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САОПШТЕНИ НА САВЕТОВАЊУ

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Уредник
Милош В. Марковић

Табеле, слике и формуле: Аутори

Припрема за штампу:
Владимир Пауновић

Корице:
Љубодраг Весић

Штампа
yu prom d.o.o Београд

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ПОЧАСНИ ОДБОР

Саша Павловић, градоначелник Града Пожаревца
Александар Ђокић, начелник Браничевског управног округа
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др Блажо Лалевић, ванредни професор, Пољопривредни факултет у Београду-Земун
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др Марија Ћосић, ванредни професор, Пољопривредни факултет у Београду-Земун
др Тамара Пауновић, доцент, Пољопривредни факултет у Београду-Земун
др Бојан Димитријевић, доцент, Пољопривредни факултет у Београду-Земун
др Јасминка Ђорђевић Милорадовић, професор, Висока техничка школа струковних студија, Пожаревац
мр Мирослав П. Премовић, консултант из области управљања отпадом

ОРГАНИЗАЦИОНИ ОДБОР

Др Горан Несторовић – председник
Бата Радовановић
Владимир Пауновић
Др Александар М. Матић
Мр Слободан Лалић
Милош В. Марковић

САДРЖАЈ

3 MW BIOGAS POWER PLANT IN PORODIN VILAGE, REPUBLIC OF N. MACEDONIA

Asso. Prof. Natasa Mojsoska, Ph.D. [1]
Asso. Prof. Mile Spirovski, Ph.D. [2]
Prof. Ing. Mgr. Zlatko V. Sovreski, Ph.D. & Ph.D.[3]
Asso. Prof. Miško Dzidrov, Ph.D.[4]
Assist. Prof. Marija Čekerovska, Ph.D.[5]

[1)] University "St. Kliment Ohridski" Bitola, Faculty of Technical Sciences -Bitola, Electrical department - Republic of N. Macedonia, e-mail: natasa.mojsoska@tfb.uklo.edu.mk
[2)] University "St. Kliment Ohridski" Bitola, Faculty of Technical Sciences -Bitola, Electrical department - Republic of N. Macedonia, e-mail: mile.spirovski@tfb.uklo.edu.mk
[3)] University "St. Kliment Ohridski" Bitola, Faculty of Technical Sciences - Bitola, Department for Traffic and Transportation - Republic of N. Macedonia and Czech Technical University in Prague-Faculty of Transportation Sciences, e-mail: zlatkosovre@yahoo.com and zlatko.sovreski@uklo.edu.mk
[4)]University "Goce Delcev" Stip, Faculty of Mechanical Engineering, e-mail: misko.dzidrov@ugd.edu.mk
[5)]University "Goce Delcev" Stip, Faculty of Mechanical Engineering, e-mail: marija.cekerovska@ugd.edu.mk

Abstract

The use of biogas is a green technology with environmental benefits. Animal wastes can be used to produce biogas. They are processed in anaerobic digesters as a liquid or as a slurry mixed with water. This process can be used for production of biogas, which with another process can be transformed into electric power. That kind of power plant is called Biogas power plant.

In this paper will be described the Biogas power plant built in s.Porodin, Republic of N. Macedonia, which was put into operation in 2016. It will be presented the basic project data and described during the construction of the same. The power plant is 3MW.

Key words: *Biogas power plant, renewable sourses, electrical energy, project*

1. INTRODUCTION

According the official data potential of biomass in Republic of N. Macedonia is huge. Of all the preferential producers that use the preferential tariff, such as photovoltaic power plants, hydropower plants and wind farms, biogas plants account for 16 percent% of production and 27 percent for financial support. They are second in the structure in terms of earnings.

In Macedonia there are 3 biogas plants: in Porodin village 3MW, Logovardi village 3MW (Bitola region) and Veze Sari and Leker in Trebos with 1MW and 0.6 MW.

The main project for electrical installations for Biogas power plant in Porodin- Municipality of Bitola, with a capacity of 3 MW using energy crops, fertilizer and food waste was made on the basis of architectural-construction substrates, as well as existing positive regulations and standards for this type of electric installations. The complete installation of the facility is in line with architectural, mechanical, and plumbing installations. The building consists of several reservoirs with bio mass, mutually appropriate related. In the ground floor there is a machine room where the main ones are located switchboards for automation and power. The subject of the design is the power supply of the pumps and motors in facility, electric lighting, grounding and lightning protection.

2. POWER SUPPLY OF THE BUILDING WITH ELECTRICITY

The power supply of the building is from the medium voltage cable transmission line in accordance with the rules of EVN-Distribution in the immediate vicinity of the object.

The power generation of electricity is composed of a part for the production of bio gas, with accompanying el. consumers, part of the engine-generator group for converting biogas into electricity. energy and part for the transformation of electric energy voltage level.

The power project provides power to some engine systems, power cable sizing for these systems, protection, as well as the switchboards for the same. The main switchboard is located in the machine room engine systems. Next to the main switchboard is the switchboard for automatic system management. In some tanks there are engines for mixing the bio mass, the same are operated frequently from the main switchboard housed in the machine room.

3. TRANSFORMERS AND MOTOR GENERATORS ARE COMPACT-CONTAINER TYPE

Figure 1. Part of biogas power plant in Porodin (Picture taken by author[1])

From the main switchboard (GRT) to the individual motor consumers Frequently operated in the given tanks is laid cable-armored type PP41 in a concrete channel in the ground, with a concrete cover. For other consumers a cable is laid in the same PP00 channel. The GRT provides a power switch (AS) with a remote control for disconnect the switchboard and all consumers supplied by it. The remote switch is located in the GRT section, and the ridge the shutdown command switch is located in the machine room, visibly separated by a glass window with the inscription: off mainly electricity supply. The inclusion of GRT is manual.

4. PRODUCTION OF ELECTRICITY

For all three generators, biogas which is produced in the field is used as fuel from the facility intended for that activity. Power consumption for part of the drive of biogas production is provided by a separate source at 0.4 kV voltage level, derived from the low voltage switchboard before the voltage is transformed, in accordance with the electrical energy consent of the EVN distribution.

Figure 2. Genset-Container type; JGC 320 GS in Porodin (Picture taken by author[1])

Production of electric energy consists of three generator - motors housed in containers in the object area The motor generator is a Genset-Container type; JGC 320 GS, with rated output power Pe = 1 MW at voltage of 0.4 kV given on Fig. 2. With help of transformer which is container type with Pn = 1600 KVA; 0.4/10(20) kV, the voltage level of the generator rises to 10 kV, where it is connected according to energy compliance with EVN's medium voltage distribution network Macedonia.

The metering of the transmitted energy is at a medium voltage level, in terms of everything power agreement. Maximum electricity delivered in the system for this power plant is Pe = 3MW.

Figure 3. View of part of the biogas power plant in Porodin (digester and machine room) (Picture taken by author[1])

5. LIGHTNING PROTECTION AND GROUNDING

The protection against dangerous contact voltage is made in accordance with the applicable norms, which predict:

- Automatic disconnection of power supply with electrical equipment in switchboards which guarantees disconnection in the event of a critical touch voltage over time less than or equal to the applicable regulation.

- Application of Class II devices or devices with appropriate insulation.

- Main leveling of the potentials of the metal parts in the building.

In the installation for all consumers, lines with a protective third are provided that is, the fifth vein (PP-Y; PPOO.). Protection to comply with the conditions of el.energy consent. To equalize the potential of all metal parts the metal rail in the EPC in the machine room was used and it is the same merged with grounding with a galvanized strip FeZn 30x4 mm.

From the EPC in the machine room to all the metal tables in the room are provides connection with single-core P / F 1x10 mm2 cable with cable connectors. Connect all metal electrical channels and regalia for electrical divorce, metal doors, pipes, etc. according to the rules.

Thunderstorm installation is used as protection from atmospheric discharges for this object lightning arrester with early start device. This lightning system is in completeness with the Macedonian standard MKS N.B4.810.

In the outer part of the building are placed 15m. metal poles of whose top are placed early starting lightning rods type Provectron. The metal pillar was

well secured mechanically with tight steel wires. Such a system of lightning protection, with a certain effect on the radius of protection from atmospheric discharges of 90 m, is suitable as for the object and also protects people around the area.

Figure 4. Provectron S6.60 on the roof of the machine room (Picture taken by author[1])

The destructive lightning rod is designed to reduce the average statistical time of initiation of the upward tracer. From the destructive lightning rod, unlike a metal rod placed in the same conditions, the upward tracer is activated earlier. This gain over time has been determined and proven laboratory.

From the mast of the lightning rod to the measuring gauge on the ground floor is used galvanized tape FeZn 30x3 mm. The tape is mounted across the metal pole. For this system of atmospheric protection it is necessary that each drain conductor is specially grounded with a earthling switch that is separate from the protective earthling and which provides a minimum of 10 ohm transient ground resistance. The work grounding of the building is separate from the protective one.

For this building, two metal pillars with fastening are provided a lightning rod on them that completely covers the protection zone of this building. Grounds are a combined system of nine metal round probes Ø 75 mm, x = 3 m vertically set-longitudinal and metal strip horizontally laid Fez 30x4 mm, as their galvanic connection also an additional grounding.

Protective earthling is performed on the foundation of individual tanks throughout the building as a thorough grounding. A grounded metal strip laid in the concrete is used for the grounding leveling MB 15, in the form of a lattice. The tape is laid in concrete to level 5 cm from the ground, between the ground and waterproofing and merge galvanically on each lower meter with the foundation rebar. The supply from the grounding ground to the equilibrium rail in the basement and the inlet to the GRT grounding are performed with the same galvanized tape FeZn 30x4 mm. All metal structures of the tanks are connect to the same strip for common grounding.

6. CONTROL SYSTEM

The continuous monitoring of the biogas plant is achieved by using a remote control system such as Supervisory Control and Data Acquisition (SCADA) system. This remote system facilitates immediate feedback and adjustment, which can result in energy savings.

Figure 5. SCADA system (Picture taken by author[1])

7. CONCLUSION

This paper describes the Biogas power plant with a capacity of 3 MW built in the village Porodin, Republic N. Macedonia, which was launched in 2016 year.

Specifically, the project for the construction of the specific power plant in Biogas describes and presents its basic data.

Potential of biomass in Republic of N. Macedonia is huge. Of all the preferential producers that use the preferential tariff, such as photovoltaic power plants, hydropower plants and wind farms, biogas plants account for 16 percent% of production and 27 percent for financial support. They are second in the structure in terms of earnings.

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