IEA Bioenergy
Technology Collaboration Programme

Case Story

IEA Bioenergy: Task 37: 07 2021

Circular economy system integrating biogas into process to produce high quality products from recycled paper

Figure 1: The W.Hamburger paper and board production facility in Pitten, Austria

Production of high quality products from recycled paper

W.Hamburger, part of the Austrian Prinzhorn Holding, located in Pitten, Lower Austria, offers its partners throughout Europe a full programme of high-quality corrugated case material products. Production is based in four European countries: Germany, Austria, Hungary, and Turkey. The group produces high-quality corrugated case material, as well as plasterboard liner and paperboard.

In Pitten, Austria, 450,000 tons of paper and board are produced annually on 2 paper machines. Due to the focus on sustainability, recycling waste streams from the industry via anaerobic digestion of wastewater is a matter of course. W.Hamburger has used recycled paper for decades as a raw material for the production of various paper and board products. In accordance with environmental regulations and additionally to gain a competitive business advantage, different stages of wastewater treatment are installed.

In Pitten, W.Hamburger operates its own wastewater treatment plant to clean wastewater volumes of 6,000 m^3 per day. After a mechanical cleaning stage, four anaerobic reactors with a total volume of 3,500 m^3 generate approximately 17,600 Nm^3 of biogas per day (c. 3m^3 biogas per m^3 wastewater), depending on the operating status. There is also a biogas storage tank with a volume of 250 m^3 at 35 mbar. The produced biogas is cleaned in a biogas scrubber and combusted in boilers for thermal energy and in a combined heat and power (CHP) process for electrical and thermal energy production. The wastewater is finally treated in an aerobic stage in house before final cleaning offsite in the municipal wastewater treatment facility.

Development of the waste water treatment facility

In 1990, the first Upflow Anaerobic Sludge Blanket (UASB) reactor was installed at the facility. Within 6 years the expansion of the facility was necessitated due to increasing loads in the incoming wastewater. The initial UASB facility had a working volume of 910 m^3. In 2004, another biological stage (UASB) with 950 m^3 volume was installed. Further increases in the load of the plant led to the addition of 2 more anaerobic reactors in 2016. These two anaerobic upflow systems operate at high loading rates in an internal re-circulation (IR) configuration with a working volume of 800 m^3 each; see figures 2 & 3.

Figure 2: Wastewater treatment facility at W.Hamburger facility in Pitten,

The entire plant treats 2 million m^3 of wastewater annually. Due to the technology used, solid compounds must be removed from the wastewater before further treatment. This separation takes place in a preliminary stage. The wastewater that enters the anaerobic stage has a dry matter content of less than 500 mg/l. The mass of COD treated is about 45,000 - 55,000 kg per day, which is increasing slightly on an on-going basis. In 2016, a microbiological desulfurization unit for the biogas was installed which oxidizes H_2S and separates it from the gas stream.

Energy utilization & process implementation

The total energy demand at the W.Hamburger plant is 645,000 MWh of heat and 160,000 MW_eh of electricity. The biogas is used in the boilers for steam generation and electricity and heat generation in the combined heat and power unit (CHP). The energy from biogas is used onsite at the production facility to provide energy for the industrial process and substitute the use of fossil fuel. Anaerobic digestion produces 5-6 million Nm^3 of biogas per year, about 30,722 MWh, which is equivalent to 5% of primary energy demand at the facility.

In addition, the sludge from the on-site aerobic wastewater treatment plant is either incinerated to generate steam and power or managed off-site by external contractors.

Figure 3: IR-Reactors at the wastewater treatment facility.

Challenges

As with many facilities that recycle residual materials, the W.Hamburger plant is also confronted with the challenge of quality of and variation in composition of input material. As the plant recycles wastepaper, the composition of the input material depends on society's attitude to collection and recycling. This leads on to variation of composition of the wastewater, which directly influences the biogas production. The anaerobic processes must react and adapt to such variations.

Another challenge for the operation of the plant is an on going consistent increasing COD concentration in the wastewater. This increases the addition of calcium, which is also found in the sludge and influences post-treatment of the sludge.

IEA Bioenergy Task 37 "Energy from Biogas" http://task37.ieabioenergy.com

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