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The Topography of Possible Hungarian Renewable Energy Regions and Cities: A Possible Interpretation Based on Three Models

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Abstract

The main task of my research was to present the process of developing renewable energy regions (RER) in Western Europe and that of it in Hungary. In regional science one always has to face the problem of accurately defining the concept, size, institution and the function of regions, because of manifold region definitions. The 3 types are as follows: Sustainable Energy Action Planning, the Modelling region and the risk based regional developing. In my research I evaluated KÁT report data published by Hungarian Energy and Public Utility Regulatory Authority, thus assigning settlements constituting potential RERs in Hungary. Results could demonstrate renewable energy cities, micro-regional and regional spatial initiations started their institutionalization process before the national formal codification of RERs. A few typical examples were found in the Western Hungarian Region, but some of them can be found in Central and Northern Hungary as well as in the Northern Great Plain.

Keywords: Renewable energy, Energy region, Energy cities, Hungarian energy and public utility regulatory authority, Methods

1. Introduction

1.1. Motivation

Recently energy issues are broadly accepted to be crucial socio-economic and natural problems. In case of Hungary energy dependence is a key geo-political question as well. Energy problem stems from the fact that the amount of fossil fuels is reduced while energy demand increases in parallel with social development. This article aims to examine emerging renewable energy sources (RES) harvesting spatial units through some theoretical frames.

The theme can also be justified by an ongoing international R&D project managed by the Department of Geography of Eszterházy Károly University College Eger, Hungary. One main element of it is to create a model region around Eger.

1.2 Energy Regions in Europe

In regional sciences we always have to face the problem of defining the concept, size, institution and the function of regions accurately, due to the fact, that region definitions are widespread and often mentioned. (Patkós, 2010)

An important aspect of researches on functional regions is how to separate them from complex regions. As long as compound and integrated regional development approaches can't focus on individual branches, functional regional initiatives have the potential to complement complex systems with this view. (OECD 2002) In the next paragraphs several international and national projects and programs will be observed.

Integrated energy and climate policy of the European Union is focused on electricity production from RES, as well as on the increased enforcement of energy efficiency considerations. To reach these issues bottom-up approaches are crucial. Community lead local development initiatives can play an increasing role to reach it (Patkós, Ruszkai, & Kozma, 2014).

Recently there is no generally accepted practice of RER development in Hungary. Areas of universal service providers in the country can be interpreted as different regions but these are huge areas without any bottom-up organized content.

The most complex system of designation of RERs can be found in Germany. In our article the German "deENet" system of energy regions is used as a base. Beyond being a theoretical benchmark it is used in practice as well. RER development in Hessen Province is based on the experiences of Kassel deENet Assocation. Different institutions (German Environment, Nature Conservation and Nuclear Safety Ministry and the Provincial Environment Agency) have accepted the "deENet" system and they were integrated in the implementation of this system.

This model consists of 5 chapters, these can be divided into 33 sub points. In case of every sub point 3 points can be obtained consequently 99 points can be reached maximum. recommended values for different RER categories are defined as follows:

- A "Beginner Region" must reach at least 20 points.
- A "100% RER" must get minimum 40 points.
- Energy cities (Frankfurt am Main, Rostock, Osnabrück).

The first level of categories is based on the definition specifications. The definition of a region based on a variety of criteria, such as natural resources, endowments, traditional cultural boundaries, technical infrastructure, administrative boundaries, state aid actors, situations or circumstances.

At the second level criteria of planned objectives relating to future RES utilization can be found. Difference between recent values and proposed levels are evaluated in this section.

The third group of criteria is related to implementation level. Complex feasibility of planned steps are supervised such as availability of exact energy supply and demand data, involvement of different stakeholders etc. This strata consists of 15 criteria, it represents the largest share in this model.

The fourth group includes the state-level criteria. The progress made in the state level must be documented. If possible quality indicators should be mapped at the state level. As only limited data are available for some regional levels, criteria can be adjusted on the basis of publicly available data. However, due to the poor quality of data availability in some cases, additional criteria should be disclosed in the report.

The last group is the cluster of other conditions (information source, consciousness and best practice) (Hoppenbrock Fisher, 2012).

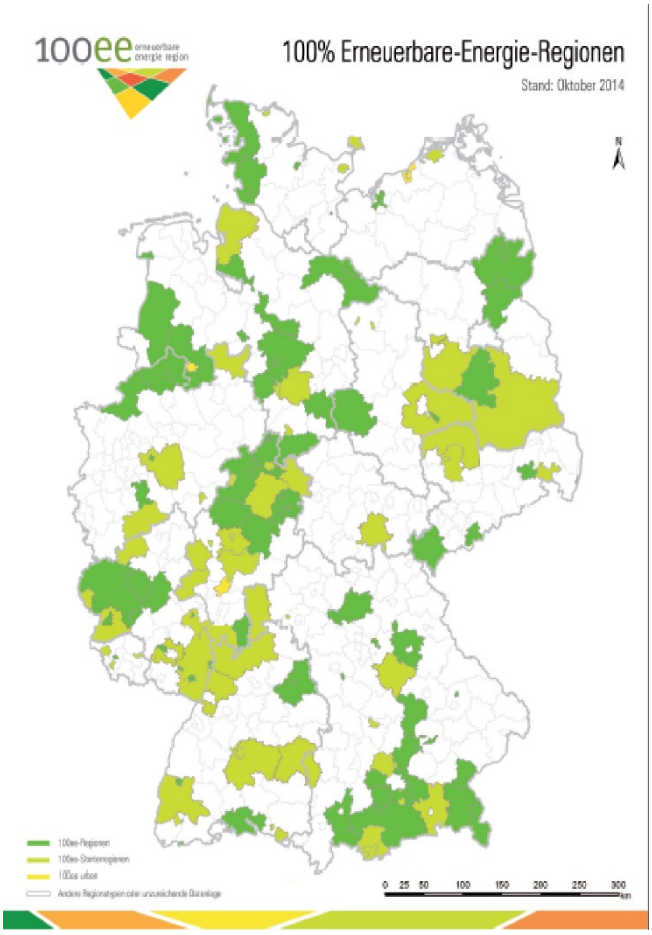


Figure 1. RERs in Germany

This provincial, and national initiative has grown to a European level. Below different generated by-projects of it will be shown.

ClimAct Region project integrates many smaller regions and institutions from 10 different

European countries wanting to adopt renewable energy to mitigate climate change. (http://www.climactregions.eu 2014.05.25) These sub-national spatial units analysed their capacities of RES. For example since in Maramures County (Romania) about 90 percent of electricity is provided by hydroelectric power plants it could be declared as a RER. (http://www.climactregions.eu/web/guest/partners#maramures 2014.05.25).

From ClimAct a new project was born named ENNEREG. Its aim is to build a database of energy efficiency and RES issues in joining regions. Members of this network can get closer through it to sustainability. A whole cluster of regional renewable energy programmes was developed for example City_SEC Regions, ClimactRegions, Come2CoM Regions, Energy for Mayors Regions, ENESCOM Regions, Isle-Pact Islands. (http://www.climactregions.eu/web/guest/publications#ENNEREG 2014.05.25).

Alpstar is a different project as it is based on the intent of Alpine countries to reduce carbon dioxide emissions and increase the use of green energy. The primary aspect of the project was to identify common development goals for entrepreneurs and regional institutions concerning RES harvest. (http://alpstar-project.eu/project/ 2014.05.25) Among joining areas region "Goms" is the leading one because of its high level of RES harvest. Consequently "Goms" can be declared a real RER. (http://reregions.blogspot.hu/2010/04/goms-energy-region-in-swiss-alps.html 2014.05.25).

It can be concluded that a number of regional energy initiatives can be found in Europe. Willing to introduce them in Hungary, it is compulsory to set up an authoritative system to measure RER candidate areas. The German regional energy model seems to be proper as it was taken over by other countries (e.g. Switzerland). (http://www.energie-region.ch/de/energie-region/ 2014.05.25).

An independent institution similar to the German system was set up in Switzerland. The first application period was opened for candidate towns, neighbourhoods, regions and communities planning to become RERs until 31 May 2014. The ultimate objective of the Swiss system is to create 2000-watt societies. (http://www.energie-region.ch/fileadmin/user_upload/Energieregion/de/Dateien/Bewerbung/einladung_bewerbung_energie_region_phase_1.pdf 2014.05.25).

1.3 Theoretical Methods to Create RERs

In connection with the production of electricity from RES in the EU according to Directive 2009/28 / EC by 2020 national targets were identified. Systems of domestic payments aim to facilitate the achievement of energy and climate policy objectives. In Hungary it was implemented by the Hungarian Energy and Public Utility Regulatory Authority in the form of Obligatory Transmission System (KÁT).

In Hungary, there is no standard system of RER determination, like the German or the Swiss examples. So a new methodology should be developed to evaluate spatial patterns of regional renewable energy systems.

A possible "energy regionalisation" could depend on the areas of different service providers.

As in Hungary there is no service providers selling 100% renewable energy, these can't be declares RERs. To create RERs–in our opinion–three opportunities are available:

1. The first case is a basic research-based, so-called positivistic method. A certain area – possibly a coherent natural landscape – is taken as a target region of a detailed basic research. I case of a Hungarian (Eszterházy Károly College, Eger) example (Pajtók Tari, 2012) fifteen thematic workgroups analysed geographic and economic conditions of all locally available RESs. Spatial patterns of geological-geothermal, soil, wind and biomass potential, additionally different qualitative and quantitative weather and climate factors were examined. Infrastructural and socioeconomic characters of the region concerning energy efficiency were also revealed. The project was implemented through a broad partnership consisting of practically-experienced Hungarian private companies and an acknowledged international think-tank of this topic (University of Kassel). Research concerning different sub-themes were conducted by prominent German experts. One main output of the research was the creation of a GIS database. New results were presented in different forms. Beyond merely scientific publications and manuscripts, thematic maps containing relevant, plain and useful information of public interest were presented to local residents in workshops (Figure 1). (Pajtók Tari, 2012) The Eger Energy Region till now is the first such energy region simulation in Hungary, but the Eszterházy College is planning to replicate it in another target area (the famous Tokaj Wine Region).

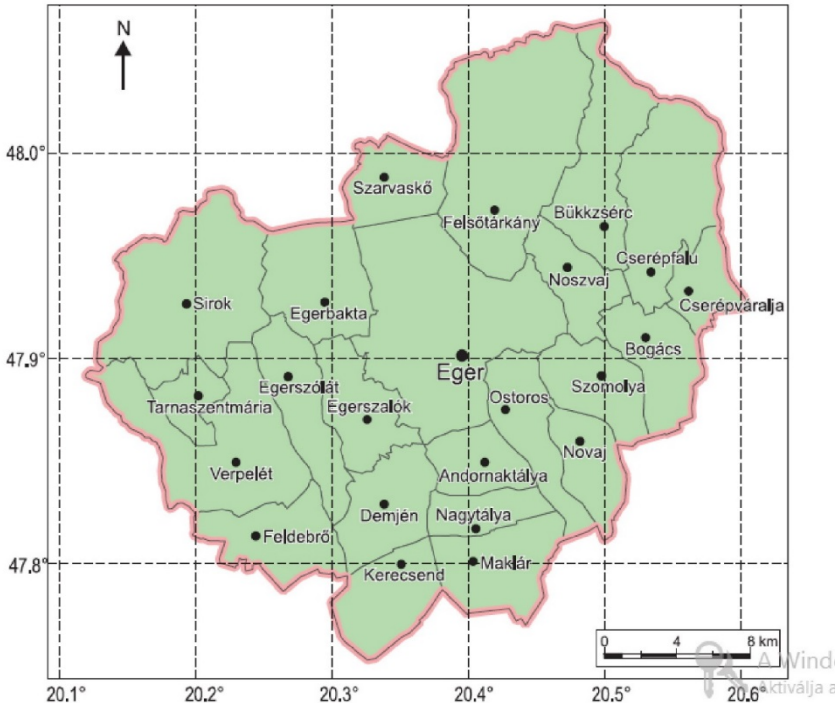


Figure 1. A map of the "Eger Energy Region" with a meteorology-purposed 0.1°×0.1° grid

Green lines represent administrative boundaries of municipalities (Mika J. et all 2014) – A useful tool of region-making?

2. A second method of RER-making can be realized through spatial planning methods. Pre-existing regions or settlements can cooperate with each other mobilizing more or less stakeholders to develop a joint action plan. This strategy may be called the "Strategic Plan" or "normative" way. Officially this document is called Sustainable Energy Action Plan (SEAP).

The Covenant of Mayors is an international initiative by the European Commission. Its main aim is to help and motivate local authorities to create and realize their own small-scale sustainable energy objectives. Settlement level must have a crucial role in CO2 level rise mitigation as according to statistics 8/10 of it can be attached to settlements. The organization has created different documents (Baseline Emission Inventory, Sustainable Energy Action Plan) playing a key role in settlement-level planning. Statements of these bills can be interpreted as reference points to followers. (http://www.covenantofmayors.eu/+-Sustainable-Energy-Action-Plans,50-+.html 2015.01.03)

The success of this initiative is proven by the high number of its claques. In 7 European countries so called "National RES Leagues" were created, additionally their international connections were institutionalized through the development of Renewable Energy Sources Champions League.

In Hungary there are two ongoing Leagues of RERs. Firstly the Solar League has been started in 2009, after 6 years of activity 120 municipalities are members of it, secondly the Hungarian Biomass League was developed in 2011.

A Hungarian NGO named ENERGIAKLUB (Energy-Club) is the focal point of them. As a main national organizer it provides information about RES best practices through workshops and information leaflets.

In Europe many municipalities try to join this program. Unfortunately many of them can't afford to realize tangible objectives, because of the lack of money and competence. An outer sphere of followers can be delineated. These quasi-members are supported through strategic, financial and technical guidance by the so-called Covenant Coordinators. (http://energiaklub.hu/node/2973 2015.01.03).

On the one hand that this European initiative can be concluded as mobilizing mainly individual settlements (towns and villages), on the other hand a Hungarian example shows its impact on a micro-regional level as well.

The so called Mecsek-Völgység-Hegyhát Association is a Hungarian LEADER local action group (LAG) comprising of 46 settlement municipalities. It was founded in 2007. In 2013 16 of the settlements decided to expand their co-operation to RES harvest. (Csanaki, 2014) At this stage this ally covers only planning and no tangible activities (e.g. development projects) were started.

3. The third method perceives existing RES as regional assets. Asset-based development methods are widespread in the U.S. and in Europe as well. (Whittam – Danson – Callaghan 2012, Nothstine 2013, ICMA 2013,) Assets are the main sources of development. Already

existing renewable energy plants are essential assets as well as the infrastructure of energy transportation. At the same time patterns of local energy demand may be conceived as assets. Additionally local communities and identities together with endemic institutions are also important factors of development. So on the one hand this method builds on existing resources and on the other hand on the institutionalization of available organizations. According to the theory of the institutionalization of regions (Paasi, 1986) territorial units are created through a long socio-economic process. In essence possible development paths committed to renewable energies are traced by these. A key factor of this method is to map assets. In Hungary data on energy plants (including RES based ones) are accurately recorded by the Hungarian Energy and Public Utility Regulatory Authority (HEPURA) (Note 2), unfortunately it doesn't contain information on heat generation. Another handicap of this system is it contains only electricity transferred to the national grid, so isolated small-grid systems are excluded.

The KÁT report contains data from 2010, 2011, 2012 and 2013, so the development of the sector can be observed in Hungary. The KÁT 2013 report was used in the analysis, as it is recently the most current data. From the database sites of individual RES based plants were retrieved, a GIS database and different thematic maps were created. From these settlements having RES based plants connected to the national grid can be seen. Based on geographical proximity groups of municipalities forming possible RERs may be determined (Figure 2).

In the next step a comparison was made between settlements in the KÁT and on the one hand (in case of rural areas) and existing LEADER LAG regions and on the other hand urban node territories. Communities of these rural and urban areas were examined through their official development plans (integrated rural and integrated urban development strategies). This method will be exposed in the next chapter. Through this step the relevance of local/regional communities and identities could be demonstrated in Hungary. Phenomena connected to regions in question are examined though the theory of the institutionalization of regions. Accordingly the first step is territorial shape. This applies to spatial localization of the region's borders and social practices to secure and identify the spatial system leading to a separate unit.

The second is the conceptual shape, where an system of symbols is created to distinguish the region from the rest. It is dedicated to raise identity towards the certain space.

The third is the institutional shape, it refers to the creation of formal institutions (mass media, education, etc), and non-formal practices.

Established role is the final stage where after the organization of the region the institutionalization could be continued either as and administrative role or as a daily communicative intercourse. This section gives the region a unique identity, which makes use of the material (nature, landscape, culture, economic system, etc.) and mental (the region's image boxes) sector.

Selected areas were analyzed through the four phases of Paasi in order to decide whether they behave as RERs.

2. Results

Renewable energy user settlements are typical in the Western Hungarian region, but can be found in Central Hungary, Northern Hungary and the Northern Great Plain regions in significant numbers as well. 116 settlements and 4 district of Budapest were processed from the KÁT report.

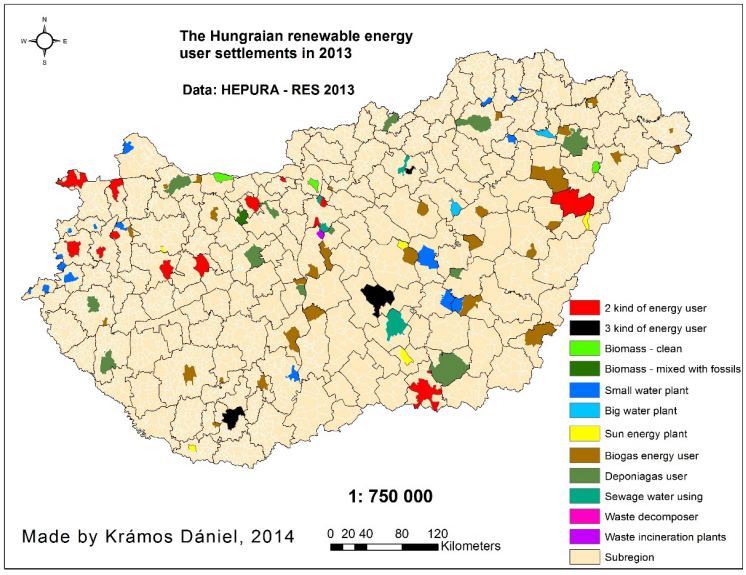
Many settlements can be characterized by a variety of RES harvest. Summarizing data in the analysis so far, the following conclusions can be made:

-According to the HEPURA's KÁT, electricity production and sales can be observed in 116 settlements.

-Several locations are also observed as being clustered in small regions.

Their characters may be summarized below as they are rare as a white crow. The first is Kecskemét, where three types of renewable energy (biogas, landfill gas, sewage gas) is harvested and sold under the KÁT scheme. The second municipality is Pécs, where sun energy plant, biomass and landfill gas are used.

Ajka harvests two types of biomass. Budapest district XXI. has wastewater and small hydroelectric power. In Szeged and Tatabánya there are biogas and deponia gas plants. In Ostffyasszonyfa wind and biogas recovery plant, in Ikervár wind and small hydroelectric power plant can be found. In Visonta and Dorog biomass and waste burning is occuring. Kapuvár has biogas utilization and small hydroelectric works. Szombathely, Veszprém, Debrecen and Sopron use landfill gas and water recovery (Figure 2).



Figures 2. Hungarian renewable energy resources user settlements in 2012

From the map the distribution of KÁT registered RES generating settlements can be declared diffused. Consequently clear RER boundaries can't be determined. Accordingly our research was extended to the relation of energy production and the location of certain local

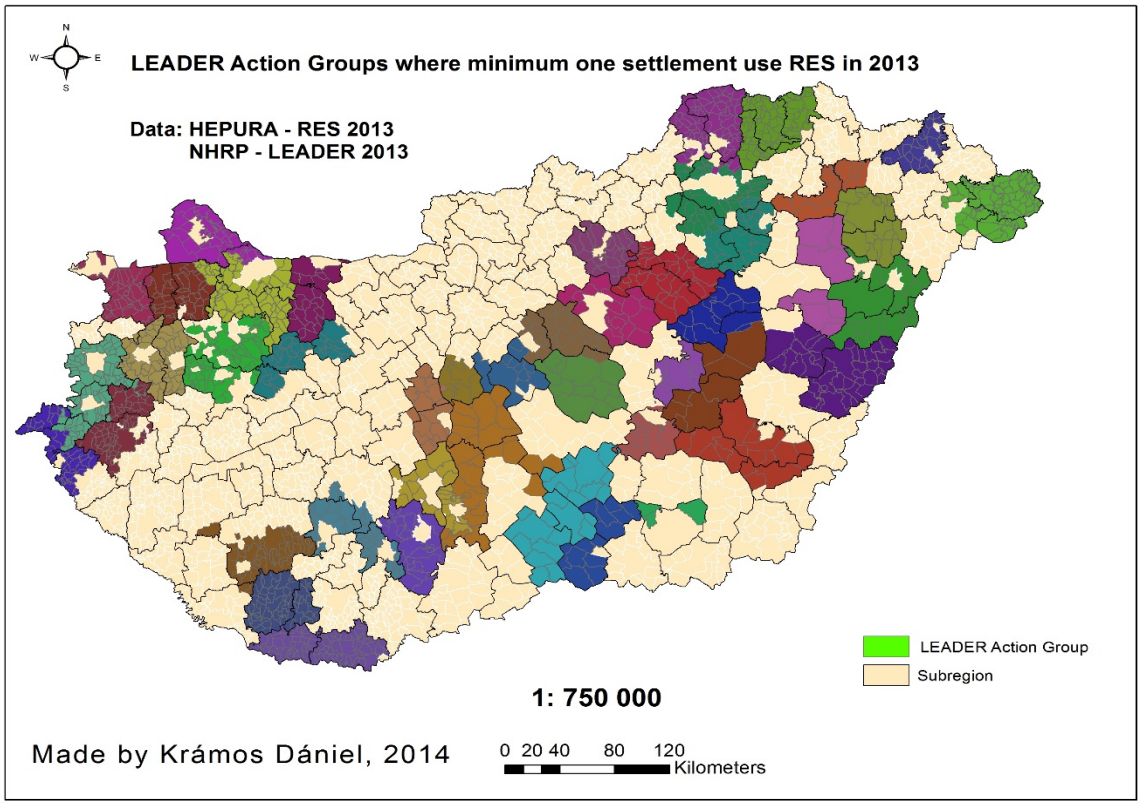
development institutions (e.g. regions).

Hereinafter Hungarian LEADER Action Groups (LAG) were analysed as regions through the theory of the institutionalization of regions. 46 LAGs were examined, they integrated 86 settlements of which, however only some could be found in the KÁT Report 2013.

Rural development as a local bottom-up process (Altieri – Masera 1993) can be a relevant concept of RES harvest. It is supposed that area of certain LEADER LAGs can be a base of RERs.

The 34 Hungarian RES harvesting settlements in KÁT are not included in any LEADER groups. (Note 3)

These areas are, of course, not considered to be RERs, since the main purpose of rural development in our country is not necessarily related to renewable energy. Accordingly the theory of the institutionalization of regions is used in order to choose from the LAGs those ones which can be declared RERs. Local integrated rural development strategies were examined to find testimonies of conscious RER development intent of communities.



Figeure 3. LEADER LAGs having at least one renewable energy seller settlement in Hungary (2013)

Based on Paasi's theory the first stage is territorial shape. The German regional energy system, puts an emphasis on sub-regional level such as "Landkreis" or LAG etc. In our case, we talk about LEADER LAGs, so that each organization fits to the German model. In the

investigation of symbolic form, we have found that symbolism (Note 4) of the following organizations foreshadows RES harvest:

- Alpokalja-Ikvamente Leader Egyesület (Note 5)

- A BAKONYÉRT Vidékfejlesztési Akciócsoport Egyesület.

- Bakonyalja-Kisalföld kapuja Vidékfejlesztési Egyesület.

- Bükk-Térségi LEADER Egyesület.

- Őrség Határok Nélkül Egyesület.

- Pannónia Kincse LEADER Egyesület.

- Sághegy Leader Egyesület.

- Szigetköz- Mosoni-sík LEADER Egyesület.

In the third phase (institutional shape) based on the German system all 7 (see above) LAGs can be seen as RERs. The last phase of the region's development is the integration of the spatial unit into the system of regions and the birth of social consciousness and regional identity. Here the objects of observation were measures, objectives, and patterns of resource allocation made by LAGs. The text of development strategies were analysed to find expressions relating to them. (Table 1.) The document analysis was based on the following questions:

- Is there any reference in the document on renewable energy?

- Were RES mentioned in the analysis phase?

- Were existing KÁT-registered RES plant mentioned in it the programming documents?

- Is there a declared objective for RES harvest?

- Are there any priorities/measures containing RES harvest in the document?

- Were there some development financed RES-based projects?

Table 1. Institutilatization of Hungarian RERs (2014)

LAGs name	Territorial shape	Symbolic	Institution	Establish role
Alpokalja-Ikvamente Leader Egyesület	+	+	+	+
A BAKONYÉRT Vidékfejlesztési Akciócsoport Egyesület	+	+	+	+
Bakonyalja-Kisalföld kapuja Vidékfejlesztési	+	+	+	+

Egyesület				
Bükk-Térségi LEADER Egyesület	+	+	+	+
Őrség Határok Nélkül Egyesület	+	+	+	-
Pannónia Kincse LEADER Egyesület	+	+	+	-
Sághegy Leader Egyesület	+	+	+	-
Szigetköz-Mosoni-sík LEADER Egyesület	+	+	+	+

Database: Local Rural development Strategy of LAGs

We may conclude that according to the theory of the institutionalization of regions the following five LAGs can be called RER-type in Hungary:

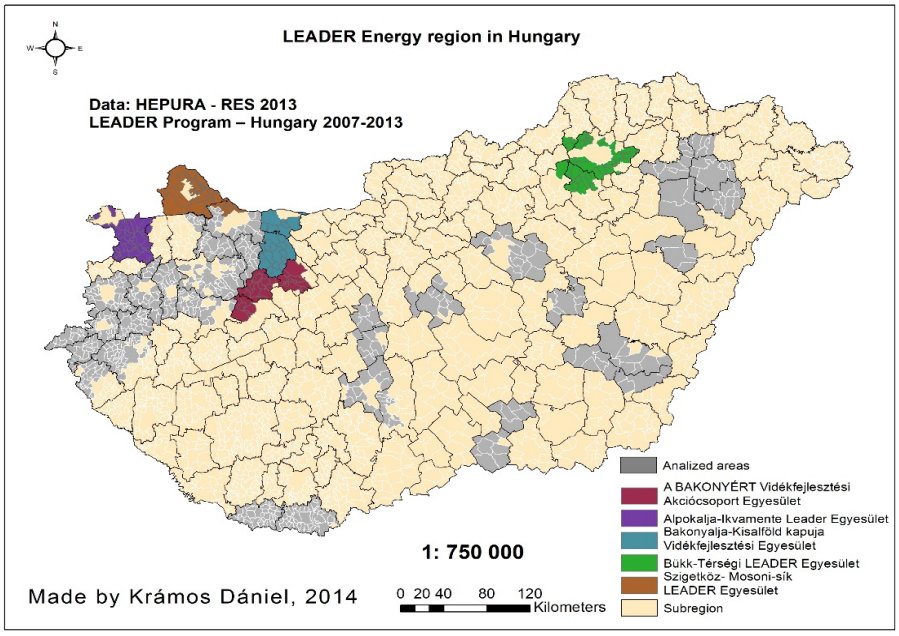
- Alpokalja-Ikvamente Leader Egyesület.

- A BAKONYÉRT Vidékfejlesztési Akciócsoport Egyesület.

- Bakonyalja-Kisalföld kapuja Vidékfejlesztési Egyesület.

- Bükk-Térségi LEADER Egyesület.

- Szigetköz- Mosoni-sík LEADER Egyesület.

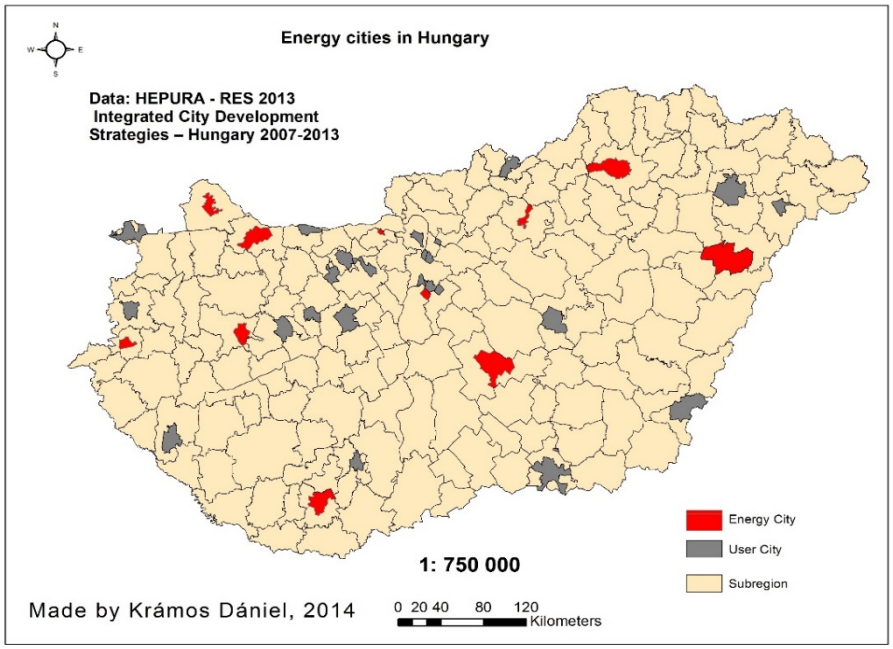


Figures 4. LEADER Program based potential energy regions in Hungary in 2013

In case of urban nodes Integrated Urban Development Strategies (IVS) were analysed though almost the same methodology. One surplus factor was integrated into research relating to this spatial type as urban nodes should attract their surroundings. Cities must create their integrated development plans beyond their administrative boundaries. Presumably this agglomeration effect can be crucial to become a real Energy City.

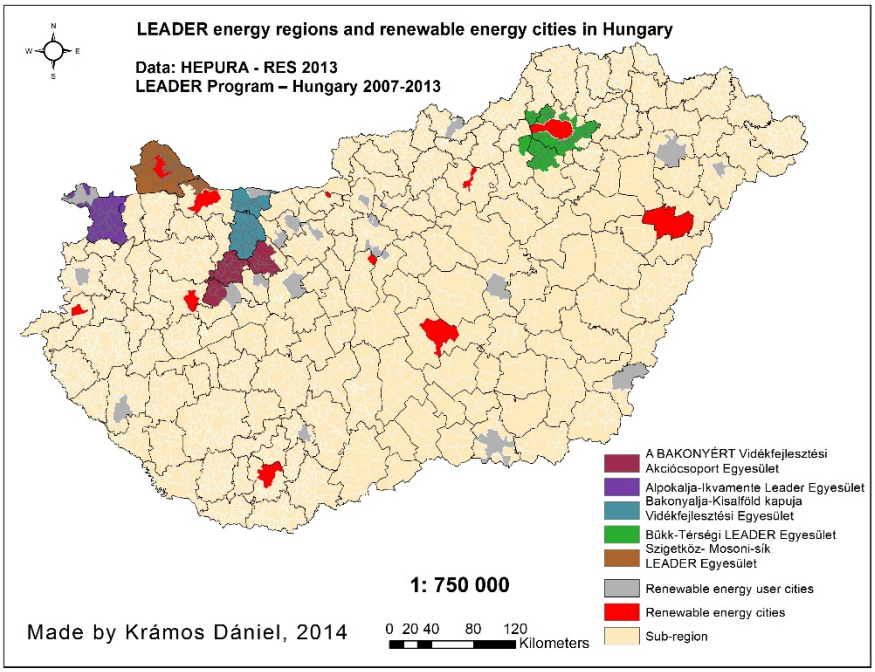
The following Hungarian settlements can be declared Renewable Energy Cities on the basis of our analysis (Figure 5):

- Győr.
- Ajka.
- Debrecen.
- Kecskemét.
- Körmend.
- Pécs.
- Dorog.
- Dunaharaszti.
- Gyöngyös.
- Miskolc.
- Mosonmagyaróvár.



Figures 5. Renewable energy cities in Hungary in 2013

Comparing map of RERs with that of Energy Cities in Hungary we may conclude that urban and rural renewable energy areas complement each other. Holes in rural RERs can be closed by neighbouring cities. For example the LAGs of "Bükk Térsége Leader Egyesület" and "Szigetköz- Mosoni-sík LEADER Egyesület" with their big urban nodes in the centre could be complex renewable energy co-operations. Unfortunately larger settlements are not eligible for rural development programmes (LEADER), but a common planning process would be useful for future RES harvesting plans. (Figure 6)



Figures 6. Renewable energy cities and energy regions in Hungary in 2013

4. Conclusions

In our article we examined the creation of possible RERs through three modes. Firstly basic-research-based RER-creation was compassed. It is currently applied in Hungary only one region (Eger Energy Region) and is mainly based on the German RER research system. Secondly SEAP planning method was described. In Hungary also one small area can be found to use it.

Finally a complex method was created based on some key concepts such as asset-based development and the institutionalization of regions. On the one hand emphasis was put on rural areas (LEADER LAGs). According to the German reference system LEADER areas are viable RERs as sub-regional entities. From among Hungarian LAGs through their symbolic shape we have picked those ones which use RES-related idioms or visual codes. As a result only a limited number of LAGs could be separated. In the established role of all remaining LEADER groups we could indicate points referring to RES harvesting (in objectives, priorities and financial allocation).

Interesting issue is the combination of rural RERs with Renewable Energy Cities. Obviously each region should begin to organize, taking into account their own resources and capabilities. And beyond the planning stage, the production of energy, realization of investments can follow it.

The three methods can be used together in combination and can also be used separately, examples both can be found in the EU. All regional organizations can choose any of above mentioned methods. Our objective was to introduce these methods for the wide public.

The overall conclusion is that in Hungary the system of RERs has also begun to develop without any national level control and financial aid system. Due to the fact that in Germany a whole system of institutions has been set up to support and develop the energy regions, it could be important even without the creation of institutions at least the separation of funds for this issue for the period 2014-2020 in Hungary.

Acknowledgements

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Notes

Note 1. KÁT: Kötelező Átvételi rendszer - Feed-in system: a price-driven operational support system, in which electricity producers - subject to certain conditions-to sell electricity generated at a predetermined feed.

Note 2. The Hungarian Energy and Public Utility Regulatory Authority operates a compulsory feed-in system called „Kötelező Átvételi Rendszer" (KÁT).

Note 3. The Hungarian LEADER LAG database is located in the website of the New Hungary Rural Development Programme where you can search for specific action groups on the basis of information and contact details of settlements. (http://www.umvp.eu/?q=leader 2014.01.14).

Note 4. In this case website of LAGs were exmined, contents of logo, banner etc. and symbolic of the local development plans were also taken into consideration.

Note 5. Egyesület = Assocation (legal form of Hungarian NGO).

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