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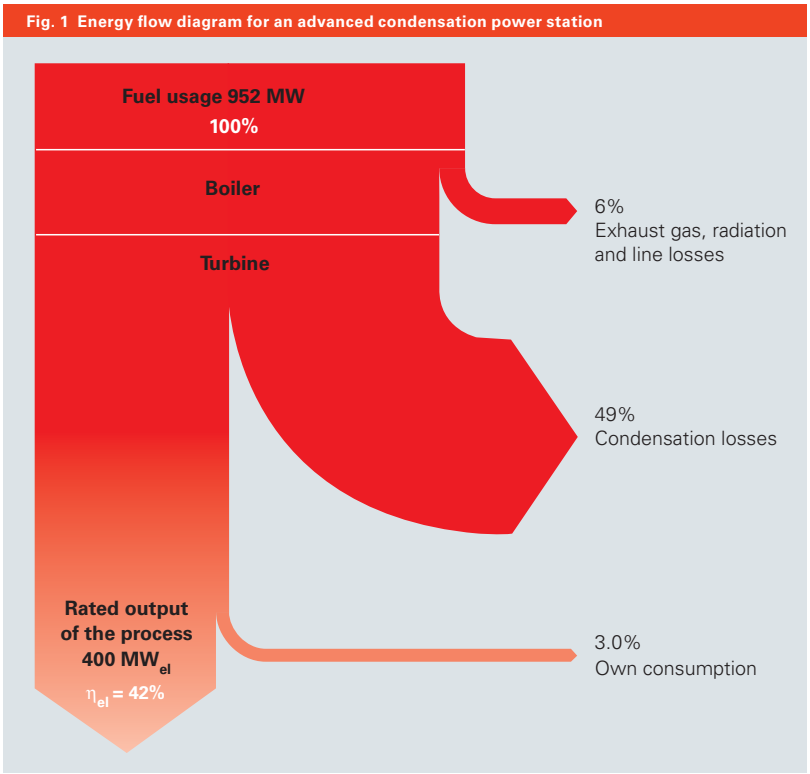
TopTechnology

Vitobloc combined heat and power units – tailor-made energy concepts for the provision of heat and power

Combined heat and power specialists ESS have been part of the Viessmann Group since August 2008. With this acquisition, Viessmann has extended its product range to include efficient gas operated systems for combined heat and power generation.

This brochure is designed to give you a quick introduction to the technology involved.

Fig. 1 Energy flow diagram for an advanced condensation power station



What exactly is a combined heat and power (CHP) unit?

The majority of power generated in Germany is produced in condensation power stations. This means that heating energy is converted into electrical power via a steam turbine. The average efficiency of all conventional power stations is approximately 38%, which means that over 60% of the energy input is lost to the environment as unused waste heat (Fig. 1).

A combined heat and power station is characterised by the fact that the overall efficiency of the station can be increased by the use of its own waste heat. In large-scale power stations, this happens via district heating lines, but here the market potential is largely exhausted. Ultimately, it only works if there are also large heat consumers, such as a housing estate, near the power station.

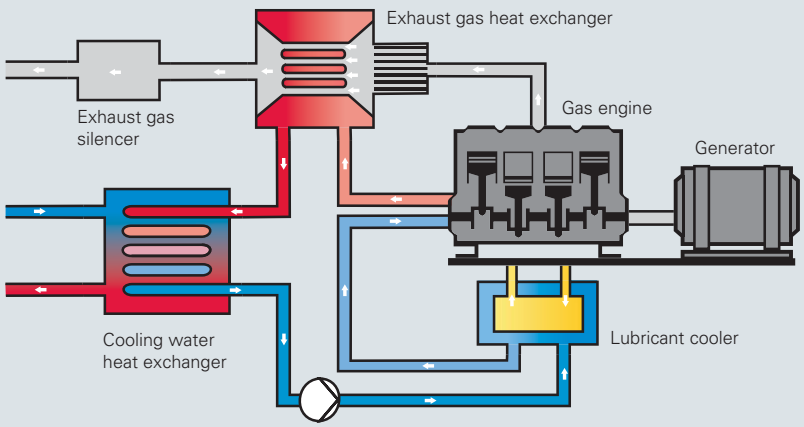
This is where the idea of decentralised combined heat and power units (CHP) with a heating bias comes into its own. Power generation takes place in relatively small units and the heat they generate does not have to be transported over long distances (where much of it is lost), but rather can be put to use directly (Fig. 2). In addition, there are no losses resulting from power distribution.

How to integrate a CHP unit into an existing setup

On the heating side, the CHP unit operates in parallel to a boiler. Both heat sources are connected to the heating system, the DHW heating or other heat consumers, such as a swimming pool. Depending on the consumption profile of the building, it may make sense to use a buffer cylinder so that the runtime of the CHP unit can be as long and uninterrupted as possible.

On the power side, the first priority is to cover the building's own consumption. If no more consumers are available, the electricity is fed into the public grid and remunerated (Fig. 3).

Fig. 2 Function schematic



A gas combustion engine drives a generator to produce power. The heat this creates is extracted from the cooling water and exhaust gas via the heat exchanger and then utilised.

How to size a CHP unit

In order to make the use of a CHP unit economically viable, the appliance should run continuously for as long as possible. The longer a CHP unit can realistically transfer heat and power into a system, the sooner it will pay for itself. When it comes to sizing, apart from some exceptions (e.g. emergency power supply) the focus is on heat. The CHP unit is designed to generate more heat than power, i.e. it operates with a "heat bias".

If we look at how the annual heating output typically spreads over a 12 month period (permanent annual line), it becomes clear that a CHP unit should not be oversized. Its thermal output is calculated in such a way that heat can still be transferred even at times of low load. In order to achieve a runtime of at least 4000 hours, we can assume approximately 10% of the boiler output as thermal output of the CHP unit to provide heating for the building (Fig. 4). Since a CHP unit essentially pays for itself by reducing the amount of power drawn from the grid (and not through the feed-in remuneration), the consumption of electrical energy in the building must also be taken into account.

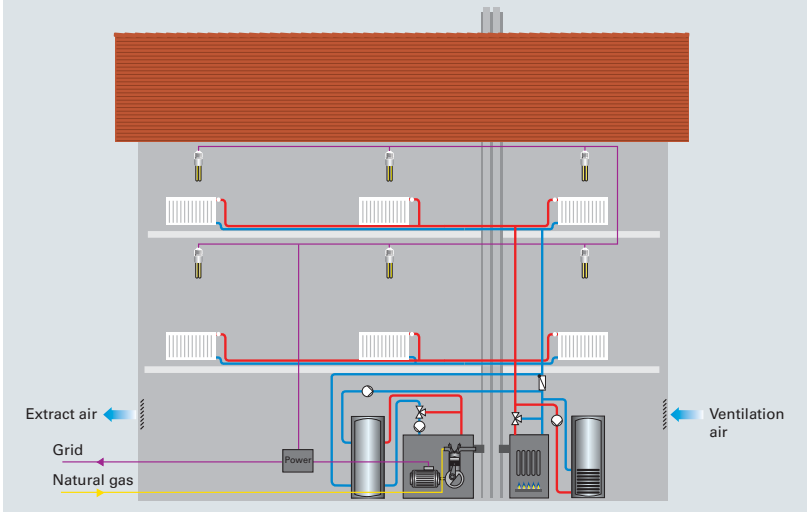
As a result, three simple questions can be asked to quickly check whether the use of a Viessmann Vitobloc CHP unit would make sense:

1. **Is the required boiler output above 250 kW or the gas consumption above 300,000 kWh/p.a. (in relation to the upper calorific value)?**
2. **Is the annual power consumption above 80,000 kWh?**
3. **Are heat and power consumed simultaneously?**

If the answer to all of these questions is "yes" and **a gas connection is available**, it is worth looking into using a CHP unit more closely. To this end, and on the basis of some further details, Viessmann has created viability considerations for our trade partners as a decision-making aid for the investor, and the company also offers technical advice on questions regarding system integration.

Advice about using a CHP unit as a generator or to generate power from biogas or landfill gas can be obtained from a specialist Viessmann team, they can be contacted through your sales consultant.

Fig. 3: Integration of a CHP unit into the building system



Viessmann product range

Viessmann Vitobloc are compact modules that are ready for operation, with a standard frame to incorporate the engine and generator, plus standard silencer casing and control system (integral control panel and control unit), thus providing a tailor-made energy solution.
The Vitobloc modules are available with an electrical output of 18 to 401 kW_{el}. Please note that the electrical output is stated first with CHP units. However for sizing, it is always the thermal output that is required.

Naturally, this includes matching system technology – including digital control systems that automatically match the output to the current energy demand, plus connection accessories for the hot gas and exhaust gas sides. After a function test at the factory, the modules are delivered ready for connection. This simplifies and shortens the commissioning process. Upon request, biogas CHP units and matching absorption machines are available.

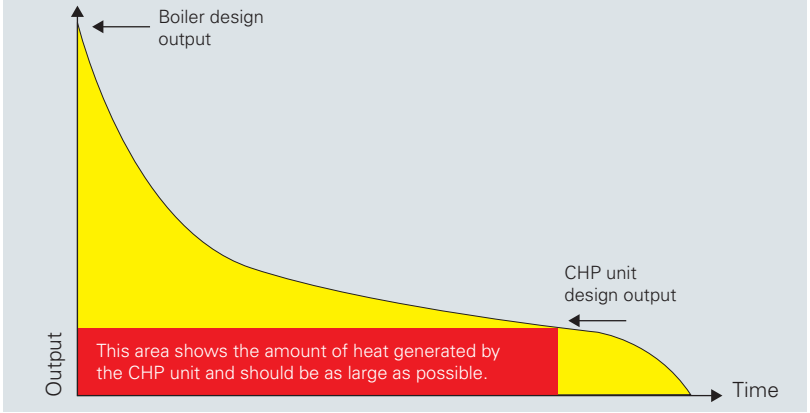
Electrical/thermal output levels:

18/36, 50/81, 70/115, 140/207, 199/263, 238/363, 401/549 kW

Note:

Vitobloc CHP units are certified to the Gas Appliances Directive.

Fig. 4: Permanent annual line for the design output of a CHP unit



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Vitobloc 200, module EM-18/36

Subsidies:
Sample calculation for Vitobloc EM-18/36 (18 kW_{el})

- Upon purchase: mini CHP incentive programme up to €11,500 (if plans show 5000 hours of operation per annum)
- During operation: CHP Act approximately €6000 per annum (at 70% own consumption)

For your individual values we require in particular

- the gas consumption in kWh/p.a.
- the total gas bill in €/p.a.
- the power consumption in kWh/p.a.
- the total electricity bill in €/p.a.

Inclusive of gas or electricity tax and duty.

Your trade partner:

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