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EXERGY CALCULATIONS IN WASTEWATER SYSTEMS. CASE STUDY

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Abstract – Faced with geopolitical, socio-economic and environmental pressures, in 21st century is a growing global demand for sustainable, renewable energy systems. These demands also apply to engineering systems and civil engineering structures. The method for analysing the energy balance of a wastewater system is exergy analysis. Exergy analysis is a measure of the efficiency of the system and also a measure of the change in the potential of the system. In this study, the amount of resources required for the wastewater system of the city of Ogre (Ogre region, Latvia) is evaluated through exergy analysis. The Ogre wastewater system is characterised by the reuse of wastewater – heat is recovered from the wastewater. The recovered heat is used to provide heating in the Ogre Central Library (the largest passive public building in Latvia). The study compares two exergy calculations. The first is calculated without a heat recovery system (the authors' patent), the second with a proprietary heat recovery system. The study shows that the wastewater system has a higher exergetic potential with a higher value if wastewater heat is recovered or used. In addition to the energy saved, carbon dioxide (CO_2) emissions are reduced proportionally. The calculations in the study were carried out using the Hellström methodology. The aim of the study is to compare the exergy balance of a wastewater system including heat recovery from wastewater. The main objective of the study is to promote the use of renewable resources in water management facilities, to highlight the importance of exergy calculations and to encourage CO_2 footprint reduction activities. Hypothesis: "using renewable resources and exergy method reduces CO_2 footprint".

Keywords – Carbon dioxide; energy; exergy; heat recovery; sustainability; wastewater system