

Contracting Solution for Energy-Supply of a Food-Production Site

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RDF-CHP Plant Stavenhagen, Contracting Solution for Energy-Supply of a Food-Production Site

Abstract

Putting the RDF CHP-plant Stavenhagen (Refused Derived Fuels Combined Heat and Power Plant) in operation by the contractor Nehlsen AG, enabled supplying the company Pfanni, potatoes based food products, with process vapor and electricity, not from a primary fossil fuel but from a secondary solid fuel, generated from a MBT Mechanical-Biological-Waste-Treatment plant. The advantages of this innovative energy supply process are saving of fossil energy resources and thermal remediation of waste, which is a consequent completion with the principles of waste recycling economy. The remains quality of this process complies perfectly with the preconditions of waste for land-fill discharge. In addition this plant secures current jobs of the food and food-supporting industry, including creation of new jobs within the RDF CHP-plant. Last but not least the MBT plant represent a real investment alternative for energy supply at the company Pfanni.

Keywords

RDF CHP Plant, MBT Plant, Company Pfanni, Process steam and electricity

1 General Description of the CHP Stavenhagen

The operator of the RDF CHP-plant Stavenhagen (Refused Derived Fuels combined heat and power plant) is the company Nehlsen Heizkraftwerke GmbH & Co. KG. Since summer 2007, the RDF CHP-plant has been supplying the company Pfanni, manufacturer of potato and potato-based instant products, with process steam and electrical power by means of a cogeneration system. Energy supplier and client are situated close-by. The surplus electric power, that would not be used neither by Pfanni nor by the RDF CHP-plant in Stavenhagen, would be fed into the local electrical grid.

The first project for the energy contracting at Nehlsen was based on considerations of the Pfanni company in Stavenhagen to realise a restructuring of their power supply.

Due to rising prices for natural gas and electricity as well, as the possibility to produce steam and electricity locally by means of a power cogeneration system, the idea came up for replacing the existing natural gas-fired heat supply station by RDF-fired heat and power station.

The first calculation showed that 95.000,00 t/a of RDF are needed. This amount could be generated from two regional MBT-plants. This idea comply strategically with both, material recycling and thermal utilisation of waste (Energy from Waste). The decision for building this power plant was felt in May 2005 under the pre-condition that in August 2007 the new power plant would cover the energy demand, steam and electricity, of the company Pfanni.

The higher estimated labour demand of the new power plant compared with a gas power plant was evaluated positively, because the desire of improving the social structure in Mecklenburg-Vorpommern.

With the new energy concept the company Pfanni is able either to extend its existing production or to develop new production lines with a high demand of steam or electricity.

The primary generated steam 400 °C / 42 Bar is mainly directed to the turbine for power production. One part of the generated steam is used at 16 Bar for food production and the other at 11 bar for cooking purposes.

The project Heizkraftwerk Stavenhagen to supply Pfanni with process steam and electricity was a major impact in the Unilever Group, because with the new type of energy supply the costs for steam and electricity could be substantially reduced. This showed itself especially in the light of the steadily rising price of natural gas, the Pfanni in an amount of 14 million m³ / a for the processing of 160,000 t / a of potatoes had to relate.

The reform of the energy was accompanied by an expansion of the Pfanni production at the site Stavenhagen, both with regard to a location for Pfanni as well as a reassessment of the flow volume of fuel meant. At this point in the planning for the fuel needs 95,000 tonnes a year at a standard calorific value H_u of 14 MJ / kg.

2 Incineration Unit and Boiler

The incineration unit is designed for reception, storage and fuel feeding device using a crane. The storage capacity is around 2.000 t, which is sufficient for 4 days full operation. The produced solid fuel via MBT is combusted in the furnace of a moving grate incinerator. The holes in the grate elements supply the primary combustion air.

The incineration heat input is around 45 MW. Resulting fly ash and flu gases would be separated within the applied semi-wet absorption process and filter unit. The annual amount of filter residue is about 5.600 t. The amount of resulting slag at the bottom of incinerators is around 20.000 t/a.

3 Turbo Generator Kit and Air Capacitor

The produced high pressure steam boiler is used a condensing-extraction turbine. The turbine has a sampling nozzle (16 bar (g)) for the provision of production steam for the factory.

The steam of low pressure level is cooled down in the air capacitor. Depending on the need of production steam the power generation varies. At the maximum need, approximately 4.8 MW el are generated, if there is no need 9.6 MW el are generated.

4 Flue Gas Purification

A highly efficient, two-stage gas cleaning unit is built downstream of the boiler. The purpose of this part of the overall system is to purify the flue gas according to the German flue gas emission regulations "17 BImSchV.

In the first purification stage the flue gas is treated in a spray dryer using lime as adsorbent. In the second treatment stage activated carbon and lime are used to polish the already treated flue gas stream. In addition a sludge recycling loop is arranged to ensure efficiency. Finally a dust separation filter is used before the cleaned flue gas released to the atmosphere. It is a six-chamber filter designed with vertically placed flat tubes.

The injection of lime, activated carbon recycling rate are optimised by controlling the temperature, pressure and humidity. The cleaning of the filter tubes is done on line in the pulse-jet process. As a filter material a 100% PTFE is used.

5 Some interesting Remarks

- The full load operation hours in 2008 as first operation year were in a range of 8200 hours
- The boiler efficiency according to the incineration efficiency diagram was always achievable also for solid fuel with lower heat value
- The temperature in the filter was controlled between 140-150 °C to avoid condensation and corrosion.
- Via the co-generation process 10.000.t/a reduction of CO₂ were achieved.
- The expectation regarding SO₂ and HCl concentration are indeed surpassed
- Removal of Dioxin was achieved using activated carbon as additive with lime in the second injection area
- The concentration of Hg in the cleaned gas are well below 10 µg/m³
- A 200 m³ silo for Ca(OH)₂ provide much better flexibility than 100 m³ silo