# Urban Batteries - The energy potential of small urban and rural settlements in the region of Vojvodina

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## Introduction

This paper discusses possibilities of applying the principles of energy efficiency in creating new and regenerating existing settlements in Vojvodina, especially smaller urban and rural units, as well as ways of linking them into active, productive and networked energy systems. The main tasks for sustainable energy systems of networked villages, seen from the urban planners and architects point of view, would be their inclusion in the network of energy-active settlements which are not only "viable", ie. not only do they meet the needs of its own spending but are also able to distribute the output to the larger urban units, which have regional or global significance.

This concept positions the principles of energy efficiency and energy active role in the group the most important principles in planning process of the development strategy of urban and regional development of Serbia and Vojvodina. It is therefore necessary to pay attention to the characteristics of built form, economic and cultural patterns of smaller urban and rural areas in order to obtain a realistic picture of the potential for a future optimization and networking. Also, it is necessary to educate planners and architects about the functioning principles of active and passive energy systems networks, technology and their networking capabilities and compliance.

Comprehensive analysis, ie. examination of strengths, weaknesses, opportunities and threats is therefore an initial step in forming the strategy of energy efficiency settlements and geographic region of Vojvodina. This would be the baseline for future concepts of spatial and urban planning and design of its smaller urban and rural units.

## Vojvodina- geographic location, cities and climate

The Autonomous Province of Vojvodina is the northern part of Serbia, a state which is located in southeastern Europe and the western part of the Balkan Peninsula. It is located in the southern part of the Pannonian basin and as such is a natural bridge between Central and Western Europe on the one hand, the Balkans and the Middle East on the other side. AP Vojvodina is an autonomous province of Serbia and covers a territory of 21,506 km2 (24.34% of Serbia). According to the 2002 census. vol. Vojvodina is inhabited by 2,031,992 inhabitants. The capital of Vojvodina, Novi Sad, which also has the largest population

(215,659), while other major cities of Vojvodina: Subotica (99,471), Zrenjanin (79,545), Pancevo (76,110), Sombor (50,950), Kikinda (41,825) Sremska Mitrovica (39,041), Vrsac (36,001), Ruma (32,125), Backa Palanka (29,431), Indjija (26,244), Vrbas (25,887) Novalja (25,703), Senta (20,363), Tower (19,293), Apatin (19,289) and Temerin (19,143) (FTN, 2008). Vojvodina climate is temperate continental with some specifics. In Vojvodina, the summers hot and winters are cold, and spring and fall of short duration. Summer temperatures average between 21°C and 23°C, and winters average around -2°C. Extreme temperatures, however, can be very large, so the difference between the highest and lowest temperatures used were 70°C and higher degrees (FTN, 2008).

Vojvodina has a variety of potential energy, especially solar, wind and geothermal energy. It is believed that Serbia has the potential to annually produce from renewable sources by 4,89 million toe (tonne of oil equivalent). If we bear in mind that domestic energy production in 2007. amounted to 8,79 million toe, it can be concluded that the Serbian half of primary energy could generate from renewable sources (Ministarstvo rudarstva i energetike, 2005).

Annually from renewable sources 0,86 million toe is produced, which means that the exploitation is only 18% of the total potential. It is almost entirely related to the production of electricity in large power plants (installed capacity over 10 MW).

Solar potential annual average value of the global energy radiation on the territory of Vojvodina is 1,300 kWh/m²/year. By comparison, the average value in Europe is 1,000 kWh /m²/year, while the average in the Middle East 1,800 kWh/m²/year. Although a significant potential for solar energy, economic factors have not been favorable.

As for wind energy, previous research showed that there are suitable sites for building wind generators in Serbia, on which the approximate 1,300 MW of wind generating capacity could be installed, reaching annual production of 2,300 GWh of electricity. One of the three best national sites for the use of wind energy is Vojvodina. It covers approximately 2000 km2 and is specially suitable for the construction of wind generators due to already available road infrastructure, utility grids, small distance from large power consumers etc.

#### Urbo- morphological characteristics of small towns and villages in Vojvodina

Vojvodina is different from other parts of Serbia in two ways: geographically and historically. It is a vast plain without many forests, except along the watercourses, so the influence of steppe-continental climate, with soil composed mostly of loess deposits is suitable for intensive agriculture.

Historically, Vojvodina has always been under the dominant influence of Central Europe, unlike other parts of Serbia that had Byzantine and Ottoman empires as their main cultural denominator. At times, these empires managed to reach Sava and Danube rivers in their

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conquests, but were rarely able to cross them, usually deciding eather to keep the rivers as the border or go to the other side. Therefore, the Ottoman ruledom in Vojvodina lasted for much shorter time than in the rest of Serbia. After the departure of Ottomans and under Austro-Hungarian rule, Vojvodina becomes the area of mixing and co-existence of many people of different origin whose cultural forms intersect. This will form the unique background for development of specific architecture and neighborhoods. The typical form of settlement during the Ottoman rule (1526-1699) was the so-called broken type characterized by low density and irregular matrix with winding streets that had no clearly defined hierarchy. This settlements could be described as temporary, as they were formed by the people migrating from central Serbia to the territories that were not under the direct Ottoman invasion. These settlements didn't have very organized pattern, as people were constantly on the move without intentions to set their roots there. Furthermore, the housing models that they introduced carried the logic of mountain settlements and had no meaningful consideration to the conditions in the plains of Vojvodina.

The shift from Ottoman to Austro-Hungarian rule changed the ways of life and the ways of forming the settlements. With the introduction of cadastre and measuring and filing the land, the conditions for planned reorganization of the settlements were established. According to its characteristics, this urban matrix belongs to the "ideal city" school of thought that prevailed in urban planning in the late seventeenth and the beginning of the eighteenth century (Kojić 1973, 182). In this model, settlements are firstly conceived as compact forms with high densities, and then the orthogonal matrix with a rectangular street lots, wide streets and canals for draining surface water are introduced. The matrix is organized with a clear hierarchy, with two major perpendicular streets. The center of the settlement is usually on the intersection of these streets. In some cases the center is accented by an extended square and sometimes it differs from other intersections by important buildings surrounding it. Dimensions of the blocks depend on the depth of the yard, and range between 200meters and 300meters in width and between 200 meters and 500 meters in length. (*Ibid.*)

Buildings are regularly and uniformly set to the street as follows: the main house lies on the border with neighbor and with forefront on the regulative line, behind is the string of barns, garages and other agricultural buildings. On the opposite side, to the border with the other neighbor there are usually storages for corn and hay. In bigger yards small apartment building can be found on this side. The main house is of longitudinal shape with a linear functional organization. The main part of the house consists of three departments (the entrance with the fireplace flanked with two side rooms) and a porch. The whole longitudinal side is always facing the sun. This spatial model that developed during the nineteenth

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century is generally held to date, with additional longitudinal development caused by increase in the number of rooms.

#### The concept of "Urban Batteries"

The concept of "Urban Batteries" primarily emphasizes the role and importance of small settlements in future development of city networks, in which small towns use their potential in terms of energy and food production. Although it is often considered that agriculture should be considered separately from urban development or even as an opposite process and furthermore that the "rural" development is needed in order to reduce rural-urban migration, successful development of rural settlements has proven to increase these migrations, because as the income from agriculture grows, demands for goods and services from urban centers in these areas also increases. Many cities have developed as centers of trade and services. In Vojvodina, a large number of smaller settlements still have a significant share of their economies owing to the agricultural sector. All urban centers rely on the services of rural ecosystems (Bicknell 2009, 18). The energy potential of small settlements in Vojvodina can be identified on two levels:

(I) *macro-urban level* that considers the position of the settlements within the system of networks, both networks of energy production as well as networks of cities and their economies. Network of cities in Vojvodina is balanced due to evenly distributed large and small urban centers. Clusters and city networks are formed on bigger spatial wholes between cities that are collaborating or have complementary functions. They are the basis for the development and activation of the local resources that individual cities have. Some clusters have already been created in Serbia, Vojvodina region being the leading one with its cities and towns that have or may take the role of "development engines" such as Novi Sad, Subotica, Sombor, Sremska Mitrovica, Pancevo, Zrenjanin, Kikinda, Vrsac (Prostorni Plan RS 2009, 147).

(II) *micro-urban level*, on which the exact features of energy-efficient urban form can be discussed. In these features, some of the main concepts of sustainable urban form can be recognized. Firstly, the compact pattern and density (of built structure, of habitants and activities), which can significantly reduce energy use primarily for transport. Secondly, the appropriate urban morphology of households for the introduction of renewable energy systems. Thirdly, form and size of the lot, location and form of the houses, greenery, good orientation to the sun and the predominantly agricultural-oriented activities. (Jabereen 2006, 39) A particularly important feature of these places are cultural patterns of the population that make it a special combination of activities related to agriculture on the one hand (that is still

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directly based on the natural environment which exists in the built environment), and the dependence and strong ties with the nearest town and the activities of trade, services, administration and culture on the other hand. This "hybrid" form makes people already preadapted to new concepts of sustainable energy production and the vital role of agriculture in the future urban development.

### Conclusion

The future of small villages in Vojvodina is primarily determined by the direction of further development of major urban areas, which are burdened by the following problems on the national level: (a) insufficient control and poorly directed processes of urbanization and spatial imbalances, (b) suburbanisation, (c) The syndrome of "free lancer", (d) insufficient competition between cities, (e) insufficient recognition and use of its own comparative advantages, (f) underdeveloped cities and urban areas with severe developmental problems, and (g) lack of knowledge or reluctance in accepting the doctrine of sustainability. (Bajić Brković 2010, 13-48) It is therefore essential to adopt a comprehensive and coordinated strategy for the development of cities and urban areas on the national, regional and local levels. It is necessary to seriously consider the role and potential of small urban and rural units in the energy sustainable functioning of major urban systems. Thanks to its characteristics that are presented in this paper in the form of macro and micro-urban levels, smaller urban and rural settlements in Vojvodina have the opportunity to introduce energyefficient technology for their needs without having to implement drastic measures and in the same time have the opportunity to become active contributors within the smart energy systems and agricultural production.

#### References

Bajić Brković, Milica (2010), 'Ka održivom razvoju gradova u Srbiji, in Bajić Brković, M. (ed.) *Kreativne strategije održivog razvoja u Srbiji*, 13-48. Beograd: Arhitektonski fakultet.

Bicknell, Jane, Dodman, David, & Satterthwaite, David (Eds.) (2009), *Adapting Cities to Climate Change*, London: Earthscan.

FTN Novi Sad (2008), Atlas vetrova AP Vojvodine- studija, Novi Sad: Izvršno veće AP Vojvodine.

Jabareen, Yosef R. (2006), Sustainable Urban Forms - Their Typologies, Models, and Concepts. *Journal of Planning Education and Research*, 26:38-52.

Kojić, Branislav (1973), Seoska arhitektura i rurizam, Beograd: Građevinska knjiga.

Ministarstvo životne sredine i prostornog planiranja RS (2009), *Prostorni plan Republike Srbije*, Beograd.

Ministarstvo rudarstva i energetike RS (2005), Strategija razvoja energetike u RS, Beograd.