are aware, this is the first study that discusses such as renewable electricity potential for Somogy county, and, that reports direct jobs creation and estimates CO_2 emissions reduction of the calculated potential.

The estimated potential of 2.7 GW_P (without considering secondary power transmission lines) is about 25 times more than the current installed capacity for generating electricity in this Somogy and represent 45% of the Hungary national target for reaching an installed solar PV capacity of 6 GW by 2030. Based on these results, we conclude that the short-term implementable solar PV potential is not only relevant for renewable energy development in Somogy county, but also is significant on at the national level. This could contribute to the self-supply of electricity in Somogy and to Hungary achieves both national and European energy transition targets. However, the full implementation of the estimated solar PV potential is not guaranteed. In Europe, there are more and more frequent demonstrations of citizens' rejection where society is becoming a barrier for large renewable energy projects. Moreover, in the case of Hungary and Somogy county, land use and land cover are key aspects from the social perspective due to the importance of the agricultural sector. All of that could affect in the successful exploitation of the estimated solar PV potential.

Finally, we suggest carry out future studies to evaluate the complementarity of solar PV plants with crops (agrivoltaics systems). All of this, in order to minimise land use conflicts and social opposition, and, at the same time, to accelerate the implementation of renewable electricity projects that help to meet climate targets and achieve greater energy independence with both socio-economic and environmental benefits.

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Authors contribution statement

Francisco Javier Rodríguez-Segura: Conceptualization, Methodology, Formal analysis, Visualization, Writing – original draft preparation, Writing –Reviewing and Editing. *Juan Carlos Osorio-Aravena*: Methodology, Data curation, Writing – original draft preparation, Writing –Reviewing and Editing. *Emilio Muñoz-Cerón*: Supervision, Formal analysis, Writing – Reviewing and Editing. *Marina Frolova*: Formal analysis, Project administration, Writing – Reviewing and Editing.

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A Somogy megyében megvalósítható fotovoltaikus potenciál első számítása és hatása a CO_2-kibocsátás csökkentésére és a munkahelyteremtésre

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Kulcsszavak: megújulóenegia-potenciál, energiaátmenet, Magyarország, napelem

Összefoglaló: A jelenlegi éghajlatváltozási tendenciák miatt fel kell gyorsítani az energetikai átállást a megújuló energiákra. Ennek érdekében az Európai Unió ambiciózus energiacélokat tűzött ki. A tagországokban, például Magyarországon azonban az atomenergia és a fosszilis tüzelőanyagok továbbra is jelentős szerepet töltenek be az energiamixben. Ennek ellenére az ország nagy napelemes fotovoltaikus (PV) potenciállal rendelkezik, amelyet alig használnak ki, különösen a déli megyékben, ugyanakkor eddig a technikai potenciált kevésbé kutatták. Somogy vármegyében a napelem-potenciál rövid távon történő kihasználásának becslésére egy többszempontú térbeli megközelítést alkalmaztunk, amely integrálja a környezeti, a műszaki (gazdasági adottságokkal) és a földrajzi (társadalmi elfogadhatósági jellemzőkkel rendelkező) térinformatikai korlátokat. Az eredmények azt mutatják, hogy Somogy vármegye rövid távon 2,7 GWp megvalósítható napelemes potenciállal rendelkezik, 3,2 TWh/év villamosenergia-termelő kapacitással. Ez az energiapotenciál mintegy 25-ször nagyobb, mint a jelenlegi beépített villamosenergia-termelési kapacitás, és a 2030-ra kitűzött nemzeti cél 45%-át teszi ki a magyarországi beépített napelem-kapacitás tekintetében. Ezen túlmenően ez a potenciál közel 35 000 közvetlen munkahelyet teremthet, és lehetővé teszi 1,16–2,65 Mt CO_2 légkörbe történő kibocsátásának megakadályozását. A javasolt megállapítások és a jövőbeni tanulmányok mind helyi, mind nemzeti szinten jelentősek, és hozzájárulhatnak ahhoz, hogy információt nyerjünk az éghajlati célok elérésére és az energiafüggetlenség felgyorsítására vonatkozó társadalmi-gazdasági előnyökre.