Interreg CENTRAL EUROPE
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REEF 2W

D.T4.3.3.

PRE-ASSESSMENT FOR EVALUATING

the suitability of 15 2W plants to become REEF 2W

Made by REGEA in 05/2020

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A) INTRODUCTION AND GENERAL INFORMATION

In the scope of deliverable D.T4.3.3.- at least three Croatian WWTPs will be examined in more details in order to check possibility of implementing REEF 2W solutions.

For accomplishing mentioned tasks and goals, REGEA contacted several WWTP operating companies in the NW Croatia to collect data about WWTPs for the pre-assessment.

As suitable for Pre-Assessment three locations were highlighted- namely WWTPs Karlovac, Ogulin and Slunj.

WWTP Karlovac

WWTP Karlovac is located in the area of Gornje Mekušje, part of City of Karlovac (55700 inhabitants). Project of establishing the WWTP was co-financed by the EU ISPA pre-accession fund and started operating on May 30, 2011. Plant has three stages of water treatment. The mechanical and biological stage of purification consists of a series of biological, chemical and physical processes that have the function of removing most organic and inorganic substances present in water. It is designed for a biological load of 98.500 population equivalent (PE) but current daily average is 43.300 PE. In the next period, it is planned to increase the load to 67.000 PE.

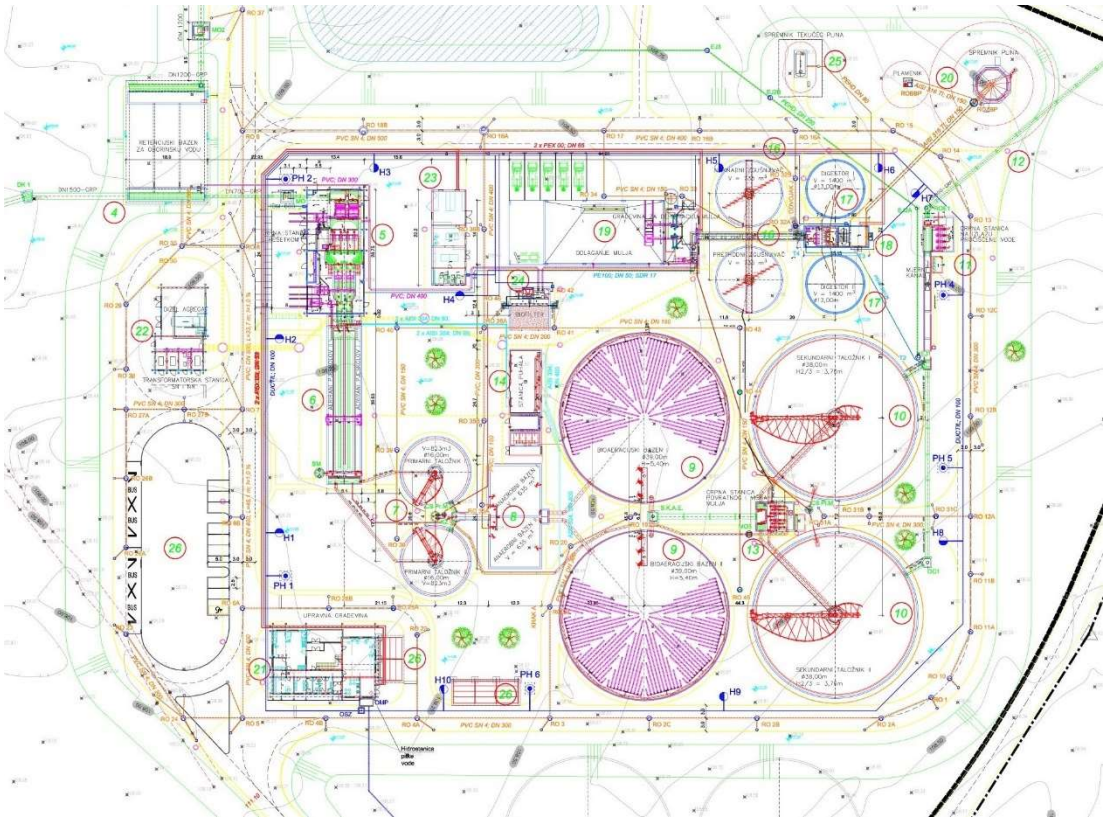

Figure 1: WWTP Karlovac (source: Vodovod i kanalizacija Ltd. Karlovac)

The process consists of the previous (mechanical) stage of purification and the second and third stage of purification. The second and third stages of purification include the process with activated sludge in bioaeration basins and pools for biological removal of nitrogen and phosphorus nutrients and secondary precipitation. Sludge treatment includes thickening, stabilization and anaerobic digestion, as well as mechanical dehydration and disposal.

As part of the project, it was planned to build a sludge drying plant that would use solar energy and additional thermal energy from the biogas plant. This would result with the degree of drying of the sludge to 90% dry matter.

Data on WWTP Karlovac:

Treatment capacity (total)	98.500	PE
Average capacity daily PE for 2019.	43.300	PE
Wastewater flow	17.988	m^3/d
COD inflow concentration	289,06	mg/l
TN in influent	5,08	kgTN/ m^3
Daily electricity consumption (2019.)	4.802	kWh
Daily biomethane production (2019.)	501,1	m^3/d
Daily primary sludge	1.733,2	kg/d

The plant is chosen for pre-assessment as very well operated plant and crew with large amount of data. Also plant has anaerobic digestion implemented.

WWTP Ogulin

WWTP Ogulin is located near the City of Ogulin (13915 inhabitants). Project of establishing the WWTP was co-financed by the EU ISPA pre-accession fund and is in full operation (phase I) with capacity of 7.500 PE. In phase II it is planned to increase the load to 15.000 PE. Plant has three stages of water treatment. The mechanical and biological stage of purification consists of a series of biological, chemical and physical processes that have the function of removing most organic and inorganic substances present in water.

Figure 2: WWTP Ogulin (source: Vodovod i kanalizacija Ltd. Ogulin)

The basic technological units of the plant are: mechanical pre-treatment with acceptance of the contents of septic tanks, biological treatment, treatment of excess biological sludge and treatment of polluted air (unpleasant odors). A mechanical pretreatment is provided on the designed device, which consists of primary treatment, a station for processing the contents of septic tanks and sand traps. The device consists of biological treatment and membrane filtration.

Data on WWTP Ogulin:

Treatment capacity (total)	15.000	PE
Average capacity daily ES for 2019.	7.500	PE
Wastewater flow	600	m^3/d
COD inflow concentration	30	mg/l
TN in influent	5,75	kgTN/ m^3
Daily electricity consumption (2019.)	987	kWh
Daily primary sludge	1.232	kg/d

The plant is chosen for pre-assessment as very well operated plant and crew interested to find out possibilities of implementing REEF 2W solutions.

WWTP Slunj

WWTP Slunj is yet to be built on location near river Korana in the City of Slunj (5070 inhabitants). WWTP design and implementation is co-financed by the EU fund and it is expected to start 2023. Plant is designed for a biological load of 5.000 population equivalent (PE).

The basic technological units of the plant are: mechanical pre-treatment with acceptance of the contents of septic tanks, biological treatment, treatment of excess biological sludge and treatment of polluted air (unpleasant odors). A mechanical pretreatment is provided on the designed device, which consists of primary treatment, a station for processing the contents of septic tanks and sand traps. The device is designed to consist of biological treatment and membrane filtration.

The plant is chosen for pre-assessment because municipality was interested In, it is a rather small capacity WWTP that will operate in small community so we wanted to analyze possibilities of REEF 2W solutions to WWTP of such scale.

Figure 3: WWTP Slunj (source: Komunalac Ltd. Slunj)

Data on WWTP Slunj:

Treatment capacity (total)	5.500	PE
Wastewater flow	750	m^3/d
Daily electricity consumption (estimate)	2.014	kWh

B) PRE-ASSESSMENT APPROACH (METHODOLOGY)

During the work on REEF 2W REGEA detected several WWTP operators and their WWTPs as possible candidates for Pre-Assessment for evaluating possibility of applying REEF 2W solutions. Among them there were WWTPs in cities of Jastrebarsko, Velika Gorica, Zaprešić, Slunj, Ogulin and Karlovac.

We sent e-mails and conducted series of phone calls and meetings with WWTP operators with purpose to inform them about REEF 2W project and to gain more information in order to choose three candidates suitable for Pre-Assessment. After this process we chose WWTPs in Karlovac, Ogulin and Slunj as the most suitable because of the available data for locations.

The data provided from WWTPs were then used for evaluating energy efficiency and renewable energy measures. In chapter A of this document there is a general information about chosen WWTPs with description of location and glimpse of collected data. In chapter C of this document there is summary of pre-assessment of energy performance of the WTTPs as well as potential for an efficient integration of surplus heat into local energy supply concepts (spatial analysis). The final part (Chapter D) provides a conclusion of the pre-assessments based on the comparison of three WWTPs and chooses the most promising site for a more detailed feasibility study.

C) RESULTS

WWTP Karlovac

Existing WWTP runs with daily average of 43.300 PE, wastewater flow of 17.988 m^3/day and consumption of electricity of 4802 kWh and produces 501,3 m^3 of biomethane daily. In the next period there is a plan to increase the load to 67.000 PE.

Since the existing wastewater treatment plant has anaerobic digestion and produces biogas, which is currently not fully consumed in the plant, further investigation of possibility to install cogeneration plant on biogas is an option. After checking available surfaces on location- potential of installing a PV plant is clear and as preliminary calculation showed- 20% of electricity consumption on location can be covered directly from installed PV. Configuration of described RES generator should cover around 1400 m^2 of roof area. With these two in mind- there is a clear potential for reducing the plant operating cost, specifically the cost for electrical energy.

WWTP don't have much surplus heating energy and is located far from the city centralized heating system so it's rightfully concluded that there is no potential to feed thermal energy to the existing grid.

WWTP Ogulin

Existing WWTP runs with daily average of 7.500 PE, wastewater flow of 600 m^3/day and consumption of electricity of 987 kWh. In the following years a plan is to increase the load to 15.000 PE.

Estimation is that capacity of this WWTP is too small to implement any feasible type of anaerobic digester or production of biogas (big investment in technology with the low biogas production amounts). In scope that, it can be further investigated is there possibility and feasibility in transport of sludge to nearby WWTP in Karlovac that has already installed digester to contribute to their production of biogas.

First rough calculation shows that there is a sufficient space for installing PV modules that could produce up to 20% of total electricity needed. There is a need to do more detailed analysis considering available roof and terrain area (connecting phase I and phase II of development) and electric consumption for the final assessment.

WWTP Ogulin is far from settlements and there is no potential for feeding any eventual surplus heating energy into the grid.

WWTP Slunj

WWTP Slunj is yet to be built and it is scheduled to start with work in 2023.

According to project blueprints and technical specifications and description, planned capacity of the WWTP is 5.000 PE. It should produce about 1 m^3 of sludge per day with about 30% of dry matter. Estimation is that capacity of this WWTP is too small to implement any feasible type of anaerobic digester or production of biogas (big investment in technology with the low biogas production amounts). In scope that, it can be further investigated is there a possibility and feasibility in transport of sludge to nearby WWTP in Karlovac that has already installed digester to contribute to their production of biogas.

The device itself is estimated at 145 kW of connected power, with annual consumption of 735.100 kWh. Part of the electricity cost could be covered by photovoltaics. First rough calculation shows that there is space for installing 300 m^2 of PV modules that could produce up to 8% of total electricity needed. Since there is not much suitable roof or open space it is necessary to make more detailed analysis for the final assessment.

City of Slunj does not have any centralized heating system so there is no possibility for feeding any eventual surplus heating energy into the grid.

D) CONCLUSION

After analysing and discussing the results, the WWTP Karlovac was chosen to be the one for which Feasibility study will be done (D.T4.3.5.). The reasons are as follows:

- Out of 6 interviewed and 3 assessed in D.T4.3.3. WWTP Karlovac and its operator Vodovod i kanalizacija Ltd. Karlovac showed most interest and provided biggest amount of data and cooperation, also it highest rate/amount regarding to capacity, population of city it serves, energy consumption and potential of energy savings
- WWTP is in operation from 2011 and valid assessment can be made due to substantial amount of data and experience gained
- WWTP has already installed anaerobic digestion (REEF 2W solution) and is looking to and is willing to implement further solutions based on RES
- WWTP is planned to upgrade capacity

In the next step that is covered with D.T4.3.5., the selected WWTP is going to be analysed in more detail, in order to demonstrate how excess energy can be used for self-supply. These options consider the amount of available surplus energy, energy consumption. The economic feasibility assessment of planned measures will be carried out through a life-cycle cost analysis incorporating generated revenues from energy savings and sales, and investment and maintenance costs.