



Energy &  
storage  
systems

# Industrial energy

**MAN Energy Solutions**  
Future in the making

Secure and independent  
power generation

# Future in the making

MAN Energy Solutions is the world's leading provider of integrated power systems. Our product portfolio comprises two-stroke and four-stroke engines for marine and power applications, turbochargers and propellers, gas and steam turbines, compressors and chemical reactors.

We focus our expertise on converting energy into sustainable progress and prosperity, sharing responsibility for the quality, reliability and sustainability of the energy supply. Our broad portfolio offers many ways to set up independent grids.

As a long-standing partner of many industrial customers, we know that an efficient and cost-effective supply of electricity, heat and cold is a key contribution to competitiveness. MAN will support your business with long-term energy supply solutions that give you the necessary flexibility to adapt to changing circumstances.

# Control your energy for better production

## The goal of independence

Energy is always a cost factor in production industries. If you rely on utilities, you depend on their prices. Furthermore, you depend on their supply – your production suffers if they have a power outage or if they can't cope with your peak demands. Industries in remote locations might not have a supply at hand. All of these challenges can be easily addressed with your own independent energy generation solutions.

## Running your own power plant

Your own power plant has to be a good match for your business in terms of size, capacity and ease of use. The quality of the energy you generate determines its cost efficiency and the security of its availability for your industrial process. The plant should also have the flexibility to adapt to your power demands and to grow with your future needs.

## Customized solutions

At MAN, we have a long track record of consulting industrial customers and providing full EPC. We offer tailor-made solutions for electricity generation, process steam, heat and cold. Our proven technologies are reliable, even in challenging environments, and we guarantee full support for maintenance and operation.



# Innovative solutions for industrial applications

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Steam-turbine-based power island

# State of independence

**Electric power**

Some businesses have no choice but to generate their own power – either because they are remotely located or because the local grid is not reliable enough. However, the more energy your business consumes, the more it makes sense to consider full or partial independence.

#### Facing the future with flexibility

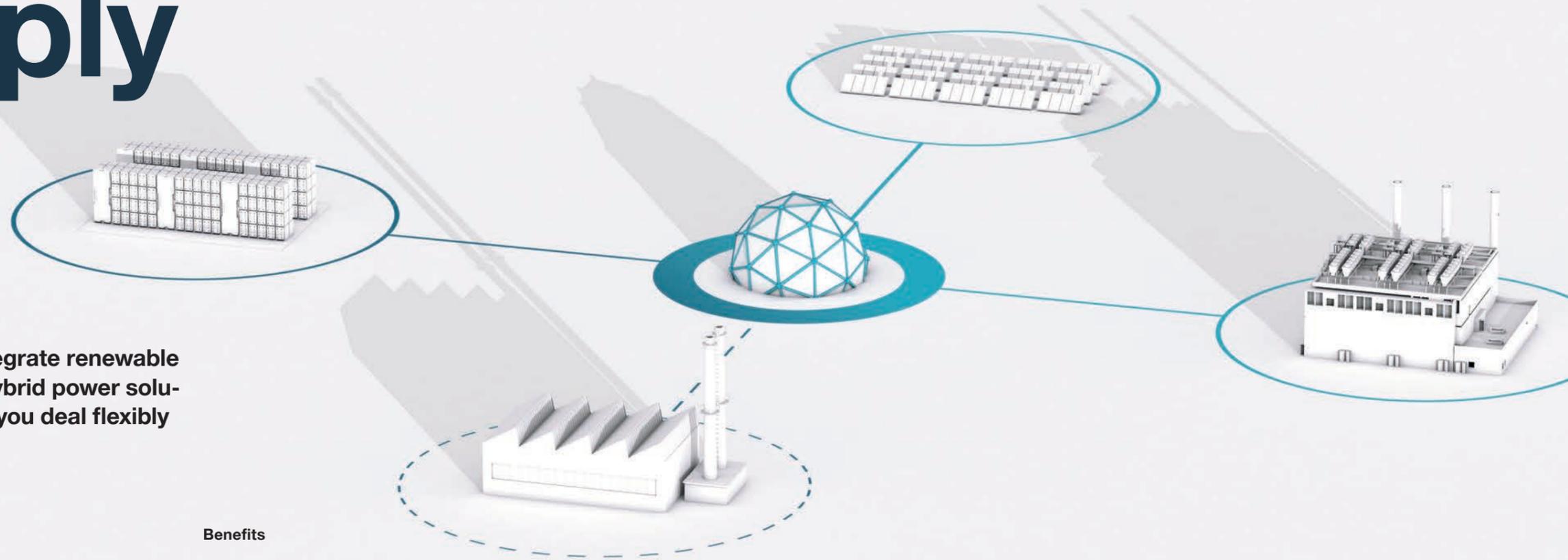
The needs of your business will define the nature of your plant but, given that it is not always possible to see far into the future, you need a solution that ensures flexibility. This is useful for industries that have extreme peaks between longer periods of low consumption, especially if your local providers cannot deliver when you have a sudden energy demand.

Efficient power generators, energy storage, renewables, and energy management systems are some of the most important elements of a power generation system for your business. The first step towards securing your supply and your capacity for expansion is to integrate them properly.

# Ensuring security of supply

## Hybrid power solutions

Discover a cost-effective way to integrate renewable resources in your own microgrid. Hybrid power solutions ensure grid stability, and help you deal flexibly with fluctuating energy needs.



### Save on fuel and emissions

By combining renewables, thermal power generation and energy storage, you can create your own microgrid. MAN hybrid solutions use a battery energy storage system (BESS) and an energy management system (EMS) to optimize the share of each power production unit, enabling highly flexible peaking and rapid backup reactions. The modular nature of the system makes it easy to adapt to your current and future needs. Another advantage is that construction times are very short.

Hybrid power plants are designed so that the renewable energy sources can always provide the maximum possible CO<sub>2</sub>-free power. The highly fuel-efficient gensets, BESS and EMS smoothen power fluctuations and provide a certain share of base load power. The gensets always run at their optimum fuel efficiency point.

### Benefits

- Reduced energy costs**  
Thanks to full use of renewable power, and high genset fuel efficiency
- Increased reliability**  
Enhanced flexibility and fuel independence
- Lower emissions and CO<sub>2</sub> footprint**  
Optimizing synergies between renewables, batteries and engines
- Increased ROI**  
Stored energy can be sold at peak times

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**Further power solutions**  
**LNG-to-power solutions**  
**Thermal power plants**  
**Energy storage solutions**

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# Steaming ahead

## High-temperature process heating

High-precision heat is used for boiling, steaming and drying processes in many industries including chemical, refinery, textile, pulp and paper, automotive, tires, and food and beverage. Businesses like these can profit from generating quality heat by using CHP with gas turbines.

### Precision, economy and efficiency

If your product quality depends on precise steam parameters, it is definitely worth considering a power generation solution that not only ensures quality heat, but keeps costs down and guarantees high plant availability and efficiency.

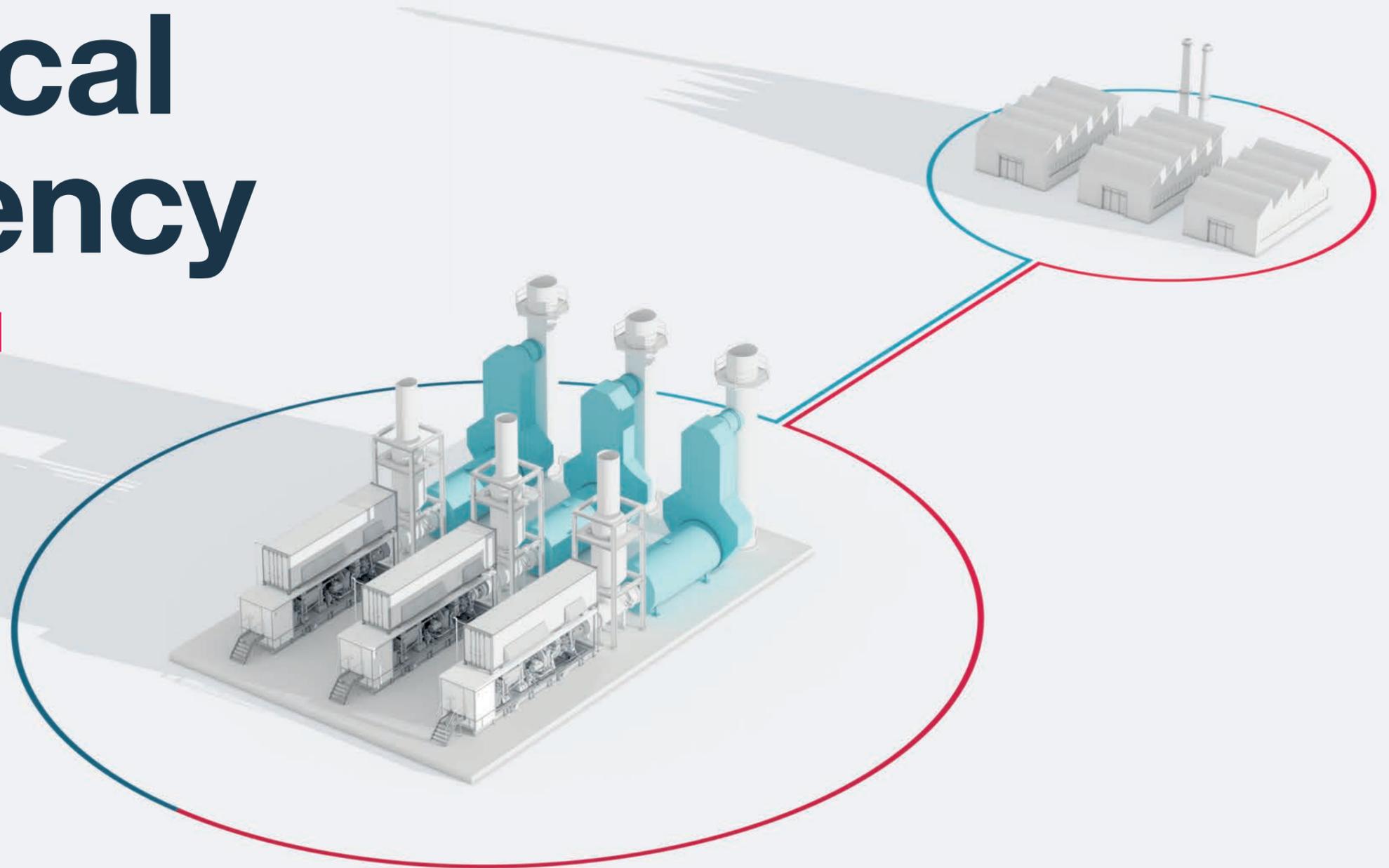
The key to maximum efficiency is working with a reliable partner who can provide a customized solution, train your technicians and ensure good service in the long term.

As well as providing high-quality steam and electricity for your own use, CHP with gas turbines can earn you additional income from electricity surpluses that you can feed into the grid.

# Economical efficiency

## Gas turbine combined heat & power (CHP)

Gas turbine generator sets provide an optimal CHP solution for your business by utilizing the surplus heat from the turbine systems to produce high-quality steam, hot water, chilled water or a combination of all three (trigeneration).



### Picking up steam

Our CHP power plants use a gas turbine to drive an electric generator while the exhaust gases produce steam and/or hot water in a waste heat recovery boiler. Only gas is used as an energy source, but with a plant of the highest efficiency. This keeps fuel consumption down and lowers operating expenses. The CHP puts you in control of your precise steam parameters, making product quality easy to maintain and enabling you to secure your electricity supply in island mode.

CHP with gas turbines has a low carbon footprint. Its modular design makes it easy to adapt to your needs as well as simplifying maintenance. It also allows the integration of energy storage which then lets you sell surplus energy at peak times when prices are high.

### Benefits

#### Fast installation times

Due to modular container design

#### Long-term cost savings

Through highest CHP efficiency

#### Very low emissions

No exhaust gas treatment needed

#### Compact installation dimensions

Small and optimized footprint of modules

### Further power solutions

LNG-to-power solutions  
Thermal power plants  
Power-to-X solutions



# Cost-effective cogeneration

**Electric power and  
thermal energy**

Approximately two thirds of all the energy consumed by industry is used for generating process heat and cold. At the same time, up to half of the energy consumed for power production ends up as waste heat. The challenge is clearly to use this wasted heat and lower your energy costs and emissions.

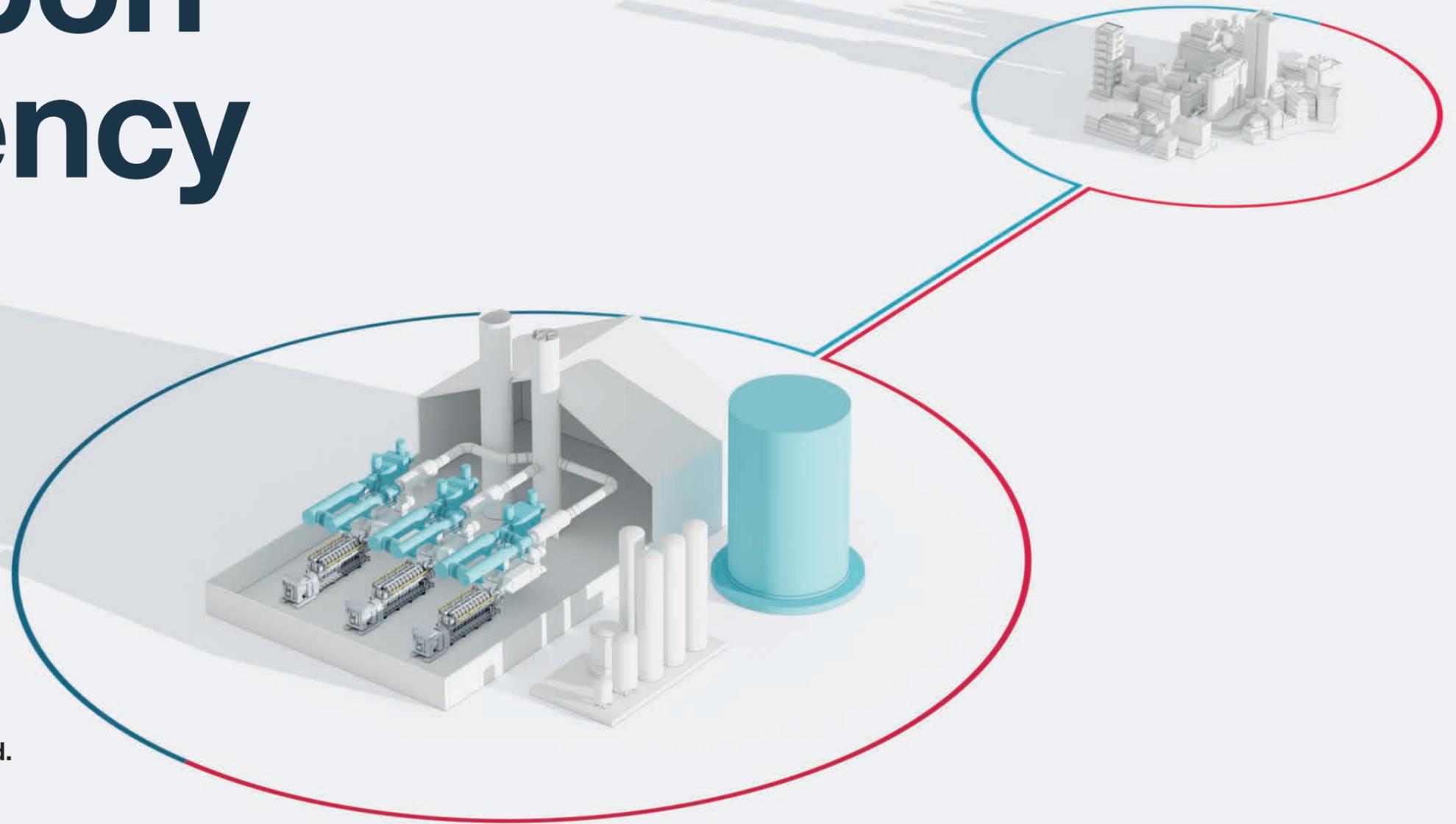
#### **Economic, clean and flexible**

From a business point of view, the main aims of running your own combined electricity and heat generation are to keep operating costs down, reduce emissions, and deliver the appropriate proportions of electricity and heat at the right times.

A flexible CHP solution will be able to adapt to fluctuating demands and different seasonal requirements for heat and electricity. Ideally, it would also have a fast start/stop capacity and allow you to enter the energy balance market. These goals require a flexible CHP engine solution.

# Low-carbon efficiency

## Engine combined heat & power (CHP)



**Engine-based CHP solutions ensure you can fulfill your changing electrical requirements and use the surplus heat from the engine to produce heat or cold.**

### Flexible and cost-effective

The objective of our CHP solutions is to get the most out of the injected energy in a sustainable way through the use of highly efficient and reliable gas engines. The almost complete conversion of the input energy with efficiencies of up to 95 % can be achieved.

The CHP modules are compact in design, enabling short system installation times. High power density and fuel efficiency lower your CO<sub>2</sub> emissions and keep running costs down. You can reap the

benefits of flexible start/stop procedures according to power and heat demand.

Continuous partial-load and low-load operation down to 15 % is possible, enabling the CHP solution to easily adapt to changing power-to-heat ratios. When there is no demand for heat, the fast-starting gensets can be used as a peaking plant, ensuring emergency availability and adding security to your business. Your processes couldn't be running more smoothly.

### Benefits

**Load flexibility**  
Adapts to changing power-to-heat ratios

**High fuel efficiency**  
Together with low emissions

**Backup capability**  
Thanks to fast-start capacity

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**Further power solutions**  
**LNG-to-power solutions**  
**Thermal power plants**  
**Energy storage solutions**

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# Turning waste heat into electricity

**Process heat for power generation**

In many chemical production processes, heat is released as a result of an exothermic reaction. This heat can be used to produce steam for the generation of electricity in a steam turbine generator set.

#### **Economy, efficiency and quality**

Installing a customized steam turbine power island which recovers your process waste heat allows you to increase your overall plant efficiency in terms of power generation, and reduces your carbon footprint.

This way, if your process delivers a surplus of heat, you can use a highly efficient steam turbine to generate electricity from this waste process heat.

The key to maximum efficiency is working with a reliable partner who can provide a customized solution, train your technicians and ensure good service in the long term.

# Process efficiency

## Steam-turbine-based power island

Steam-turbine-based power islands are an optimal solution for your industry. Using the waste heat sources of your facilities, they generate electricity and provide precision heat or process steam for your production.

### Raise your electrical output

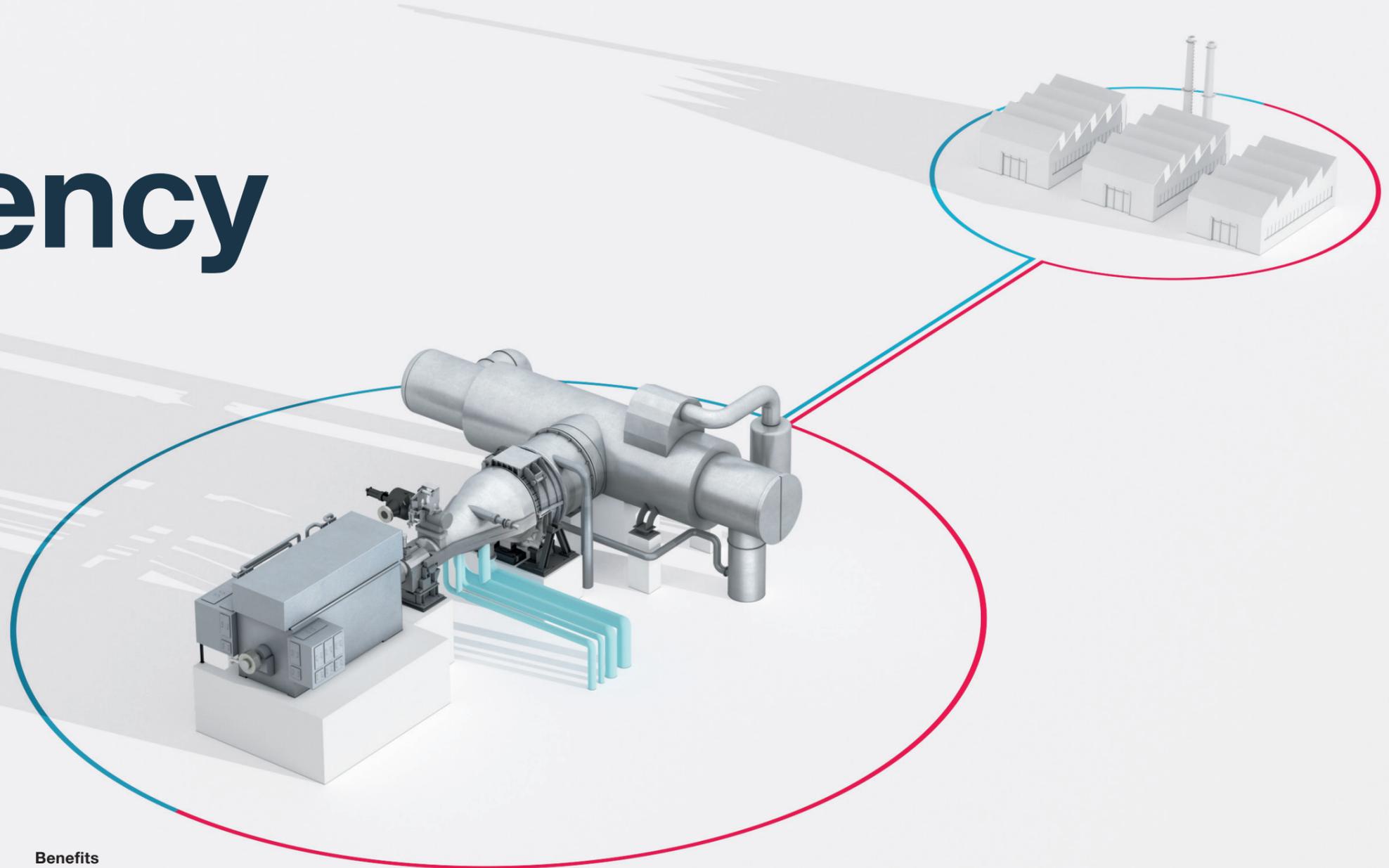
Our power generation islands use a steam turbine generator set with all related auxiliaries and process steam extractions to match your special process requirements. The steam turbine is optimized to meet process conditions.

Exothermic processes provide heat that is used to generate steam and drive a steam turbine generator set. This arrangement can increase the overall electrical power production in your plant without consuming additional fuel.

The modular design concept keeps delivery and costs at competitive levels and simplifies maintenance. It also allows the integration of energy storage which then lets you sell surplus energy at peak times when prices are high.

### Benefits

- Highest efficiency**  
Based on optimized turbine design
- Highest availability**  
Based on highest industrial standards
- Customized for specific customer requirements**  
Special sizes and features
- Long overhaul intervals**  
Proven, robust design



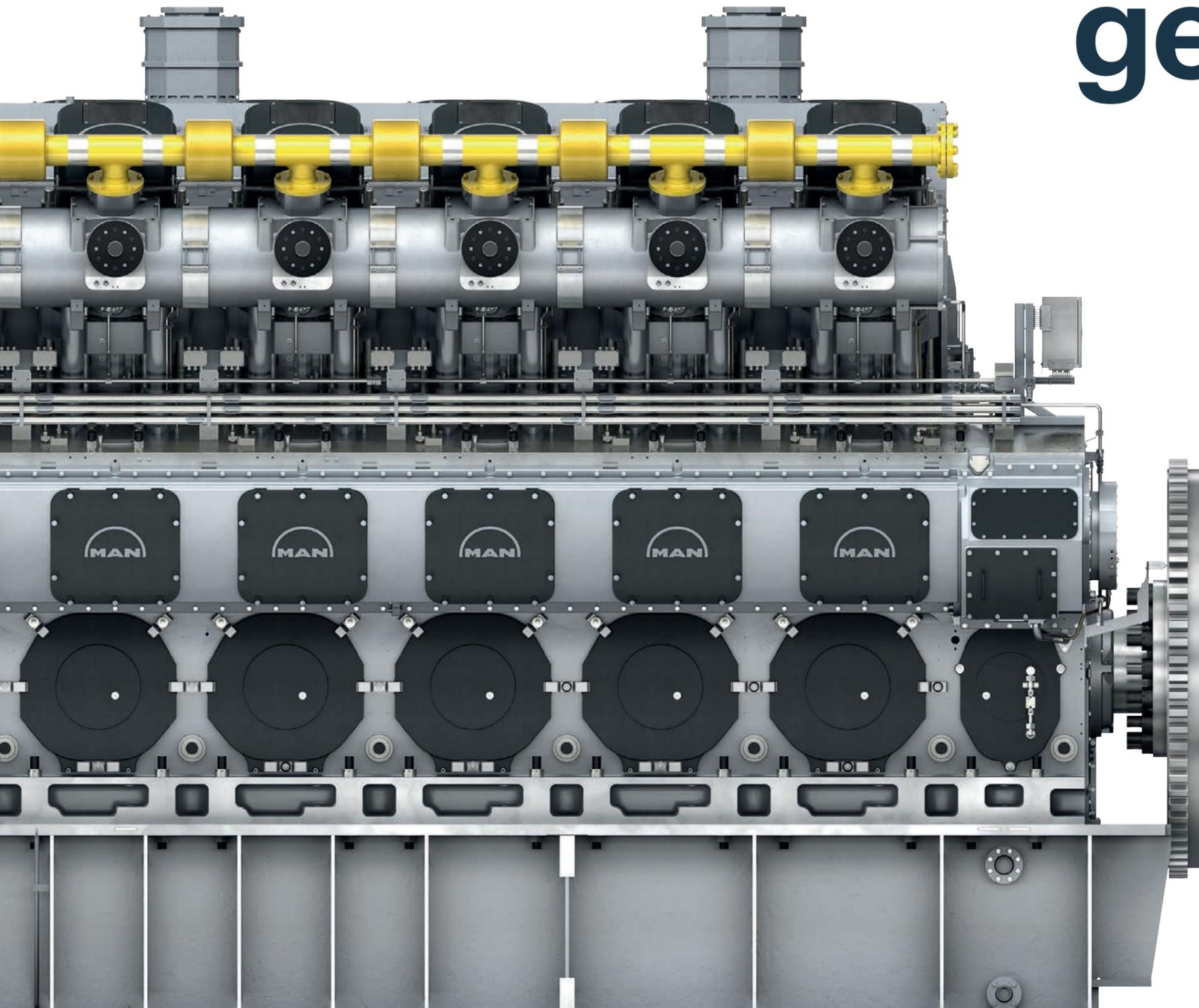

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**Further power solutions**  
**LNG-to-power solutions**  
**Thermal power plants**  
**Power-to-X solutions**

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# Secure power generation

## MAN engines



### The genius of gas

Gas is the cleanest fossil fuel and drastically reduces emissions compared to other fuels. It is widely available and it is generally cheaper than other fossil fuels. The high efficiency and flexibility, fast starting and ramp-up capability, and low-load performance make MAN gas engines an excellent choice for industrial applications. Electrical efficiency of up to 50% and total efficiency of around 95% for CHP applications are possible.

### Dual fuel flexibility

Our dual fuel engines switch seamlessly between gas and diesel operation, enabling multiple applications with a variety of fuels and delivering maximum output flexibility and reliability. MAN dual fuel engines are environmentally friendly, clean and comply with international environmental requirements. The modular plant design makes it possible to achieve fast realization times and easily extend existing power plants.

### Liquid fuel efficiency

High fuel efficiency makes MAN diesel engines reliable workhorses. But they are also agile, with a fast starting and ramp-up capability as well as high partial-load efficiency and low-load operation capacity, so they can adapt to the changing needs of your business. Our exhaust gas after-treatment technologies meet strict international emission standards.

### Benefits

#### Fuel and operational flexibility

With HFO, diesel, natural gas, biogas

#### Environmentally friendly

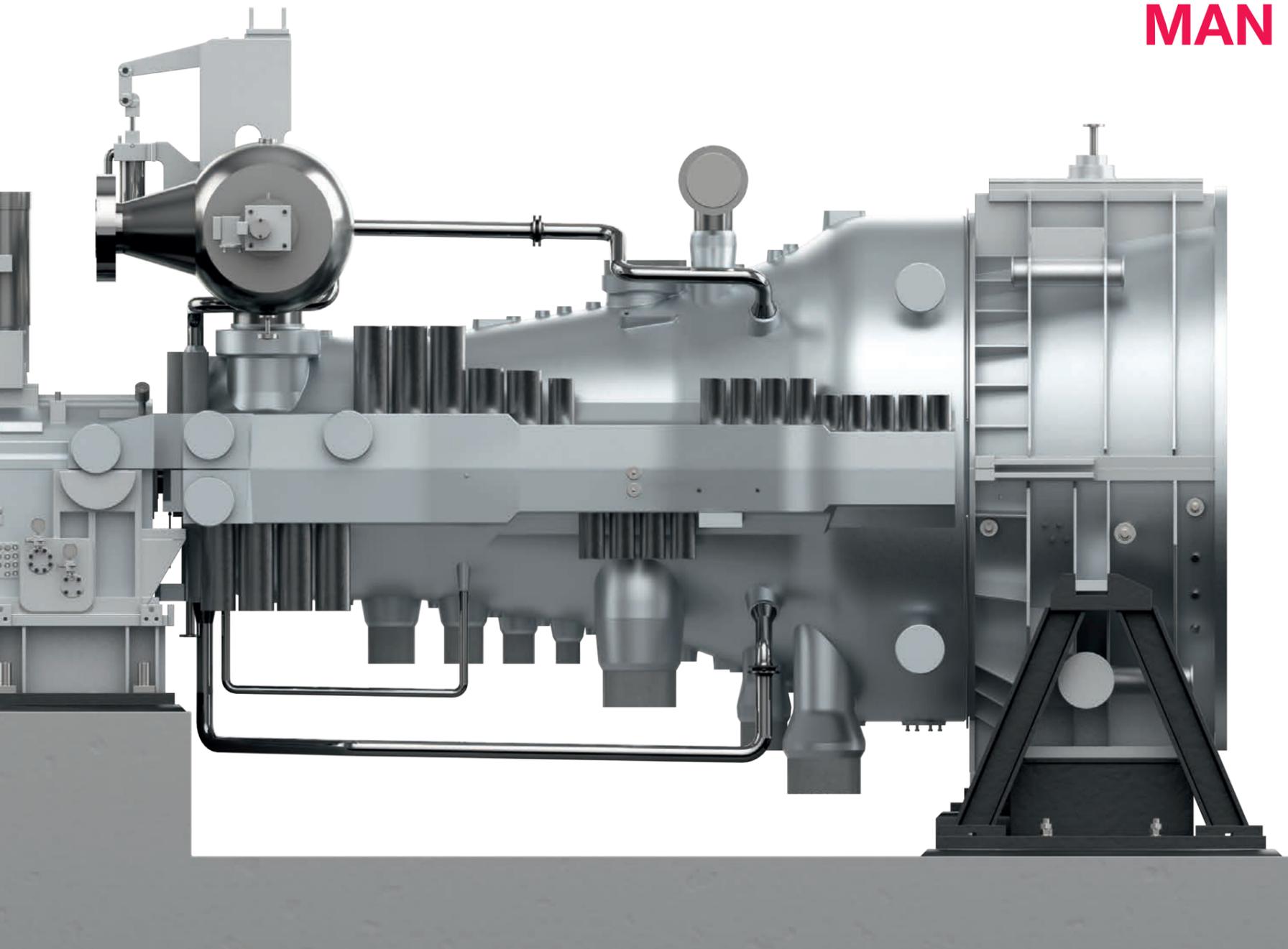
Comply with international environmental requirements

#### Modular design

Makes it possible to achieve fast realization times and easily extend power plants

# Reliable plant operation

## MAN steam & gas turbines



### Modern steam

Our robust steam turbines combine experience with state-of-the-art technology. Various models and sizes are available, including condensing type turbines, backpressure and saturated steam turbines.

Our steam turbines are characterized by a variety of modular design features for an optimized turbine configuration to meet challenging process conditions. This includes applications such as CHP, ECC, biomass, concentrated solar power (CSP), geothermal energy, waste-to-energy and regeneration in storage. The MAN steam turbine portfolio for power generation covers the range up to 180 MW.

### State-of-the-art gas

The MAN gas turbine portfolio for power generation covers the range of 6-13 MW. The focus is on robust, high-efficiency operation, high availability, fast start-up as well as starting reliability and the capability for quick transient load responses. Using our unrivaled grasp of large gas turbine technology, we aim to make our turbines progressively cleaner, more powerful and more efficient.

### Benefits

**Green power**  
Lowest emission levels in their class

**Reliable and robust**  
Partial-load behavior at highest-in-class performance levels

**Modular design**  
Very short setup and commissioning times

**Meet your demand for process steam**  
As well as heat and electricity

# Consulting services

## Talk to the experts

Energy and storage projects are capital-intensive and need expert consultancy throughout their entire lifetime. We fully understand your needs and expectations, and are able to develop the best tailor-made solutions together with you. Hands-on technical expertise is what sets our service apart: it saves you money and time and gives you valuable insights into the future development of power generation technologies.



### New project development

When developing new projects, it is important to consider different alternatives and assess competitiveness, security of supply and environmental friendliness as well as financing and partnerships. Early project development, financing support, and technical consulting are key building blocks.

On the basis of our international experience in energy solutions, we offer services for all power plant project phases. We act as a solution service provider for our customers to develop capital-intensive projects as partners. Our project development department will work with your team to develop the most fitting project solution.

### Engineering, procurement, construction (EPC)

We have the experience and the capacity to work as a main contractor or consortium leader in the construction of complete power plants. Our scope of supply can range from individual gensets to complete, ready-to-run power plants based on full EPC.

### Areas of expertise

- Project analysis, due diligence
- Development of business models (contractual, financial, commercial)
- Setup of the judicial, financial and fiscal framework requirements and structuring of contract
- Support for the bidding procedure, assignment of deliveries, commercial business planning
- Risk management, project controlling (costs, quality, target dates during the development)
- Negotiations for all project contracts (taking account of multifaceted interdependence between contracts)
- Financial engineering, financial model, negotiations with banks and guarantors

# MAN PrimeServ

# Service with passion

MAN PrimeServ is the dedicated MAN Energy Solutions service brand. Via a network of over 100 service centers worldwide, MAN PrimeServ provides 24/7 service across the globe. Our range of services includes technical support, consulting and OEM spares, as well as maintenance, repair and comprehensive individualized service plans.



# 365

days a year

# 24

hours a day

#### MAN PrimeServ provides

- Prompt delivery of high-demand OEM spare parts within 24 hours
- Fast, reliable and competent customer support
- Individually tailored O&M contracts
- Ongoing training and qualification of operators and maintenance staff
- Global service, 24 hours a day, 365 days a year
- Diagnosis and troubleshooting with our high-performance online service



#### MAN Energy Solutions and legacy brands

MAN PrimeServ is our brand name for high-quality aftersales support for the entire MAN Energy Solutions product portfolio. Through refinements to our products and repair techniques, we ensure and enhance our technological leadership and technical expertise as an original equipment manufacturer (OEM) for the brands united under MAN Energy Solutions.

# Worldwide service

**100**  
service centers  
worldwide

**We offer retrofitting and upgrade services to bring engines, turbines and turbochargers already in service up to the very latest standards of performance and efficiency.**

Using the latest digital technology, we enable you to maximize the performance and availability of your MAN equipment by accessing real-time data analysis, remote support and rapid solutions. We also offer an extensive range of training courses at MAN PrimeServ academies around the world.

PrimeServ Assist is a remote monitoring solution that empowers you to maximize the efficiency, safety and availability of your MAN machinery and helps you reduce OPEX through proactive maintenance and performance optimization.

With our operation & maintenance agreements, PrimeServ can play a larger role in your facilities. This ranges from advisory management support to full management, operation and maintenance of a power plant.

For more information please visit [man-es.com/services](http://man-es.com/services)



# Let the energy flow ...



#### **An interactive experience**

Download our MAN Brochure Store app from the App Store or Google Play Store. Use its exciting interactive features to explore our complete range of products and services. Suitable for iPhone, iPad and Android.

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