CASE STUDY
by Termogamma

ENERGY EFFICIENCY UPGRADE: FREE STEAM AND HOT WATER FOOD INDUSTRY, MENA COUNTRIES

KitCOG-200/Steam

BACKGROUND

In many areas with frequent and extended blackouts or such without centralized power distribution network, one of the few cost-effective options for power generation remains diesel generators (gensets). Uninterrupted power supply is especially important for manufacturing industries, which cannot afford to lose work hours, respectively revenues, on a regular basis.

There are such areas all over MENA which is actually investing and improving its power generation and distribution networks, but there is a lot yet to be done. In the meantime, many companies have installed gensets to provide the energy needed for their manufacturing processes.

SITE DESCRIPTION

The case explores the potential energy efficiency upgrade of a food factory which operates continuously-24 hours per more than 300 days per year.

As it is in an area without centralized power supply, it generates its electrical energy on site through several diesel generators of 500 kW each, operating non-stop while the manufacturing process is on.

The manufacturing process consumes also large quantities of thermal energy in the form of steam and hot water, i.e. 4 ton/hour of steam of 8,5 bar and hot water of 85°C. Both are currently generated by on site through diesel boilers.

PROPOSED SOLUTION

The proposed energy and cost saving solution for this factory consists in the implementation of a customized waste heat recovery system, model KitCOG-200/Steam, which will recover the ample waste heat produced by the diesel generators. The new system will allow the factory to save the diesel fuel which it currently consumes to generate its thermal energy.

KitCOG-200/Steam will be customized to meet exactly the thermal energy needs and resources of this factory. Thus,

one system coupled with one genset will be able to recover 230 kW of waste heat in order to deliver it as steam (173°C, approximately 300 kg/h, at 8,5 bar), plus additional 187 kW of waste heat which it will deliver in the form of hot water (85°C).

All components of the system will be completely integrated at the manufacturer's site and the system will be delivered to the food factory ready for operation. The only installation work that will have to be performed on site is the connections between the new system and the existing steam/hot water distribution systems.

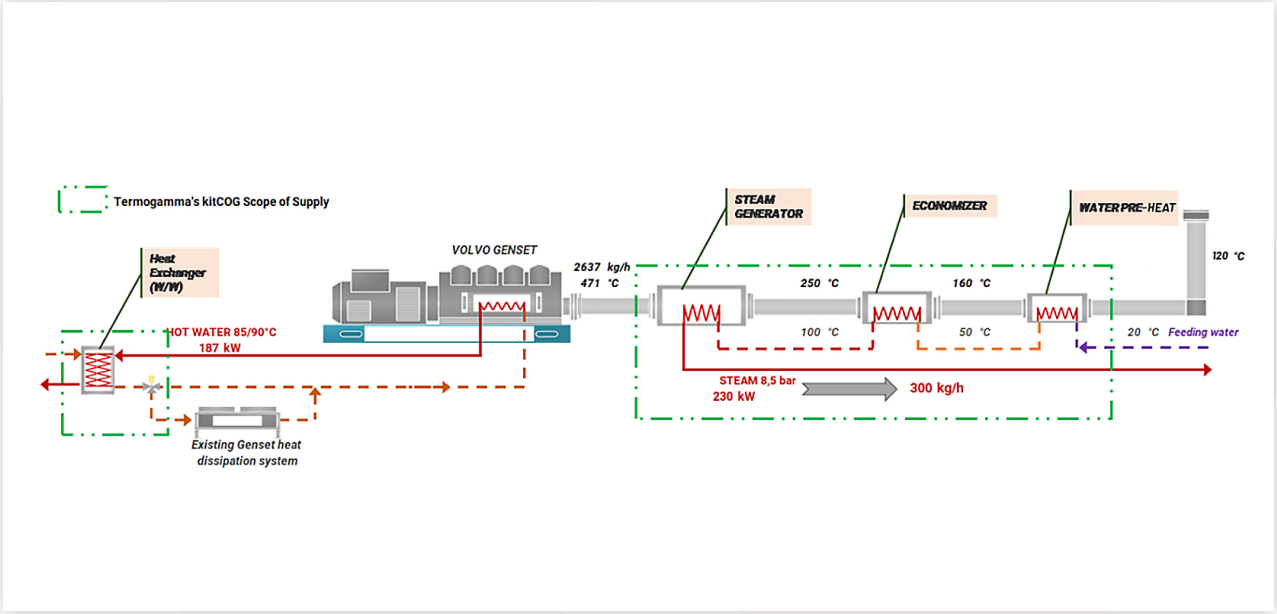
SUMMARY OF THE MAIN ADVANTAGES

- **Free energy - steam and hot water:** while the generator produces electricity, it develops waste heat in the exhaust gases and in the engine itself. It is recovered as steam (8,5 bar) and hot water (85°C), which are delivered where they are needed. The steam and hot water are therefore available at 0 cost, which means immediate savings on fuel.
- **Fast installation:** all components needed for the system's operation (pumps, valves, sensors, electric boards, pipes, heat exchangers...) are included, installed and

connected inside a special skid, which strongly reduces installation and connection time at the client's site.

- **Automated operation:** the system operates automatically and continuously with minimum operator supervision.
- **Remote monitoring and control**, providing constant performance tracking and historic record of key parameters (temperatures, batch history, etc...).

SYSTEM COMPONENTS



Steam Generator

The steam generator is placed as close as possible to the genset, at the beginning of the exhaust gases discharge circuit. It recovers heat from the genset's exhaust gases and uses it to convert the steam generator's water into steam.

Economizer

The economizer is placed just after the steam generator and uses the residual heat of the genset's exhaust gases. It consists of an exhaust gases/water heat exchanger and is used to pre-heat the steam generator's inlet water.

Water Pre-Heater

The water pre-heater is placed just after the economizer and also uses the residual heat of the genset's exhaust gases. It consists of an exhaust gases/water heat exchanger and is used to pre-heat the economizer's inlet water.

Hot Water Heat Exchanger

The hot water heat exchanger recovers heat from the engine jackets' cooling circuit. It consists of a water/water heat exchanger that intercepts the engine's heat dissipation circuit.

Exhaust Gases Discharge System

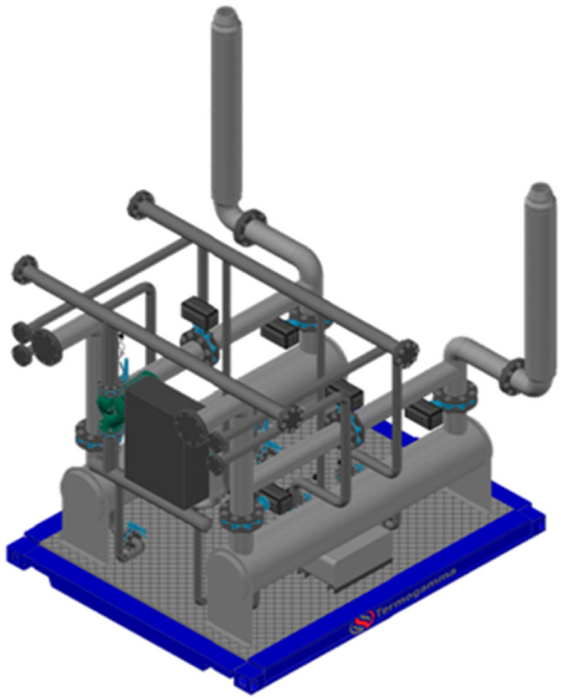
After all the waste heat recovery takes place, the genset's exhaust gases are discharged directly into the atmosphere through the exhaust system. The composition of this system is highly specific for the type of installation to be carried out at the user site.

TECHNICAL DATASHEET

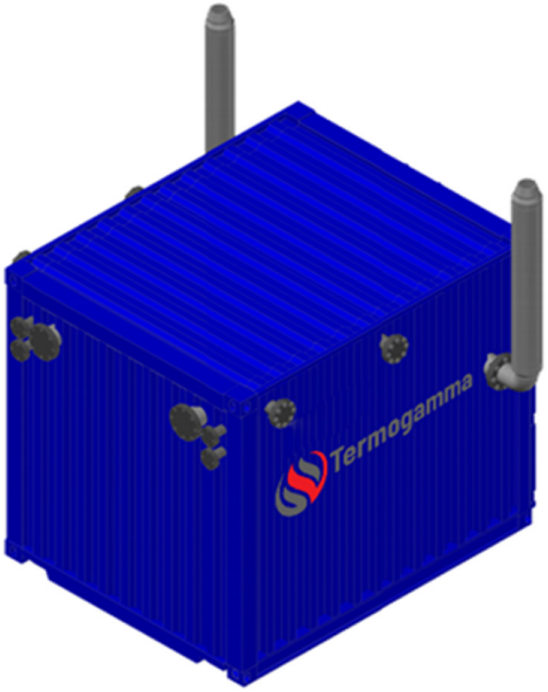
KITCOG-200/ Steam	Value	Unit
OUTPUT PARAMETERS		
Steam capacity	230	kW
	300	kg/h
Steam pressure	8,5	bar
Hot water capacity	187	kW
Hot water temperature Outlet:	85	°C
Inlet:	75	°C
Exhaust gases outlet temperature	120	°C
INPUT PARAMETERS		
Exhaust gases INLET temperature (from client genset)	471	°C
Exhaust gases INLET flow (from client genset)	2.637	kg/h
Inlet water temperature	20	°C

KITCOG-200/ Steam	Value	Unit
OPERATION CONDITIONS		
Working ambient temperature range	15 – 40	°C
Working ambient relative humidity range	20 - 80	%
Start-up ambient ref. conditions (alt/T/RH)	<100/25/30	masl /°C/%
LAYOUT & DIMENSIONS		
Kind of installation	INDOOR STD	
Width	2.800	mm
Length	3.200	mm
Height	3.200	mm
TOLERANCES		
Steam capacity	±10	%
Hot water capacity	±10	%
Temperatures	±3	°C
Dimensions	±10	%

Technical data and dimensions are indicative only and subject to changes without notice.



INDOOR LAYOUT



OUTDOOR LAYOUT

Layout is not representative of the system model described above. It shows a general view for example purposes

PROJECTED RESULTS

Annually, each KitCOG 200/Steam system will recover 1.400 MWh of thermal energy (as hot water 85°C) and 1.700 MWh of thermal energy (as steam at 8,5 bar), thus avoiding the consumption of more than 350.000 litres of diesel fuel and saving up to 1.000 tons of CO_2 emissions. The emissions aspect is especially important in MENA, as various studies have shown that the lack of centralized power supply there contributes significantly to its worsened air quality.

Based on the provided information regarding the factory's annual work hours and energy-related costs (diesel, electricity and water), the calculated payback time of the new system is less than one year, whereas its useful life is more than ten years.

The calculations are based on the installation of a single KitCOG-200/Steam system. However, the food factory has the necessary conditions to install several such systems, and therefore the total fuel savings, cost savings and CO_2 emission cuts will be several times bigger than those presented above. ■