POWER YOUR BUSINESS

with efficient energy and economics

JENBACHER
INNIO

RISING ENERGY COSTS

and grid stability

You are under pressure. Your processes require significant electrical and thermal energy, but you face rising energy costs and a more vulnerable grid, driven by globally growing power demand.

At the same time, environmental mandates to save energy and reduce emissions are more important than ever, and you are increasingly evaluated by the carbon footprint of your produced goods.

Modern energy solutions in the industrial as well as consumer goods world are required to meet the needs of both a reliable sustainable energy supply and cost-effective production processes.

INNIO has tailored solutions that can meet or even exceed your energy requirements with decentralized, highly efficient engine technology.

DECENTRALIZED

power supply concepts

Electricity often is procured from the public grid or from an energy provider. Thermal energy is converted from other energy sources at production facilities or procured from utilities. One way to address the current challenges and increase energy supply security is to contract with the public energy provider in combination with a backup power installation.

Another trend in the industrial and consumer world is to use decentralized onsite power generation equipment to obtain higher supply security and grid independence. One of the most efficient ways to do so is with combined heat and power (CHP) as well as combined cooling, heat and power (CCHP) plants.

These systems produce dependable electricity, heat and/or cooling from a single energy source while reducing fuel input by approximately 30% compared to the separate generation of electricity and thermal energy. Add in the fact that building energy systems at or near the point of use helps alleviate supply and distribution losses while providing a high degree of supply security and grid independency.

SUSTAINABLE

cogeneration and trigeneration solutions

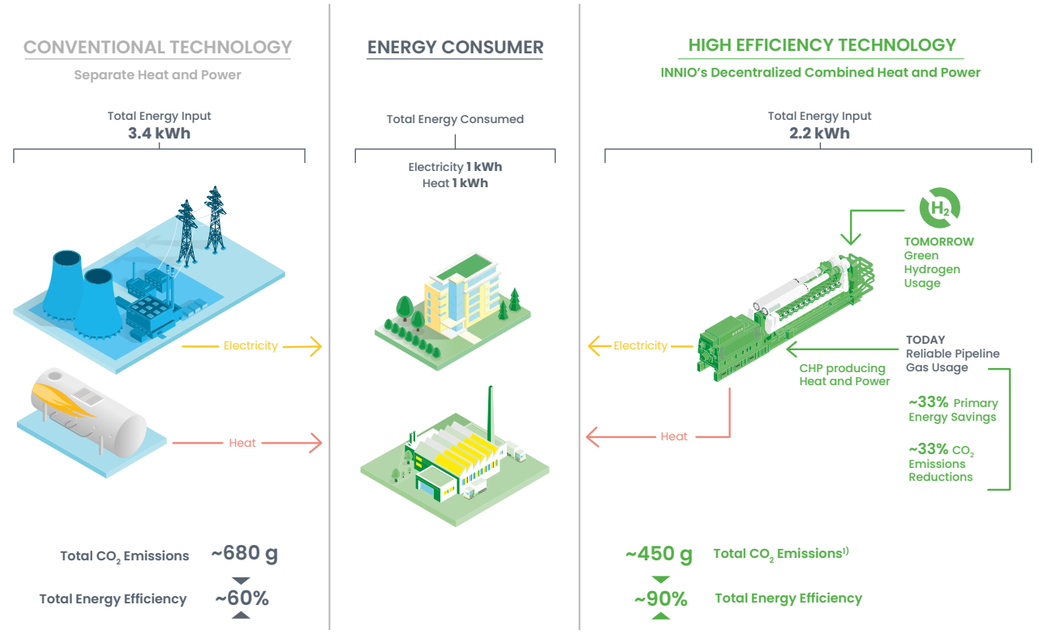
INNIO offers flexible and innovative Jenbacher CHP (cogeneration) and CCHP (trigeneration) power plant solutions. With a wealth of experience, Jenbacher is among the global technology leaders when it comes to engine-based power generation and waste heat recovery solutions.

In addition to providing power for your local site, CHP also can be used to export generated electricity to the public grid, opening up additional value streams for you while supporting the local grid as needed. Similarly, you can use the generated thermal energy to satisfy your onsite thermal loads by creating hot water, hot air, steam or process heat. Thermal energy also can be stored for later or used for trigeneration to meet your air conditioning or refrigeration demands.

With the rise of non-dispatchable renewable generation assets in the grid, the value of the cogeneration plant's flexibility is even higher. Ultimately, this degree of energy independence and emission savings can mean the difference between a thriving or failing business.

And there is potential for an even more sustainable solution:

INNIO's Jenbacher energy systems can use a mixture of pipeline gas and CO_2-free hydrogen as fuel today and be converted to 100% hydrogen (H_2) operation once H_2 becomes more available.



[1] With Heat Bonus ~225 g/kWhel

CONVINCING ADVANTAGES

Lower your energy costs and emissions

With up to 95% total efficiency, CHP solutions can reduce your energy consumption and CO_2 emissions by more than 30% compared to the separate generation of an equivalent amount of power and heat. This lowers your energy costs because self-generated power and recovered thermal energy are more economical than the purchased electricity and boiler fuel they displace.

Operate economically

CHP combined with heat storage allows you to operate your asset flexibly and optimize energy cost savings. You can run the plant when electricity costs are high and buffer heat to balance differences in thermal energy production and demand.

Increase resilience

During natural or manmade disasters, CHP systems can support your critical facility operations or stem potential losses sustained by your facility when the local or regional electric grid fails. Cogeneration plants equipped with decoupling devices to monitor voltage, frequency and short interruptions help you provide an extra level of security and energy continuity.

Make a sustainable investment

While many CHP systems run on pipeline gas, INNIO's products can harness a wide variety of renewable and special customer-generated gases such as syngas from industrial processes. This application makes cogeneration much more economical than traditional power production and reduces emissions.

Open up the opportunity of CO_2-free operation

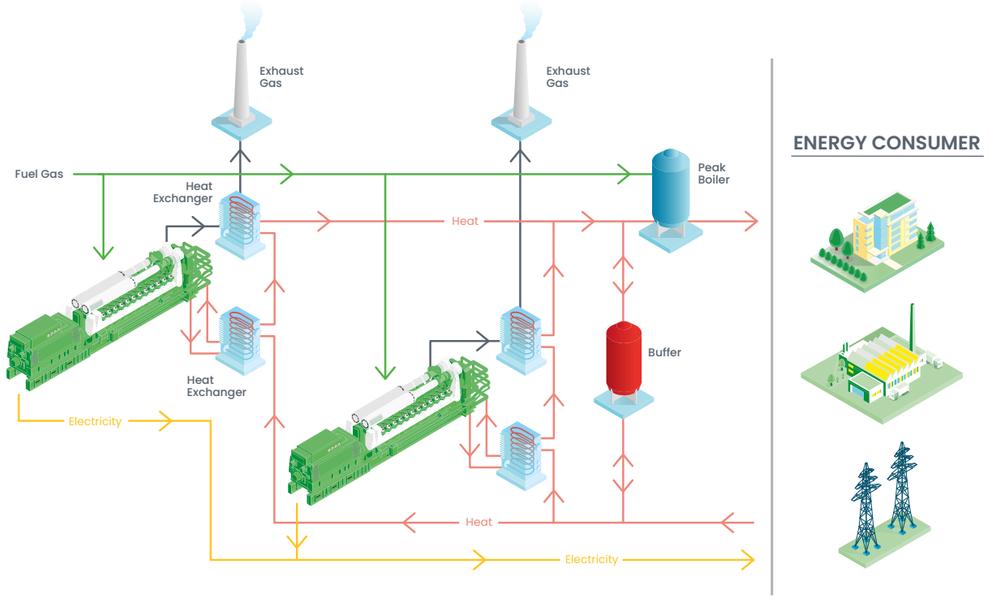
Today's Jenbacher engines with our Ready for H_2 option can use up to 20% (vol) of H_2 blended into the gas pipeline. As hydrogen becomes more readily available, all Ready for H_2 new units and most of the currently installed Jenbacher conventional gas-fueled engines can be converted to operate on 100% H_2. Type 4 engines and CHP systems are available today to run on 100% H_2, enabling a CO_2-free power supply with your cogeneration system today.

TAILORED

to your specific industrial operation

A Jenbacher cogeneration plant consists of the power generation unit with an engine and a generator along with heat exchangers to take advantage of the heat resulting from the combustion process.

The energy systems use all related heat sources such as the engine cooling water, lubricating oil, the air/fuel gas mixture and the exhaust gas. Water temperature levels of 100°C and more can be achieved, making INNIO's CHP and CCHP solutions highly flexible.



Customized hydraulic integration

Through special hydraulic integration variants, INNIO allows for flexible sequencing of the different heat sources of the cogeneration unit to provide thermal energy at temperature levels specifically tailored to your production needs.

Boiler systems for heat storage

Combining the cogeneration plant with a boiler system can help you meet peak heating requirements, leading to added plant flexibility and efficiency with decoupled heat production and consumption.

Steam generation option

With a Jenbacher CHP system, the thermal energy from the engine exhaust system can be used to generate steam for your production through the installation of an exhaust gas steam boiler.

Support for drying and pre-heating processes

The different heat sources of the cogeneration plant can be used to support your onsite production processes such as drying or pre-heating of hay, wood and bricks. Depending on the temperature levels required in your industrial process, the CHP unit can work independently or be co-fired with other energy sources for even higher temperature levels.

Trigeneration for cooling

Trigeneration—or combined cooling, heat and power (CCHP)—provides a substantial advantage over traditional cooling methods. An excellent solution for sites with fluctuating heating and cooling requirements, trigeneration offers you an efficient year-round source for both thermal and cooling power needs. With an absorption chiller linked to the Jenbacher CHP system, excess energy can be used to generate chilled water for air conditioning or refrigeration.

With no moving parts, the absorption chiller offers you significant benefits compared to compression chillers. It is nearly silent, and reduced component wear results in lower operating and lifecycle expenses. Because it uses water as a refrigerant, the absorption system does not release any harmful substances into the atmosphere, helping to improve your facility's overall energy efficiency as well as its environmental footprint. The CCHP system can be complemented with electrical chillers to meet your peak cooling demands.

A POWERFUL

portfolio

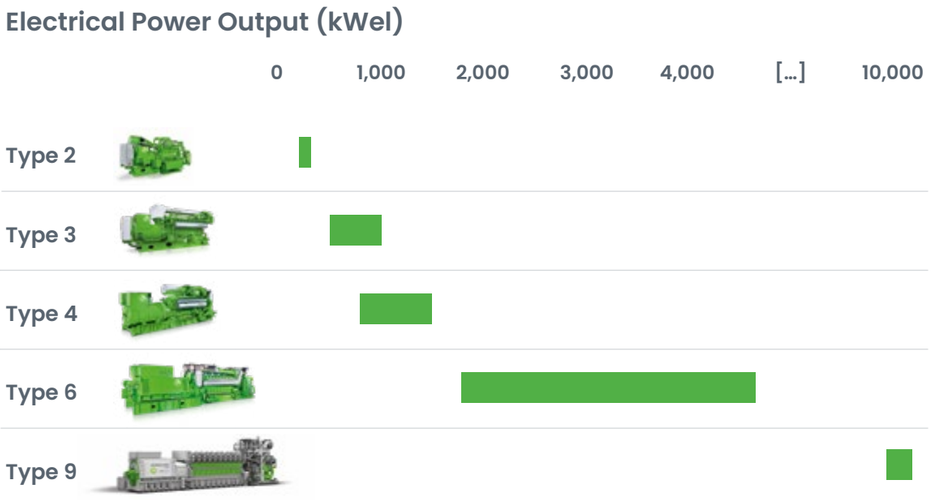
INNIO offers you a comprehensive portfolio from 250 kW up to 10 MW of single unit electrical power output. By using multiple CHP systems in one plant, the power output can be scaled up while part load performance and reliability are significantly increased.

A wide range of available generator voltage levels and flexible hydraulic integration variants are available to allow for excellent integration into your existing electrical and thermal systems.

Depending on your needs and capabilities, INNIO can provide you with the basic module, including its control system, or with an extended supply scope that includes balance-of-plant equipment.

Benefit from modular container solutions

For faster installation, Jenbacher Type 2, 3 and 4 engines optionally can be installed in 20-foot and 40-foot containers. For Type 6, we offer special, easily transportable container solutions that allow for highly flexible operations for a variety of locations.



ready for H_2

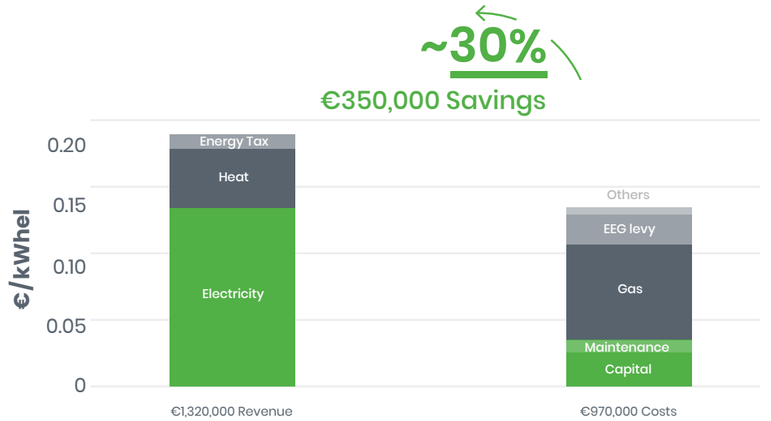
Want to prepare for a greener future?

Visit innio.com/hydrogen to learn more about INNIO's hydrogen solutions.

INVESTING

in Jenbacher CHP and CCHP technology pays off

With INNIO's CHP and CCHP solutions, you gain economically, and so does the environment. Want to know how? Here is an example based on a real business case, with data from one of our customers.



Customer business case and saving potential[2]

Plant Key Technical Data:

Engines	1 x J612
Energy Source	Pipeline Gas
Electrical Output	1,999 KW
Thermal Output	2,196 KW
Total Efficiency	91%

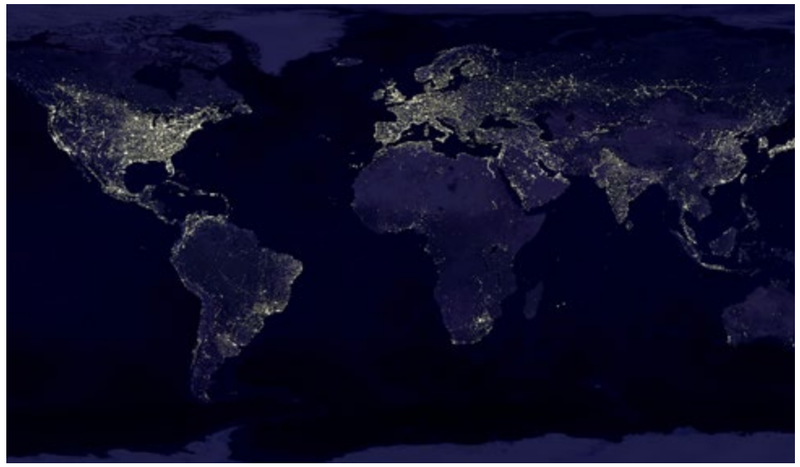
[2] Assumptions: 3,500 annual operating hours, Renewable Energy Sources Act (EEG) and 80% energy self supply

13,000 CHP SYSTEMS

around the globe

Our delivered CHP fleet can generate an overall electrical output of approximately 19,500 MW and has the potential of an annual production of 156 TWh of electricity and more than 163 TWh of heat.

This amount of energy can deliver electricity for around 42 million EU homes[3] and heat for as many as 16 million EU households[4]. Our fleet has the potential to reduce CO_2 emissions by about 40 million tons[5], which corresponds to taking 22 million European cars off the road for one year[6]. That's powerful proof of INNIO's leading position with our highly efficient CHP technology.



[3] Based on average electricity consumption of households in EU, 2018 www.odyssee-mure.eu/publications/efficiency-by-sector/households/electricity-consumption-dwelling.html
[4] Based on heating and cooling data, European Commission, 2018 www.ec.europa.eu/energy/en/topics/energy-efficiency/heating-and-cooling
[5] Based on EU natural gas emission factor, 2017, EU Open Data Portal www.data.europa.eu/euodp/en/data/dataset/jrc-com-ef-comw-ef-2017 and carbon intensity of power generation, 2021, IEA www.iea.org/reports/tracking-power-2021
[6] Based on average EU car CO_2 emission, 2015 www.vcd.org/fileadmin/user_upload/Redaktion/Themen/Auto_Umwelt/CO2-Grenzwert/2018_04_CO2_emissions_cars_The_facts_report_final.pdf

Energy security for Deutsche Börse in Germany

This onsite CHP plant operating on pipeline gas helps enhance the energy security of the Deutsche Börse operations, which play a vital role in supporting Germany's economy every day. Surplus electricity is sent to the regional grid for increased energy reliability in the Frankfurt area.

Eschborn
Germany

PLANT FACTS

Engines	2 x J412
Energy Source	Pipeline Gas
Electrical Output	1.7 MW
Thermal Output	1.7 MW
Total Efficiency	86.1%

Reduced environmental impact for Barts NHS Hospital in the UK

Since 2015, one of the oldest hospitals in the UK has obtained cooling, heat and power from a single Jenbacher J420 unit. The 1.4 MW cogeneration unit powered by pipeline gas includes a 250 kW absorption chiller that delivers cooling water to the hospital.

London
United Kingdom

PLANT FACTS

Engines	1 x J420
Energy Source	Pipeline Gas
Electrical Output	1.4 MW
Thermal Output	1.6 MW
Total Efficiency	86.9%

»The organization selected INNIO's engines due to their reduced environmental impact along with Clarke Energy's excellent services support. This collaboration highlights numerous energy-efficiency opportunities throughout the NHS and other power-intensive industries.«

Fiona Daly
Barts NHS Trust Hospital

Reducing Vitalait's energy costs in Tunisia with CCHP

With two INNIO Jenbacher J612 engines and a total electrical output of 4 MW, this co-generation plant helps reduce Vitalait's energy costs with monthly savings of more than €51,000[7]. Plus, carbon emissions are reduced by more than 6,000 metric tons (tonnes) per year.

Mahdia
Tunisia

PLANT FACTS

Engines	2 x J612
Energy Source	Pipeline Gas
Electrical Output	4 MW
Thermal Output	3.1 MW
Total Efficiency	78%

[7] 166,000 Tunisian Dinar

Beijing
China

Efficient CCHP for Huadian Industrial Park in China

The Huadian Corporation operates two J620 pipeline gas CCHP units with a combined electrical output of 6.7 MW. The installed trigeneration system provides about 18 million kWh of electricity to the industrial park each year as well as heat and cooling, with a total efficiency of around 87%. That translates into annual power savings of about 23%.

PLANT FACTS

Engines	2 x J620
Energy Source	Pipeline Gas
Electrical Output	6.7 MW
Thermal Output (Cooling)	3.3 MW
Total Efficiency	87%

»This project fully aligns with China's intention to create an efficient energy supply system that is a foundation of the nation's energy development efforts. By conforming to the strategic goal of clean, low-carbon urban development, our energy station embodies the concept of rigorous environmental protection in modern industrial parks.«

Zhao Shengguo
Huadian Distributed Energy
Engineering Technology Company

OUR COMMITMENT

to you

Flexibility and experience you can count on

For the last 65-plus years, INNIO has been an innovator of power generation technology. Today's highly flexible Jenbacher CHP systems deliver energy independence through an efficient, low emission, secure and cost-effective energy solution. We have already delivered more than 13,000 CHP systems globally.

Thinking long-term. Thinking Circular.

With our flexible, scalable, and resilient energy solutions and services, INNIO is embracing the circular economy—recycling, reusing, and upgrading our engines to meet the latest environmental requirements. For example, upgrading to hydrogen operations for a renewed life or using heat that normally would be wasted during power generation are sustainable solutions that can keep entire communities or businesses warm and electrified.

Through our service network in more than 80 countries and our digital capabilities, we provide life-cycle support for over 40,000 installed units globally, helping to ensure a greater runtime for longer equipment life.

Zero-carbon H_2 operation tomorrow

In addition, the same proven and economically viable INNIO equipment can be moved from conventional fuels today to full CO_2-free H_2 operation tomorrow, once H_2 becomes more readily available.

BENEFIT

from a powerful digital platform

Through our myPlant Performance digital solution, INNIO provides digital remote support for our connected customer-operated systems across the globe. Today, more than 10,000 engines are managed remotely, evaluating more than 900 billion data points annually—a powerful proof-point of INNIO's knowledge and experience.

Fulfill emission requirements

Our engine and fleet emission monitoring solutions help you more easily comply with emissions requirements—until you can operate your plant with 100% H_2 and become carbon-free.

Improve business planning

Increase your power system's lifespan by taking advantage of self-learning algorithms that analyze component condition and calculate parts lifetime.

Optimize engine management

Real-time engine monitoring and operations provide you with remote access to your assets via desktop or app, whenever you need it, by aligning operational practice with maintenance requirements.

Achieve greater availability

With the ability to solve about 65% of logged cases remotely, you can reduce the need for travel to your site—saving time and money.

Rely on INNIO's engagement to sustainability

For INNIO, ethics and compliance, along with a sustainable way of conducting business, are front and center of everything we do. By selecting INNIO as your supplier, you enter a long-term relationship with a dependable collaborator. Our fundamental mission to accelerate the world's transition to net zero was recognized with the prestigious EcoVadis Silver Medal Rating for 2021 and Gold Medal Rating for 2022. Also in 2021, INNIO joined the "Race to Zero" campaign, initiated by the United Nations, to bring together global leadership for a healthy transition to a net-zero future. Thanks to our efforts in 2021, INNIO's ESG Risk Rating places it number one of more than 500 worldwide companies in the machinery industry assessed by Sustainalytics.*

*Rating took place in February 2022

INTERESTED?

INNIO is among the world's technological leaders in CHP! Let us develop a powerful energy concept for your company.

Reach out today by completing the contact form online: innio.com/contact

Our Sales contact will follow up with you.

INNIO is a leading energy solution and service provider that empowers industries and communities to make sustainable energy work today. With our product brands Jenbacher and Waukesha and our digital platform myPlant, INNIO offers innovative solutions for the power generation and compression segments that help industries and communities generate and manage energy sustainably while navigating the fast-changing landscape of traditional and green energy sources. We are individual in scope, but global in scale. With our flexible, scalable, and resilient energy solutions and services, we are enabling our customers to manage the energy transition along the energy value chain wherever they are in their transition journey.

INNIO is headquartered in Jenbach (Austria), with other primary operations in Waukesha (Wisconsin, U.S.) and Welland (Ontario, Canada). A team of more than 3,500 experts provides life-cycle support to the more than 54,000 delivered engines globally through a service network in more than 80 countries.

INNIO's ESG Risk Rating places it number one of more than 500 worldwide companies in the machinery industry assessed by Sustainalytics.

For more information, visit INNIO's website at **www.innio.com**

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ENERGY SOLUTIONS.
EVERYWHERE, EVERY TIME.

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