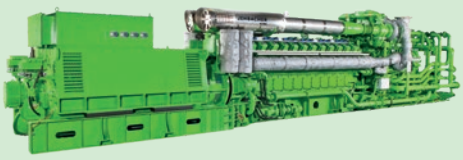
JENBACHER

LET'S TALK ABOUT **POWER PLANTS.**



Jenbacher greenhouse solutions
from INNIO – your gas engine expert

ENERGY SOLUTIONS.
EVERYWHERE, EVERY TIME.

INNIO

THE GREENHOUSE HORTICULTURE INDUSTRY

A global increase in both food demand and environmental awareness has led to a rapid rise in the greenhouse horticulture industry. That is because greenhouses today have the ability to simultaneously increase the viability of their crops and effectively control carbon dioxide (CO_2) emissions. INNIO*'s technology can provide you with heat, electricity and CO_2 fertilization, increasing your greenhouse's total efficiency, profitability and plant production. Today, more than 1,500 Jenbacher* cogeneration units with CO_2 fertilization have been installed worldwide, providing about 3,300 MW of power.

FACING SIGNIFICANT CHALLENGES

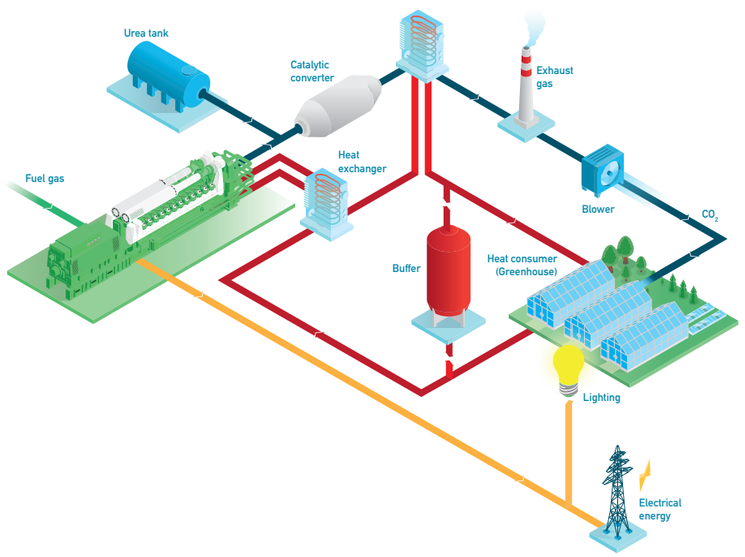
Although the greenhouse horticulture industry is growing rapidly, greenhouse growers and plant owners face substantial challenges, too: increasing production costs, access to cold storage, lack of proper transportation infrastructure, and growing governmental regulations. As a result, you need ways to increase the efficiency of your horticulture production while meeting new governmental requirements.

FASTER GROWTH WITH GAS ENGINES

INNIO's Jenbacher combined heat and power (CHP) systems not only provide electricity for on-site or public grid use, but also heat and CO_2 to fertilize plants and meet the requirements of an efficient greenhouse. By increasing the intensity of the artificial lighting that is found in some greenhouses, plants absorb even more CO_2. Plant growth and the subsequent harvest yield can be significantly increased by enriching the greenhouse environment with CO_2, keeping the temperature constant, and providing sufficient lighting.

THE JENBACHER CONCEPT

The energy created by gas engine cogeneration systems in greenhouses can be used in various ways. The electricity can provide the power for artificial lighting and/or be fed into the public grid. And while the heat can efficiently meet the greenhouse's requirements, the CO_2 from the engine exhaust gas can help fertilize the plants. That is because the exhaust from gas engines burning natural gas contains approximately 0.2 kg of CO_2 per kWh of energy input.



After the purification of the exhaust gas with special catalytic converters (SCR and oxidation catalytic converters), it is cooled down by a heat exchanger to approximately 55°C and supplied to the greenhouse for CO_2 enrichment. A device that constantly measures the exhaust gas levels helps ensure the vegetation's safety.

ADVANTAGES

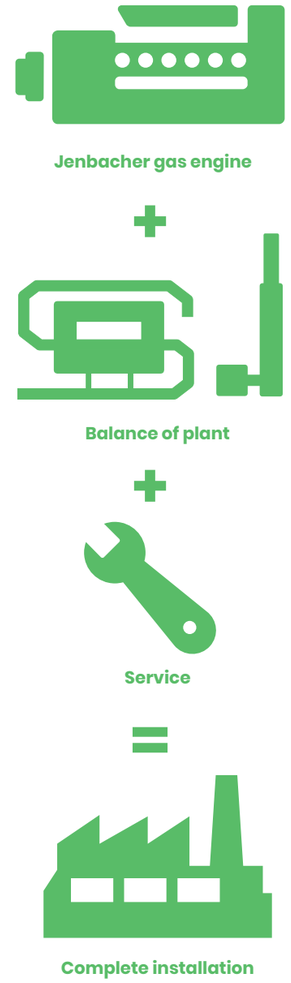
- Higher efficiency: Our system takes less than 12 months to construct and can achieve overall efficiency levels of 95% or more.
- CO_2 fertilization: With 50% less heat output than a boiler, the CO_2 level can be doubled for crop efficiency increases up to 140%.
- Standardized design. Our compact modular design creates a small footprint and can be adjusted to your spatial requirements.
- Lower emissions: CO_2 captured during power production helps increase crop production.
- Flexible power: Produced thermal energy can be stored for use as needed. Electricity can be fed into the public grid or used for artificial lighting, and we offer an optional full island lighting control system.

FRAMEWORK REQUIREMENTS

- Efficient operation is possible with approximately 1 hectare (2.47 acres) or larger greenhouses
- CO_2 fertilization is suitable for all crop types while artificial illumination is primarily suitable for vegetables (such as tomatoes or peppers) and flowers (such as chrysanthemums or roses)
  - CO_2 fertilization with simultaneous heat supply: dimensioning for 0.5 MWel/ha
  - CO_2 fertilization with simultaneous heat supply and illumination: dimensioning for 0.35 MWel/ha

OUR GREENHOUSE PACKAGE

With our standardized greenhouse cogeneration technology, the Jenbacher gas engine, catalytic converter, heat exchanger and all balance of plant equipment and controls are provided in one convenient package. INNIO's greenhouse experts can help develop your balance-of-plant specifications as well as perform engineering and site and design work to meet your spatial requirements. Our standardized package makes your service experience easier, too, since the generator and all other installations can be removed at the same time.



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INNIO* is a leading solutions provider of gas engines, power equipment, a digital platform and related services for power generation and gas compression at or near the point of use. With our Jenbacher* and Waukesha* product brands, INNIO pushes beyond the possible and looks boldly toward tomorrow. Our diverse portfolio of reliable, economical and sustainable industrial gas engines generates 200 kW to 10 MW of power for numerous industries globally. We can provide life cycle support to the more than 50,000 delivered gas engines worldwide. And, backed by our service network in more than 100 countries, INNIO connects with you locally for rapid response to your service needs. Headquartered in Jenbach, Austria, the business also has primary operations in Welland, Ontario, Canada, and Waukesha, Wisconsin, US.

For more information, visit: innio.com

Center of Excellence for Greenhouse Applications

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