

Stationary Power

Medium speed engine burning waste oil

MAN Diesel



High Efficiency Co-Generation Plant

Running on waste cooking oil

Medium Speed Engines

Part of the greenhouse gas solution

With the highest fuel efficiency of any combustion engine, large diesel engines have the potential to be part of the solution in reducing emissions of the greenhouse gas carbon dioxide (CO₂) especially in electrical power generation and co-generation applications.

Reinforcing the efficiency aspect is the ability of slow and medium speed diesels to run on a range of treated and untreated plant oils, waste oils and animal fats – fuels which cause problems in high speed diesels with more sensitive fuel injection equipment.

Further underscoring the Diesel engine's claim to be part of the solution in the fight against global warming, where there is a use for the thermal output of the engine – i.e. heat recovered from its lubricant, intercoolers, coolant and exhaust gases – overall energy utilisation levels well over 90% can be achieved, as in the best industrial and municipal co-generation (co-gen) plants.

Waste oil to electricity and industrial fuel

Among the most futuristic applications of MAN Diesel's plant oil engines is a six cylinder type 21/31 diesel operating on waste cooking oils at a waste water treatment (sewage) works in Fritzens, Tyrol, Austria. In a co-gen plant the engine powers a generator set that provides electrical power to the Austrian national grid at preferential rates under the "Oekostromgesetz" ecological electricity scheme, and thermal power for processes and consumers at the plant itself.

Outputs	1.13 MW electrical 1.34 MW thermal
Overall efficiency	88%
GenSet	1 x 6L21/31
Fuel	Used cooking oils and fats
Fuel conditioning	Heating, separation, filtration
Recovered heat utilization	Space heating Acceleration of sewage digestion Drying of sewage sludge



The attractive Fritzens power house resembles a boat

Background

The waste oil co-generation plant is part of a response by the waste water utility “Abwasserverband Hall” in Fritzens, Tyrol to problems caused by the disposal of cooking oils into the local sewer system. Before a preventive programme was instigated, the utility experienced regular blockages of waste water pipes due to solidified cooking oil. Both private households and gastronomic establishments were literally throwing their used fats and oils down the drain. Clearing the blockages cost an estimated Euros 400 per ton of discarded oil.

To counter this the authority introduced an infrastructure for waste oil disposal in which sealable “Oelis” containers are distributed to households and eating places. They are then expected to return the full “Oelis” to local collection points.

Within a short time the scheme began to yield around 1800 tons of oils and fats per year, allowing the “Abwasserverband” to construct a co-gen plant with multiple energy recovery stages.



The 21/31 bio-fuel engine and generator

Optimised energy balance

On arrival at the Fritzens plant the waste oil is stored in a settling tank to remove larger food residues. Before injection into the engine it is conditioned by heating and fine filtration.

As well as feeding the separated oil to the engine, the sediment from the settling process is fermented with other waste products in the sewage digesters at the Fritzens site. It thus contributes to the production of bio-gas which is burnt in a smaller co-generation plant based on two 300 kW gas engines.

To further maximize the energy balance of the plant, the thermal output of the 21/31 waste oil engine and the smaller gas engines is used in two ingenious additional energy recovery stages.

In the case of the gas engines, recovered heat is used to accelerate the fermentation process and in the case of the waste oil engine for space heating at the plant and to dry the solid residues (sludge) from the sewage fermentation process.



Fuel conditioning separator



Solids separated from the used cooking oil are fermented with other waste to produce methane for two 300 kW gas engines

Overall savings

The 9 GWh annual electrical output of the oil and gas engine generator sets at the Fritzens co-gen plant covers both the works' own consumers and a contribution to the local electricity supply grid equivalent to the annual consumption of around 6000 citizens.

The thermal output of the diesel and gas engines covers the entire energy requirement of the sludge drying process. It is equivalent to the annual thermal consumption of 2000 people.

Renewable-in, renewable-out

Further optimising the energy balance of the Fritzens plant, the sewage sludge drying process produces dried and granulated or pelletised combustible material which can be used as fuel in fired boilers or process heat furnaces. Currently the plant supplies this additional CO₂-neutral fuel to a cement works. Alternatively, the sludge could be used to produce combustible gas in a pyrolysis process.

Emissions and performance

MAN Diesel has monitored major aspects of engine operation, including emissions and the effect of this unusual fuel on the injection system and other engine components. In spite of acid content in the waste oil, the injection pumps are achieving satisfactory times between overhauls.

The plant features an exhaust aftertreatment system consisting of a selective catalytic reduction (SCR) system using urea as the reducing agent and a subsequent oxidation catalyst to remove possible ammonia slip.

The emissions of the 21/31 engine are monitored regularly by the "TÜV" technical inspectorate and are well within the limits of applicable clean air legislation. A major finding is the excellent levels of particulate emissions achieved by the engine. The low levels of elemental carbon in the exhaust gases are attributed to the high oxygen content of the used cooking oil.



Logistics – To collect used cooking oils for use in its Fritzens co-gen plant, the waste water utility “Abwasserband Hall” in Fritzens, Tyrol has distributed “Oeli” sealable, reusable plastic containers to households and eating places in its area.



Recycling – “Oeli” containers come in a range of sizes. Filled containers are delivered by the public and businesses to collection depots for transport to the co-gen plant. They are returned to the collection depots after emptying and cleaning.

MAN Diesel SE

86224 Augsburg, Germany

Phone +49 821 332 3879

Fax +49 821 332 1460

powerplant@mandiesel.com

www.mandiesel.com