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ENI Cross-borderCooperationProgramme
2014-2020

The guide to the best energy solutions in the Carpathian region

GUIDEBOOK

2023

The project was co-financed by the European Union

CONTENT

EU program: Hungary – Slovakia – Romania – Ukraine

Hungary Slovakia Romania Ukraine

NESiCA

THE GUIDE TO THE BEST ENERGY SOLUTIONS IN THE CARPATHIAN REGION

developed as part of the project HUSKROUA/1702/6/1/0014

«New energy solutions in the Carpathian region (NESiCA)»

2023

The project was co-financed by the European Union

INTRODUCTION

Efficient and economical use of energy resources is becoming an increasingly urgent task every day. The development of technology and the increase in the number of people on our planet are constantly increasing the appetite for energy consumption. The production of which is currently mostly associated with the use of non-renewable sources that pollute our planet to a large extent. Therefore, informing and discussing issues related to increasing energy efficiency and encouraging the introduction of renewable energy sources is an extremely important and urgent task.

Awareness of the need and importance of a balanced and responsible attitude to the consumption of the energy resources of our planet by every person at different levels of social status can to a large extent improve the rather difficult situation that has developed.

The guide to the best energy solutions in the Carpathian region aims to demonstrate and provide information about the best practical solutions that have been implemented in the countries participating in the "NeSiCa" project. The presented solutions were selected by expert participants of the project, which are the most successful and relevant solutions for this region, which can demonstrate real examples of the correct use of available energy resources and solving energy saving problems in certain conditions.

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Ukraine

1. Solar power plant
Tiglash village, Uzhgorod district, Transcarpathian region
GPS coordinates: 48.4838462,22.2282411
Google Maps link: https://goo.gl/maps/1buon1MYBRXRZ3Bu9

As of mid-2021, industrial HPPs with a total installed capacity of about 240 MW have been put into operation in Zakarpattia Oblast. SPPs are also being built at a rapid pace on the premises and on the roofs of the buildings of individuals and legal entities. Their number is currently about 3,000 with a total installed capacity of 88 MW. Surplus electricity produced by such SPPs is transferred to the unified energy system at a green tariff, which is even slightly higher than the average tariff for industry (about 15 eurocents per KWh). Solar energy, despite the uneven schedule of electricity production and its dependence on natural conditions, as well as certain reductions in the "green" tariff, will continue to develop, although perhaps not so rapidly.

An example of such construction of small SPPs can be the recently built small solar power plant near the city of Uzhgord near the village of Tiglash:

Location - Tiglash village, Uzhgorod district, Zakarpattia region.

Commissioning - February 2018

The installed capacity is 21.5 MW

The area of the land plot is 35.3 hectares

The number of photovoltaic modules is 79,548 units. (JA Solar)

Number of inverter stations - 379 pcs. (TRIO-50.0-TL-OUTD-POWER MODULE)

The expected annual output is 25.11 million kWh

Solar power plant near the Tiglash village in Transcarpathian region.

2. Micro-hydroelectric power plant
Turya Polyana village, Transcarpathian region.
GPS coordinates: 48.6882584, 22.2856137
Google Maps link: https://goo.gl/maps/vWjfnfCAxRRBTHGJA

The resource potential of the small mountain rivers of Transcarpathia, which is estimated to be the largest in the structure of renewable energy in the Carpathian region, is being developed at a much lower rate than solar energy. This is due to better stimulation of solar energy producers with a "green" tariff. From 2010 until now, almost 15 small and mini hydroelectric power plants with an installed capacity of hydro turbines from 0.63 to 2.2 MW have been built at the expense of non-state funds. Their total capacity is about 15 MW. In addition, the Tereble-Ritska HPP, which was built on two rivers (27 MW, 1956), as well as the Onokivska and Uzhgorod small HPPs (2.65 and 1.92 MW, respectively), which were built back in 1937, are still operating. - in 1943, on the channel that diverted water from the Uzh River for the water supply of the city of Uzhhorod. Taking into account the unique technically available energy potential of mountain rivers in the region, the rate of its development is very low.

The main reasons for this state of affairs are the lack of a clear strategy for the development of the region in this direction of energy and other collective problems, such as the low level of awareness among citizens of the need for the development of renewable energy and sometimes false fears about the impact of hazardous facilities on the ecology of the region. It is worth adding that developing the hydropower

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potential of rivers partially solves the problem of flood protection, maintaining the cleanliness of riverbeds and banks, replenishing budgets at various levels, etc. It should be noted that several MHPs built in recent years, in particular on the Turya and Brusturyanka rivers, are the best in Ukraine, meeting European standards in terms of technical and technological, environmental protection and aesthetic implementation.

Water intake with a fish chute for the Shipit-2 mini-hydroelectric power station on the Turya River in the Transcarpathian region.

3. Biomass power plant
Chopivtsi village, Transcarpathian region.
GPS coordinates: 48.4872273, 22.6178136
Google Maps link: https://goo.gl/maps/9qhKtMq8txL9eGVT9

In recent years, in the Transcarpathian region, which has a significant potential for bioresources, the practical development of organic waste in the agro-industrial sector for the industrial production of electricity has been started.

In the village of Barvinok, Uzhgorod district, the first biogas power station "Ekoenergia Barvinok" was put into operation. The power plant has an installed capacity of 0.6 MW and was built by the company "Latex", which received a license for the production of electricity and obtained a green tariff of 12.39 eurocents per kWh. In the village of Chopivtsi, Mukachevo district, since 2018, "Ekokoshet" LLC has been building a more powerful bioenergy complex and reconstructing facilities for the processing and utilization of manure effluents of the Chopiv pig complex using modern technologies. The biogas plant with a capacity of about 5 MW, which is shown below, produces electricity and heat by burning biogas obtained from processed manure effluents with the addition of additional plant material (silage from corn and other crops or solid waste from the agricultural sector).

Biogas energy complex in the village of Chopivtsi with a capacity of 5 MW

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Romania

1. Solar thermal power plant

Stefan cel Mare University of Suceava campus, Suceava municipality
GPS coordinates: 47.64229109468406, 26.244229705691144
Google Maps link: https://goo.gl/maps/c27TKEWZejjxzBLM6

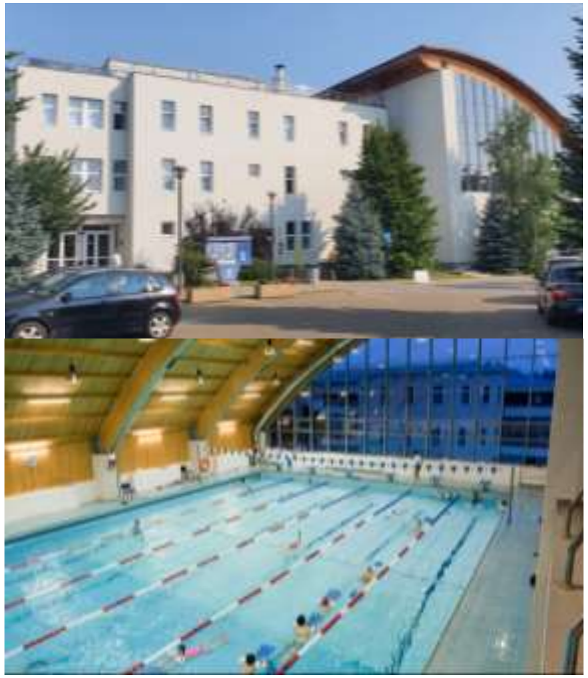
On Stefan cel Mare University of Suceava (USV) campus, a solar thermal power plant has been operating since 2010, using flat solar panels. The solar thermal power plant serves a physiotherapy complex and a swimming pool.

From a geoclimatic point of view, the location is at 47°39’ northern latitude, 26°15’ eastern longitude and 374 m altitude, the duration of sunlight is 2384 hours/year which corresponds to an average annual flow of specific global solar radiation of 575 kWh/m^2/year or an average hourly value of 241 Wh/m^2/h.

The use of solar energy in low temperature heat conversion can bring an appreciable energy intake in the hot season, with direct effects on primary energy consumption and emissions. The heating agent and hot water are prepared in its own thermal power plant which is equipped with boilers operating with natural gas and a solar installation comprising 92 flat solar panels with a total surface area of 200 m^2.

The solar installation works all year and is connected in series with the conventional hot water preparation installation and brings an estimated average contribution of 100 MWh/year. By using the solar installation throughout the year, the degree of capitalization of the available energy potential increases and the efficiency of the adopted solution respectively.

During the period of maximum solar input (June), the installation can ensure a maximum instantaneous flow of 8000 liters/hour, hot water with a temperature of 50 ^{0}C, which fully covers the technological need to heat the additional water and compensate for heat loss from the pool, as well as the necessary for the operation of the showers. The 92 solar panels are organized in two capture fields CS1 and CS2, comprising 74 panels respectively 18 solar panels. The orientation of the solar panels is in the SE direction with an inclination of 45^0 (for CS1) and 30^0 (for CS2).



Swimming and physiotherapy complex in USV campus

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Solar thermal power plant. General view of solar collectors

The total volume of hot water storage is 4000 liters. It should be mentioned that, in the hot season (May - August), the solar installation fully ensures the technological need for the operation of the swimming pool.

For the operation of the solar installation in periods characterized by a low level of solar irradiance, the system is provided with a classic installation for the preparation of hot water for consumption, with an installed power of 110 kW. The scheme provided for the hot water preparation installation has a high functional flexibility allowing their operation independently (solar or classic) or jointly, in parallel or in series.

The estimated value of the amount of energy supplied annually by the solar installation is about 100 MWh/year (82.7 Gcal/year), which corresponds to a saving of 16 tons cc/year or 10 thousand Nm3 natural gas per year. By default, a reduction of noxious emissions of 19.4 tons of CO_2/year and 23.2 kg of NO_x/year is obtained, which can be capitalized by reducing the impact on the environment.

Solar hot water systems have a reasonable efficiency of 38 - 40%. Thermal energy sources using natural gas and solar energy remain the best solutions in terms of energy efficiency, low pollution and operating costs.

2. Biomass power plant

Bioenergy, Thermonet Company, Suceava Municipality
GPS coordinates: 47.650487105405375, 26.303363920951373
Google Maps link: https://goo.gl/maps/6Ab19qWprfitRmfdA

Biomass power systems produce electricity from the chemical energy contained in organic matter. Biomass power plants eliminates the need for waste disposal, lowers energy costs and maintains a high availability of the power supply. This kind of power plants occupy a significant share in the global renewable energy mix, as new technologies reach commercial deployment and some coal-fired plants, are converted to reduce pollution. Thus, biomass electricity offers a realistic and sustainable alternative to fossil fuels currently used. In the same time, biomass electricity complements solar and wind which provide fluctuating electricity and require fast reacting backup power to compensate for their fluctuations.

Most of the world's biomass power plants use direct combustion to produce renewable and low carbon electricity. Direct combustion systems burn biomass in boilers to produce high pressure steam. The steam turns a turbine connected to a generator. As the turbine rotates, the generator turns, and electricity is produced. This is the simplest and oldest method of generating electricity from biomass. Investments in the production of electricity and heat based on biomass are a priority for both the European Union and Romania, including in the energy strategy being given a special importance to this type of renewable energy. Suceava County has the largest forested area of all counties in the country, about 50% of the total area, and in this context, the exploitation of wood is one of the basic activities.

The residents of the city of Suceava benefit from heating through a cogeneration plant of thermal energy and electricity, which uses biomass as a source of heat production, with an efficiency of 86%. In addition, Bioenergy Suceava is the largest and most efficient power plant of this kind in South-Eastern Central Europe, being a private investment worth 86 million euros. This power plant replaced the old CET that operated on the basis of coal, thus significantly reducing local pollution. Moreover, by using biomass as a source of heat agent production, Bioenergy Suceava reduces the consumption of exhaustible resources at the national level, exploiting a renewable resource, which, until 2013, was polluting mountain rivers, being a waste resulting from logging of the forest, which was not compacted, but remained and depreciated in nature.

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Biomass thermal power plant. Suceava municipality. General view and biomass supply area

Biomass thermal power plant. Suceava municipality.

Steam turbine, electric generator, hot water boiler

In Suceava municipality, a high-efficiency biomass cogeneration plant has been operating since 2013. This power plant provides the necessary thermal energy for the population of Suceava.

The power plant consists of 5 sources of thermal energy using solid fuels – biomass: 4 steam boilers of 30 t/h and 25 MW_t used for the production of electricity and heat in cogeneration and one 15 MW_t hot water boiler, used for heat production. The power plant is equipped with 3 sources of heat production by burning gaseous fuels - natural gas: 3 hot water boilers of 14.7 MW_t each, used for heat production at peak loads.

A steam turbine is used to produce electricity, which allows the admission of steam at a pressure of 65 bar and a temperature of 520^0C, coupled to an electric generator of 31.1 MW_e, with a rated voltage of 10.5 kV.

Electricity is delivered to the National Energy System (SEN), and thermal energy in the form of hot water is used for the supply of the district heating system of Suceava municipality. From the transmission and distribution network, the thermal agent is delivered to individual homes and economic agents, consumers of thermal energy.

Bioenergy Company Suceava is a high-efficiency cogeneration plant, which ensures the production, at the lowest price, of the thermal agent for the approximately 50.000 Suceava residents connected to the centralized heating system, which uses biomass (wood scraps, sawdust, branches, etc.) for the production of thermal energy and electricity in cogeneration.

3. Biogas cogeneration power plant

Ecoterra Biogas Company, Moara Commune, Suceava Municipality
GPS coordinates: 47.57759105944895, 26.14417725058253
Google Maps link: https://goo.gl/maps/kUmP7mngskhTvETc6
Video presentation: https://www.youtube.com/watch?v=Yyvtlm7fGco

The cogeneration plant is located in Suceava County, Moara commune, Vornicenii Mici village, on a land with an area of 29.500 m^2, being at that time the largest biomass power plant in the Romania. The main activity of the plant is the production of electricity and heat in cogeneration using renewable energy sources - biomass (energy crops - corn silage and animal manure). The investment benefits from the system for promoting the production of energy from renewable sources, through green certificates.

Biogas cogeneration power plant. Moara Commune, Suceava County

The biogas plant has a biogas production capacity of 2 MWh and a total installed capacity of approx. 3 MWh with a processing capacity of 50.000 tons per year of clean organic waste. The biogas plant was put into operation in March 2014. The cogeneration plant is equipped with 2 cogeneration engines manufactured by GE Jenbacher - JMS 420 that run on biogas, with an electrical capacity of 1.487 MW_e, respectively a thermal power of 1.445 MW_t each, and a total efficiency of 83.9%. The cogeneration turbines produce and deliver daily electricity in national electricuty grid, between 07:00 AM and 23:00 PM, with a biogas consumption of approximately 1.600 m^3/hour.

The raw material used is in proportion of over 97% energy culture - corn silage (annual consumption approx. 36.200 tons/year) and 3% agricultural waste - animal manure (annual consumption approx. 1.000 tons/year). The raw material used for this biogas plant is 90-95% silage corn, the difference being manure, mostly, it is purchased from the farm.

Regarding the actual process of electricity production, first there is an anaerobic fermentation of biological material - biomass and manure, which produces biogas, which is then used, through a combustion process, to obtain electrical and thermal energy, in cogeneration. The biogas production made during the night is stored in a tank and is used during the day. The thermal energy produced is used only in the plant and in the future will be used to heat greenhouses. The internal electricity consumption of the biogas plant and the cogeneration plant is ensured during the day from the produced electricity production, and during the night it is ensured from national electricity grid.

4. Biomass thermal power plant

Holzindustrie Schweighofer Company, Rădăuți city, Suceava County
GPS coordinates: 47.85552483361226, 25.977834755403435
Google Maps link: https://goo.gl/maps/JCP78QyN2mRJSrHx7

The use of biomass for obtaining electricity and thermal energy is promoted both internationally and at the European and national level. The main argument for the use of biomass is the need to reduce CO_2 emissions, which at the same time represents the main target of the energy policy of the European Union, which was also taken over by Romania.

Romania's medium-term energy development strategy provides for the use of clean, efficient and safe technologies, which are based on renewable energy resources; in this sense, biomass represents a priority renewable energy resource.

The advantages of using biomass as fuel:

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• biomass is obtained on site and thus requires the shortest transport routes;
• biomass is renewable and leads to independence from foreign material suppliers raw materials and energy;
• biomass creates a local value, ensures and produces jobs;
• supporting waste management through the internal utilization of biomass waste.

The largest cogeneration power plant based on biomass in Romania was inaugurated in 2009, in Radauti, Suceava County by the austrian company Holzindustrie Schweighofer. The plant has a total capacity of 22 MW, of which 17 MW thermal energy and 5 MW electric energy, the investment being 20 million euros. The maximum electrical power that can be developed by the steam turbine is 15.3 MW, but on average it will operate at a power of 12 MW.

Biomass thermal power plant, Rădăuți city, Suceava County. General view

The cogeneration power plant consumes 40 cubic meters of biomass per hour. The thermal energy produced will be used to dry timber from the nearby Holzindustrie Schweghofer factory, but also to heat 7.000 apartments in the municipality of Radauti. Electric energy is provided in the national energy system. Wood waste and recyclable wood that cannot be used in production are used as fuel for biomass-based power plants.

The installation of a hot air generator based on biomass in Radauti will produce energy for the production of wooden boards and will reduce the factory's gas consumption. Thus, the biomass EGGER factory will become more independent from external energy sources. Compared to burning natural gas, the EGGER biomass power plant will save approximately 40.000 tons of carbon dioxide (CO_2) annually, which corresponds to the emissions of 9.000 homes.

Biomass energy is supported by the support scheme through two green certificates for each MWh injected into the electrical grid. In the biomass thermal power plant, the most important raw material will be biomass. The biomass used for the combustion grate is hereafter referred to as solid fuel, and the biomass used for the blower hearth is referred to as fines.

The plant consumed 198.000 tons/year of solid fuel and 9.000 tons/year of fine solid material and 19.000 tons/year of fine material in powder form. These values were estimated for the biomass thermal plant for an operating time of 8.200 hours per year and an average utilization of 95% of the maximum thermal power of 83 MW. The electricity estimated to be consumed will be 8.000 MWh.

Methane gas will be used to start and heat the biomass thermal power plant. Above the combustion grate, 2 gas burners will be installed, these being used for the controlled start and stop of the plant and, in case of necessity, for sustaining the combustion and for maintaining a certain minimum temperature in the combustion chamber (e.g. if the biomass is very wet or of poor quality).

The increased requirements for the protection of the environment (reduction of emissions, including CO_2), intensified competition in the sphere of wood supply and the permanent increase in energy costs, determine the need to develop new concepts in terms of maximum energy efficiency and electricity production. Thus, thermal energy installations with cogeneration are mainly requested, in which the energy is used to the maximum.

In the case of biomass thermal power plant operation (8.200 hours per year, at an average yield of 95% of the nominal thermal power of 83 MW) the amount of thermal energy is 646.570 MWh/year. If this amount of heat were produced by burning natural gas, then an amount of approx. 130.000 t/a of CO_2 (201 kg CO_2/MWh).

The biomass thermal power plant will produce hot air for the operation of the dryers and steam for the production of electricity. **Energy efficiency** means a high percentage share of effective energy compared to supplied energy: $\eta = Q_{useful} / Q_{supplied}$.

Compared to a standard steam boiler, the biomass boiler will not have waste gas losses, because the thermal energy of the combustion gases is used as thermal energy in the form of hot air for drying the chips. The residual gas losses of a standard steam boiler represent, depending on the exhaust temperature, ~ 8 **-** 9%, and these losses are used in the biomass thermal power plant.

The wood material will first be utilized as best as possible as a raw material in the wood processing industry within the EGGER industrial platform, so that the remaining material and waste resulting from production will then be utilized energetically (thermally). Such concepts bring logistical advantages and produce a valuable economic and ecological contribution in the sense of a closed circuit of wood exploitation.

Following the thermal exploitation of biomass, a balanced CO_2 balance results; in other words, by burning biomass, only that amount of CO_2 is released/resulted that was absorbed/taken up during the biomass growth phase. Unlike

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biomass, the burning of fossil fuels such as natural gas, oil and coal results in additional CO_2 emissions.

5. Micro-hydroelectric power plant
Holda village, Broșteni city, Suceava County
GPS coordinates: 47.85552483361226, 25.977834755403435
Google Maps link: https://goo.gl/maps/JCP78QyN2mRJSrHx7

In january 2022, 50 electricity generation plants were operating in Suceava county, of which 41 micro-hydropower plants, 6 biomass power plants, and one each for photovoltaic, wind and biogas plants. The total power installed in the hydroelectric plants operating in Suceava county is 10.954 MW.

The Barnar micro-hydroelectric power plant was put into operation in 1983 and operates with a Francis type turbine on a secondary water course river which flows into Bistrita main river. The height of the water fall is 75.3 m. The installed power on the Francis type turbine is 515 kW. The generator is an asynchronous type with a power of 800 kW, the maximum power produced being 600 kW. The nominal speed of the asynchronous generator shaft is 750 rpm. The nominal flow rate is 1.2 m^3.

The surface of the hydrographic basin is 93 km^2 with an average altitude of 1228 m. The average multiannual flow of the Barnar water course is 1.1 m^3/s with a length of 19 km.

The electrical energy produced by the micro-hydroelectric power plant is injected into the medium voltage network (20 kV).

Micro-hydroelectric power plant on the river Barnar – general view of the main building

Micro-hydropower plant on the river Barnar – Francis turbine details; water discharge from the turbine

Micro-hydropower plant on the river Barnar – the electrical generator, the calming and escape channel

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Hungary

1. Photovoltaic Installation at the University of Nyíregyháza

University of Nyíregyháza, Nyíregyháza municipality
GPS coordinates: 47.973702, 21.714342

The global irradiation and solar energy potential in Hungary makes it feasible to use solar panels for generating electric energy. The annual in-plane global irradiation for an optimally inclined (38°) photovoltaic module in Nyíregyháza is 1532 kWh/m^2 , which realistically translates into an annual 1205 kWh generated for every 1 kW_{peak} of installed solar panels, if optimally inclined.

The solar panels at the University of Nyíregyháza are oriented with the slope angle of 20° and the azimuth of +14°, so the annual in-plane global irradiation is somewhat less, 1477 kWh, ideally yielding 1116 kWh output energy per year per 1 kW_{peak} installed.

The photovoltaic (PV) system at the university began operation in August 2014. The system has a peak output of 367.92 kW and consists of 1533 Recom Amur Leopard poly-crystalline PV modules on the flat roof of most of the university buildings. The system is connected to the grid, but only in a limited way – it can only supply the university's internal 400 V internal electric grid. Feeding power into the national grid is not allowed and this requirement is enforced by progressively disconnecting parts of the system when supply exceeds demand. The PV modules are organized into strands whose output are fed into 21 Growatt inverters, which, in turn, feed into the mains network.

The inverters continuously measure and log current electric power production data. The data are uploaded to the manufacturer's servers where they are available for near real-time monitoring and analysis.

According to the calculator, a PV installation with a maximum output of 367.92 kW located at the University of Nyíregyháza and oriented ideally (facing exactly south and with the optimal slope angle of 38°) should provide 443.5 MWh of electric energy per annum (assuming 14% system loss). The actual average annual production from 2015 to 2022 was 334.3 MWh per annum.

Using renewable energy sources is not only a good investment financially, but also an investment into the future. The global climate change crisis requires that we take immediate action to slow the process – and moving more and more towards low-carbon energy technologies is an essential step in that direction.

PV systems produce green energy and the benefit can be quantified as a reduction in CO_2 emissions. These savings depend on the energy mix of the country; and since that of Hungary has gradually moved towards lower emissions in recent years, the greenhouse gas emission savings of the university's PV installation has also declined by over 40% since 2015.

Aerial view of the campus, showing the PV panels installed on the roof of most buildings


Part of the PV installation on the roof of Building B and some of the switch boxes and inverters

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2. Biomass power plant
Bioenergy, DBM Dél-nyírségi Bioenergia Művek Energiatermelő Company, Szakoly Municipality
GPS coordinates: 47.7663318, 21.8728258

The foundation stone was laid in 2006 and the plant started operations three years later. The power plant, which was inaugurated in 2009, is Hungary's first biomass-fired power plant to be built with greenfield investment. With a rated capacity of 19.8 megawatts and providing jobs for 55 people, the plant generates electricity by burning pure biomass - wood chips and sawmill by-products.

Hungary's fourth largest pure biomass power plant generates electricity for the national grid. The annual fuel demand of the power plant is approximately 180 000 tonnes, which is provided from renewable fuels using woody biomass and agricultural by-products. Electrical power capacity: 19,8 MW.

Biomass power plant. Szakoly municipality. General view
(Source: https://biomassza.veolia.hu/en/szakoly-power-plant/)

The plant covers a total area of 20 hectares. The site comprises three parts: the power plant with its associated woodyard, a pond for storing fire water, and a 10/120 kV station.

Layout of biomass power plant site
(Source: maps.google.com)

The power plant is fuelled by wood-based biomass. Here the wood is stored and chipped to the size required for combustion. The area can store up to a month's worth of biomass, if weather or other conditions or unexpected events block the supply. In front of the boiler, there is also a 50 m^3 hopper where the fuel is delivered from the outside through a grate and an iron pick-up magnet.

The unit has a rated output of 19.8 MW and an efficiency of 30.7%. The required amount of fresh steam is produced by a grate-fired boiler. The fresh steam entering the Siemens turbine is at a pressure of 93 bar and a temperature of 513 °C. The steam is fed from the turbine to the mixing condenser via axial outlets. Cooling is provided by two dry cooling towers.

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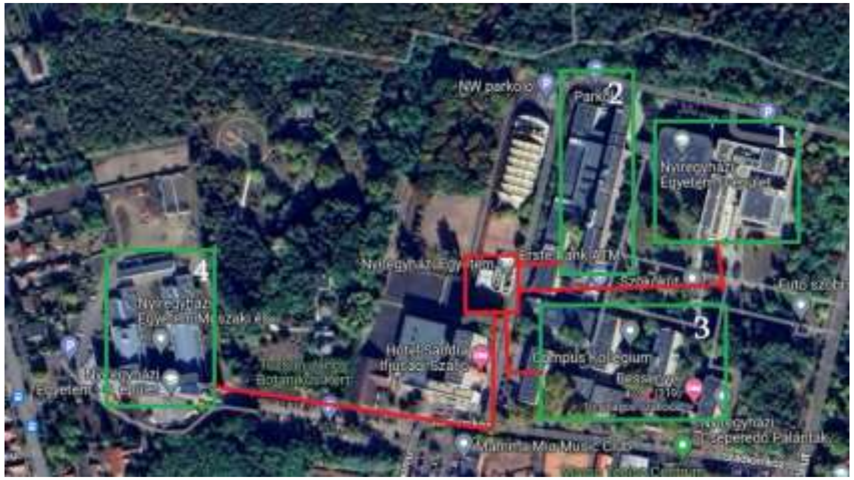
3. Gas engine power plant at the University of Nyíregyháza

University of Nyíregyháza, Nyíregyháza municipality
GPS coordinates: 47.972902, 21.712539

The gas engine power plant has been operating at the University of Nyíregyháza since 2003. The power plant serves a dual purpose: on the one hand it generates electricity and on the other, its waste heat, generated by cooling the internal combustion engines, is used to heat or cool the university buildings. The Combined Heat and Power Technology (CHP) unit is located on the campus. The CHP unit is connected to all buildings of the university.



The CHP unit also provides heating and cooling for the University buildings 1 – Main building (Building "A"), 2 – Building "B", 3 – Dormitories, 4 – Building "C"
(Source: maps.google.com)

The CHP unit using two G3516 Caterpillar type natural gas internal combustion engines. The engine has 16 cylinders in "V" arrangement. The displacement of the engines is 69 dm^3 and the compression ratio is 12:1. The maximum performance of the engine is 1078 kW. The engine drives a synchronous generator (400 V, 50 Hz) which produces electricity. The generated electricity is connected to the medium-voltage grid.

The G3516 Caterpillar type natural gas internal combustion engine

In the heating season, the thermal energy generated by cooling the engines is used to heat the buildings using a heat exchanger. This solution can provide the necessary heat energy for a significant part of the heating season. If necessary, additional demand can be covered by the municipal district heating system. In the summer, the heat produced by the CHP unit is used to air-condition the buildings using an absorption chiller.

The heat exchanger of engine and the absorption chiller

The project was co-financed by the European Union

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Partners:
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Ştefan cel Mare University of Suceava (Romania)
NGO European Initiatives Centre (Ukraine)
Technical University of Košice (Slovakia)
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Slovakia
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The Hungary-Slovakia-Romania-Ukraine ENI CBC Programme 2014-2020 provides EU funding for sustainable development along the border of Ukraine with Hungary, Slovakia and Romania, helps reducing differences in living standards and addressing common challenges across these border
The Member States of the European Union have decided to link together their know-how, resources and destinies. Together, they have built a zone of stability, democracy and sustainable development whilst maintaining cultural diversity, tolerance and individual freedoms. The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders

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