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The first anaerobic-aerobic WWTP commenced its operation in 1991 in Rimavská Sobota sugar refinery with the daily capacity of 2000 t of sugar beet; a two-stage anaerobic-aerobic system. The anaerobic reactor was a 19.5 m high cylindrically shaped stirred tank with the diameter of 16 m and the overall volume of 3000 m³. The anaerobic stage comprised two rectangular activated sludge tanks of 2x950 m² surface area connected in series. The designed wastewater flow in the biological WWTP was 1800 m³/d with COD of 7,000 mg/l (organic loading rate of 4.2 kg COD/m²·d). In average, approx. 95000 m³ of biogas was produced in one run in an anaerobic reactor (1760 m³/d) used for heat generation in a sugar refinery heating plant. This WWTP is not in operation anymore, neither is the sugar refinery plant in Rimavská Sobota. Sugar refineries and their WWTPs in Šurany and Trnava followed the same pattern. Two sugar refineries – in Sere and Trenčianska Teplá – are still in operation, both with anaerobic-aerobic WWTPs operating on the same principles as the one in Rimavská Sobota. The sugar refinery in Sere processes approx. 4000 t of sugar beet a day, while 490600 m³ of biogas are produced in one run (4055 m³/d). The sugar refinery in Trenčianska Teplá processes approx. 6000 t of sugar beet a day, though only 200000 – 300000 m³ of biogas are produced in one run.

By the end June 2015, 111 biogas plants were operated in Slovakia with the installed power capacity of 103 MW; though the situation in connecting new biogas plants to the grid is unclear, since the end of 2013. In december 2013, the distribution corporations Západoslovenská distribučná, a.s., ZSE-D, Stredoslovenská distribučná, a.s., SSE-D, and Východoslovenská distribučná, a.s., VSE-D, decided not to accept nor process any further applications for connecting new energy generating facilities to the grid.

Other existing anaerobic reactors worth mentioning are the IC reactors in Enviral in Leopoldov (distillery), Harmanec (paper mill) and Hurbanovo (brewery); in Table 2 also two other IC reactors are listed, though these are not in operation anymore, unfortunately, neither are the plants.

Electricity is produced from biogas only in the Hurbanovo brewery, where two CHPs with the power capacity of 2x160 kW are installed.

Smaller anaerobic reactors for wastewater treatment worth mentioning are the hybrid reactor in the cheese producing plant PD Slovenská Ľupča (farm), and the UASB reactor in Frucona, Obišovce (fruit and vegetable processing).

Biogas Production at Biogas Plants

Despite the long experience with biogas plants in the former Czechoslovakia, dating back to the early 1970s (biogas plant in Tebo (Czech Republic) for pig manure processing), only a few biogas plants

obligation has been stipulated in the law since it came in effect, though the sanction, i.e. supplier of energy from renewable resources is entitled by the law to be paid for the green energy supplied to the grid or to be granted a bonus when consuming this energy, was incorporated only on October 22nd 2013 by the Act 382/2013, and is effective since January 1 2014. It should be noted that most of the sanctioned energy producers had contracts with the grid operators for 15 years and that the estimated volume of supplied energy declared in the reporting obligation is not mandatory.

The content of the substrate represents another problem for biogas plants in Slovakia as the majority uses maize silage as the main substrate; more than one quarter of maize silage produced in Slovakia is used in biogas plants. Despite the fact that the numbers of cattle do not prove the increasing need to produce maize silage, it is obvious that using maize silage as the key substrate for biogas production is not sustainable and neither is the general production of first generation biofuels. Changes in the substrate composition for biogas plants are further discussed below.

Biogas Production at Land II

According to the Ordinances 283/2001 and 310/2013 on executing certain provisions of the Waste Act as amended, issued by the Slovak Ministry of the Environment, biogas produced at land II, i.e., land II gas, needs to be

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