ÖkoFEN
PELLET HEATING

Pellematic e-max

Electricity and heat in the medium power range

www.okofen-e.com

Pellematic e-max

Consumer-oriented and efficient production of electricity and heat plays a key role not only in the private sector.
Also in the **larger power range** for example in commercial buildings there is a trend to the simultaneous heat and power generation.

ÖkoFEN_e 5.0 - the combined heat and power system for the medium power range is planned to use for generating heat and electricity for large buildings.

- ✓ **Project goal:** Development of a power-generating pellet heating system for the medium performance range
- ✓ Approx. **55 kW** thermal power
- ✓ Approx. **4.5 kW** electrical power
- ✓ Target group: **Commercial buildings, hotels, residential complexes**
- ✓ **Technology:** Stirling engine and approven ÖkoFEN pellet heating technology

Two specialists in their field

ÖkoFEN PELLET HEATING

Qnergy Renewable. Reliable. Resilient.

unite for the development of the project **Pellematic e-max.**

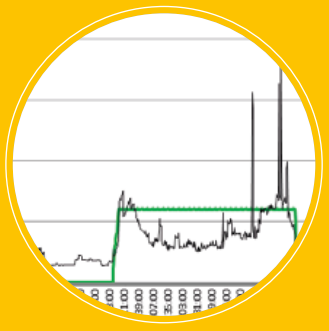
PELLEMATIC E-MAX

The power generating pellet heating for the medium power range: This cogeneration plant will be mainly used as a base load boiler in large buildings. In these applications high running times, related with a high annual power output, can be achieved.

The Pellematic e-max as a base load boiler leads - at constant energy prices - to a relatively short payback time.

Efficient heat and electricity generation at the place of use

Low emission and ecological: **CO2-neutral energy balance** for heat and electricity



As a base load boiler: long, continuous runtimes and thereby a predictable energy yield

Short payback time due to optimum use and long run-times

Milestones

Approven ÖkoFEN pellet heating technology meets Qnergy Stirling engine to develop the Pellematic e-max - a wood pellet power station for the medium power range.

2013	First meetings with Qnergy with the aim to develop a CHP system for a large power range	**Start of cooperation with Qnergy**			
2014		August: First functional prototype is taken into operation on the test bench	September: Construction of a prototype & first long-term tests with the functional model	October: Stirling engine achieves for the first time an electrical output of 4.5 kWel	December: Assembling of the first prototypes & tests on the test bench
2015	**February: First official presentation of the „ÖkoFEN_e Project 5.0“ at the expoenergy in Wels**	April: Start of endurance test - ÖkoFEN_e 5.0 Prototype installed as a base load boiler at headquarters	August: Finalization of prototypes & preparation for type testing	October: Type testing of the ÖkoFEN_e 5.0 system at the BLT in Wieselburg	December: Final product name: Project 5.0 becomes Pellematic e-max
2016		February: Final preparations of the field test phase	Spring: Evaluation and selection of suitable partners for the pilot phase	Summer - Autumn: Installation and initial start up of the first pilot plants	

Composition of the electricity generating pellet heating system

For the integration of the Onergy Stirling engine a separate pellet boiler was designed and adapted to the needs of the Stirling engine. This pellet boiler has a thermal output of approximately 55 kW while providing 4.5 kW electricity.

Constant combustion conditions in the burner chamber are very important for a proper operation and the highest possible electricity yield. Therefore a concept was developed to ensure a steady flue-gas flow for the Stirling engine directing the heat from all sides to the heater head.
A maintenance door provides a good access to the heater head of the Stirling engine and allows post-cleaning of the Stirling engine if necessary.
In future this cogeneration system should be installed especially in the mid-power sector in interaction and combination with other boilers. This electricity generating pellet boiler, which was mainly designed for base-load applications, should be preferably installed in larger buildings. In this field of application very high running times and related to that a very high annual electricity yield can be achieved.

These factors have a significantly positive effect on the payback time of the entire system.
Remaining and steady energy prices and the use of the Pellematic e-max as a base load boiler can lead to a relatively short payback time of the system. The Pellematic e-max can be integrated as a base load boiler in a cascade system but is also available as single heat source in multi-family houses or similar buildings.

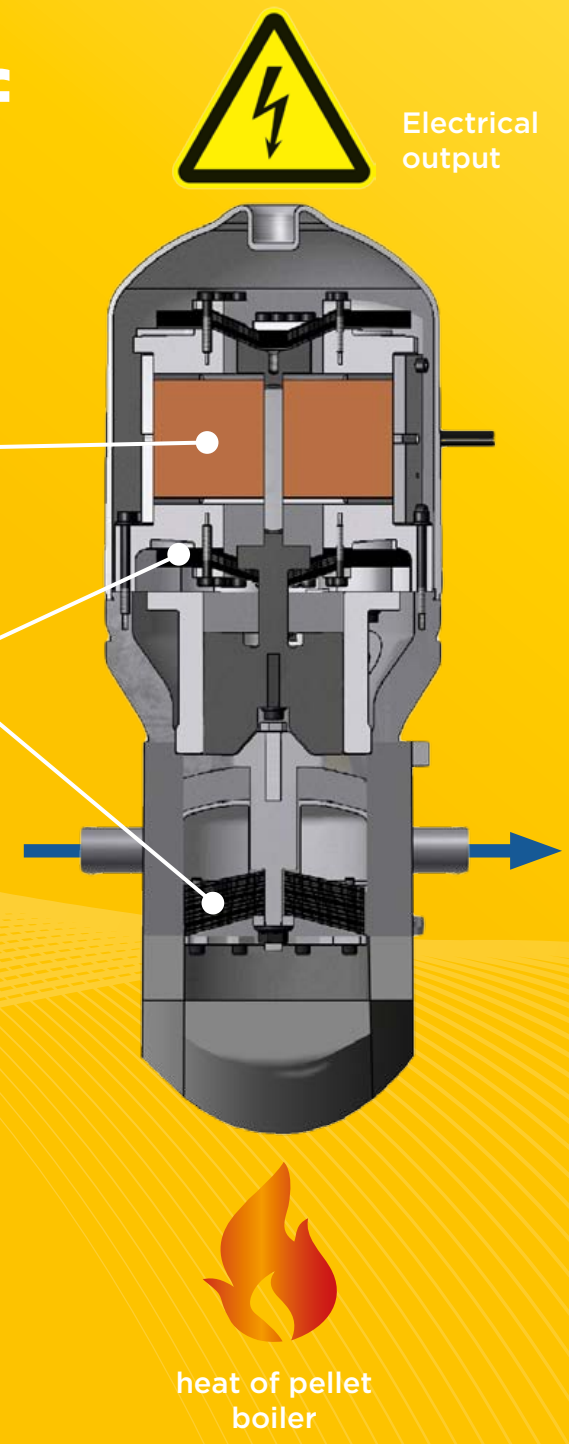
Composition of the Qnergy Stirling engine

The free-piston Stirling engine of Qnergy works with helium.

The supplied heat from wood pellets moves the piston internally. This allows to generate up to 4.5 kWe electric power completely maintenance-free and environmentally friendly.

The electric performance of the Stirling engine modulates depending on the heat supply or the temperature in the combustion chamber, and can therefore be adapted.

Electricity feed-in to the public grid is possible through an Fronius inverter.



Economical performance possible?

The switch to a pellet cogeneration system makes sense and can be profitable in a short time. This is shown in a simple payback calculation.
Basis for this calculation is the replacement of an oil boiler (stock) through the Pellematic e-max (new investment). Three different scenarios will be compared.

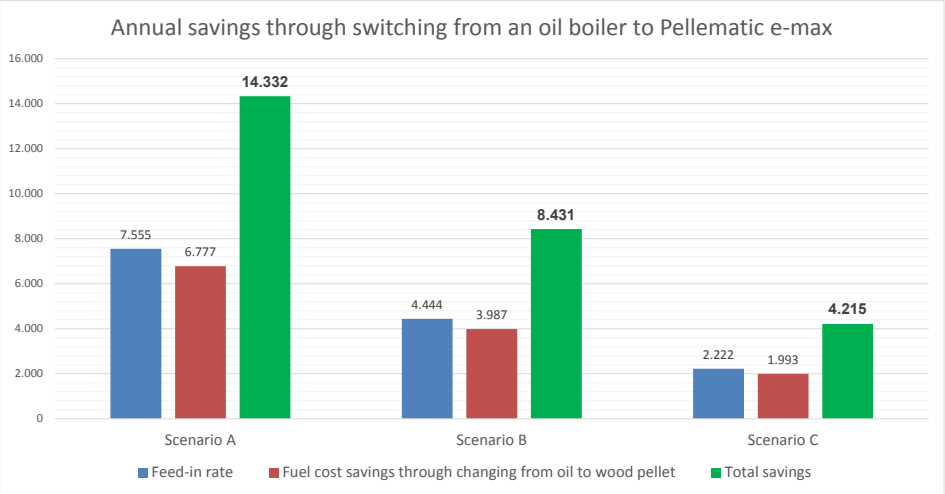
Scenario A:
Pellematic e-max replaces an oil base load boiler
heat load of the building >150 kW
running hours per year: 8.500 h

Scenario B:
Replacement an oil base load boiler
heat load of the building <150 kW
running hours per year: 5.000 h

Scenario C:
Pellematic e-max replaces an oil boiler, operation only in heating period for domestic hot water and heating of the building heat load of the building approx. 55 kW
running hours per year: 2.500 h

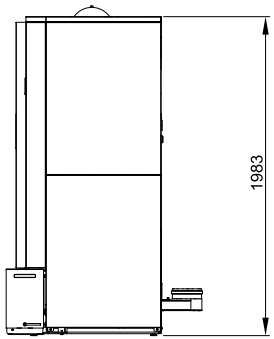
The calculation of the amortization time includes of course the investment of the Pellematic e-max. Investment costs for the oil boiler are not included as the boiler is already existing. The annual fuel costs for the pellets are compared with the annual fuel costs for oil. The result is a saving of fuel costs through to the cheaper price of wood pellets. Also the annual income for the feed in of electricity is calculated and results in an income through feed-in. The initial investment costs are divided by the annual savings (fuel costs and feed-in rate) – result is the payback period of the whole investment.

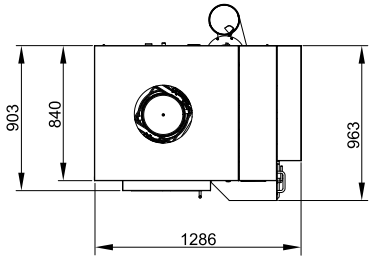
Depending on in which system the Pellematic e-max is installed the payback periods vary between three years and about nine years. Even when the Pellematic e-max is used as a single heat source a payback period of about 9 years can be achieved. Generally the more running hours within a year can be achieved the more attractive the system is!



For the calculation an average power of 4.000 Watt was assumed.

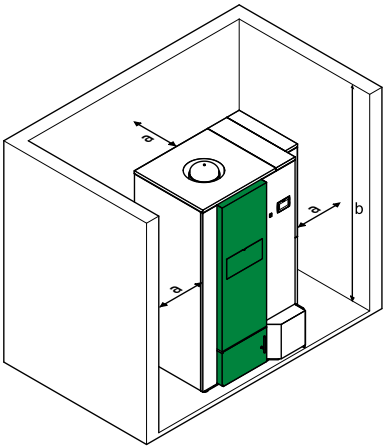
Technical data





		Pellematic e-max
Nominal power	kW	55
Electrical power	W	4.500 *
Width - total	mm	1.286
Height - total	mm	1.995
Height of suction system filling unit	mm	1.635
Depth - total	mm	1.230
Maximum unit dimension	mm	890
Tilted height	mm	2.160
Water supply/return Ø	Zoll	6/4"
Height of inlet/return	mm	VL 1.343 / RL 686
Flue gas tube connection height	mm	280
Dry weight fully equipped not packed	kg	ca. 780
Boiler efficiency rated power	%	ca. 93
Water capacity	l	ca. 152
Flue gas temperature rated power	°C	ca. 100
Flue gas tube diameter (at the boiler)	mm	180
Chimney diameter		min. 180 mm as per chimney calculation
Chimney construction		qualified for condensing – solid fuel – damp resistant – N1 or P1 (as per flue calculation)
Electrical connection value		230 VAC, 50 Hz, 16 A
Volume hopper	kg	66

Please pay attention to technical changes!
* In operation it can be expected by temporally slightly delayed starting times, starts and stops with an average output of 4,000 watts.



a	Min. distance from boiler side to the wall or building component	650 mm
b	Min. ceiling height	2.300 mm