

THE ENER-SUPPLY PROJECT AND PRELIMINARY ANALYSIS OF THE STATE-OF-THE-ART AND THE ACTION PLAN FOR RES POTENTIAL MAP BUILDING

PROJEKAT ENER-SUPLAJ I PRELIMINARNA ANALIZA STANJA I AKCIONI PLAN ZA IZRADU MAPA OBNOVLJIVIH IZVORA U VOJVODINI

Maša BUKUROV, Siniša BIKIĆ

*Faculty of Technical Sciences, 21000 Novi Sad, Trg Dositeja Obradovića 6, Serbia
e-mail: mbukurov@uns.ac.rs*

ABSTRACT

According to the Serbian energy strategy implementation in the field of renewable energy sources for the period 2006-2010 and its implementation until 2015, will be created conditions for new jobs what requires big and fast changes and actions at the local level with a help of authorities at national and local level. Project Ener-Supply should assist the local authorities in these actions, particularly in relation to the utilization of renewable energy sources (RES) and the implementation of energy efficiency (EE) measures. The project Ener-Supply is financed by the South-East Europe Transnational Cooperation Programme of European Union. The target of the project in Serbia is AP Vojvodina. Here is presented an analysis of the state of the art and action plan for RES map building in Vojvodina and legal framework and strategies at national and local level as well as available RES studies. Also is presented planned implementation of RES projects with SWOT analyses.

Key words: RES, RES potential map.

REZIME

Implementacijom strategije razvoja energetike u Srbiji u oblasti obnovljivih izvora energije za period od 2006. do 2010. i njenim sprovođenjem do 2015, predviđeno je da se stvore uslovi za otvaranje novih radnih mesta zbog čega je potrebno sprovesti velike i brze promene i aktivnosti na lokalnom nivou uz pomoć organa vlasti na nacionalnom i lokalnom nivou. Projekat Ener-Suplaj treba da pomogne lokalnim vlastima u ovim akcijama, posebno u pogledu korišćenje obnovljivih izvora energije (OIE) i mera energetske efikasnosti (EE). Projekat Ener-Suplaj finansira se iz fonda Evropske unije - Transnacionalni program saradnje Jugoistočne Evrope. U ovom radu su predstavljani pravni okviri i strategija na nacionalnom i lokalnom nivou, kao i dostupne studije OIE. Takođe su predstavljene planirane primene projekata OIE sa SVOT analizom.

Ključne reči: OIE, mape potencijala OIE.

INTRODUCTION

According to the Serbian energy strategy implementation in the field of renewable energy sources for the period 2006-2010 and its implementation until 2015, conditions for employment of 24,000 workers will be created; 4000 workers to maintain the newly built plants, 17,000 workers in the design and manufacturing facilities and 3,000 employees in associated activities. But in order to achieve these figures it is necessary to make a big and fast changes and actions at the local level with a help of authorities at national and local level. Project Ener-Supply should assist the local authorities in these actions, particularly in relation to the utilization of renewable energy sources (RES) and the implementation of energy efficiency (EE) measures. The project Ener-Supply is financed by the South-East Europe Transnational Cooperation Programme of European Union. There are 14 participants in the project from 11 countries, led by the Municipality of Potenza, Italy, making an effort to improve use and production of energy, apply good planning, employ appropriate management methods and improve energy balances of the countries. The project started in April 2009 and will finish in March 2012.

The target of the project in Serbia is AP Vojvodina. In this paper is presented an analysis of the state of the art and action plan for RES map building in Vojvodina. In order to improve utilization of renewables it is necessary to have proper information of situation. Vojvodina is a region in which a dominant place in the total energy balance, takes electricity with 38.4%,

followed by refined petroleum products with 33.5% and natural gas with 26.0% (estimated for 2007). The share of coal was insignificant (2.1%), and the share of renewable sources is so small that it is practically zero in the balance. In addition, the dependence of Vojvodina from outside sources of energy is high: 95.8% of electricity is transported from sources outside the Autonomous Province of Vojvodina, 91.8% of the natural gas consumed in the Autonomous Province of Vojvodina is imported from Russia, 72.0% of coal is imported or transported outside the territory of AP Vojvodina and 56.1% of oil imported meet the demand in the province.

MATERIAL AND METHOD

Vojvodina is a region highly dependant from outside sources of energy. Therefore, provincial government has established four basic strategic direction of energy development in Vojvodina in the following period (Implementation Program of the Energy Strategy of the Republic of Serbia in the AP Vojvodina, 2009):

- Construction and reconstruction of energy facilities for the production electricity of higher power and thermal energy,
- Increased production of crude oil and natural gas through concessions in the country and from abroad
- Increase energy efficiency in all energy sectors,
- A significant increase in the combined use of renewable energy sources.

Project Ener-Supply complies with these goals and could help building capacities to intensify RES usage and application of EMS. One of the goal of the project is building RES poten-

tials map which would improve presentation of municipalities to attract interested investors in the field of RES energy production.

GIS Maps

In order to make RES potential maps, it is necessary to create a base for such actions - GIS maps. Serbia is not covered with GIS maps. Making GIS maps requires time and money and above all political will. It is not likely that this task will be completed soon. To make GIS maps a lot of data are required, like: administrative boundaries, altimetry, land ownership, hydrology, geodesy, satellite images, land use, farmland, forest areas, roads, urban areas, industrial areas, energy consumption, demography, flood zones and other data. Biomass potential maps require more or less all of these data. Due to limited resources, in the frame of Ener-Supply project will be completed wind potential maps for two municipalities: Titel and Zabalj. In this case the task is not so demanding. Data needed for these maps are: longitude, latitude and altitude, beside meteorological data which are, all together, processed in WASP software.

RES legal framework and strategies in Vojvodina, Serbia

The new legal framework of Serbia in the field of energy, and thus in the field of renewable energy sources, was established by passing the Law on Energy (*Law on Energy, 2004*), but the by-laws but have not yet been made. It is expected that the new law for rational utilization of energy will be adopted this year. In order to promote use of renewable energy sources, Law on Energy stipulates the possibility that manufacturers who produce electric or thermal energy from renewable energy sources can acquire the status of privileged power producers (article 84 of the Law on Energy), and preferential producers of thermal energy (Article 139 of the Law on Energy). For the privileged producers of energy the Law predicted subsidies, tax reduction, customs and other facilities, in accordance with law and regulations governing taxation, customs and other duties, and subsidies and other incentive measures. By adopting Decree on measures of incentives for the production of electricity using renewable energy sources (*2009*) was created a legal framework for the introduction of the organized system of incentives for the production of electricity from renewable sources that exist across Europe, such as for example a system of privileged tariffs (feed-in tariff). Still, vague propositions do not help create the market conditions neither encourage investments in renewable energy projects. In addition, procedures for obtaining permits to install facilities for the production of energy from renewable sources are very complicated.

Main indicators of agricultural enterprises, financial result and financial position in Vojvodina and their negative net financial result (*Vukoje, 2009*) show that introduction of energy production is the necessity for an agricultural plant. There is a significant awareness about the use of biomass as a fuel, eg. from fruit processing residues (*Đević et al., 2008*), fruit and grapevine pruning residues (*Radojević et al., 2007*) growing energy crops, trees or oil plants (*Jovanovska and Jovanovski, 2009*) or from agricultural by-products (*Dakić, et al., 2009*). Utilization of remains of farming and forestry production for energy purposes can be used both for meeting energy needs and as an important manner of deploying such wastes. The competent authorities of the provincial government should certainly in their perspective domains coordinate the action and make utilization of biomass in the AP Vojvodina become fully affirmed in the period until 2012. This implies building and adoption of a long term plan which will involve: education and promotion, construction of

demonstration plants, selection and favoring highly energy efficient equipment, research and affirmation of biomass for co-generation, subsidies and provision of loans for the implementation of projects fulfilling the established criteria and a variety of other program activities. It will be also necessary to stimulate cultivation of energy plants at formerly untilled and desolate areas.

Bio-fuels along with the biomass are certainly the second largest potential relevant to overall significance in the utilization of renewable sources of energy in the AP Vojvodina and affirmation of their use should be prioritized. According to some authors (*Tešić et al., 2009*) the largest share of potential areas for biodiesel raw materials production is located in central Serbia, not in Vojvodina, since 20% of arable land is already covered with oilseed crops. The interest in maize as an ethanol producing plant has been expanding recently (*Radosavljević, 2007; Radosavljević et al., 2009*). Experience from our neighboring countries should also be taken in consideration, especially from Hungaria (*Lakner et al., 2008; Beszedes et al., 2009*), since both Vojvodina and Hungaria have similar opportunities considering biomass potential.

Geothermal potential in the AP Vojvodina is not large but it is attractive especially for agricultural purposes (*Mitić et al., 2007*) and suitable for small users and because of that it should have a deserved position in local energy balances.

Although photovoltaic is not the subject in the Ener-Supply Project, it must be taken into account when it comes to integrating energy production in an agricultural plant. Photovoltaic systems can be freely applied in Vojvodina, since irradiation is quite sufficient (*Čorba et al., 2009*).

Until 2012, it is planned to construct wind generators with the total power of 250 MW and annual production of around 450 GWh/a (about 5,7% of the today's electrical energy consumption). Based on formerly prepared studies in the regions of south and southeast Banat, the annual average wind velocity at the height of 100 m is 5 - 6 m/s, i.e., over 6 m/s, whereas in the remaining parts of Vojvodina, this speed varies from 4,5 - 5 m/s. At the height of 200 m, almost 35% of the territory of Vojvodina (southeast) has average wind velocity exceeding 6 m/s, whereas the remaining parts have velocities of 5 - 6 m/s (*Katić, 2008*). These potentials fall in the class 3 (yellow color in the EU classification with the 1-5 color code), and can be assessed as good (substantial) thus, providing grounds for more intensive construction of wind generators.

Increasing the share of small hydropower plants in the overall production of electrical energy is a general preference of the world's energy policy and professional public and it has an important position in energy plans of all progressive economies. The EU gives special importance to this potential. It is necessary to establish overall technically usable potential and proceed with the construction hydro power plants for deploying economically utilizable potential at this moment. The remaining potential should be protected against unplanned construction which can make it worthless as economically utilizable category varies in time. The largest potential of the hydro system the Danube - Tisa - Danube, where small hydropower plants will be built within the existing sluices (including also the dam on the Tisa) as there are already constructed steps. The primary functions of the hydro system would still be the priority but "forced" operations could be applied for the purpose of increasing hydro-energy potential. According to surveys up to now, it will be possible to construct 13 hydropower plants with the aggregate power of 20,2 MW and annual average production of 90,7 GWh (about 1,2 % of the today's consumption of electrical energy). The use of hydro energy potentials will generate other benefits such as increased

flow in the canal network (important from the aspect of environment protection) and dual function of some hydro power plants (pumps- turbines) (*Cadastré of small hydropower plants in Vojvodina, 1989*).

Available RES data sources

Existing RES data are mainly in paper format, only few are in raw electronic form. A lot of different studies has been conducted containing necessary data. These studies are free and most of them are on-line. Most of the data are several years old. In some cases it can be a problem. Data should be relevant especially those presented in strategies, studies, programme documents, since they were presented in public, are available to the public, financed by government, signed by experts.

Here are some of the available sources of data: National Sustainable Development Strategy, 2007; Study on Potentials and possibilities of briquetting and pelletizing of waste biomass in the territory Province of Vojvodina (*Brkić et al., 2007*), Study: "Possibilities for utilization of energy potentials of Geothermal waters in Vojvodina" (*Bašić, 2005a*), Study: "Utilization of energy potentials of the geothermal water drill in Bečej for energy requirements of local consumers" (*Bašić, 2005c*), Study: "Research and defining geothermal potential in the area of Indija and possibilities for different purposes" (*Bašić, 2006*), Study: "Wind atlas of Vojvodina" (*Katić, 2008*), Study: "Estimated wind speed on selected locations" (*Rajković and Popov, 2005*), Study: "Cadastré of small hydropower plants in Vojvodina" (*1989*), Action plan for Biomass (*2010*).

The Study "Wind Atlas of AP Vojvodina" (*Katić, 2008*) as a part of the analysis of the possibilities of utilization of renewable energy sources in the Autonomous Province of Vojvodina prepared map of the winds of Vojvodina. It is based on data from a number of regular measurements of hydro - meteorological stations in Vojvodina (in the study are used data of RHMS, collected from 8 major meteorological stations (GMS) placed in Vojvodina Novi Sad (Rimski Šančevi), Palić, Sombor, Zrenjanin, Sremska Mitrovica, Kikinda, Vršac and Banatski Karlovac, also the data of available specific wind speed measurements conducted at several locations in Vojvodina (Sombor, Kikinda, Novi Sad - R.Šančevi and Sr. Mitrovica) in 2007. under the auspices of the Council for renewable energy sources as well as by application of verified software WASP (Wind Atlas Analysis and Application Program).

The final results of the study show that Vojvodina is rich in quality winds, especially at heights over 50 m above the ground, especially over 100 m above the ground, which corresponds to modern wind turbines of 2-5 MW in power. Particularly is interesting southern and southeastern region of Banat, where the full exploitation of wind energy is economically viable (mean annual wind speed over 6 m/s).

The small-scale study "The possibilities of using geothermal water energy potential in Vojvodina" (*Bašić et al., 2005b*) contains: geothermal potential of Vojvodina, the overall picture of significant and relevant characteristics of geothermal waters in Vojvodina, the use of geothermal energy, the actual drilling and energy prices, advanced technology for the use of geothermal energy, economic assessment and scheme preparation system, transformation and use of thermal energy and water resources exploitation integrated GTW scheme. In the study is pointed out that in the territory of Vojvodina, were explored quite thoroughly hydrothermal water drilling at 75 sites of which 65 were active. Also, quite a large number of holes, i.e. 27 of them are technically equipped for the exploitation of hydrothermal systems, and only 15 sources were used or are in use now. Thus, this region belongs to the European continent explored areas, and its resources can be discussed safely enough.

It is also stated that resources, explored from the standpoint of energy, are modest, especially in terms of temperature of geothermal water on the blaze. There are only a few with over 60°C at depths around 1,000 m, and only 3 were between 70 and 82°C. It is unlikely that further exploration and drilling sets would give a higher temperature potential. Therefore, all potential is below 90°C, which is the generally accepted threshold in Lindal's diagram for use in the production of mechanical (electrical) energy using still rare binary plant and well below 150 °C for use in conventional power plants.

The study "Possibilities of CHP from biomass in Vojvodina" (*Martinov et al., 2008*) aimed to examine the technology of cogeneration based on biomass and assess its maturity for application in practice, to assess the potential of biomass for cogeneration in Vojvodina, to define the limits and barriers, to give the basis for economic evaluation of CHP plants, to give guidance for introduction of incentives and legal measures aimed to achieve optimum conditions for use in Vojvodina, to perceive the possibility of European and other funds for the construction of CHP plants using biomass, above all demonstration ones, as well as to reach the good basis for making plans in this field in Vojvodina. It includes a review of the potential of biomass for cogeneration in Vojvodina, perspective of biomass application for cogeneration and potential incentive funds.

The conclusions of the study states that the most important potential of biomass for combined production of electricity and thermal energy in Vojvodina are remains of agriculture, in small and medium-sized farms. Current potential for CHP are estimated to cca. 229 GWh of electricity and 510 GWh of heat annually. If the collection of maize of early hybrids were improved, production of fast-growing forests introduced and other technologies for collection of plant remains improved, as well as procedures for cogeneration, the potential would be increased to 640 GWh electricity and 1480 GWh of heat annually in 2020. The construction of electrical plants that would use biomass as fuel in the case of giving full priority to production of electricity would be an alternative. Three plants, with individual power of 15 MW_{el} per year would produce about 320 GWh of electrical energy, using about 250,000 tons of plant remains, mainly straw. Potential of biogas production in pig and cattle farms in Vojvodina is about 9.5 x 10⁶ m³/a. The total possible amount of produced electricity, from these farms is about 20 GWh per year, and heat about 8 GWh.

RESULTS AND DISCUSSION

SWOT analyses of RES

Strength

- Favorable legal framework for the use of RES,
- The existence of different plans and feasibility studies for the use of RES,
- Vojvodina has a significant amount of biomass
- Biogas is an important potential source of energy in Vojvodina
- In Vojvodina there are adequate resources of geothermal energy
- Availability of wind energy in some areas of Vojvodina provides the preconditions for investment,
- There are plans to build a small hydro power plant on the canal network DTD
- Solar irradiation is quite favorable for the Vojvodina region,

Weaknesses

- Vojvodina hydro power resources are very modest,
- A small range of altitude for the use of hydropower,

- Production of wood biomass in Vojvodina is carried out to only 6.5% of the territory,
- Seasonal characteristics of the demand for energy,
- A relatively small volume of demand for el. energy per capita, and per unit of national income,
- Energy consumption per unit of housing and office space is 2.5 to 3.5 times higher than the average of European OECD countries
- Energy consumption per unit of national product is three or more times higher than the energy consumption per unit of national product in developed OECD countries in Europe,

Opportunities

- Growth of heat energy consumption in a district heating systems in urban areas,
- Developed European energy market
- Better use of the valuation and better use of rents for natural resources consumption,
- The opportunity for economic development that would be neutral in terms of CO₂ emissions,
- Developed European market of services in connection with the reduction of greenhouse gas emissions,

Threats

- The available resources of biomass, hydropower or other renewable sources are outspread on relatively large area and have a small average density per unit of territory,
- Retarded integration into the European market,
- There are numerous opportunities to reduce productivity and competitiveness of system biomass – hydro power,
- The problem of coordination between the production of hydropower, water conservation regime and biomass production,
- Inadequate economic arrangements between water resources management in Vojvodina, spatial planning, land resources management and biomass production

Scenarios on short and medium term (2020, 2030) for RES local development

Due to slow implementation of the existing scenarios of development up to 2015 (*Long-term energy development strategy of the Republic of Serbia until 2015, 2007*), the medium-term scenarios up to 2020 and 2030 were not developed. In such conditions, the present practice, still under-represented and planned up to 2015 could be prolonged to the medium-term scenarios up to 2020 up to 2030.

As for the development of renewable energy in Vojvodina most important task and interest is to do the study of economic and environmental feasibility of using biomass as fuel in Vojvodina. Vojvodina has to set prices that distributors will have to pay to manufacturers of electrical and/or thermal energy produced from renewable energy sources. Vojvodina is not only political and administrative rather than just a specific area of business that must have clear information about its interests and capabilities in the use of renewable forms of energy, especially biomass from their territory. These prices must be linked to agricultural production as agriculture, in addition to food products, should over time become more producer of energy, and from these activities should be realized not low income. Vojvodina government must calculate price of electricity produced from biomass taking into account specific features of agricultural production and specifics of Vojvodina.

Especially important potential in Vojvodina is biomass, which in total energy of renewables participate with more than 63%, followed by solar, wind energy, small hydropower and

geothermal energy, respectively. Estimated RES potential of Vojvodina is 1.3 million tons of oil equivalent per year.

Energy strategy implementation in the field of renewable energy sources should create conditions for new jobs.

CONCLUSION

Vojvodina is a region highly dependant from outside sources of energy. Therefore, provincial government has established four basic strategic direction of energy development in Vojvodina in the following period:

- Construction and reconstruction of energy facilities for the production electricity of higher power and thermal energy,
- Increased production of crude oil and natural gas through concessions in the country and from abroad
- Increase energy efficiency in all energy sectors,
- A significant increase in the combined use of renewable energy sources.

Project Ener-Supply complies with these goals and could help building capacities to intensify RES usage and application of EMS. One of the goal of the project is building RES potentials map which would improve presentation of municipalities to attract interested investors in the field of RES energy production.

Still, there are a lot of obstacles to implement planned strategy. The solution could be seen through:

- Clear and unconditional political will expressed energy policy
- The development of energy markets and energy
- The development of institutions to implement and monitor the execution of individual projects,
- Implementation and development of new energy technologies and services in the field of energy,
- Define and ensure implementation of incentive measures.
- Organization of education of all strata of society on the importance and potential increase energy efficiency and renewable energy sources.

Thus defined objectives require the engagement of all stakeholders of government and professional institutions in the appropriate fields. Only simultaneous and well coordinated action can make long-term expected and tangible results.

ACKNOWLEDGMENTS: This paper is supported by South-east Europe Transnational Cooperation Programme in the framework of the Project SEE AF/A/037/2.4/X – ENER-SUPPLY.

REFERENCES

- Action Plan for Biomass, Republic of Serbia, Ministry of Mining and Energy (Akcionni plan za biomasu, Republika Srbija, Ministarstvo rudarstva i energetike, 2010).
- Bašić, Đ., et al., The Study: Research and defining geothermal potential in the area of Indjija and possibilities for different purposes (Studija: Istraživanje i definisanje geotermalnog potencijala na području opštine Indjija i mogućnost korišćenja u različite svrhe), Faculty of Technical Sciences, Novi Sad, 2006
- Bašić, Đ., Marić, M., Drgutinović, G., Petrović, J., The Study: Possibilities for Utilization of Energy Potentials of Geothermal Waters in Vojvodina (Studija: Mogućnosti korišćenja energetskog potencijala geotermalnih voda u Vojvodini), Faculty of Technical Sciences, Novi Sad, 2005
<http://www.psemr.vojvodina.gov.rs/vojvodina2/studija2/Englis h%20BrosuraSG.pdf>
- Bašić, Đ., Marić, M., Drgutinović, G., Petrović, J., The Study: The possibilities of using geothermal water energy potential in Vojvodina, Faculty of Technical Sciences, Novi Sad, 2005
<http://www.psemr.vojvodina.gov.rs/vojvodina2/studija2/Englis h%20BrosuraSG.pdf>

- Bašić, Đ., Marić, M., Petrović, J., Varga, P., The Study: Utilization of Energy Potentials of the Geothermal Water Drill in Bečej for Energy Requirements of Local Consumers (Studija: Istraživanje i definisanje geotermalnog potencijala na području opštine Bečej i mogućnost korišćenja u različite svrhe), Faculty of Technical Sciences, Novi Sad, 2005 <http://www.psemr.vojvodina.gov.rs/vojvodina2/studija3/English%20BrosuraSB%20Becej.pdf>
- Beszedes, S., Szep, A., Kertesz, S., Laszlo, Z. (2009). Microwave Pre-Treatment for Enhancing of Biogas Product and Biodegradability of Food Industrial Sewage Sludge, PTEP- Journal on Processing and Energy in Agriculture, 13(1), p. 71-74
- Brkić, M. (2007). The Study: Potentials and possibilities of briquetting and pelletizing of waste biomass in the territory Province of Vojvodina (Studija: Potencijali i mogućnosti briketiranja i peletiranja otpadne biomase na teritoriji pokrajine Vojvodine), Poljoprivredni fakultet, Novi Sad, <http://www.psemr.vojvodina.gov.rs/studije/studija.pdf>
- Cadastre of small hydropower plants in Vojvodina (Katastar malih hidroelektrana u Autonomnoj Pokrajini Vojvodini), "Hidroinvest" DTD, 1989. godine
- Čorba, Z., Katić, V., Miličević, D. (2009). Fotonaponski sistemi u poljoprivredin (Photovoltaic Systems in Agriculture), PTEP - Journal on Processing and Energy in Agriculture, 13(4), p. 328-331
- Dakić, D., Erić, A., Đurović, D., Erić, M., Živković, G., Repić, B., Mladenović, M., Nemoda, S., Mirkov, N., Stojanović, A., (2009). Jedan od načina korišćenja nus proizvoda iz poljoprivredne proizvodnje kao goriva (One of the Possibilities How to Use Agricultural Biomass By-Products as Fuel), PTEP- Journal on Processing and Energy in Agriculture, 14(1), p. 81-84
- Decree on Measures of Incentives for the Production of Electricity Using Renewable Energy and Combined Production of Electricity and Thermal Energy, Ministry of Mining and Energz, Republic of Serbia (Uredba o merama podsticaja za proizvodnju električne energije korišćenjem obnovljivih izvora energije i kombinovanom proizvodnjom električne i toplotne energije, Ministarstvo rudarstva i energetike, Republika Srbija), 2009.
- Dević, M., Dimitrijević, A., Blažin, D., Blažin, S., (2008). Korišćenje ostataka iz prerade voće kao gorivnog materijala (Possibilities of Using Fruit Processing Residues as Burning Material), PTEP- Journal on Processing and Energy in Agriculture, 12(3), p.111-114
- Implementation Program of the Energy Strategy of the Republic of Serbia in the AP Vojvodina (amendments and supplements), Provincial Secretariat for Energy and Mineral Resources, Novi Sad, 2009. (http://www.psemr.vojvodina.gov.rs/pdf09/POS_AP_V_2009_eng.pdf)
- Jovanovska, V., Jovanovski, N., (2008). Agriculture and biomass Energy, PTEP - Journal on Processing and Energy in Agriculture, 12(3), p. 183-185
- Katić, V. et al., The Study: Wind Atlas of AP Vojvodina (Studija: Atlas vetrova AP Vojvodine), Faculty of Engineering, University of Novi Sad, 2008 http://www.psemr.vojvodina.gov.rs/studije_pdf_2009/Studija_Atlas_Vetrova_APV_2008.pdf
- Lakner, Z., Kajari, K., Somogyi, S., (2008). Rise and Fall of National Bio-Fuel Programme - a Case Study from Hungary, PTEP - Journal on Processing and Energy in Agriculture, 12(3), p. 118-124
- Long-term energy development strategy of the Republic of Serbia until 2015, Ministry of Mining and Energy, Republic of Serbia (Strategija razvoja energetike Republike Srbije do 2015. godine, Ministarstvo rudarstva i energetike, Republika Srbija), 2007 http://www.crnarupa.singidunum.ac.rs/Godina%202009%20-%202010/FIM/Procesna%20i%20energetska%20efikasnost%20-%20prof.%20dr%20Dragan%20Markovi%C4%87/PEE_07/strategija_energetika_lat.pdf
- Low on Energy, Republic of Serbia (Zakon o energetici, Republika Srbija), 2004. (http://www.parlament.gov.rs/content/lat/akta/akta_detalji.asp?Id=160&t=Z#)
- Martinov, M., et.al., The study: "Possibilities of CHP from biomass in Vojvodina" (Studija: Mogućnosti kombinovane proizvodnje električne i toplotne energije iz biomase u AP Vojvodini), Faculty of Technical Sciences, Novi Sad, 2008 http://www.psemr.vojvodina.gov.rs/studije_pdf_2008/Studija%20-%20Mogucnosti%20kombinovane%20prijodvodnje%20el.%20energije%20i%20toplotne%20energije%20iz%20biomase%20u%20APV.pdf
- Mitić, N., Stojiljković, D., Stojiljković, S., Đurović-Petrović, M., (2007). Korišćenje geotermalne vode Sijarinske banje za sušenje mrkve (The Use of Geothermal Water of Sijarinska Spa for Carrots Drying), PTEP- Journal on Processing and Energy in Agriculture, 11(1-2), p. 70-71
- National Sustainable Development Strategy, Republic of Serbia, 2007. http://www.un.org/esa/agenda21/natinfo/countr/serbia/nsds_serbia.pdf
- Radojević, R., Živković, M., Urošević, M., Radivojević, D., (2007). Tehnološko - tehnički aspekti korišćenja rezidbe voćaka i vinove loze (Technological - Technical Aspects of Using Fruit and Grapevine Pruning Residues), PTEP- Journal on Processing and Energy in Agriculture, 11(1-2), p. 32-36
- Radosavljević, M., (2007). Kukuruz - obnovljiv izvor energije i proizvoda (Maize - a Renewable Source of Energy and Products), PTEP- Journal on Processing and Energy in Agriculture, 11(1-2), p. 6-8
- Radosavljević, M., Mojović, Lj., Rakin, M., Milašinović, M., (2009). ZP hibridi kukuruza kao sirovina za proizvodnju bioetanol (ZP Maize Hybrids as Raw Material for the bioethanol Production), PTEP- Journal on Processing and Energy in Agriculture, 13(1), p. 45 - 49
- Rajković, B., Popov, Z., The Study: Estimated wind speed on selected locations (Studija: Procena brzine vetra na izabranim lokacijama), Centar za meteorologiju i modelovanje životne sredine, Univerziteta u Novom Sadu Republički hidrometeorološki zavod, Meteorološka opservatorija, Novi Sad, 2005 http://www.psemr.vojvodina.gov.rs/vojvodina2/studija/procena_vetar.pdf
- Tešić, M., Kiš, F., Marinković, R., (2009). Mogućnost proizvodnje sirovina za biodizel u poljoprivredi Vojvodine/Srbije (Potentials for production of Biodiesel Raw Materials in Agriculture of Vojvodina/Serbia), PTEP- Journal on Processing and Energy in Agriculture, 13(1), p. 31-34
- Vukoje, V., Milić, D., (2009). (The Analysis of Profitability of Agricultural Enterprises in Vojvodina (2003-2007)), PTEP- Journal on Processing and Energy in Agriculture, 13(2), p. 162-165

Received: 23.06.2011.

Accepted: 04.09.2011.