The efficient way to convert energy

www.bosch-kwk.de

Electricity – heat – compressed air

BOSCH
Invented for life

Bosch KWK Systeme: cutting-edge technologies in system construction

We have been designing and constructing standardised and custom-built combined heat and power systems for both biogenic gases and natural gas since 1983. This means that we possess decades of experience in the combined heat and power segment. Our powerful portfolio of CHPs is complemented by ORC systems for waste heat power generation and by the provision of heat and compressed air from natural gas (compressed-air-and-heat systems).

Central power plant at Bosch Thermotechnik GmbH in Lollar (picture by Bosch KWK Systeme GmbH)

Bosch – a strong brand, top quality

It is not only our CHP units that stand out for their high quality but also the wide variety of other products and services we offer. We owe this to you. Meeting your needs and expectations is our top priority. It is exactly for this reason that we call upon all our knowledge and experience. We measure ourselves against international standards and our own strict guidelines to which each of our employees feels a personal commitment. This enables us to reaffirm our brand's promises every day.

Innovative power

At Bosch, new ideas are a tradition. The development of innovations always goes hand-in-hand with the systematic optimisation of existing products and technologies. That Bosch plays an important role as a global innovation-driver becomes immediately evident not least in the number of Bosch patents registered around the world. As the Bosch Thermotechnik competence centre for combined heat and power systems we, Bosch KWK Systeme stand among the pioneers of new and innovative technologies, such as, for example low-temperature ORC systems (Organic Rankine Cycle). We have been applying our innovative powers to the constant development and advancement of methods for the generation of electric power from waste heat since 2005, to such an extent that we now possess extensive expertise and reliable operational experience in a sector that has only relatively recently emerged.

Powerful and comprehensive portfolio:

- CHP systems up to 2 MW_{el}: customer-specific solutions for operation with biogenic gases or natural gas
- CHP modules from 12 to 400 kW_{el} ready for connection to natural gas or bio-methane supplies
- Compressed-air-and-heat systems (CHP CA 570 NA): Heat and compressed air from natural gas
- ORC systems: CO_2-free conversion of waste heat into electricity

Sustainable utilisation of resources: with innovative energy solutions from Bosch

Energy systems from Bosch contribute to the sustainable utilisation of existing energy sources. They protect and conserve not only your financial resources but also our environment.

Cost-effective and environmentally friendly heat and power generation

Rising energy costs and mandatory regulation of CO_2 emissions lead to only one logical conclusion: the responsible handling of energy resources and the increased efficiency of technical plants and systems are essential. Environmentally compatible and decentralised energy generation is an important key to safeguarding our future. The comparison of Bosch CHP solutions and conventional heat and power generating systems provides clear proof: the bottom line is that the Bosch CHP consumes less gas. CO_2, CO and NO_x emissions are accordingly lower.

Compact CHP modules: the space-saving and efficient solution

The power to save hard cash
Bosch compact CHP modules are available with power ratings of 12 to 400 kW_{el}. Primary energy savings can be up to 40 % in comparison with conventional solutions. Our CHP systems achieve overall efficiency ratings of almost 100 %. In comparison, the overall efficiency of electricity from conventional power stations and heat from heating boilers reaches a figure of only 56 %.

Serial-produced efficiency
The reliable, high-performance engines are serial-produced and have proved their quality in numerous applications. The geometry of the combustion chamber, air intake and exhaust gas systems is optimised. An exhaust gas heat exchanger exploits the heat of exhaust gases for your heating system and passes it directly to the heating water cycle. The compact CHP modules with power ratings of 12, 19 and 50 kW_{el} are fitted with a condensing-capable plate heat exchanger and the higher-performance options are equipped with a smooth pipe heat exchanger. Lubricating oil consumption is low and maintenance intervals are particularly long.

Condensing boiler technology for optimum energy yield
The waste gas condensing heat exchanger makes an important contribution to the high overall efficiency of the system. It also enables utilisation of the heat of the steam contained in the waste gas and optimises thermal yield. It is already integrated into the 12, 19 and 50 kW_{el} CHP module options and is available as an optional accessory for external connection to the higher-performance options.

Reliability guaranteed by a synchronous generator
Depending on specific requirements, in options with power ratings of 50 kW_{el} and more, the synchronous generator allows solutions to be installed as stand-alone units or operated in parallel with mains power supply. At the same time, the synchronous generator prevents reactive current being drawn from the mains power supply.

Simple installation
Our compact CHP modules are delivered as complete, installation-ready modules. The engine, peripherals, generator, heat exchanger and cooling cycle components are all installed on a single base frame. The electrical switchgear is already installed. The compact module is flexibly mounted to suppress vibration and is fitted with effective acoustic insulation. All components are perfectly matched to ensure optimum operational efficiency. The compact module can be effortlessly integrated into a centralised heating or power plant. This enables you to realise a customised energy concept for the supply of heating energy, hot water and electricity with systems from one single source, and simultaneously makes the installation and commissioning of your plant much easier.

Compact CHP modules: perfect in every detail

Bosch CHPs provide innovative and reliable technology with compact, space-saving dimensions. By combining optimum components, perfect hydraulic tuning and intelligent Bosch control technology, they provide a future-proof solution to meet your current and future needs. Thanks to their high energy-saving potentials, the systems literally pay for themselves within a period of only a few years.

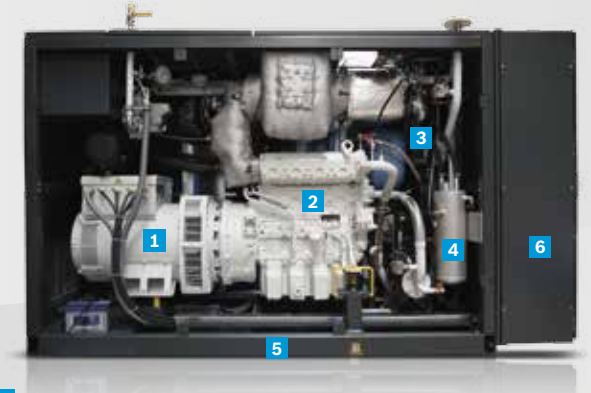
Simple and convenient touchscreen control
Integrated electronic systems control and monitor operations, the starting and stopping of the engine and handle synchronisation with electricity supply from the grid. On top of this, they also monitor auxiliary drive systems. A convenient touchscreen panel serves as a display and operating console on which settings can be entered directly and simply by a tap with a fingertip.

The full-colour touchscreen panel ensures convenient and simple handling. All settings – from synchronisation to maintenance – can be entered conveniently by tapping items on the screen.

The benefits of Bosch CHPs at a glance:

- Particularly low energy costs, thanks to the combined generation of electricity and heat
- Options with power ratings from 12 to 400 kW_{el}
- Protection of the environment due to low CO_2, CO and NO_x emissions
- Also configurable as emergency power supply systems
- Also suitable for air conditioning in combination with absorption cooling systems
- Can be effortlessly integrated in centralised heating or power plants
- Problem-free compatibility with the latest Bosch control systems

Bosch compact CHP module with 50 kW electrical power output



1 Synchronous generator (options with power ratings of 50 kW_{el} and more)
2 Gas-powered engine
3 Choice of heating hydraulics: Various heating hydraulics options, depending on planned application (e.g. for integrated utilisation of condensing technology)
4 Integrated condensate drainage
5 Sealed bottom tray
6 Integrated switchgear cabinet for control and monitoring

Compact CHP modules: perfectly planned with optimum support

Precise and professional planning is essential for successful utilisation of our combined heat and power systems. We would be pleased to advise you about your project and can offer you a wide range of supporting services in the planning phase.

Efficiency begins in the consulting phase
Whether heat or power generation is the main objective in your decision for a CHP plays no role at all for Bosch. Thanks to our broad-based service portfolio, we can provide the best possible advice and find the perfect solution for your particular needs. What's more, we provide high-quality services throughout the planning phase – from cost comparisons and system configuration design to optimised planning software. Simply ask us, we will be glad to help.

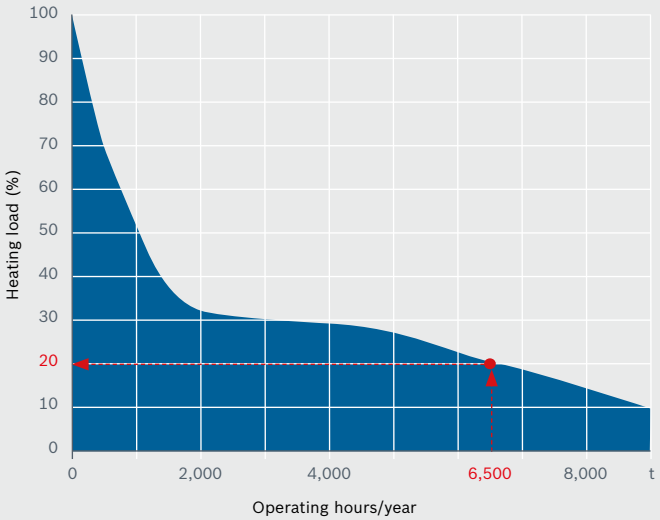
Precise configuration is the key to success
If your CHP is planned to predominantly supply heating energy for a residential property, the capacity should be calculated with 10 to 20% of the building's heating load (or more, if required). A conventional system with a heating boiler can then cover heating periods with peak demand. Alternatively, you can use the CHP primarily for the generation of electricity. From an electrical power rating of 50 kW, the use of the system as an emergency power back-up system also makes good sense. In this scenario, you can do without the emergency generator you would usually require. If the heat produced is not intended for immediate use, it is often advisable to install an appropriately-dimensioned back-up storage tank. As a further option, in buildings with air conditioning, you could also utilise a CHP for the supply of cool air in summer by combining it with an absorption chiller.

Utilisation scenarios for Bosch compact CHP modules

- **Building heating** (individual supply) – apartment build-ings, hotels, conference facilities, restaurants and guesthouses, residential and nursing homes
- **Public facilities** (object supply) – administrative build-ings, sports facilities, schools, indoor and outdoor swimming pools, hospitals
- **Process heat** (industrial heat generation) – commercial enterprises, industry, absorption cooling
- **Local and regional heating** (wide-area supply) – local and regional heating supply, terraced housing, residential areas

Grid access according to the rules
Grid access is one of the important aspects in the planning phase. Legal requirements vary and depend on the intended use and the technical specifications of your CHP. Our certification service takes this problem off your hands and enables hassle-free access of your CHP to the grid. It is essential that the matter of grid access is coordinated with your power supplier at an early stage of planning.

The right configuration for your CHP
tabulated annual load profile (example)



If the CHP is configured to cater for 20% of the heating load of an object (dotted line), it efficiently and reliably covers the base load for the heating energy supply. This means that the CHP operates at optimum capacity for the greater part of the year (6,500 operating hours). A further, conventional, heating boiler system can be switched into the system to cover for periods of peak demand.

Compact CHP modules: intelligent teamwork with renewable energies

If you are planning a heating system with a Bosch CHP, you should certainly consider integrating renewable energies into your concept.

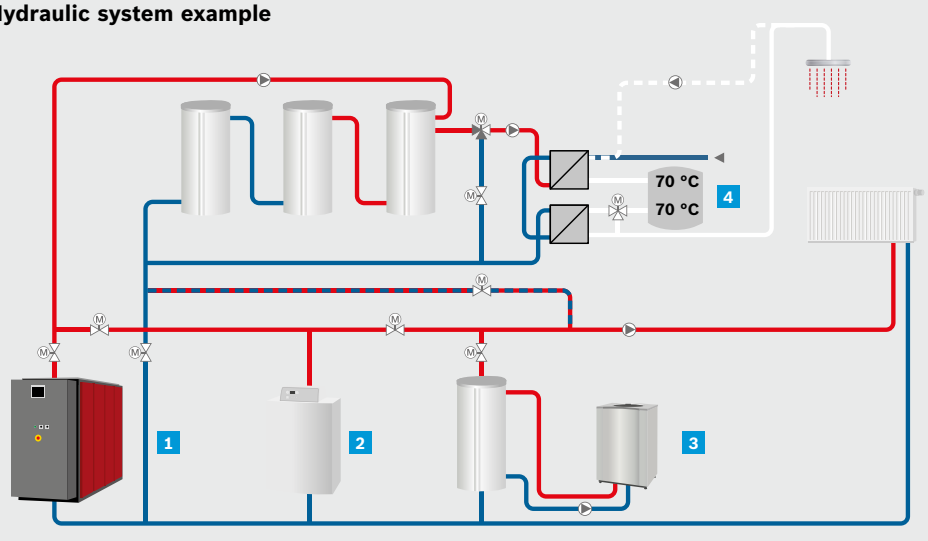
Optimum combination of different technologies
The integration into a heating system and the additional utilisation of renewable energies creates a multivalent-regenerative, multi-component system that can further improve overall system-efficiency. This could, for example, look like this: you could install a Bosch gas-condensing boiler and a split air-water heat pump alongside the Bosch CHP. In this scenario, you would enjoy the benefits of efficient CHP technology and free heat energy drawn from the environment by the heat pump. This is not only exceptionally cost-effective but – as it does more to conserve fossil fuel resources and reduce harmful emissions – is also good for the environment.

Simple installation, perfect control
Thanks to standardised connections on the top, the Bosch CHP can be quickly and easily integrated into a multivalent-regenerative multi-component system. The thermally actuated shut-off device and the magnetic stop valve, which closes without the need for electric current, are also mounted externally for convenient connection to the gas supply. At the same time, the high-performance energy management system from Bosch ensures perfect interaction between all system components – whatever the season of the year.

The advantages of multivalent-regenerative multi-component systems:

- Ideal for new, large-scale developments and the modernisation of older properties
- Significant energy savings and reduced CO_2 emissions thanks to efficient fuel utilisation and the use of renewable energy resources
- Heating energy supplied by a heat pump, even at low outdoor temperatures
- Optimum control of system components by intelligent controller technology
- Simple installation and easy maintenance

Hydraulic system example



1 Bosch CHP
2 Bosch gas-fired condensing boiler
3 Bosch split air-water heat pump
4 Energy and storage management

CHP systems: custom solutions for your project

CHP systems up to 2 MW_{el}: customer-specific solutions for operation with natural gas, sewage gas or biogenic gases.

Utilisation scenarios:

- Buildings with year-round heating requirements – e.g. administrative buildings, commercial properties, industrial buildings, local and district heating supply, residential homes, hospitals, indoor pools
- Sewage treatment plants
- Biogas plants

Containerised CHP systems

If you are looking for a standard container, a custom-built solution, indoor installation or a 3-room container, we have the ideal solution for your needs. The CHP container contains all necessary components – from the CHP itself to the entire process control equipment. The sophisticated safety equipment is state-of-the-art. Here, the numerous years of experience in plant construction have been exponentiated rather than summed. The container and the entire technology it contains are planned and constructed in compliance with all appropriate standards and guidelines.

Pre-configured, checked and ready to run

- Two-compartment container with a CHP and an equipment room or a three-compartment container with an additional switchgear room
- Installation frame for the entire re-cooling equipment and exhaust gas piping

Container options

- From 10 feet, depending on CHP type, size and additional equipment (accessories)
- 1, 2 or 3 compartments

Acoustic insulation

- Noise emissions from the standard version reach a level of 75 dBA at a distance of 10 metres, and can be further reduced to 65 dBA
- Fermacell cladding inside the container ensures low interior noise levels

Special features

- We keep cool where others can't stand the heat: 100 % performance, even when the intake air temperature reaches 40 °C
- You can also rely on our technology in regions with low temperatures

Simple installation:
Following the successful completion of functional testing at the factory, the container and the installation frame can be easily separated for transportation. At the building site, the separate units are then assembled without any unnecessary piping and cabling work.

Modularised system technology for CHP systems from 600 to 2 145 kW_{el}

The advantages of modularised, large-scale CHP systems from Bosch for you

Cut your planning times and costs
Whether the CHP is a standalone solution or is scheduled for integration with four-pass boiler technology from Bosch, whether it has a power rating of 400 V or 10.5 kV, whether it is freestanding, fitted with a soundproofed cabin or needs to comply with more stringent noise abatement requirements – we have already planned it, designed it and drawn up the plans.

We provide you with the technical documentation you need for planning your project – technical drawings in dwg or dxf format, datasheets and tender documents – all within 24 hours.

Cut your installation times and costs
The prefabricated and checked modules are delivered to the site complete with connected switchgear and only need to be insulated and connected up to the appropriate piping and cables. All components and monitoring sensors are already installed in the right places, have been checked, tested, preset and are ready for use. That's what Bosch quality is all about.

The benefits of compact flexibility
Lack of space is a common problem, one that can only be solved by units with compact dimensions. The modular design of the Bosch system brings you maximum flexibility.

The compact modules can not only be delivered and installed separately, they can also be set up in configurations to match the available space. They can of course also be delivered in unassembled form and can then be assembled where they are needed.

Reduce your maintenance and service times and costs
The construction of the modules doesn't happen straight from the drawing board, everything is closely coordinated with experienced service technicians and engineers. Optimum accessibility and standardised parts make maintenance and repairs much easier and reduce servicing times and costs.

CHP plus four-pass boiler: the efficient combination

Do you need steam and heat as well as electric power? If you do, a system combining a Bosch CHP and a four-pass boiler is the ideal solution. The efficient and reliable technology from a single source saves costs and reduces environmental impact. In this combination, the CHP delivers the electricity and the downstream boiler system utilises the hot flue gases from the CHP for the generation of steam, heating energy or process heat.

Cut your energy costs
The combined generation of electric power and process heat saves costly energy, secures a constant supply of the resources you need and makes you independent from fluctuations in the prices of electricity dictated by suppliers.

Stay flexible
Our system construction concept makes it possible to independently modulate the CHP and the steam boiler.

Reduce your environmental impact
Combined energy conversion reduces CO_2 emissions. That is good for the environment and helps to prevent global warming.

Cost-effective planning
Our system protects your investments and thus safeguards the economic success of your company.

Your benefits at a glance:

- Safeguarding of basic energy supply
- Independence from the electricity market
- Reduced annual energy costs in comparison with separate provisioning of electric power, heat, energy and steam
- Protection of investments already in place
- High economic efficiency
- Simple, reliable planning throughout the entire operational lifecycle

Compressed-air-and-heat system: CHP CA 570 NA

Compressed air generation without electric power
In most companies, the provision of compressed air, heating energy and process heat is a critical cost factor. Production facilities must be heated, and products dried or heated as a part of the manufacturing process. Compressed air is utilised in many ways in modern industries, and its production accounts for around 10 % of total energy costs. This generates high operational overheads that are influenced not only by the costs of energy and gas, but also by changing political conditions. Conventional systems are thus becoming increasingly uneconomical.

The cost-effective and energy-efficient solution
We developed the innovative CHP CA 570 NA compressed-air-and-heat system to reduce operating overheads. It combines an oil-cooled screw compressor with a gas-powered engine. For energy utilisation with maximum efficiency almost all of the waste heat developed is passed to the heating cycle.

Practical experience
Our first compressed-air-and-heat system was installed in an industrial company in 2015. At a utilisation level of 90 % this system brought annual savings of over 50,000 euros, reduced the carbon footprint by half and recouped the investment within less than three years.

The bottom line
Compressed-air-and-heat system are a viable proposition for a number of reasons:

- Lower energy costs
- Higher overall efficiency
- Reduced carbon footprint
- Independence from political framework conditions

Are you thinking of leasing a compressed-air-and-heat system? – Call us for more details.

Flexible usage scenarios
Our compressed-air-and-heat systems meet a wide range of needs:

- Compressor output is continuously variable (above 60 % engine speed)
- Maximum outlet pressure: 8.5 bar
- Inlet flow temperature to heating system: constant 90 °C

CO_2-free energy conversion with Bosch ORC systems

Experts estimate that a large proportion of all energy used around the world is lost in the form of waste heat. This is a costly extravagance that increases global warming, particularly when we consider the fact that a major proportion of this energy is generated from fossil fuel resources – namely valuable energy sources that are already creating problems today due to dwindling and finite reserves. Our ORC (Organic Rankine Cycle) systems provide clear proof that there are other ways of addressing this problem. They exploit your waste heat to generate valuable electric power.

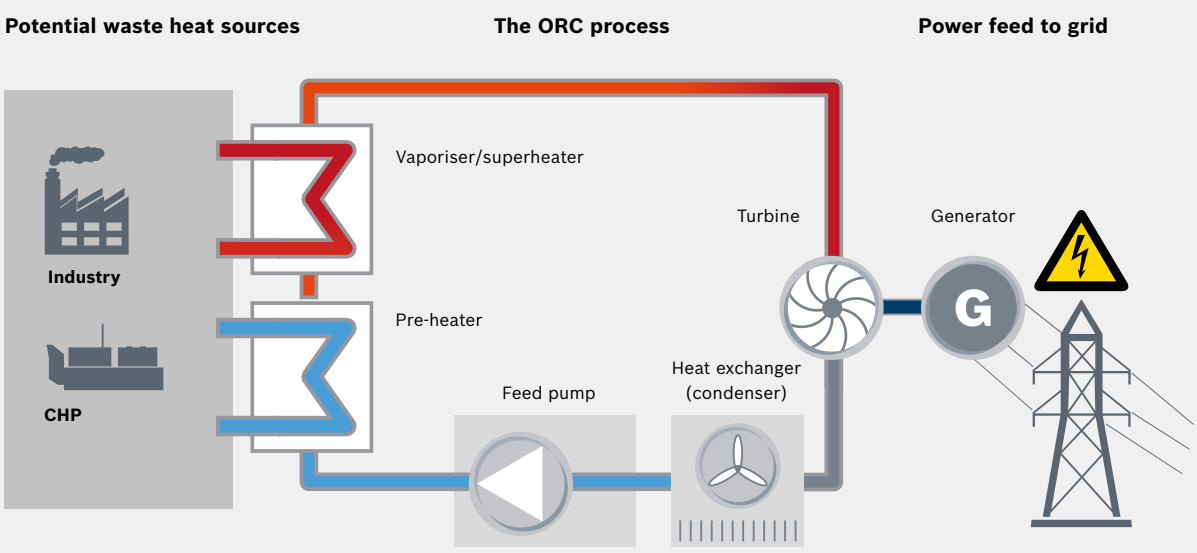
Waste heat recycling with Bosch ORC technology
The principle of the ORC process is based on an organic coolant that enables the generation of electric power at comparatively low temperatures. Our ORC systems are ideal for a wide range of applications and can be effectively used wherever waste heat energy that otherwise remains unused is produced – a fascinating solution for a broad spectrum of usage scenarios. The generation of electricity from waste heat is already a viable and cost-effective proposition with thermal inputs from 400 kW.

The cyclic process – simple principle, amazing effect
ORC technology can be explained in just a few words: waste heat is passed through a heat exchanger and transfers its heat energy to a coolant in a closed cycle. This creates high steam pressure, even at low temperatures. This pressure is used to drive a turbine that is, in turn, connected to a generator. The medium is returned to its fluid state in an air-heat exchanger, is cooled, and then fed back into the vaporisation cycle.

Solutions that make it possible for you to recover energy from your waste heat and utilise it for the generation of valuable electric power make good sense in more ways than one:

- Reduction of CO_2 emissions
- Savings on primary energy
- Conservation of natural resources
- Enhanced sustainability

Process flowchart



ORC technology from Bosch KWK Systeme: power generation from waste heat using various waste heat sources.

Source
We can configure and realise a precisely tailored solution to meet your specific needs. Thanks to our decades of experience in systems construction, we are in a position to offer not only the integration of a hot water heat exchanger, but also all connections to the power grid. Depending on your needs and project requirements, we can also provide all engineering and planning services, e.g. integration of the ORC control system into an existing process control system (PCS), including the configuration and installation of appropriate interfaces. So, depending on the scope of your order, you can receive the complete, ready-to-run system all supplied to you from one single source.

Short installation periods
To ensure fast and simple installation, all relevant ORC system components are preinstalled in a container and delivered as a turnkey package for outdoor installation close to your building or at the location of your choice. The condenser is mounted on the roof frame of the container to ensure fast and hassle-free integration.

Your benefits as a user of a Bosch ORC system

- Low cost of operation, service and maintenance
- Reliable recycling of waste heat all year round
- Electricity generation without the need for additional raw materials or fuels
- Significant increase in overall efficiency
- Consistent and calculable revenue thanks to high availability and stable operation
- Depending on the situation, the electricity generated can be sold back to the public grid or utilised as self-generated power for your on-site needs
- Regionally-specific funding opportunities

Technical data for Bosch ORC systems*

ORC-type**	Usable heat output (approx.) in kW_{th}	Electric power rating in kW	
		Gross	Net
WHR OR 75 (L)	452–625	75	62.5
WHR OR 150 (L)	843–1,167	140	116.5
WHR OR 225 (L)	1,750–1,264	210	175.0
WHR OR 300 (L)	1,686–2,333	280	233.0
WHR OR 375 (L)	2,108–2,917	350	291.5

* Temperature of waste heat source > 140 °C; design temperature 18 °C
** All ORC systems can be supplied as options with proportional low-temperature feed (e.g. WHR OR 75 L)

The advantages of Bosch ORC technology:

- Extremely efficient, low-maintenance turbine with magnetic bearings and excellent partial load performance
- Particularly safe and environmentally compatible overall concept
- Easy to integrate into existing plants or systems
- Available as a standalone solution or as part of a system
- Scalable power output from 75 to 350 kW_{el} by combining several turbines
- No influence on the operation of the original source of heat
- No fuel costs

Country-specific funding opportunities for the Bosch ORC technology are existing – one example is the KfW Energy Efficiency Program in Germany.

Comprehensive, professional and personal: enjoy the benefits of perfect service.

If you need help with commissioning, the procurement of replacement parts or servicing and maintenance, you can always rely on professional online support and the 24-hour Technical Hotline of the Technical Service team from Bosch KWK Systeme. Our qualified specialists will attend to your needs promptly, reliably and competently. They thus make a significant contribution to ensure that our solutions fulfil the high expectations they associate with the Bosch brand.

Comprehensive, professional, personal
You should never leave the issue of operational reliability to chance – put it in the safe hands of our specialists. Optimum, cost-efficient operations and high availability of your system can only be guaranteed by professional servicing and expert maintenance. Technical services directly from the builder of your system is the best possible route to take. Our specially trained and highly qualified personnel is familiar with your project from as early as the planning phase and know your system that well that absolute certainty and peace of mind is guaranteed.

Let Bosch regularly inspect your system
Statistics show that regular inspections and maintenance significantly reduce the number of accidents that occur when working with electrical equipment and systems. In fact, there is a statutory obligation to perform inspections (DGUV (German Social Accident Insurance) Regulation 3). To ensure compliance with this obligation, you can take advantage of our professional service portfolio. Our highly-qualified specialists know every part and function of your system and the inspections they perform guarantee best possible security.

‘95 % availability guarantee’ for compact CHP modules from 12 to 240 kW_{el}
In conjunction with a Premium Maintenance Agreement and MEC Remote, you can also choose the ‘95 % availability’ option. Here, internal CHP software monitors and documents the availability of your compact CHP module and sends the data via a remote link for analysis by our service staff. A bonus/malus rule regulates compensation for deviations in availability, while all other terms and conditions of the agreement remain unchanged.

MEC Remote: Online support for optimum on-site assistance
Master Energy Control (MEC) Remote enables online support to be provided by us, the manufacturer. With your consent, our customer service engineers and our central control room are granted direct access to the control systems of your plant. The services offered include, for example, software updates, parametrisation, remote diagnostics and the elimination of sources of faults. In addition to this, MEC Remote allows you to easily and quickly check the relevant system data on your own account. The data can be called up with any commercially available desktop PC or by mobile devices from any location. The visualisation of current operating values in text form or as a graphic overview pro-vides a detailed overview of your system’s status. A notification service forwards important status reports such as maintenance or faults to you by SMS or email. Further options include the display of events and a history of logged data. Smart functions also allow you to analyse the data to assess the energy efficiency and cost-effectiveness of your system.

The advantages of MEC Remote:

- Secure access, at any time and from anywhere
- Platform-independent internet access
- User-interface in German, English and Russian
- All your CHP units at a glance
- Quick, convenient and cost-efficient monitoring of your system data
- You are kept constantly informed by notification by text-messaging or email
- Updating and remote troubleshooting by Bosch service technicians

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Printed in Germany