

# Howden's range of Turblex® steam turbines for waste heat recovery



Sewage sludge incineration plant generates its own Energy: N.V. Slibverwerking Noord-Brabant (SNB), Moerdijk, Netherlands.

**In the Netherlands, N.V. Slibverwerking Noord-Brabant (SNB) operates a type of dedicated plant and processes approximately 450,000 tons of dewatered sewage sludge every year.**

The dried sludge is incinerated at a temperature of approximately 1652 degrees Fahrenheit.

Dedicated plants that only incinerate sewage sludge offer the advantage that valuable raw materials contained in the sludge, particularly phosphorous, can be separated and reused as fertilizers

The world's largest plant for the incineration of sewage sludge is now nearly energy-neutral. With two newly installed steam boilers and one steam turbine, it is generating at least 95 percent of its power requirements from the waste heat of the incineration process itself.

**Operating costs have been reduced by nearly 10 percent.**

Until now, the plant only generated low-pressure steam from the waste heat. The steam is used in various processes and, to a limited extent, for power generation. One boiler specialist has now replaced two of the four low-pressure steam boilers with high-pressure boilers and has installed a turbine that generates electricity via a generator. This makes it possible for the operator to use the exhaust heat much more efficiently and produce nine times more power than before.

#### **Retrofit during operation**

When the SNB plant was retrofitted with two high-pressure steam boilers for power generation, engineers from boiler specialist faced two challenges.





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They had to design the boilers so they could fit into the plant, which was built in 1997. In addition, the boilers had to be installed as quickly as possible while the plant was in partial operation so as not to disrupt processing of sewage sludge.

Experts implemented a boiler that meets the specifications for the turbine (842 degrees Fahrenheit steam temperature at a pressure of 870 psi) while also complying with prescribed restrictions for size and weight. They achieved this in part by using a smaller diameter for the boiler's economizer tubes, which allowed them to reduce wall thickness and hence weight. In addition, it was necessary to adjust the spacing of pipes in accordance with height restriction while at the same time taking into account the fouling characteristics of the fuel. Engineers had to pay special attention to the selection of steam temperature. Sewage sludge contains many different chemical elements, some of which corrode metal at very high temperatures.

That's why the steam temperature was limited to 450 degrees Celsius even though the boilers and turbine would be able to operate at higher temperatures.

#### Steam turbine with two modules

The steam drives a Howden TWIN industrial steam turbine. The turbine has two modules connected in parallel. A high-pressure module is operated at a steam pressure of 870 psi. After this, a low-pressure module supplies the remaining steam in the form of process steam at a pressure of 36.3 psi. This low-pressure steam is used primarily to dry the sewage sludge, which contains approximately 75 percent water upon delivery. Retrofitting with high-pressure boilers eliminated the steam motor operated with low-pressure steam that had previously been used to generate electricity with a 450-kilowatt generator. Instead, the plant now uses a 3.5-megawatt generator to cover nearly all of its power requirements.

#### Steam turbine parameter

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Steam turbine: TWIN

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Power output: 3.5 MW

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Inlet steam pressure: 60 bar(a) / 870 psi

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Inlet steam temperature: 450°C / 842°F

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Exhaust steam pressure: 2.5 bar(a) / 36.3 psi

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#### Customer benefits

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95 percent of power requirements generated by itself

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10 percent lower operating costs

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9 times more power generation than before

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Boiler and steam turbine design to fit into existing plant

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Installation during partial operation of the plant

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Adjusted steam parameter due to fuel characteristics

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