

One equipment manufacturer had a challenge on its hands when tasked with installing agitators for square tanks

The Dutch agitators

Brothers Jan and Toine Aben from Wanroij, North Brabant in the Netherlands, run a family business called Aben BV. The company operates in dairy farming, pig farming, and recycling with a biogas plant. These utilities are spread over four different locations.

In 2003, the brothers founded Aben Recycling BV. The recycling branch includes the mentioned biogas plant, and Aben is one of the first pioneers in the Netherlands' biogas market. Electricity production began in 2004 with a 230kW combined heat and power (CHP) unit which produces enough electricity to power more than 500 households. In addition, a portion of the heat from the plant is used to heat Aben's stables, and a portion was used for the sanitisation of manure to make it suitable for export. Multiple extensions and modifications over the years have expanded the installation and grown its installed capacity to approximately 5.7MW. This will provide power for more than 10,000 households.

All the heat released in the plant is fully utilised. Among other features, a 2km-long heat duct was built between the plant and a nearby farm to heat its chicken pens. In addition, a vast majority of the heat is used at a large drying installation. The heat exhaust of the CHP plant is also being used in an organic ranking cycle to produce electricity.

Requirements

In 2014 Aben Recycling contacted Jongia Mixing Technology, based in the

Netherlands. Founded in 1937, Jongia is today a market-leading manufacturer of mixing and stirring equipment. Aben was looking for an agitation technology provider that could deliver agitators for square tanks with an optimal digesting process. Aben intended to build a rectangular concrete basin of 40x80m and a volume of 32,000m³, divided into eight segments of 20x20x11m. The chosen design would save Aben building space and make the tank compartments highly compact.



Overview of the top of the tank

However, the design came with a difficulty. The stored slurry has to be agitated enough so that sediment will not accumulate in the corners of each square basin. Aben also wanted to install the robust agitator outside the digester. The whole agitator also needed to be removable without emptying and entering the digester.

Jongia accepted the challenge. The geometry of the tanks, together with the flow behaviour (rheology) of the products to be agitated, were known in this case. After determining the right process result with the right velocity of the top over bottom bulk flow by using Jongia's own agitator design program together with

a computational fluid dynamics (CFD) model, Aben requested Jongia to produce a scale model of its solution. Jongia created a scale model for Aben with a special agitator design in which homogeneity and preventing a floating layer and sedimentation were the goals to be reached.

The results of the scale model tests, together with the CFD model, convinced Aben that Jongia could deliver the sought after process results with a tailor-made agitator. In 2015 Aben Recycling placed

an order for Jongia to deliver and install the agitators. Jongia scaled up the scale model agitator design, thus achieving the same bulk flow velocity as in the scale model.

From the design table to reality

In Q4 of 2015 the agitators were installed and running. Aben Recycling measured the power consumed by the agitators at about 21kWe, which was within Jongia's calculations. The eight agitators can also be removed in their entirety without emptying or entering the digester, according to Aben's specifications.

The agitators are equipped with hydrofoil propellers to

generate a controlled axial/vertical flow from top to bottom. These propellers are also energy efficient compared to traditionally used propellers/turbines. As another design feature, the agitator will once a day run backwards for a number of minutes to shake off any build-up of fibrous material from the agitator propellers. This build-up on the propeller blades causes the blades to become unbalanced, which can result in a breakdown. The Jongia design reduces this risk.

Just above the tank bottom, Jongia placed a radial turbine on the shaft to have a high radial speed along the bottom to reduce sedimentation to an absolute minimum. The agitators have free hanging shafts without bottom bearing.

The Jongia special agitator design can handle inert materials like plastics. Due to the high down force liquid movement by the hydrofoil propeller just under the liquid level, the formation of a floating layer is prevented.

With over 15 years of experience, Jongia has delivered its special agitator technology to many of the Netherlands' industrial biogas plants, including Shanks/Orgaworld in Amsterdam which operates the biggest wet biomass plant in Europe called Green Mills, HoSt Bioenergy Installations, Van de Groep, Croda, Wageningen University Research for its demonstration plant in Leeuwarden, Hydrothane, Omrin, and Vagron. Jongia has also provided its technology for international biogas plants. ●

For more information:

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