

ADVANTAGES OF BIOGAS POWER PLANTS IN ENERGY TRANSITION OF PANNONIAN COUNTRIES – BENEFITS FOR THE NATIONAL ECONOMY

¹Panon – think tank for strategic studies, Osijek, CROATIA

²Josip Juraj Strossmayer University of Osijek, Faculty of Electrical Engineering, Computer Science and Information Technology, Osijek, CROATIA

Abstract: This paper points out benefits for the national economy from construction of biogas plants (BgP) – especially important for countries of the Pannonia Plain. Research data show that BgP has the most favorable effects on GDP of the national economy – compared to other renewable sources. Benefits from BgP for the national economy are: reducing CO₂ emissions and municipal waste disposing, fewer imports of electricity, gas, and oil, significantly better economic performance in energy sector, balancing functioning of the national electricity system, hiring domestic companies and activating domestic resources and use of biogas in transport.

Keywords: Biogas power plants, Energy transition, National economy, Pannonian countries, Renewable energy sources

INTRODUCTORY NOTE

In the paper “Advantages of biogas power plants in energy transition Pannonia countries – Benefits for the local community” we pointed out the unfavorable position of biogas power plants (BgP) in government structures (stronger interest groups for wind and solar power plants) and the benefits of the local community from the construction of BgP.

In this paper we pointed out benefits to the national economy – especially important for the countries of the Pannonian Plain. Research data show that BgP has the most favorable effects on the GDP of the national economy – compared to other renewable sources – through investment, intermediate consumption and employment of domestic labor and the activation of national resources. This will be illustrated by the example of the Republic of Croatia [1–5].

BENEFITS OF BIOGAS POWER PLANTS FOR THE NATIONAL ECONOMY

The national economy and energy sector have a number of very significant benefits from investing in the construction of biogas plants compared to other renewable sources – as shown in Figure 1.

— Climate change – meeting EU obligations

Each EU member state has committed itself to reducing CO₂ emissions and disposing of municipal waste, in order to mitigate climate change. It should be emphasized here that these are not unimportant and only formal obligations imposed from above – but a civilization and planetary obligation to prevent catastrophes for humanity. As much as wind and solar power plants are neutral in terms of greenhouse gas emissions, so is the disposal of livestock manure in BgP – especially in cattle breeding due to methane emissions.

There is special issue of disposal, i.e. recycling of municipal waste; e.g. Croatia should have separated and recycled 50% of municipal waste by 2020. But this has not been achieved;

the rate of separate collection of municipal waste in Croatia in 2020 was 41%.

According to the current practice Croatia will pay penalties until the assumed obligations are fulfilled as paid by Bulgaria, Greece, Hungary, Italy and Poland (about ten million € per quarter). [3]

— Fewer imports of electricity, gas, and oil

The production and use of biogas contribute to the reduction of imports of fossil fuels. E.g. in the last 10 years, the Republic of Croatia has imported between 30 and 40% of electricity and the same amount of natural gas. A significant increase in the production of biogas and electricity from BgP has a positive impact on reducing national energy dependence, i.e. reducing import of these energy sources. [4]

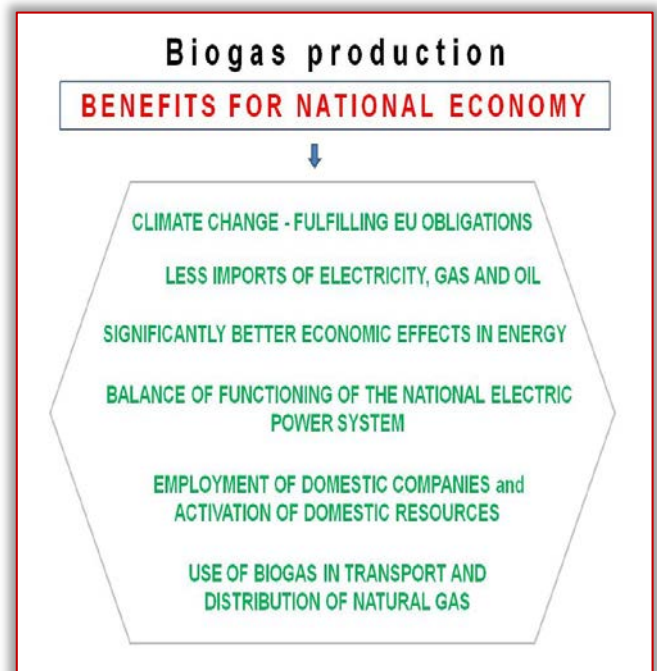


Figure 1. Benefits to the national economy from the construction of biogas power plants

— Significantly better economic performance in energy

The largest impact on GDP and employment in Croatia among renewable energy sources (RES) is achieved by GDP; as shown in Tables 1 and 2. Also – with BgP, investments per MW in electric power plants are lower.

Table 1. Investment channels – effects on € 1 million value of total investments.

Source: [6]

Power plant type Indicator	Wind farms	Solar	Biomass	Biogas	Small hydropower
GDP (000 €)					
Direct effect	739,1	973,6	188,9	215,8	916,3
Indirect effect	193,3	17,5	671,5	608,0	73,3
Induced effect	91,0	7,4	336,5	183,5	35,3
Total effect	1023,3	998,6	1197,0	1007,3	1025,0
Number of employees in terms of annual labor input					
Direct effect	0,6	0	11,7	8,6	6,0
Indirect effect	6,5	0,5	37,8	33,3	2,5
Induced effect	3,6	0,3	13,1	7,2	1,4
Total effect	10,7	0,7	62,7	49,1	9,8

Table 2. Intermediate consumption channel – effects on € 1 million value of total investments. Source: [6]

Power plant type Indicator	Wind farms	Solar	Biomass	Biogas	Small hydropower
GDP (000 €)					
Direct effect	130,0	238,4	217,1	240,9	235,9
Indirect effect	94,2	181,0	178,1	212,9	200,6
Induced effect	120,5	216,9	199,9	220,3	210,7
Total effect	344,6	636,3	595,1	674,1	647,3
Number of employees in terms of annual labor input					
Direct effect	6,1	8,2	9,8	11,9	11,6
Indirect effect	3,2	6,5	6,5	6,6	6,1
Induced effect	5,0	8,5	8,6	9,0	8,3
Total effect	14,3	23,2	24,9	27,5	26,0

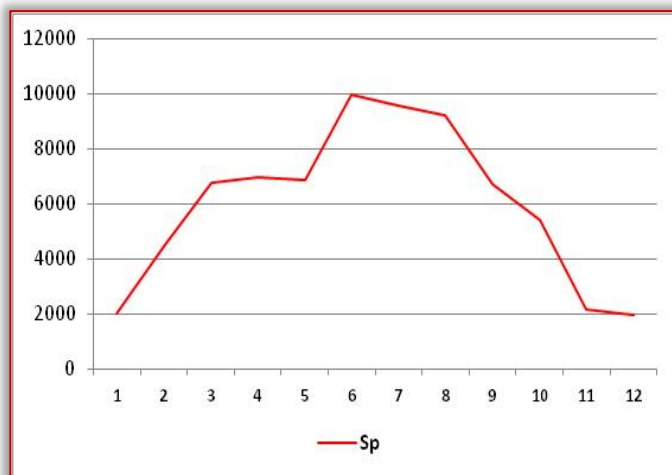


Figure 3. Production of electricity from solar power plants in Croatia in 2019 – by months [7]

— Balancing the functioning of the national electricity system

Biogas plants do not have daily and seasonal oscillations in production – such as hydro, solar and wind power – which contributes to balancing the functioning of the country's electricity system. E.g. Figures 2 and 3 show the monthly oscillations in the production of electricity in the power system of the Republic of Croatia from renewable energy sources. Balanced production of BgP and biomass power plants (Bp) is observed in contrast to wind power plants (Wp) and solar power plants (Sp).

— Hiring domestic companies and activating domestic resources

Data on investments in renewable and energy sources in Croatia in the period from 2009 to 2016 show that about 80% of the total investment costs in biogas plants are realized by the domestic economy, unlike wind farms and other technologies where imports of equipment and materials and foreign costs h contractors amount to over 80 percent. Figure 4 shows the BgP complex (2 MW) "Biointegra" Slatina – built by domestic contractors with domestic construction materials and a significant part of domestic equipment.

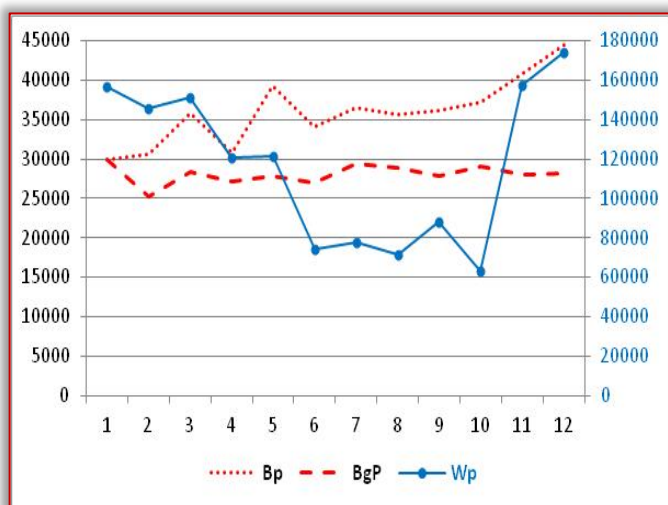


Figure 2. Production of electricity from renewable energy sources in Croatia in 2019 – by months [7]



Figure 4. Biogas power plants (2 MW) "Biointegra" Slatina, Croatia [8]

USE OF BIOGAS IN TRANSPORT AND DISTRIBUTION OF NATURAL GAS

Finished biogas (biomethane) in developed EU countries has been used for years as a fuel in road transport or as a supplement in the distribution of natural gas. To use biogas as a fuel for road vehicles or in the natural gas distribution network, additional processing is needed – removal of CO₂ and sulfur. The treated biogas (now biomethane) is compressed to the gas network pressure level and can be placed in the natural gas network distribution system. In the developed European countries, in the past decade, there has been strong growth in the construction of biogas capacity and the use of biogas, and especially strong growth in the capacity for biogas refining, i.e. biomethane production; Figure 5 shows the annual growth rates of the number of biogas and biomethane plants in Europe. [9][10]

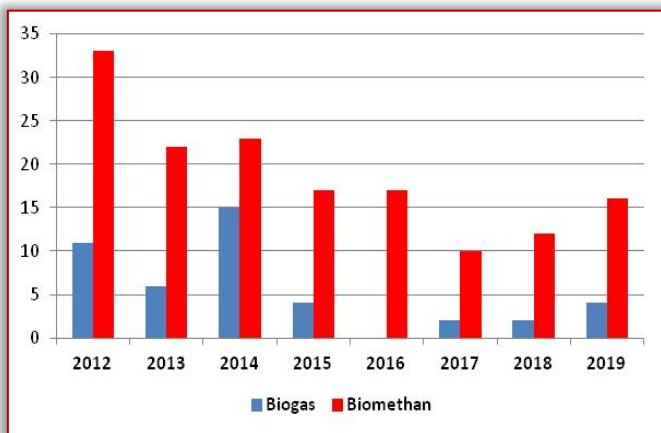


Figure 5. Annual growth rates of biogas and biomethane plants in Europe (%) [10] Unfortunately, no biogas refinery has been built in the Republic of Croatia, and according to available information, it is not in the plans.

CONCLUSIONS

Our considerations – on the example of the Republic of Croatia – showed:

- That BgP have the most favorable effects on the GDP of the national economy – compared to other renewable sources – through investment, intermediate consumption and employment of domestic labor and activation of national resources.
- Importat benefits for the national economy are to: reducing CO₂ emissions and municipal waste disposing; fewer imports of electricity, gas, and oil; significantly better economic performance in energy; balancing functioning of the national electricity system; hiring domestic companies and activating domestic resources; and Use of biogas in transport
- European developed countries are achieving strong growth in biogas capacity building and biogas use, and especially strong growth in biogas refining capacity (biomethane production).
- States in the Pannonian area should pay special attention to investments in renewable energy sources and objectify

the eco–friendly, ecological and energy effects of certain forms of renewable energy sources, and not be subject to the influence of interest lobbies without a critical approach.

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References

- [1] Glavaš, H.; Ivanović, M.; Mandić, N.: Resources and Possibilities of Agro Biomass Usage for Energy Purposes in Slavonia region (Croatia), ENERGYCON 2014; IEEE, Dubrovnik, Croatia 13–16 May, 2014; Proceedings pp 4.1 – 6
- [2] Ivanović, M.; Glavaš, H.; Vukobratović, M.: – Bioplinne elektrane u Slavoniji i Baranji, 15. skup o prirodnom plinu, toplini i vodi, Osijek, 27.–29.09.2017. Proceedings, pp 204–215
- [3] Ivanović, Milan – Komunalno zbrinjavanje otpada – stanje u gradovima slavonske regije; 28th International Conference OTO 2019. Vinkovci, Decembre 12, 2019; Panon think tank Osijek, Proceedings, pp 163–172
- [4] Ivanović, Milan – Kružna ekonomija i bioplinne elektrane u Slavoniji i Baranji; 35. Međunarodni znanstveno–stručni susret stručnjaka za plin, October 21 – 23, 2020,. Proceedings, pp 225–235
- [5] Ivanović, Milan – Bioplin u kružnoj ekonomiji Europske Unije; 35. Međunarodni znanstveno–stručni susret stručnjaka za plin, October 21 – 23, 2020, Proceedings, pp 236–247, <https://www.researchgate.net/publication/344905290>
- [6] El „Hrvoje Požar“ & Ekonomski institut Zagreb. Integralna analiza dosadašnjih učinaka razvoja i izgradnje obnovljivih izvora energije u Hrvatskoj u razdoblju od 2007. do 2016. Zagreb, 2018, <https://www.hops.hr/>
- [7] HROTE – (<http://www.hrote.hr/>)
- [8] CONSULTARE d.o.o. Vrbovec – <https://www.consultare.hr/hr/projekti/bpp-slatina#>
- [9] Ivanović, Milan; Tonković, Zlatko: Kapaciteti za rafinaciju bioplina i korištenje biometana u EU, PLIN 2021 – 19. skup o prirodnom plinu, toplini i vodi, Osijek, September, 22 – 23, 2021, Proceedings, pp 216–227
- [10] Policy Brief: Bioelectricity, Bioenergy Europe Statistical Report 2020, <https://bioenergyeurope.org/article.html/241>



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Faculty of Engineering Hunedoara,
5, Revolutiei, 331128, Hunedoara, ROMANIA
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