CHP units for heat and power
CHP units for the combined generation of heat and power with an output range from 5.5 to 481 kWel.
Combined heat and power units up to 401 kW\textsubscript{el} and 549 kW\textsubscript{th}

Tailor-made energy concepts for applications requiring a medium output in municipal buildings, and industrial and commercial enterprises.

A gas driven combined heat and power (CHP) unit generates heat and power simultaneously. These units are sized to suit residential complexes and commercial operations. On the heating side, the CHP unit operates in parallel to a boiler. Both heat generators are connected to the heating system when providing heating water or DHW.

Compact ESS appliances are designed as decentralised CHP units with a bias towards heating. These comparatively small units generate electricity for consumption on site. The heat that is generated by this process is used simultaneously, almost without losses, for heating. Any power not required is exported to the public grid and the power supply utility provides remuneration accordingly.

The overall efficiency of CHP units can be as high as 95 percent. The Vitobloc 200 EM-20/39 module achieves thermal efficiency of over 62 percent and electrical efficiency of over 32 percent.

**Heating with biogas benefits the environment**

A CHP unit is also particularly environmentally responsible if run on biogas or bio natural gas, as in this case, its operation is CO\textsubscript{2} neutral. This way, users can make themselves independent of fossil fuels such as natural gas, since biogas and bio natural gas are locally generated fuels.

BIOFerm and Schmack, which are also members of the Viessmann Group, design and build plants for the generation of biogas. The biogas generated in these plants is ideal for the operation of a CHP unit.

At the core of the CHP unit lies the 4-stroke gas engine.
When and where to use CHP units

Advanced economical engines for powerful, highly efficient CHP units.

**CHP unit viability**

With the standard manufacture of CHP units powered by natural gas or biogas, Viessmann is extending its comprehensive range for applications requiring a medium output in municipal buildings, and industrial and commercial enterprises. To safeguard the economic viability of a CHP project operated with natural gas, it is recommended that the output is precisely matched to the heat and power demand. The boiler output should be in excess of 60 kW or the gas consumption in excess of 90,000 kWh/a; power consumption should be in excess of 32,000 kWh/a.

**Mini CHP unit with condensing technology**

The Vitobloc 200 EM-20/39 module, used in combination with a peak load boiler, is ideal for residential complexes from 30 to 50 units, for medium-sized hotels, residential homes for the elderly, and car showrooms, etc. Thanks to its condensing technology, the mini CHP unit is highly efficient in its operation, achieving an overall efficiency of up to 95 percent. It is recommended both for new build and modernisation projects.

The Vitobloc 200 EM-50/81 mini CHP module is a further powerful version, offering an overall efficiency of 90.3 percent.

**Operation in mains parallel and mains substitution mode**

All modules can be operated in mains parallel mode as well as in mains substitution mode as standard. This means that, in the event of a power grid failure, the Vitobloc 200 can supply the plant with power after a short start-up time.

**Benefits at a glance**

- High electrical efficiency through the use of energy efficient engines, resulting in the highest possible power bias for maximum economy
- All Vitobloc 200 units are capable of modulation
- Shielded against poor heating water quality, thanks to system separation by means of central plate heat exchanger
- The standard equipment level includes starter batteries and a synchronous generator. As a result, the CHP unit is equipped for mains substitution mode with no increase in the idle current demand of the customer’s system
- Suitable even for demanding connection conditions, as, for example, the cos φ can be controlled via the software
- Can be operated with natural gas, biogas, sewer and landfill gas
- Time and cost savings during engineering, installation, commissioning and operation through generous standard equipment level
- Longer service intervals through integral lubricating oil supply with optimised tank volume – operating costs and idle times are reduced as a result
- Completely ready-to-connect units tested in the factory; therefore minimum installation effort and tested output values
- Proven technology with more than 1500 systems installed
- Proven remote monitoring and automation systems
- Attractive subsidy programmes (particularly in Germany)
- Extensive service concept, for example different service options – from standard to full service

The Vitobloc 200 is characterised by its compact design.
Combined heat and power units compared with conventional heating technology

Decentralised power generation

When power is generated in power stations (centralised power supply), the heat that is created is often lost to the environment without being used. The utilisation of this heat, for example for heating buildings, reduces the energy loss and lowers emissions that are damaging to the environment. Combined heat and power generation enables up to 36 percent of the primary energy to be saved, making it one of the most efficient energy saving methods available today.

### Power generation

<table>
<thead>
<tr>
<th>Power station (Coal)</th>
<th>Separate generation</th>
<th>CHP unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficiency</td>
<td>55 %</td>
<td>87 %</td>
</tr>
<tr>
<td>Energy usage</td>
<td>157 %</td>
<td>100 %</td>
</tr>
</tbody>
</table>

### Losses

<table>
<thead>
<tr>
<th>Power station (Coal)</th>
<th>Separate generation</th>
<th>CHP unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Losses</td>
<td>70 %</td>
<td>13 %</td>
</tr>
</tbody>
</table>

### Reduction

<table>
<thead>
<tr>
<th>Power station (Coal)</th>
<th>Separate generation</th>
<th>CHP unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction</td>
<td>100 %</td>
<td>99.0 %</td>
</tr>
<tr>
<td>Dust</td>
<td>100 %</td>
<td>98.5 %</td>
</tr>
<tr>
<td>SO₂</td>
<td>100 %</td>
<td>98.5 %</td>
</tr>
<tr>
<td>NOₓ</td>
<td>100 %</td>
<td>29.0 %</td>
</tr>
<tr>
<td>CO₂</td>
<td>100 %</td>
<td>58.0 %</td>
</tr>
</tbody>
</table>

### Saving

<table>
<thead>
<tr>
<th>Primary energy</th>
<th>Separate generation</th>
<th>CHP unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saving</td>
<td>100 %</td>
<td>36.0 %</td>
</tr>
</tbody>
</table>
Attractive subsidies and environmentally responsible operation with high efficiency

All power generated by CHP units is subsidised by the German CHP Act.

CHP units operate with great environmental responsibility. In addition to primary energy savings of up to 30 percent, CO₂ emissions are significantly lower compared to a conventional central power station. For this reason, the German government subsidises CHP technology.

As part of the German CHP Act (KWKG), CHP power has been subsidised since 2009, regardless of source and place of consumption. This means that even CHP power you use yourself can receive state subsidies. Alternatively, power produced by means of bio natural gas (biogas that has been upgraded to natural gas quality and fed into the natural gas grid) is eligible for subsidies in accordance with the German Renewable Energy Sources Act (EEG).

Top quality to retain high value

Only suitable components from well known manufacturers are used in the production of the CHP units. This guarantees high operational reliability, assured spare parts availability for many years and consequently a high value retention of the system.

The control panel is integrated into the CHP module for optimum space utilisation. The basic design of the CHP unit and control panel is identical in each module, and all components are easily accessible. This results in shorter servicing times and therefore reduced costs for the user.

The Vitobloc 200 is equipped with a synchronous generator and starter batteries, as standard.
Services and maintenance
A comprehensive service available for every system – from engineering to maintenance

From control panels to maintenance contracts, ESS offers a comprehensive range of services for all CHP units.

Tailor-made control panels with established software
Since 1983, ESS has been offering tailor-made control panels and matching software for PLC, automation, network coupling, auxiliary drives, control units and power units.

The company can draw on extensive experience to deliver bespoke solutions, especially when it comes to modernising existing CHP systems. Smaller domestic control systems with optional remote monitoring can also be supplied.

Commissioning and handover
Prior to despatch, each individual CHP unit is subjected to extensive tests on the in-house test bed. As part of these tests, specified output values for the units are documented, keeping the effort when commissioning the system at the customer’s premises to a minimum.

ESS hands over these appliances fully tested and ready for operation.

Each customer can assemble their own individual service package from the options available, according to their particular demands and requirements. This includes everything – from commissioning via training to complete operational management.

Monitoring operations
If customers do not have their own technical personnel, ESS can take care of system maintenance as well. For this, remote monitoring and control options are available to optimise the entire energy centre. The system data is regularly scanned, checked and re-programmed if required. This way, the gas engine system always performs with high efficiency and at its most economical level.

In a residential area of Regensburg, for example, approximately 600 residential and 20 commercial units are supplied with heat and power from three CHP units that form a stand-alone network. Any faults are immediately reported to the service control centre. In most cases, faults are remedied before the customer has noticed anything amiss.

Maintenance contracts
Different maintenance contracts offer a balanced price/performance ratio and ensure an all-round service.

Local service engineers ensure that the system runs smoothly.
Efficient heat and power supply with compact combined heat and power units

Gas engine modules in natural gas operation.

<table>
<thead>
<tr>
<th>Combined heat and power unit</th>
<th>Number of cylinders</th>
<th>Output(^1) [kW]</th>
<th>Gas usage DIN ISO 3046 [kW]</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>EM-5/13</td>
<td>R3</td>
<td>5.5</td>
<td>20.2</td>
<td>Lambda = 1(^4)</td>
</tr>
<tr>
<td>EM-20/39</td>
<td>R4</td>
<td>20</td>
<td>62</td>
<td>Lambda = 1(^4)</td>
</tr>
<tr>
<td>EM-50/81</td>
<td>R4</td>
<td>50</td>
<td>145</td>
<td>Lambda = 1(^4)</td>
</tr>
<tr>
<td>EM-70/115</td>
<td>R6</td>
<td>70</td>
<td>204</td>
<td>Lambda = 1(^4)</td>
</tr>
<tr>
<td>EM-140/207</td>
<td>R6</td>
<td>140</td>
<td>384</td>
<td>Lambda = 1(^4)</td>
</tr>
<tr>
<td>EM-199/263</td>
<td>R6</td>
<td>199</td>
<td>538</td>
<td>Lean turbo with mixing cooler(^5)</td>
</tr>
<tr>
<td>EM-199/293</td>
<td>R6</td>
<td>199</td>
<td>553</td>
<td>Lean turbo with mixing cooler(^6)</td>
</tr>
<tr>
<td>EM-238/363</td>
<td>V12</td>
<td>238</td>
<td>667</td>
<td>Lambda = 1(^4)</td>
</tr>
<tr>
<td>EM-363/498</td>
<td>V12</td>
<td>363</td>
<td>960</td>
<td>Lean turbo with mixing cooler(^5)</td>
</tr>
<tr>
<td>EM-401/549</td>
<td>V12</td>
<td>401</td>
<td>1053</td>
<td>Lean turbo with mixing cooler(^5)</td>
</tr>
</tbody>
</table>

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\(^1\) Output acc. to DIN ISO 3046 part 1 (at 1000 mbar air pressure, 25 °C air temperature, relative humidity 30 %, cos $\varphi = 1$)

\(^2\) Electrical output at the generator terminals at cos $\varphi = 1$

\(^3\) Available thermal output from coolant, lubricating oil and exhaust gas when cooled down to 120 °C (natural gas) or 150 °C (biogas); with the Vitobloc 200, type EM-5/13 and EM-20/39, cooled down to 60 °C (at 40 °C heating water temperature on entry into the module)

\(^4\) Engines with three-way catalyst and operation with air ratios of Lambda = 1

\(^5\) Engines with lean burn combustion, mixture charging and external mixture cooling

\(^6\) Engines with lean burn combustion, mixture charging and internal mixture cooling
Gas engine modules in biogas operation.

<table>
<thead>
<tr>
<th>Combined heat and power unit</th>
<th>Number of cylinders</th>
<th>Output¹) [kW] electrical²) cos φ = 1.0 ± 5 %</th>
<th>thermal³) ± 5 %</th>
<th>Gas usage [kW] DIN ISO 3046 ± 5 %</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitobloc 200 Module EM-140/207</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BM-36/66</td>
<td>R4</td>
<td>36</td>
<td>66</td>
<td>122</td>
<td>Lambda &gt; 1⁴)</td>
</tr>
<tr>
<td>BM-55/88</td>
<td>R6</td>
<td>55</td>
<td>88</td>
<td>165</td>
<td>Lambda &gt; 1⁴)</td>
</tr>
<tr>
<td>BM-190/238</td>
<td>R6</td>
<td>190</td>
<td>238 + 16</td>
<td>493</td>
<td>Lean turbo with mixing cooler⁵)</td>
</tr>
<tr>
<td>BM-366/437</td>
<td>V12</td>
<td>366</td>
<td>437 + 16</td>
<td>950</td>
<td>Lean turbo with mixing cooler⁵)</td>
</tr>
</tbody>
</table>

¹) Output acc. to DIN ISO 3046 part 1 (at 1000 mbar air pressure, 25 °C air temperature, relative humidity 30 %, cos φ = 1)
²) Electrical output at the generator terminals at cos φ = 1
³) Thermal output available from the coolant, the lubricating oil and the exhaust gas with cooling to 120 °C (natural gas) or 150 °C (biogas)
⁴) Engines with lean burn combustion without charging and operation with air ratios of Lambda > 1
⁵) Engines with lean burn combustion, mixture charging and external mixture cooling
Reliable and economical: CHP units offer many advantages

ESS has many satisfied customers thanks to the comprehensive standard equipment level of its products.

The heating centre at the Park-Hotel Egerner Höfe complex was completely renewed at the end of 2009. Around 68 percent of the total power demand is covered by the CHP unit. This system is exceptional for being entirely financed and operated by a contracting company.

The overall heating system is operated internally as a local heating network.

- CHP unit: ESS Viessmann Vitobloc 200 EM-140/207
- Gas condensing boilers: 2 x Vitocrossal 200, type CT2 (each 198 to 593 kW)
- Heating water buffer cylinders: 4 x 2200 litres
- CHP control unit: The system is equipped with telecontrol remote monitoring and Vitocom 300. This captures a wide range of data, including the buffer temperature, the charging by Wilo Stratos pumps via Wilo-Digicon, as well as the information from heat meters.

CHP units are not only the right choice for property developers investing in residential complexes and estates; their efficiency and economy make them equally attractive in many other applications. For example:

- **Commerce and industry**
  Food processing, pharmaceutical and chemical industries, etc.

- **Tourism**
  Pubs, hotels, etc.

- **Local and district heating associations**
  Municipal authorities, cities, contractors
Tailor-made system solutions for swimming pools

Badeparadies Schwarzwald leisure complex, Titisee (Germany).

A Vitobloc 200 CHP unit was installed in the Badeparadies Schwarzwald leisure complex to provide low cost power and heat. The system is operational for around 8000 hours per year and primarily produces power for use by in-house consumers.

The simultaneously generated heat is used for central heating and DHW, resulting in an energy utilisation level in excess of 90 percent for this CHP system. The Vitobloc 200 provides the base heat load that is required all year round.

In the warm summer months, the CHP unit is the sole provider of power and heat.

During the winter, a Pyroflex woodchip system covers the additional heat demand. For redundant backup and possible peak loads, two Vitoplex 200 low temperature boilers were installed.

**Specification**

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHP unit</td>
<td>Vitobloc 200 EM (401 kW_elect/549 kW_thermal)</td>
</tr>
<tr>
<td>Low temperature boiler</td>
<td>2 x Vitoplex 300 (3200 kW)</td>
</tr>
<tr>
<td>Wood combustion system</td>
<td>Pyroflex FSR (2100 kW)</td>
</tr>
<tr>
<td>Fuel type</td>
<td>Natural gas, oil, biomass</td>
</tr>
<tr>
<td>Commissioned</td>
<td>2010</td>
</tr>
</tbody>
</table>

CHP unit (left) in the leisure complex
Two Vitoplex boilers cover peak loads when required.

Tropical atmosphere at the "Badeparadies Schwarzwald" leisure complex.
At the head office of the German Social Accident Insurance Institution (DGUV) in St. Augustin near Bonn, five Vitobloc 200 CHP units generate the power that is used in the building itself. If there is a public grid power failure, the system can provide emergency power in island mode and safeguard the necessary power demand. The mains substitution management system this requires is provided by the Viessmann multi module management system 300.

The heat generated by the CHP plant is mainly used for operating absorption refrigeration machines and for heating the building. If required, a Vitoplex 300 low temperature boiler supplies additional heat.

**Specification**

<table>
<thead>
<tr>
<th>Item</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHP unit</td>
<td>5 x Vitobloc 200 EM</td>
</tr>
<tr>
<td></td>
<td>(238 kW_e/363 kW_th)</td>
</tr>
<tr>
<td>Low temperature boiler</td>
<td>Vitoplex 300</td>
</tr>
<tr>
<td></td>
<td>(1250 kW)</td>
</tr>
<tr>
<td>Fuel type</td>
<td>Natural gas, oil</td>
</tr>
<tr>
<td>Commissioned</td>
<td>2012</td>
</tr>
</tbody>
</table>

**Standard delivery**

- Combined heat and power units
- MMM 300 multi module management system for mains substitution management, including active load distribution
- Low temperature boiler

The DGUV administration building with five CHP units in St. Augustin.
Heat and power for high-tech factory

Manufacturing site for OSRAM Opto Semiconductors.

OSRAM continuously strives to improve efficiency in all its departments. Deciding in favour of the Vitobloc 200 CHP units was therefore an easy choice for those responsible. Their efficiency in excess of 90 percent speaks for itself.

Together, the two CHP units generate an electrical output of 280 kilowatts. This power is used in the factory itself – primarily for the operation of two refrigeration units located in the immediate vicinity of the CHP units. In addition the units generate 414 kilowatts of heat, which is fed into the heating system and is used, in part, for technical processes.

An independent combustion air supply system was realised, to prevent any refrigerant escaping during maintenance from being drawn in by the engines of the two CHP units. Consequently, the units were implemented with separate supply air feeds and exhaust air systems. This ensures that only outdoor air is induced into the engines.

The plant operators have entered into a 300plus service/maintenance contract. This covers all maintenance and repair measures for a period of ten years. As a result, OSRAM Regensburg can truly plan ahead with absolute security.

**Specification**

<table>
<thead>
<tr>
<th>CHP unit</th>
<th>Vitobloc 200 EM (280 kW_e/ 414 kW_h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel type</td>
<td>Natural gas</td>
</tr>
<tr>
<td>Commissioned</td>
<td>2011</td>
</tr>
</tbody>
</table>

Both CHP units achieve an efficiency above 90 percent.

Tropical atmosphere at the “Badeparadies Schwarzwald” leisure complex.
### Individual solutions with efficient systems

The comprehensive range of products and services from Viessmann offers individual solutions with efficient systems for all fuel types and application areas. As one of the world’s leading manufacturers, Viessmann offers intelligent, convenient and efficient systems for heat, air conditioning/ventilation, cooling and decentralised power generation. Viessmann products and systems are synonymous with the very highest efficiency and reliability.

Our comprehensive product range offers top technology and sets new benchmarks. By focusing on using energy efficiently, we can help cut costs, save natural resources and protect the environment.

#### Everything from a single source

The Viessmann range offers the right products and systems for every requirement. Our heating systems can be wall mounted or floorstanding and are suitable for detached houses, large residential buildings, commercial and industrial premises or local heating networks. Whether for modernisation or new builds, Viessmann is always the right partner for providing heating, cooling, steam and power.

The wide ranging expertise we have at our disposal in the Group enables us to provide our trade partners with perfect solutions. Our product portfolio is rounded off with a full range of services.

### Detached houses
- Boilers for oil up to 116 MW heat or up to 120 t/h steam
- Solar thermal systems and photovoltaics

### Apartment buildings
- Boilers for gas up to 116 MW heat or up to 120 t/h steam

### Industry/commerce/municipal
- Boilers for oil up to 116 MW heat or up to 120 t/h steam
- Boilers for gas up to 116 MW heat or up to 120 t/h steam

### Local heating networks
- Solar thermal systems and photovoltaics
The comprehensive Viessmann product range: Individual solutions with efficient systems for all energy sources and application areas

### The product range for all energy sources and output ranges
- Boilers for oil and gas
  up to 116 MW heat or 120 t/h steam
- Combined heat and power generation
  up to 50 MWel
- Heat pumps up to 2 MW
- Wood combustion technology
  up to 50 MW
- Biogas production plants from 18 kWel to 20 MWgas
- Biogas upgrading plants up to 3000 m³/h
- Solar thermal systems
- Photovoltaics
- Accessories
- Refrigeration technology

### Maintenance and service
Whether it concerns commissioning, maintenance or troubleshooting – trade partners can count on the Viessmann Group for professional support. Our team will be more than happy to talk to you on the phone or in person. Our online tools can provide you with valuable tips, and if necessary spare parts can be delivered the next morning.

### Training
The Viessmann Academy offers a wide range of courses, from business management seminars to technical training, designed to keep our trade partners abreast of the very latest developments in our industry.
The company
Viessmann – climate of innovation

Viessmann is one of the world’s leading manufacturers of intelligent, convenient and efficient systems for heating, air conditioning/ventilation, cooling and decentralised power generation.

As a third generation family run business, Viessmann has been supplying highly efficient and clean heating systems for many decades.

A strong brand creates trust
Together with our brand label, our key brand message is an identifying feature throughout the world. "Climate of innovation" is a promise on three levels: It is a commitment to a culture of innovation. It is also a promise of enhanced product benefits and, at the same time, an obligation to protect the environment.

Acting in a sustainable manner
For Viessmann, taking responsibility signifies a commitment to acting sustainably.

This means bringing ecology, economy and social responsibility into harmony with each other, ensuring that current needs are satisfied without compromising the quality of life for the generations to come.

We consider climate protection, environmental responsibility and resource efficiency to be key priorities throughout our company, which has more than 10,600 employees worldwide.

Example of Best Practice
With its strategic sustainability project, Viessmann demonstrates at its own head office in Allendorf (Eder) that the energy and climate policy goals set for 2050 can in fact be achieved today with commercially available technology. The results speak for themselves:

- Expansion of renewables to 60 per cent
- CO₂ emissions reduced by 80 per cent

The long-term goal is for the company to sustainably meet all of its own heating energy requirements.

![Deutscher Nachhaltigkeitspreis](image)

Energy Efficiency Award 2010

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**Viessmann Group**

**Company details**
- Established in: 1917
- Employees: 10,600
- Group turnover: €1.89 billion
- Export share: 54 percent
- 27 production companies in 11 countries
- Sales companies and representations in 74 countries
- 120 sales offices worldwide

**The comprehensive product range from the Viessmann Group for all energy sources and output ranges**
- Boilers for oil or gas
- Combined heat and power units
- Heat pumps
- Wood combustion technology
- Biogas production plants
- Biogas upgrading plants
- Solar thermal systems
- Photovoltaic systems
- Accessories
- Refrigeration technology