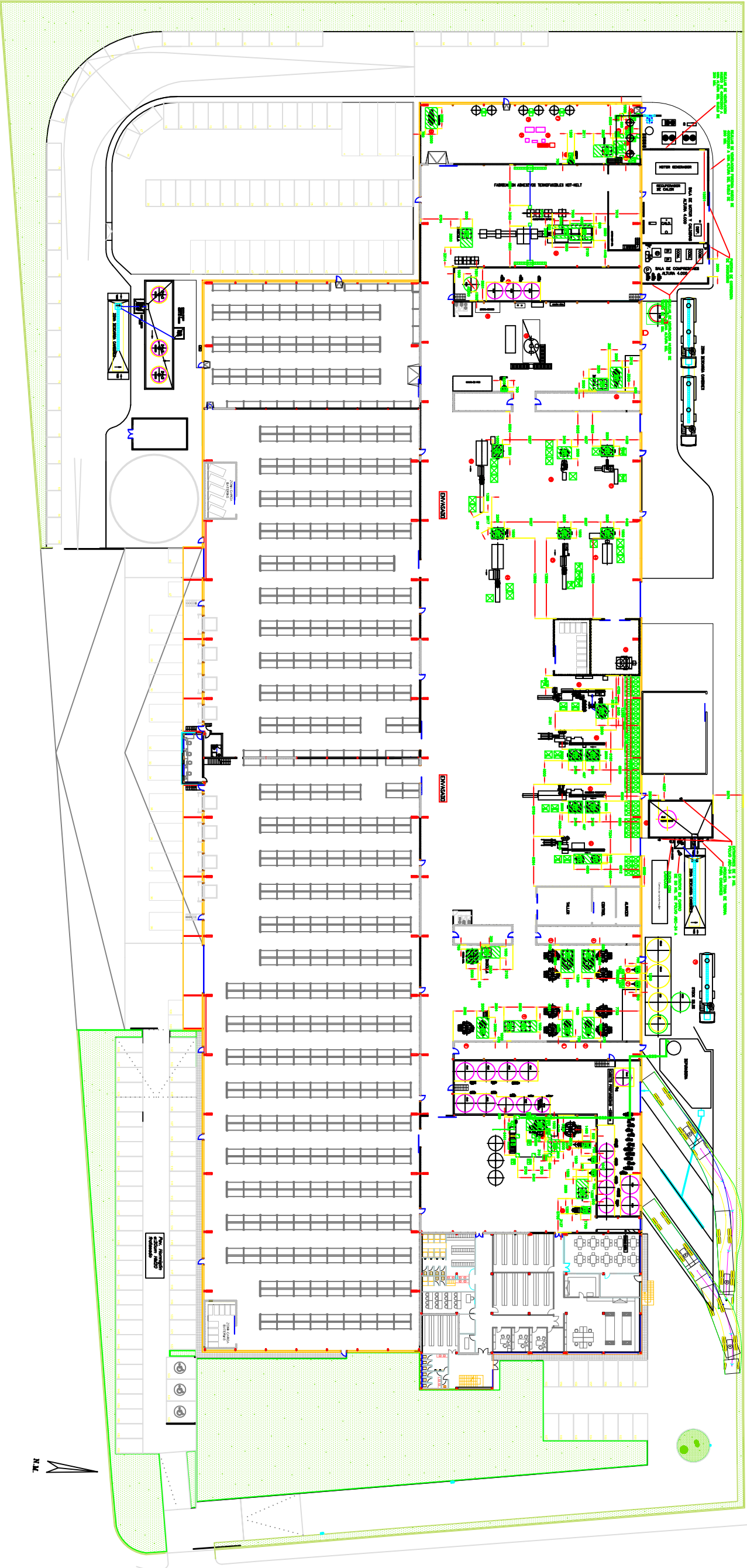


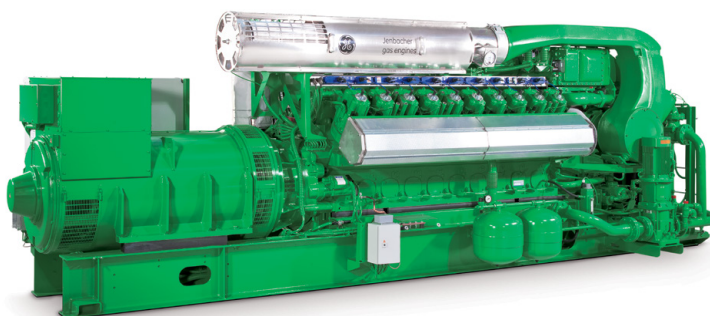


TITULO		ESQUEMA	FOLIO
PROYECTO	FECHA		
PROYECTO DE COGENERACION	2010	1	1

Jenbacher tipo 4

Todo un hito en rendimiento

Basado en los acreditados conceptos de diseño de los tipos 3 y 6, los motores modernos tipo 4 en la gama de potencia de 800 a 1.500 kW se caracterizan por una alta densidad de potencia y un rendimiento excepcional. El sistema de regulación y control perfeccionado permite un mantenimiento preventivo óptimo, y asegura la máxima fiabilidad y disponibilidad.



Instalaciones de referencia

J416 Richard van Schie, invernaderos; Monster, Países Bajos

Combustible	Tipo de motor	Potencia eléctrica	Potencia térmica	Puesta en marcha
Gas natural	2 x J416	2.260 kW	2.806 kW	08/2004 (a), 07/2007 (b)

a) 1er motor b) 2a motor

En este invernadero, el módulo de cogeneración Jenbacher genera energía eléctrica para la iluminación de asimilación, calor y CO₂ para aumentar la capacidad productiva del cultivo de crisantemos. El CO₂ producido a partir de los gases de escape de los motores, se utiliza para la fertilización de las plantas dentro de los invernaderos. El usuario obtendrá así un beneficio económico adicional gracias a la venta de energía eléctrica a la red.



J420 Vertedero Bootham Lane; Doncaster, Reino Unido

Combustible	Tipo de motor	Potencia eléctrica	Potencia térmica	Puesta en marcha
Gas de vertedero	2 x J420	2.666 kW	-	05/2001 (a), 12/2002 (b)

a) 1er motor b) 2a motor

En este vertedero, el contenido en metano del gas puede bajar hasta el 35%. Los motores Jenbacher se adaptan fácilmente a las fluctuaciones del contenido en metano gracias a su sistema patentado de combustión de mezcla pobre LEANOX *. Así, estas variaciones no provocan una reducción de rendimiento. Esta instalación está operada por United Utilities Green Energy Limited.



J420 Hospital; Padua, Italia

Combustible	Tipo de motor	Potencia eléctrica	Potencia térmica	Puesta en marcha
Gas natural	2 x J420	2.832 kW	2.576 kW	02/2002 (a), 10/2003 (b)

a) 1er motor b) 2a motor

Dos módulos de cogeneración Jenbacher ayudan al hospital de Padua a controlar sus costes energéticos, proporcionando energía eléctrica y térmica con altos niveles de rendimiento. El rendimiento eléctrico de cada motor es del 42,3%.



J420 Solución en contenedor; Planta de biogás SBR; Kogel, Alemania

Combustible	Tipo de motor	Potencia eléctrica	Potencia térmica	Producción de vapor	Puesta en marcha
Biogás	1 x J420	1.413 kW	751 kW	1.037 kg/h a 3 bar o potencia térmica de 698 kW	10/2003

Esta planta de biogás utiliza restos de comida de hospitales, hoteles y cantinas así como desechos residuales orgánicos de la industria alimenticia para producir biogás, que sirve como combustible para nuestro motor a gas. La electricidad generada se suministra en su totalidad a la red y los gases de escape procedentes del motor se utilizan para la producción de vapor. Este vapor sirve para la pasteurización de los residuos, los cuales posteriormente pueden utilizarse como fertilizante esterilizado.





Características técnicas

Característica	Descripción	Ventajas
Recuperación de calor	Una amplia gama de gases posibles y el aire de combustión se mezclan a baja presión antes de entrar en el turboalimentador	- Máximo rendimiento térmico, incluso con temperaturas de retorno altas y variables
Válvula dosificadora de gas	Válvula dosificadora de gas regulada electrónicamente, con alta precisión de regulación	- Tiempo de reacción muy corto - Ajuste rápido de la relación aire/gas - Posibilidad de regular grandes variaciones en el poder calorífico
Culata con cuatro válvulas	Diseño optimizado para mejorar turbulencias y geometría de flujos mediante los más modernos métodos de cálculos y simulación (CFD)	- Pérdidas minimizadas en el intercambio de cargas - Posición central de las bujías aporta condiciones óptimas de refrigeración y combustión
Biel tipo crack	Aplicando una tecnología de fabricación, probada y demostrada en la industria del automóvil, a nuestros motores estacionarios	- Alta estabilidad y precisión dimensionales - Reducido desgaste del cojinete de biela - Fácil mantenimiento

Datos técnicos

Configuración	V 70°			Dimensiones l x an x al (mm)		
Taladro (mm)	145			Gen-Set	J412	5.400 x 1.800 x 2.200
Carrera (mm)	185				J416	6.200 x 1.800 x 2.200
Cilindrada/cilindro (lit)	3,06				J420	7.100 x 1.900 x 2.200
Velocidad nominal (rpm)	1.800 / 1.200 (60 Hz) 1.500 (50 Hz)			Módulo de cogeneración	J412	6.000 x 1.800 x 2.200
Velocidad media del pistón (m/s)	7,4 (1.200 rpm) 9,3 (1.500 rpm)				J416	6.700 x 1.800 x 2.200
					J420	7.100 x 1.800 x 2.200
Alcance de suministro	Gen-Set, módulo de cogeneración, Gen-Set/ módulo de cogeneración en contenedo			Contenedor	J412	12.200 x 3.000 x 2.600
Tipos de gases utilizables	Gas natural, flare-gas, biogás, gas de vertedero, gas de depuradora. Gases especiales (p. ej., grisú, gas de coque, gas de madera, gas de pirolisis)				J416	12.200 x 3.000 x 2.600
					J420	12.200 x 3.000 x 2.600
Tipo de motor	J412	J416	J420	Peso seco (kg)		
N° de cilindros	12	16	20	Gen-Set	11.000	13.200
Cilindrada total (lit)	36,7	48,9	61,1	Módulo de cogeneración	11.600	13.800
					J412	J416
					J420	J420
</						

Potencias y rendimientos

Gas natural		1.500 rpm 50 Hz					1.500 rpm 50 Hz					1.200 rpm 60 Hz				
NOx <	Type	Pel (kW) ¹	ηel (%) ¹	Pth (kW) ²	ηth (%) ²	ηtot (%)	Pel (kW) ¹	ηel (%) ¹	Pth (kW) ²	ηth (%) ²	ηtot (%)	Pel (kW) ¹	ηel (%) ¹	Pth (kW) ²	ηth (%) ²	ηtot (%)
500 mg/m ³ _N	J412	889	42,9	920	44,4	87,4	850	41,1	937	47,1	88,2	634	41,8	657	43,3	85,1
	J416	1.189	43,0	1.224	44,2	87,2	1.137	41,3	1.298	47,1	88,4	850	42,0	876	43,3	85,4
	J420	1.487	43,0	1.529	44,2	87,2	1.426	41,4	1.623	47,1	88,6	1.063	42,0	1.094	43,3	85,3
250 mg/m ³ _N	J412	889	41,5	984	46,0	87,5	850	40,0	1.008	47,4	87,4	599	41,1	639	43,9	85,0
	J416	1.189	41,6	1.312	46,0	87,6	1.137	40,1	1.343	47,4	87,5	799	41,1	851	43,8	85,0
	J420	1.487	41,7	1.639	45,9	87,6	1.426	40,3	1.680	47,4	87,7	1.004	41,4	1.065	43,9	85,2
350 mg/m ³ _N	J412	889	42,1	945	44,8	86,9										
	J416	1.189	42,3	1.260	44,8	87,0										
	J420	1.487	42,3	1.574	44,7	87,0										

Biogás		1.500 rpm 50 Hz					1.500 rpm 50 Hz				
NOx <	Type	Pel (kW) ¹	ηel (%) ¹	Pth (kW) ²	ηth (%) ²	ηtot (%)	Pel (kW) ¹	ηel (%) ¹	Pth (kW) ²	ηth (%) ²	ηtot (%)
500 mg/m ³ _N	J412	889	42,0	902	42,6	84,7	850	40,2	956	45,2	85,3
	J416	1.189	42,4	1.201	42,8	85,2	1.137	40,4	1.274	45,1	85,4
	J420	1.487	42,4	1.502	42,8	85,2	1.426	40,4	1.594	45,7	85,6
250 mg/m ³ _N	J412	889	41,6	918	43,0	84,6	850	39,2	989	45,7	84,9
	J416	1.189	41,7	1.223	42,9	84,7	1.137	39,4	1.319	45,7	85,0
	J420	1.487	41,8	1.464	41,1	82,9	1.426	39,5	1.648	45,7	85,2



1) Detalles técnicos de acuerdo a la norma ISO 3046
2) Potencia térmica total con una tolerancia de +/- 8%, enfriamiento de los gases de escape hasta 120°C, con biogás hasta 180°C
Todos los valores se refieren a un funcionamiento del motor a plena carga y están sujetos a cambios debidos al desarrollo técnico.
Puede obtener otras versiones de motores, previa solicitud.

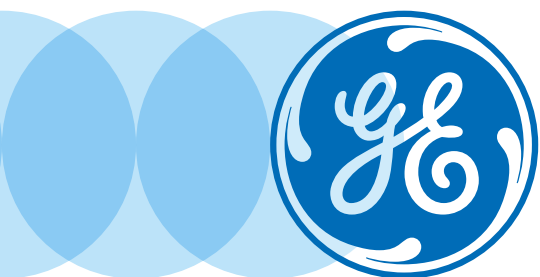
Now you can have it all! more innovation, power & efficiency

Lasting power with the incredible
new 10 MW range Jenbacher gas engine

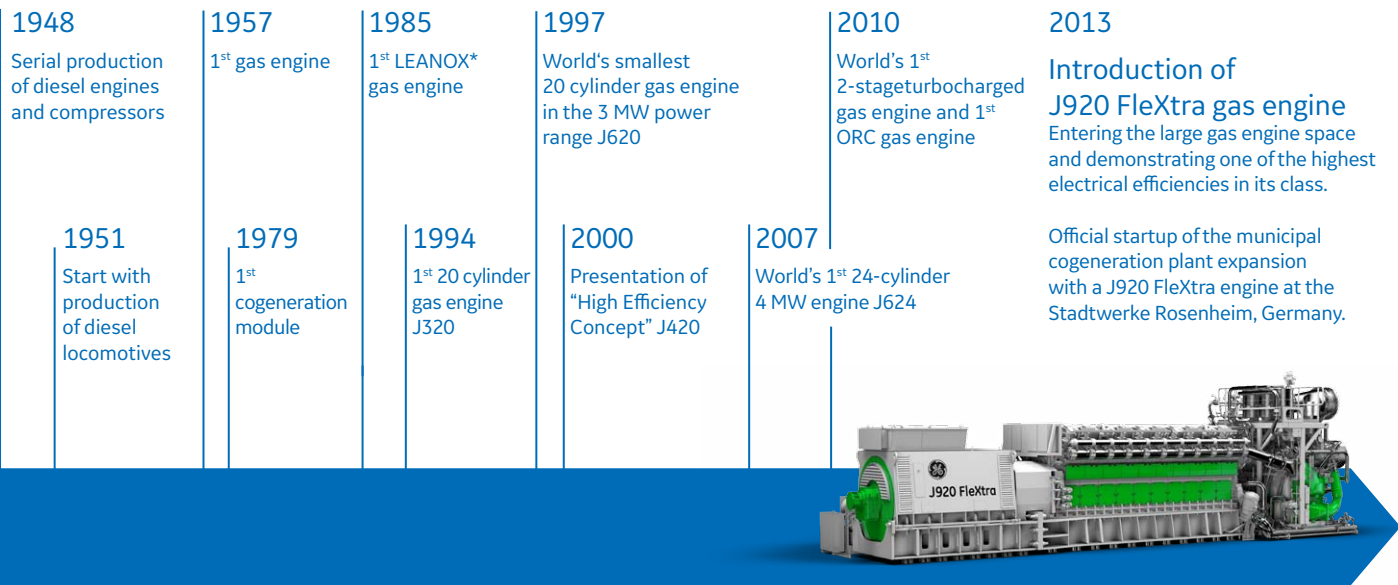


Flextra

ecomagination



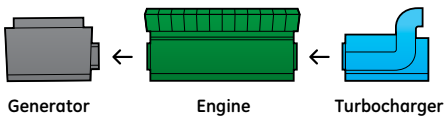
A range of innovative solutions leading to J920 Flextra gas engine



Innovative design for ease, installation, and maintainability

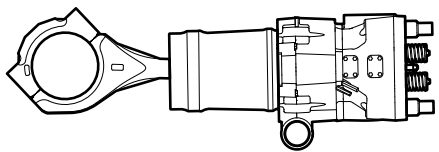
GE's J920 Flextra gas engine is at the top of its class for electrical efficiency and is designed for durability, simple installation, and maintainability. The engine consists of three modules—a generator, engine, and turbocharger auxiliary module—that provide a high-quality, pre-fabricated, standardized generator-set module. Each module is factory-tested, then shipped separately and assembled on site, offering reduced installation time. In addition, the modules have highly standardized interfaces that work well with the balance of plant (BoP) systems, and ultimately simplify BoP

installations and total plant construction time. To increase plant availability, GE's J920 Flextra gas engine is designed for top operation and maintainability.



Power unit

The J920 Flextra power unit helps to ensure low downtime, as it is easily replaced without major disassembly of the engine.



Divided camshaft

The J920 Flextra is equipped with a segmented camshaft, allowing easy exchange through a maintenance window at the top of the crankcase.

Coupling

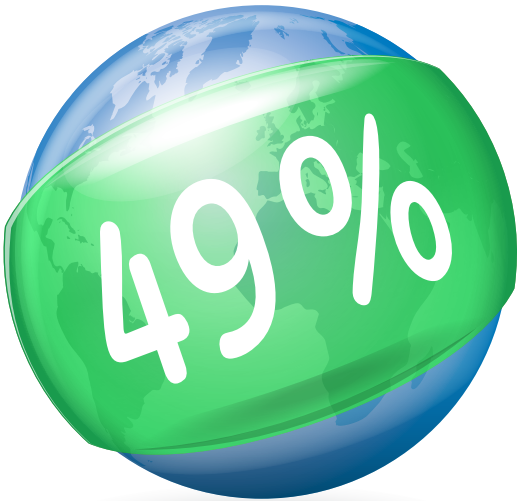
With the modular engine design, decoupling the units is a simple process. Major engine parts stay in place and are easily accessible.

Lasting power with less fuel consumption and CO₂ emissions

Offering small and large power generation gas engines, GE introduces the innovative J920 Flextra 9.5 MW system. Whether you're seeking full power at high-efficiency levels or a unit capable of short start-up times, GE's J920 Flextra gas engine is your ideal solution for reliable lasting power and grid stabilization with a lower carbon footprint.

J920 Flextra – customer benefits:

- Excellent electrical efficiency of up to 49%
- High power density at low investment costs
- Stable power output and reliable efficiency in any ambient condition
- Quick startup for grid stabilization
- Fast and easy installation
- Simple maintainability
- Full plant flexibility available with any multiple-engine installation
- Combined heat and power solution with more than 90 percent efficiency
- Lower water usage
- Designed for high reliability
- Renewable backup power
- Extended maintenance intervals



Make the most out of energy sources

Combustion

Based on the extensive experience of GE's Type 6 gas engine combustion system, the J920 Flextra unit is equipped with an advanced pre-chamber combustion system with spark ignition and advanced conditions for longer part life. In addition, the individual gas mixing achieved by port injection in combination with cylinder-specific sensors allows each cylinder to be controlled to operate at top performance. The J920 Flextra mechanical structure is designed to allow high-peak firing pressure. In combination with the latest miller technology and two-stage turbocharging, the J920 Flextra engine can achieve an excellent electrical efficiency of up to 49%.

2-stage turbocharging

The 2-stage turbocharger design enables improved miller technology and high-power density. Compared to single-stage turbocharging, GE's 2-stage turbocharging technology allows higher cooling water temperatures, making it an ideal fit for independent power production projects in hot ambient conditions. Combined heat and power (CHP) applications benefit from the use of charge air cooling heat at high temperatures. No deration at higher altitudes is another advantage.

Engine management system

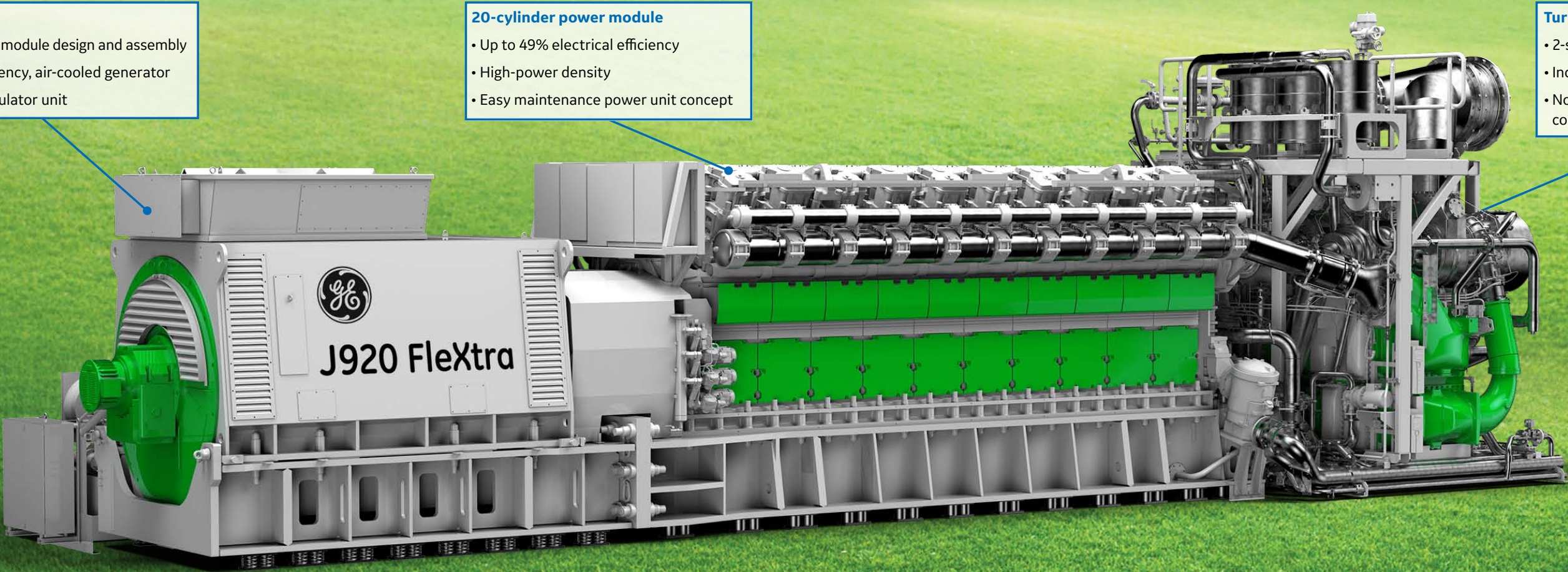
The J920 Flextra is equipped with GE's well-proven comprehensive Jenbacher gas engine management system with a programmable logic unit, handling engine and plant controls as well as visualization. To allow for smooth plant operation, the system specifically supports adaptive condition-based controls, individual cylinder balancing, optimization and protection of core controls, and limp home mode. Designed as part of the entire module system, with all core competencies in-house, every function is developed with a holistic point of view.

Revolutionary three-modules concept

- Generator**
- Integrated module design and assembly
 - High-efficiency, air-cooled generator
 - Digital regulator unit

- 20-cylinder power module**
- Up to 49% electrical efficiency
 - High-power density
 - Easy maintenance power unit concept

- Turbocharger auxiliary module**
- 2-stage turbocharging technology
 - Increased efficiency
 - No deration in hot ambient conditions or at high altitudes



Key performance data		
Performance Data	J920 FleXtra (50Hz / 1,000 rpm)	J920 FleXtra (60Hz / 900 rpm)
Electrical output	9,500 kW	8,550 kW
Electrical efficiency	48.7%	49%
Heat rate	7,392 kJ/kWh	7,347 kJ/kWhe
Thermal output	8,100 kWth	7,200 kWth
Total efficiency	90%	90%
Output and efficiency at generator terminals, ISO 3046, Nat. Gas MN >80, Power Factor 1.0, 500 mg/Nm3 (@ 5% O2) NOx, Efficiency at LHV		

Installed dimensions				
	Length	Width	Height	Weight
Engine	8.4 m	2.9 m	3.3 m	92.5 t
Generator	5.2 m	2.5 m	2.9 m	62 t
TCA Module	3 m	3.9 m	5.1 m	25.5 t

Solving more than simple electricity needs

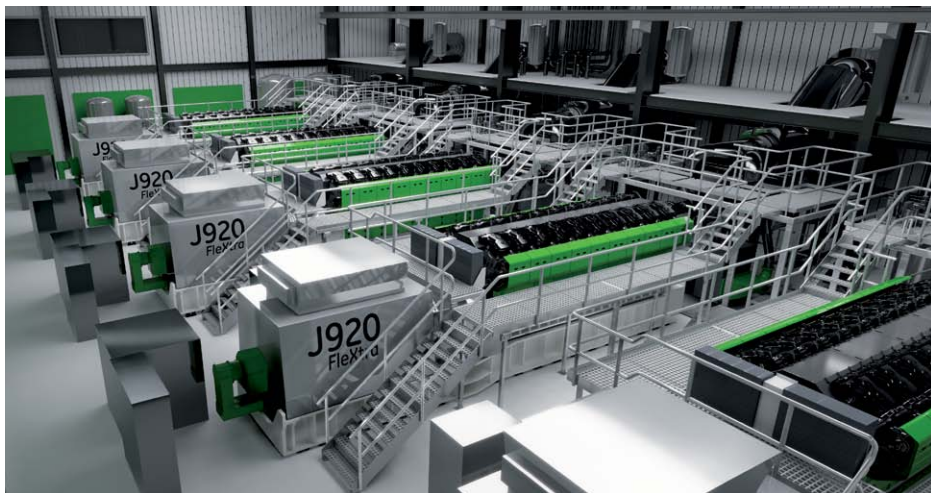
GE's J920 Flextra gas engine is engineered to support a broad variety of multiple-engine power plant solutions – from remote power supply to combined heat and power (CHP) generation.

Powerhouse solutions

GE's J920 Flextra is specially adapted to large gas engine power plants. It offers a highly standardized powerhouse plant concept with fast delivery times and low installation costs. While the size of the plant, actual plant design, and layout depend on your specific customer needs and site requirements, the J920 Flextra plant solution is developed as a modular system with a minimal footprint. This design allows for seamless installation with any multiple-engine configuration, and, therefore, offers flexible size options for a multiple 9.5 MW system at constant excellent electrical efficiency levels. Combining the multiple-engine concept with a 5-minute engine start-up time provides flexible power – from baseload to cyclic and peak operations.

Combined heat and power

The simple use of jacket water heat and heat from oil and charge air coolers, combined with heat from the gas engine exhaust makes CHP in combination with the J920 Flextra gas engine a favorable solution. When the heating water circle is designed to include return water at 70°C and hot water at 90°C, a total efficiency improvement is achieved. The 2-stage turbocharging technology has the ability to increase the total efficiency for providing power and heat to more than 90% – about 3% points better than that of a single-stage turbocharging gas engine.



Reducing life-cycle costs and environmental impact

Created to achieve excellent electrical efficiency levels, GE's J920 Flextra solutions allow you to benefit from low fuel consumption, operating costs, and CO₂ emissions. Operating a J920 Flextra at 48.7% electrical efficiency for 50 Hz and 49% for 60 Hz level has the capacity to produce almost 76 million kWh of electricity, enough to power over 18,500 European households for a year.

By offering a high electrical efficiency, the J920 Flextra gas engine avoids:

- The consumption of more than 6.4 million kWh of natural gas per year, saving over € 217,000 per year at a natural gas price of € 0.034 per kWh
- The emission of approximately 1,500 metric tons of CO₂ per year, equivalent to the annual CO₂ emissions of about 800 cars on European roads

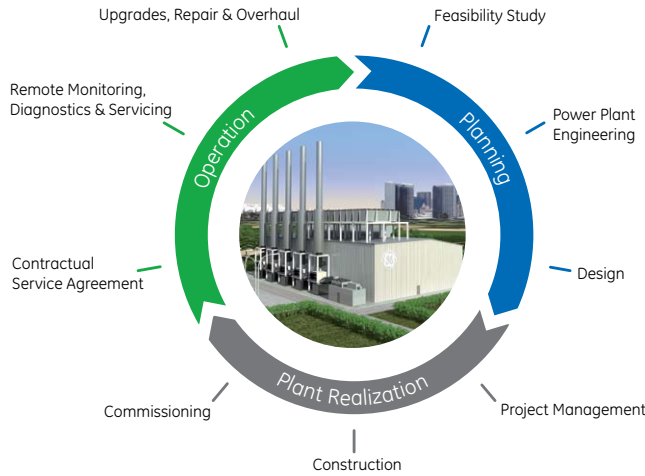
With more than 90% overall efficiency compared to the separate production of heat and electricity, a J920 Flextra as a CHP solution achieves over the course of a year¹:

- Over 130 millions kWh primary energy savings, equivalent to the energy contained in more than 76,000 barrels of oil
- Emission reduction of more than 7,800 metric tons of CO₂, equivalent to the CO₂ emissions of over 4,100 cars on European roads

GE's J920 Flextra is approved under ecomagination, a corporatewide initiative to aggressively bring to market technologies that help customers meet pressing environmental challenges (www.ecomagination.com).

We are at your service—for the life of your J920 Flextra powerhouse plant

With a full range of life cycle services—from planning and plant realization to operation—GE can keep your plant up and running with the utmost efficiency. Our highly skilled staff will give you the support you need to achieve top performance levels with a solution based on our J920 Flextra powerhouse plant concept.



Planning

GE is available to support you from the inception of your power generation project proposal to the design, testing, and completion of your plant. Based on our modular plant concept and your specific requirements, our highly experienced system engineers accompany you through every critical planning phase – including the feasibility study, power plant engineering and design – to tailor the best solution for your plant.

Plant realization

GE's trained project managers and system engineers offer project management expertise to support you during the plant realization phases. Construction and commissioning procedures are standardized to minimize risks and assure successful implementation. As part of our

construction and plant installation services, GE can also provide engineering, procurement and construction (EPC) support as well as a worldwide qualified EPC-network. GE's start-up and commissioning service includes a series of tests performed by our experienced service technicians to ensure installation and functionality of your plant.

Operation

Our contractual service agreements are designed to provide flexible, advanced care for your plant during operation. Through our global service network, you'll have dedicated personnel who can help to ensure predictable operating costs and risk mitigation. GE's online monitoring and diagnostic tool provides you with online access to your plant and J920 Flextra equipment. In addition, myPlant* technology enables us to monitor and control your global fleet of Jenbacher gas engines. The myPlant

technology transmits sensor data back to our enterprise servers so that we can calculate your plant's operational state, predict faults and analyze any issues. All maintenance work on your J920 Flextra gas engine system—including upgrade, repair and overhauls—is performed at your plant, saving you time while updating your engine to the latest technology.

Service benefits

- Longer lifetime service
- Advanced service design for easier maintainability and shorter downtime
- Easy access to consumable parts
- Remote Monitoring & Diagnostics cut costs and boost equipment availability
- Sensors that monitor vital engine parts
- Excellent engine operations through fleet comparison



www.ge-distributedpower.com

GE Power & Water provides customers with a broad array of power generation, energy delivery and water process technologies to solve their challenges locally. Power & Water works in all areas of the energy industry including renewable resources such as wind and solar, biogas and alternative fuels; and coal, oil, natural gas and nuclear energy. The business also develops advanced technologies to help solve the world's most complex challenges related to water availability and quality.

As a leading provider of power equipment, engines and services, focused on power generation at or near the point of use the product portfolio includes highly efficient industrial gas engines that generate 100 kW to 10 MW of power for numerous industries globally. The business provides lifecycle support for more than 35,000 gas engines worldwide.

More information on GE Power & Water's industrial gas engines:

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Imagination at work

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