

REGIONAL RENEWABLE ENERGY POTENTIAL IN HUNGARY. THE CASE OF KOPPANY VALLEY

A MEGÚJULÓ ENERGIA REGIONÁLIS POTENCIÁLJÁNAK LEHETŐSÉGEI MAGYARORSZÁGON. KOPPÁNY VÖLGYE PÉLDÁJÁN

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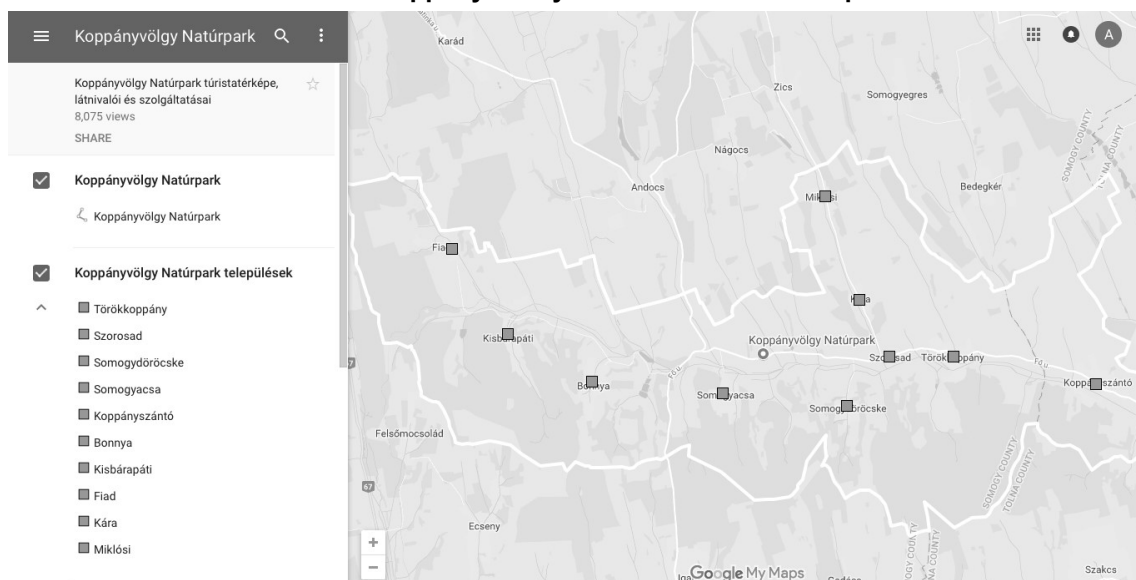
Abstract

Koppány Valley is the target region within the framework of the RuRES research project. Using relevant literature the authors draw their attention to the regional renewable energy potential's estimation taking into consideration the best Hungarian practices in this field. The aim of the paper is the analysis of the specific territorial data on renewable energy sources particularly appropriate for Koppány Valley including solar and biomass regional potentials. From the other point of view the authors recognise the necessity to investigate the structure of energy consumption of Koppány Valley based purely on statistical data. The authors conclude with recommendations for the energy efficiency improvement towards green local society development.

1. Introduction

The acronym RuRES refers to the research project undertaken within the framework of Hungarian-Croatian cross border cooperation programme and implies renewable energy sources (RES) and energy efficiency (EE) in the function of rural development. It aims to investigate the solar, the wind and the biomass potential of eligible settlements. Besides, a survey of the attitude, the socio-cultural circumstances and environmental consciousness of the citizens of rural areas regarding RES and EE is going to be conducted. This article reports the very first results and further proposals of the RuRES project which was started from September, 2017. Particular focus of the authors was directed to the regional solar energy potential, the regional biomass energy potential and the public acceptance survey regarding RES. The research area is the Koppány Valley located in Somogy county of Hungary, 40 km to the North-East from Kaposvar. This area was selected taking into consideration the reason of already existing initiatives related to the green local society development run by Vox Vallis development association (Filep-Kovács et. al, 2016). The plans to establish locally photovoltaic elements and biogas power plant station are among them. That is why the relevance of the current research to assess the potentials of the sources of energy listed and to investigate, accordingly, the awareness of the rural stakeholders raises its value.

Pic.1.: Koppány Valley Nature Park on the map



Source: <https://koppanyvolgy.com>

Koppány Valley Nature Park is the development unit consisting of 10 settlements: Fiad, Kisbárapáti, Bonnya, Somogyacsa, Somogydöröcske, Szorosad, Kára, Miklósi, Törökkoppány, Koppányszántó. The lead organisation is Vox Vallis association in cooperation with members of the self-governments of these settlements. Törökkoppány is the first pilot location for the proposed methodology which is going to be applied for the other settlements as well.

2. Literature review

Several authors have been working on the topic in Hungary. The potential for the production and use of biomass-based energy sources in Hungary has already been considered (Garay et al., 2012). The paper gives a broad introductory part including the consideration of the national and European renewable policy aspects, particularly focusing on solid biomass and its estimated amount in Hungary. The authors provided comparison models between Hungary and other European countries in biogas and biofuel production as well. They concluded that solid biomass would continue to be the most used bioenergy source in Hungary; the amount of solid biomass that would be needed by 2020 is already available from forestry and agriculture; in Hungary the potential to produce first generation bio-fuel from domestically grown crops was significantly higher than in most EU Member States but the development of the sector had not met the expectations yet. A significant biomass potential has been investigated in Hernad Valley (A. Bai et al., 2016). Photovoltaic panels were recognised as highly accepted by the local population. The authors found that the population did not have adequate knowledge in regard to RES. The lack of information sources was listed as a main reason for that fact. Seventeen settlements of Heves County were examined through the survey in order to research the subject of public acceptance of renewable energy sources based on biomass and to explore the general knowledge, innovative attitude, acceptance and willingness of application as well as the estimation of the benefits of the use of RES within the inhabitants (Bujdosó et al., 2012). The authors found that knowledge on various bioenergy-related technologies in

general was moderate. Knowledge on biogas, biodiesel and the combustion of biomass exceeded 40%. Environmental protection aspects proved to be the most relevant among the most important benefits in relation to the use of RES. The authors admitted that the society took the biomass energy into consideration and its importance and responsibility were increasing.

3. Materials and methods

For the regional solar potential the latest version of the photovoltaic geographical information system, photovoltaic software PVGIS 5 was applied. For the biomass regional potential assessment Methodology based on MePar-Agricultural Parcel Identification System is proposed to be used.

4. Results and discussion

4.1. Regional solar energy potential

According to the European Commission, global irradiation and solar electricity potential based on optimally-inclined photovoltaic modules in Hungary is relatively moderate in comparison with other European countries. The average amount of inland solar energy potential lies in the range between 1000 kWh and 1200 kWh.

Pic. 2.: Global irradiation and solar electricity potential in Hungary



Source: European Commission

The local solar energy potential in Törökkoppány village was estimated based on PVGIS 5 system. PVGIS 5 allows to select defined settings to identify the performance of grid-connected PV such as: solar radiation database, PV technology, mounting position and so on. In our case Satellite application facility on Climate Monitoring PVGIS-CMSAF database was applied as the most traditional one. Crystalline silicon and Cadmium telluride PV technologies were tested by the model. The GPS coordinates of the target location were chosen apart from them. The results demonstrated the following: yearly PV energy production in Törökkoppány, which is recognised as the regional energy potential on micro-level, is 1140 kWh-1180 kWh depending on the solar panel technology. In fact, CdTE PV cells were found as the most efficient in this order. The received numbers correspond, in general, to the overall Hungarian data. But indeed, regional solar energy potential based on PVGIS 5 might be improved through several options:

- Usage of different solar radiation database (PVGIS-CMSAF, PVGIS-SARAH, PVGIS-ERA5, PVGIS-COSMO);
- Different PV cells technology (Crystalline silicon, CdTE, CIS);
- Adding tracking options.

Also, results may differ from each other due to the building integrated or free standing mounting.

Nevertheless, the current situation in the research states that the PVGIS software allows only 90m resolution according to the solar potential map and provides the horizon height which is strictly built on the landscape shape. The improvement in the project is expected to precise the resolution of the map up to 6-10 m in order to incorporate the shadowing effect of buildings and trees plus the identification of ideal surfaces for the solar panel installation (size, slope, N-S exposure). The methodology is going to be applied to achieve such improvements based on field experiment using a manual device for measuring the horizon height at a certain place; measuring points will be defined as grids supplemented by GPS information; detailed horizon file to be uploaded to the software's simulation model.

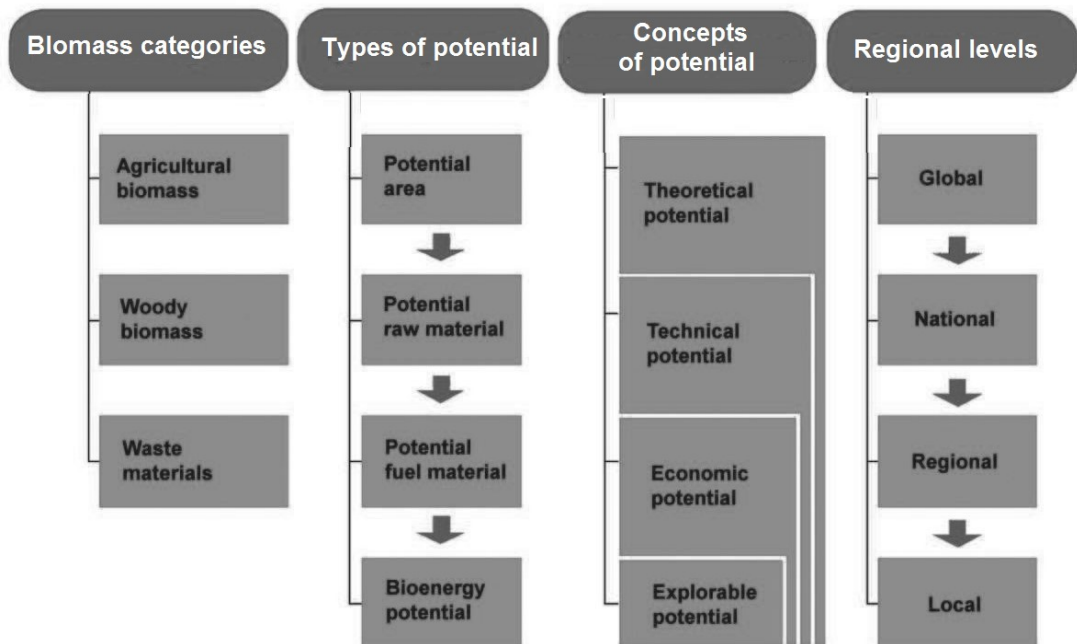
The test approbation of the given methodology has been recently conducted at the student campus of Kaposvar University with successful results.

4.2. Regional biomass energy potential

If we look at the theoretical concepts for the various types of biomass potential (Pic. 4), we may declare that in our research we are going to take into consideration all of the biomass categories mentioned as agricultural, woody and waste material. A potential area has already been selected, the bioenergy potential is going to be estimated on regional and local levels.

MePar - Agricultural Parcel Identification System is the universal software allowing to get satellite maps equipped with the function to distinguish different layers for appropriate data selection. In our case, it is suitable for the identification of agricultural layouts as well as vineyards, orchards, uncultivated fields, etc. namely all the possible territories which may be used for the biomass resources collection.

Pic.4.: Biomass potentials form different points of view



Source: Schubert et al., 2012

On the other hand, MePar is convenient for the investigation of potential surfaces for solar panel installation. It provides a detailed map about the building constructions of a settlement.

To summarise briefly, biomass-based energy data are going to be collected by the following sources:

- MePar system;
- Local agricultural statistics;
- Waste management agency’s data;
- Questionnaires for the local residents.

4.3. RES public acceptance survey

Three hundred samples of the questionnaire will be distributed among the local population of the 10 eligible settlements in Koppany Valley. The survey is planned to be started from April, 2018.

The questionnaire focuses on:

- General knowledge and awareness about RES (types of RES, information sources, reasons to use etc.);
This part includes questions like:
 - Have you ever heard about renewable energy sources?
 - What kind of renewable energy sources do you know?
 - What is the main information source to know about the RES in your local area?
 - What are the main reasons to use RES instead of conventional ones?
 - What kind of RES would you wish to have in your local community: small hydro, solar thermal, photovoltaic panels, wind, biomass-based power plants? etc.

- Particular emphasis on biomass for energy purposes (domestically used amount of biomass, willingness to be involved in related community activities, influence on the local economy, etc.).

That part includes questions like:

- Do you know what biomass is?
 - Do you use biomass for heating in your residence?
 - Which forms of energy-related utilization of biomass do you know (heating, electricity, etc.)?
 - What bio-energy resources do you know or/and use (energy forest, energy grass, bio-briquettes, pellets, bio-gas, bio-fuels)?
 - What positive/negative aspects can you see regarding the usage of biomass? etc.
- Some of the questions will contribute to the domestic use of biomass data collection.

5. Conclusions

Koppany Valley is the target research area for the RuRes project. The estimated regional solar energy potential in Koppany valley is 1180 kWh, which is a bit higher than the Hungarian average. Regional solar and biomass energy potential maps will be created based on collected data. A RES public acceptance survey will be conducted. An approved methodology will be provided for other regions.

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