



Megatrends Demand Innovations

Transportation and Energy Solutions for the Future

Engineering the Future – since 1758.

MAN SE

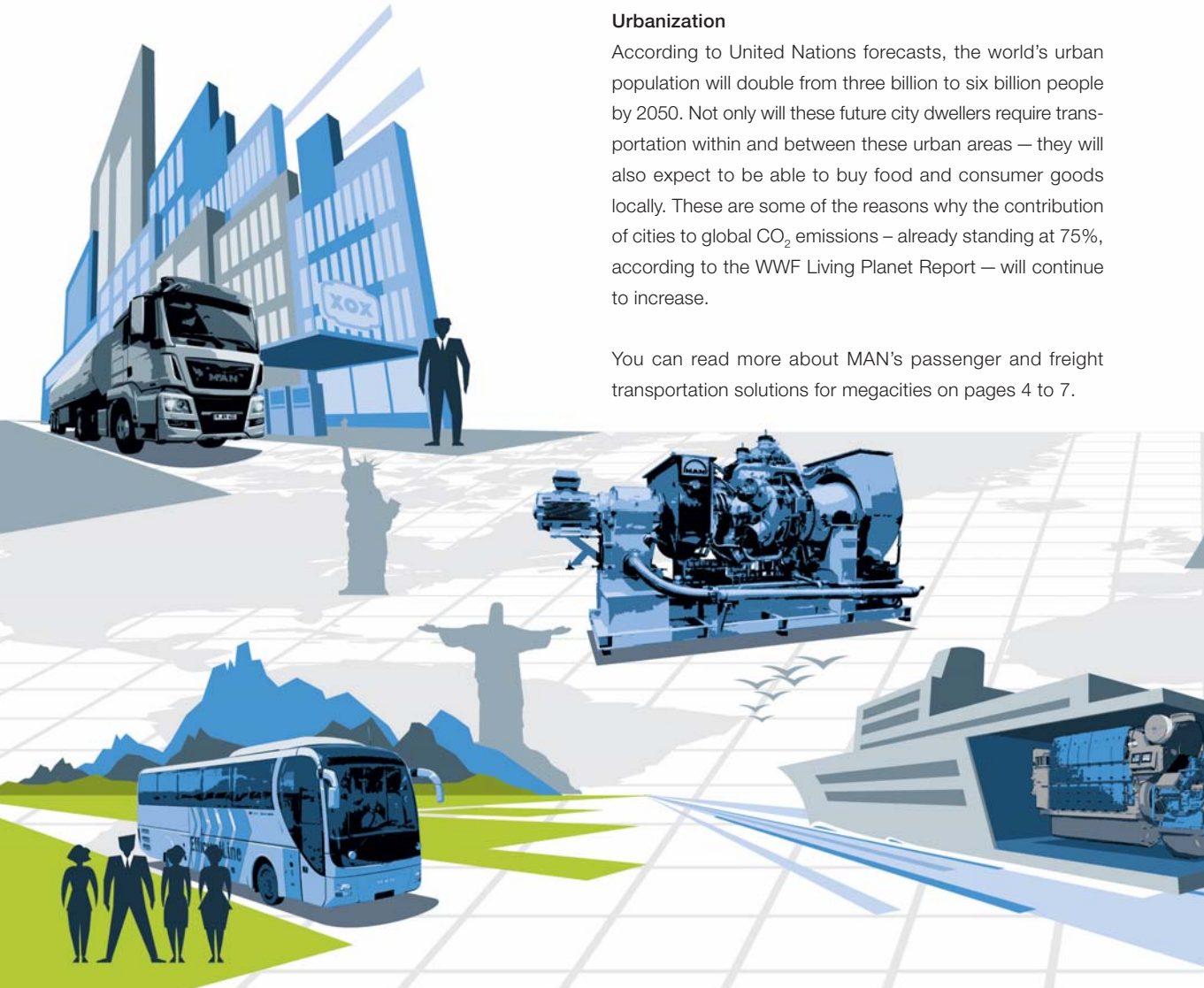


The Megatrends Set Us a Challenge **We Accept the Challenge**

Urbanization

According to United Nations forecasts, the world's urban population will double from three billion to six billion people by 2050. Not only will these future city dwellers require transportation within and between these urban areas — they will also expect to be able to buy food and consumer goods locally. These are some of the reasons why the contribution of cities to global CO₂ emissions — already standing at 75%, according to the WWF Living Planet Report — will continue to increase.

You can read more about MAN's passenger and freight transportation solutions for megacities on pages 4 to 7.



Globalization

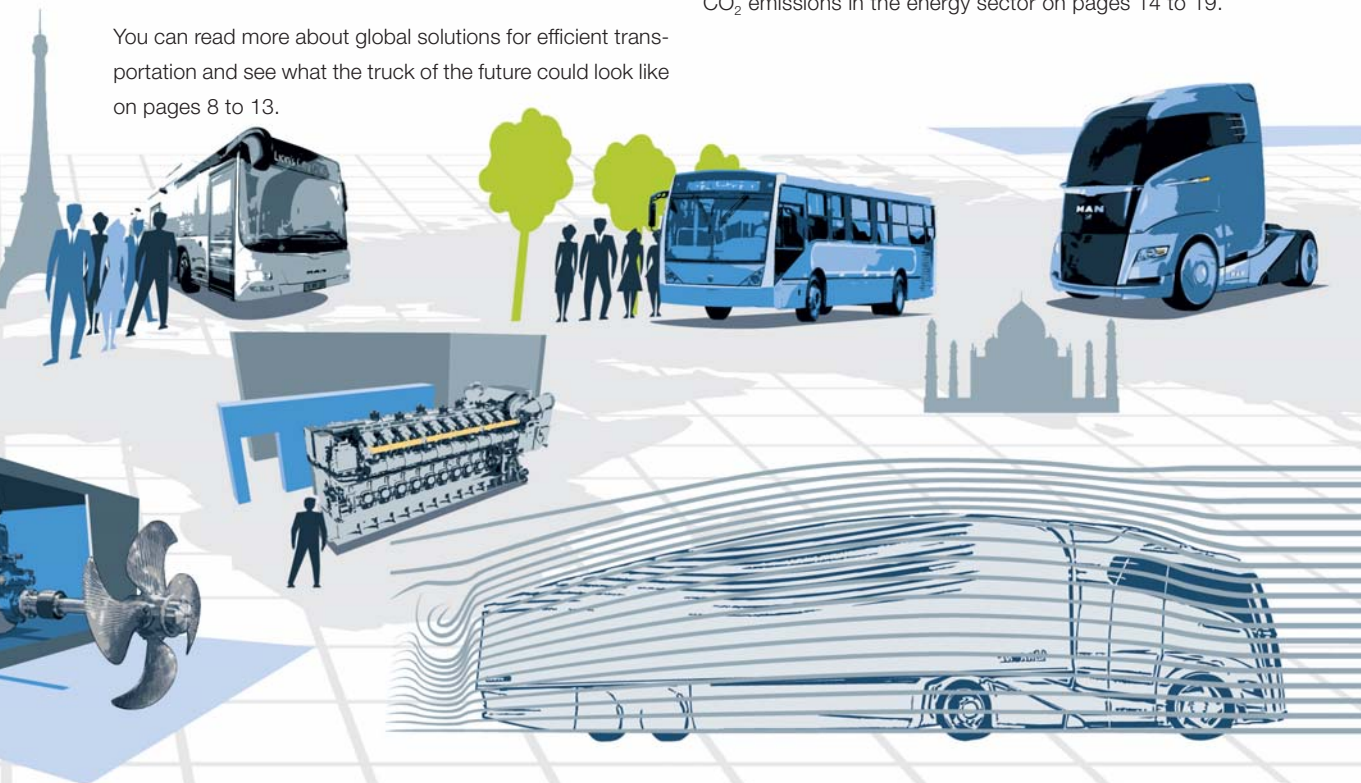
According to the International Transport Forum forecast, global transportation volumes will increase threefold by 2050. This means the number of trucks on the world's roads will also grow. The transportation sector is already responsible for around 15% of global CO₂ emissions and this will increase to 22% by 2020. These trends present ever-greater challenges for our customers in the form of rising greenhouse gas emissions and energy prices.

You can read more about global solutions for efficient transportation and see what the truck of the future could look like on pages 8 to 13.

Climate change and environmental protection

The United Nations predicts a world population of over nine billion people by 2050. This growth means energy demand will almost double over the next 20 years. Energy derived from fossil fuels produces CO₂ emissions — a primary cause of climate change. According to the OECD, emissions from electricity generation will soar in the coming years.

You can read more about how MAN is helping to reduce CO₂ emissions in the energy sector on pages 14 to 19.



Megatrend: Urbanization

Freight Transportation in Megacities

MAN TGS TS Euro VI – ultra-light semitrailer tractor

- Efficiency benefits: fuel savings of almost 1 l/100 km, negligible soot and nitrogen oxide emissions
- Market launch date: 2013 (Euro VI version)
- Application: semitrailer tractor for the tanker and silo sector

This truck already meets the Euro VI emissions standard to be introduced in 2014. Radical weight savings and optimized powertrain design ensure low fuel consumption. Automatic tire pressure monitoring reduces rolling resistance.



**MAN Metropolis —
“whispering” zero-emission research truck**

- Efficiency benefits: zero CO₂ emissions when powered by renewable electricity
- Market launch date: real-world testing under way since 2013
- Application: heavy-duty urban transportation applications, e.g. garbage collection

In all-electric mode, this hybrid truck offers zero emissions and low-noise driving and working. Its lithium-ion battery can be easily recharged at an electric socket. A passenger-car diesel engine serves as a range extender if the vehicle needs to cover longer distances.



VW Constellation 17.280 6x2 Hibrido — hybrid truck for emerging markets

- Efficiency benefits: up to 25% reduction in fuel consumption compared with a conventional truck
- Market launch date: 2014
- Application: urban transportation applications in emerging markets, e.g. garbage collection

Brazil's first hybrid truck uses diesel/hydraulic hybrid technology. Braking energy is converted into hydraulic pressure. This is used to provide a power boost when moving off from a standstill.

Megatrend: Urbanization

Passenger Transportation in Megacities



MAN Lion's City CNG — the natural gas-powered bus

- Efficiency benefits: when operating on biogas, up to 90% reduction in CO₂ emissions compared with diesel-powered vehicles
- Market launch date: 2013 (Euro VI version)
- Application: scheduled urban bus services

Unlike other fossil fuels, natural gas produces almost no soot during combustion. And buses capable of operating on natural gas can also run on biogas. The biogas content of gas supplied from the public grid is growing. This has the potential to enable near-carbon-neutral local passenger transportation.

Volksbus 17.280 OT V-tronic — dual-fuel principle offers more flexibility

- Efficiency benefits: up to 20% reduction in CO₂ emissions
- Market launch date: 2014
- Application: scheduled urban and regional bus services

The dual-fuel principle allows this bus to operate on both diesel and natural gas. The electronic management system controls both natural gas and diesel injection. The bus can therefore also be operated in areas where gas is not available.

MAN Lion's City Hybrid – Hybrid technology for the city

- Efficiency benefits: up to 30% reduction in fuel consumption, zero emissions when moving away from bus stops
- Market launch date: 2010
- Application: scheduled urban bus services

This hybrid bus captures braking energy and stores it in ultra-capacitors, which are housed under the roof. The bus uses this energy to move off under electric power only. This saves fuel and reduces CO₂ and noise emissions. The vehicle's two electric drive motors are assisted by a low-emission diesel engine.



Megatrend: Globalization

Efficient Transportation

MAN Lion's Coach EfficientLine – eco-friendly travel

- Efficiency benefits: annual fuel savings of up to 4,500 liters; CO₂ savings of 12 tons a year
- Market launch date: 2012 (Euro VI version 2013)
- Application: touring coach and scheduled long-distance bus services

The efficiency of this coach is down to a powertrain optimized for low fuel consumption, a high-torque engine, and a long final-drive ratio which ensures low engine speeds. The automated 12-speed manual transmission helps reduce fuel consumption and weight.





MAN TGX EfficientLine — low-emission transportation

- Efficiency benefits: fuel savings of up to 3 liters per 100 kilometers
- Market launch date: 2013 (Euro VI version)
- Application: long-haul freight transportation

The efficiency of this truck is enhanced by minimized drag and rolling resistance, auxiliary consumers which are only activated on demand, and daytime running lights with energy-efficient LEDs. Rim-mounted sensors monitor tire pressure to prevent an increase in rolling resistance.

Megatrend: Globalization Efficient Roads to the Future





**MAN Concept S and Krone trailer —
a semitrailer rig of the future**

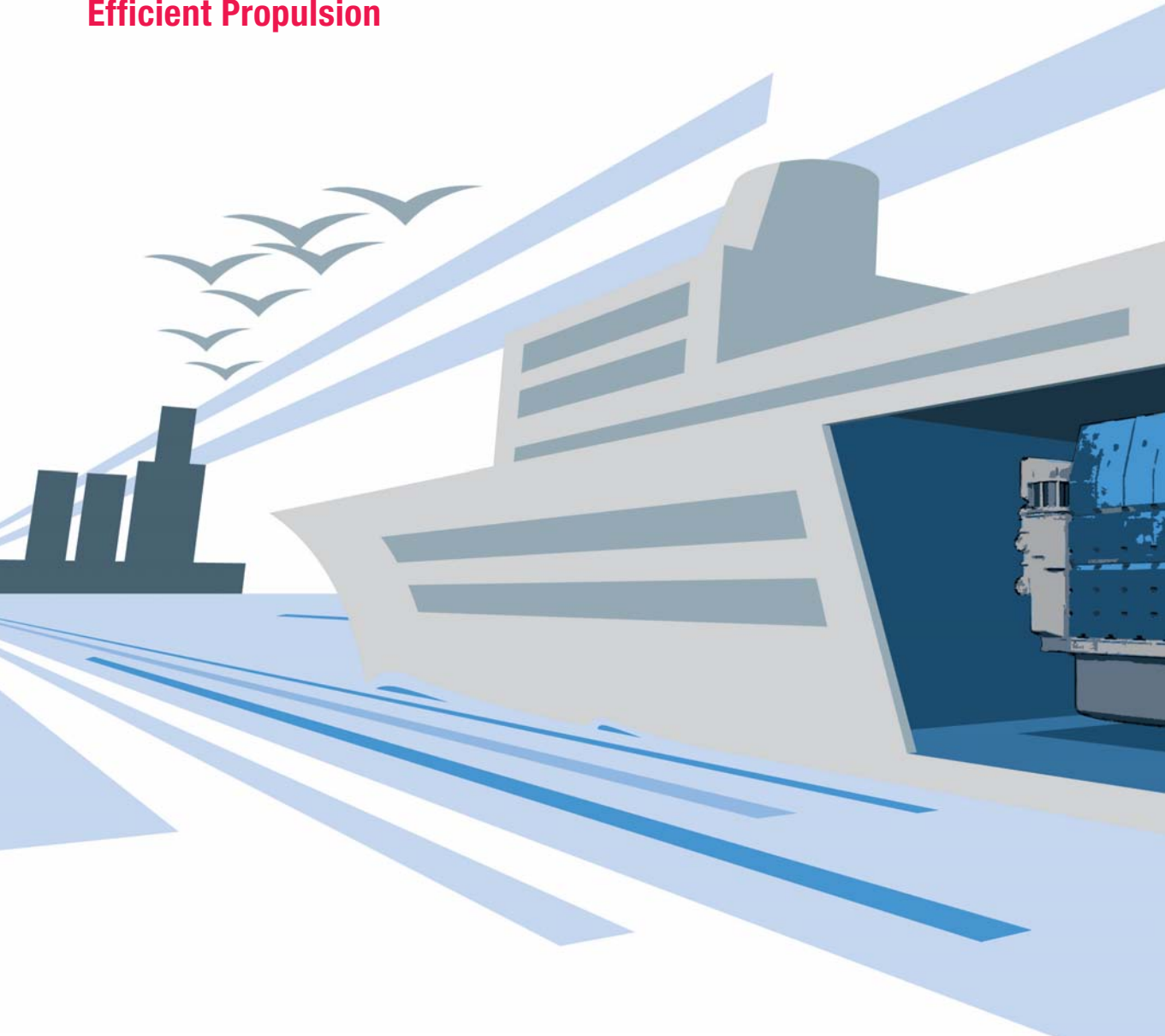
- Efficiency benefits: up to 25% fuel savings compared with a conventional truck
- Market launch date: no launch plans at present for this concept, which is intended as a contribution to the public debate on trucks of the future
- Application: long-distance freight transportation

Aerodynamic design optimizes the airflow around the vehicle. To this end, the frame and fuel tanks are enclosed in the bodywork. Cameras integrated in the direction indicators replace conventional exterior mirrors and help to reduce drag to passenger-car levels.

The tractor and trailer form a streamlined unit. The newly developed rooftop spoiler bridges the gap between tractor and trailer. Full side paneling and the tapering rear end complete the optimized aerodynamic design of the rig.

Megatrend: Globalization

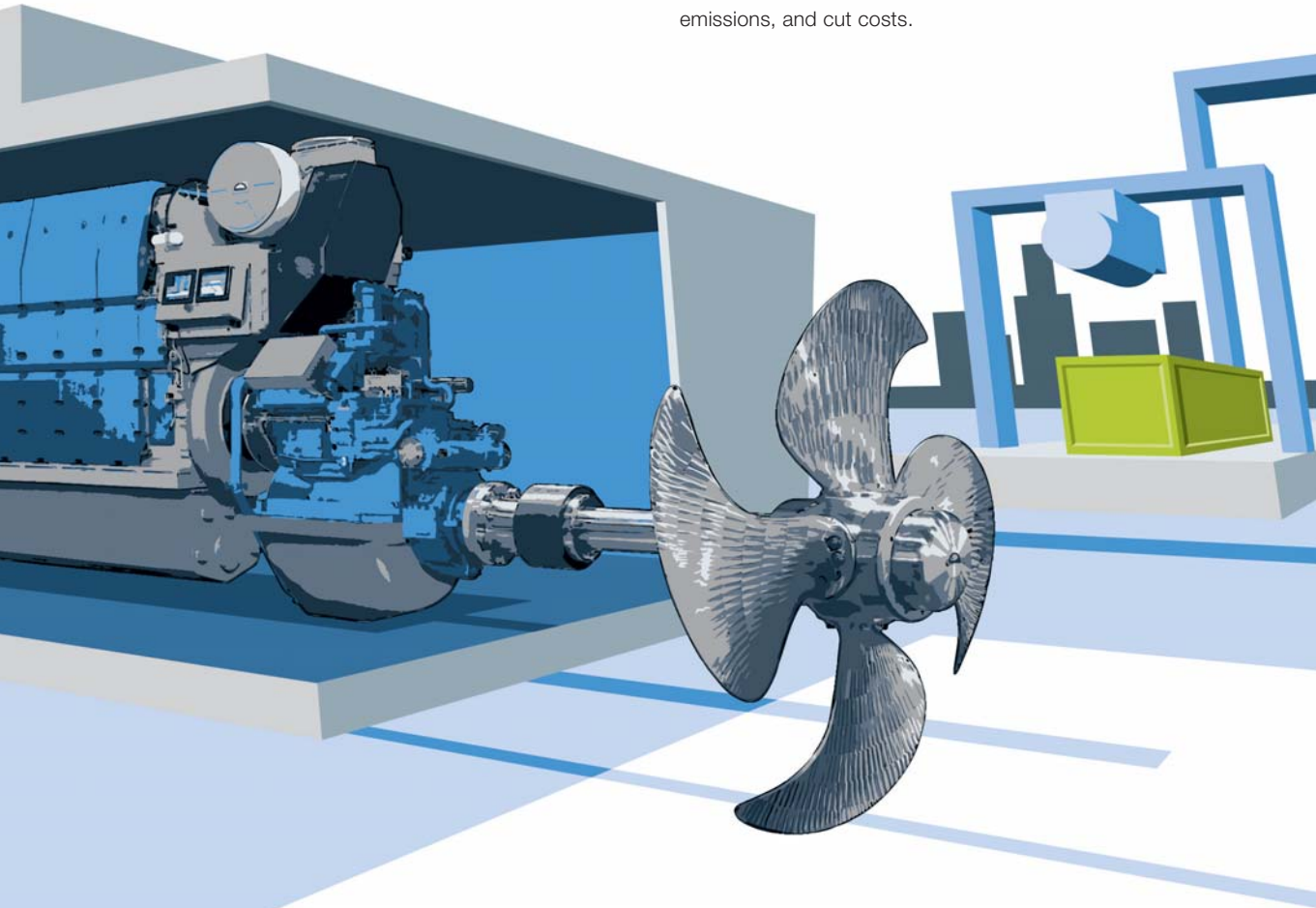
Efficient Propulsion



Integrated drivetrain for enhanced efficiency

- Efficiency benefits: up to 8% greater efficiency
- Market launch date: 2013
- Application: maritime shipping, e.g. ferries, tugboats

The secret of efficiency lies in the overall package. This combination of a medium-speed engine with common-rail fuel injection (offering high fuel efficiency and low emissions), an efficient Renk gearbox, and an Alpha propeller with the optimized Kappel blade design helps save fuel, reduce emissions, and cut costs.



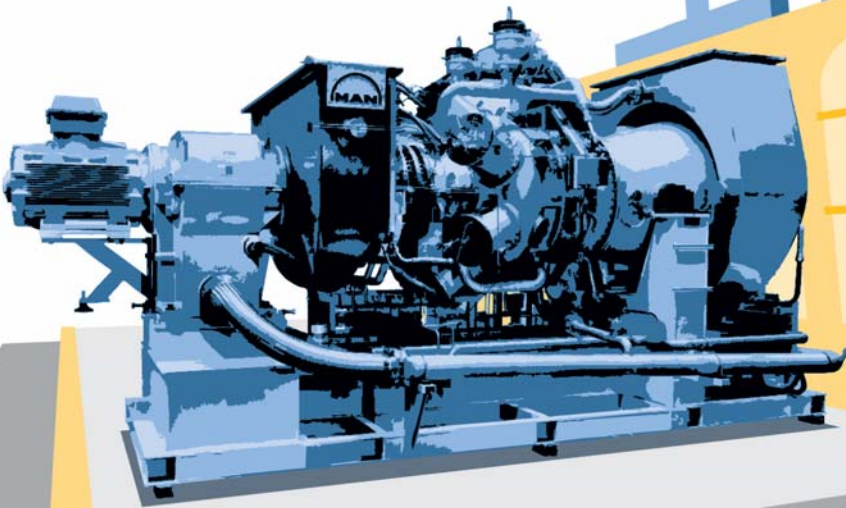
Megatrend: Climate Change and Environmental Protection

Clean Energy

MAN GT6 gas turbine – efficient energy generation

- Efficiency benefits: up to 34% efficiency
- First presented: 2011
- Application: distributed energy generation, mechanical drive

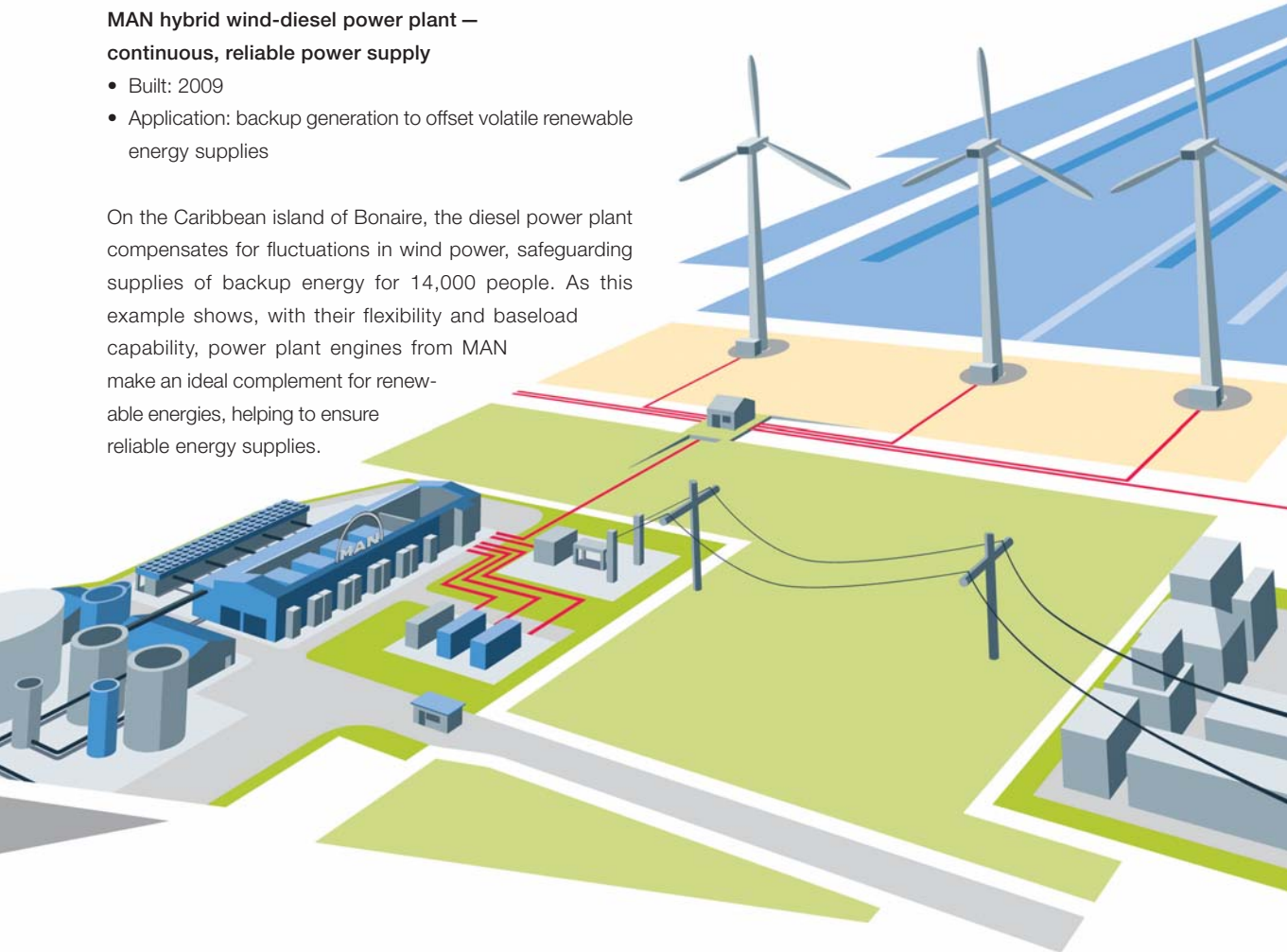
High fuel efficiency reduces not only CO₂ emissions but also nitrogen oxide emissions and operating costs. The turbine's exhaust temperatures allow steam to be generated for combined heat and power (CHP) or process applications.



MAN hybrid wind-diesel power plant — continuous, reliable power supply

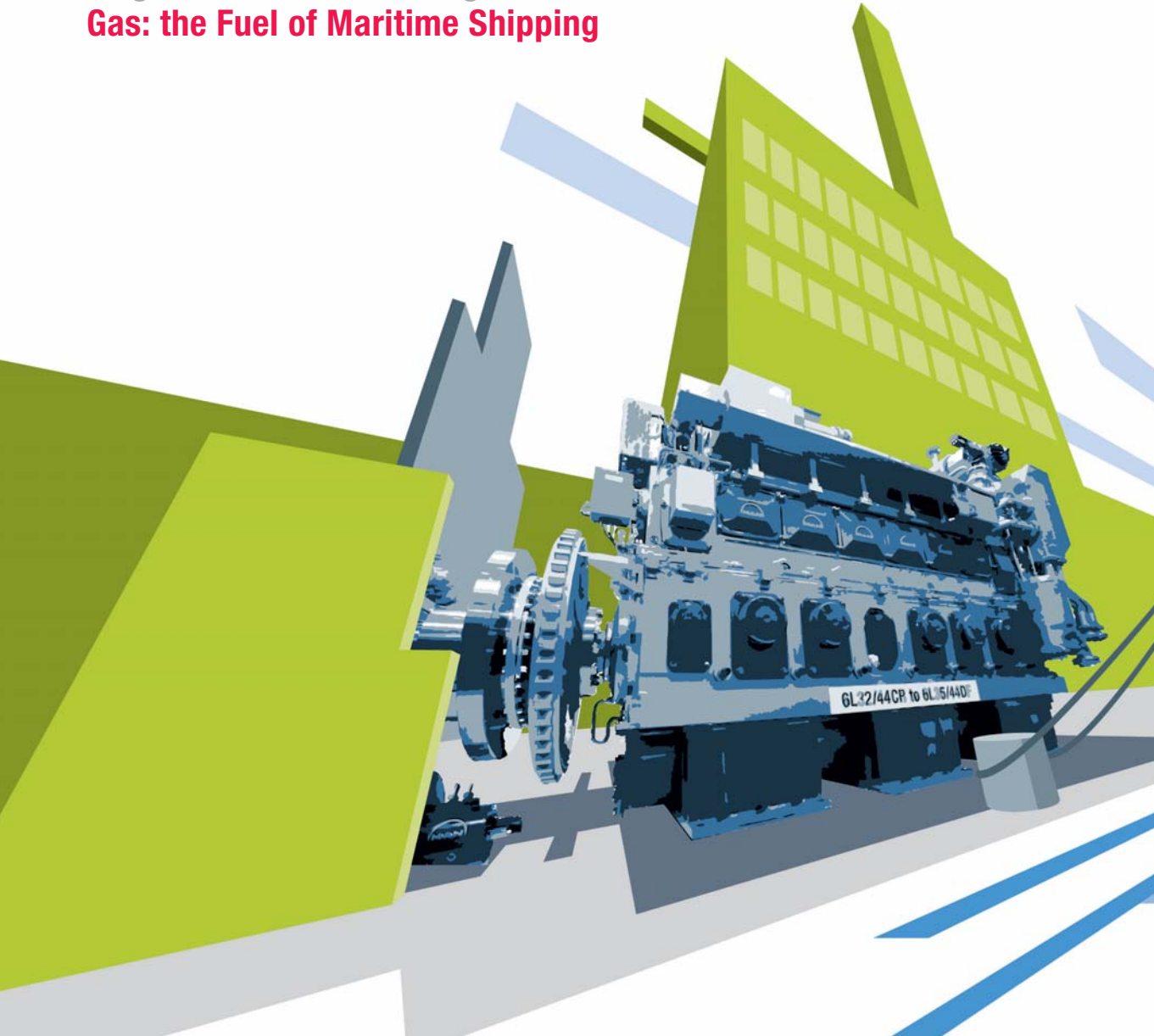
- Built: 2009
- Application: backup generation to offset volatile renewable energy supplies

On the Caribbean island of Bonaire, the diesel power plant compensates for fluctuations in wind power, safeguarding supplies of backup energy for 14,000 people. As this example shows, with their flexibility and baseload capability, power plant engines from MAN make an ideal complement for renewable energies, helping to ensure reliable energy supplies.



Megatrend: Climate Change and Environmental Protection

Gas: the Fuel of Maritime Shipping





**MAN35/44DF (four-stroke engine) —
dual-fuel makes for flexible operation**

- Efficiency benefits: significantly reduced CO₂ and nitrogen oxide emissions when operating on gas
- First presented: 2012
- Application: maritime shipping

This dual-fuel engine can operate on both liquid and gaseous fuels. Operating on gas, it already complies with the International Maritime Organization Tier III emission regulations for marine applications, which will come into effect in 2016.

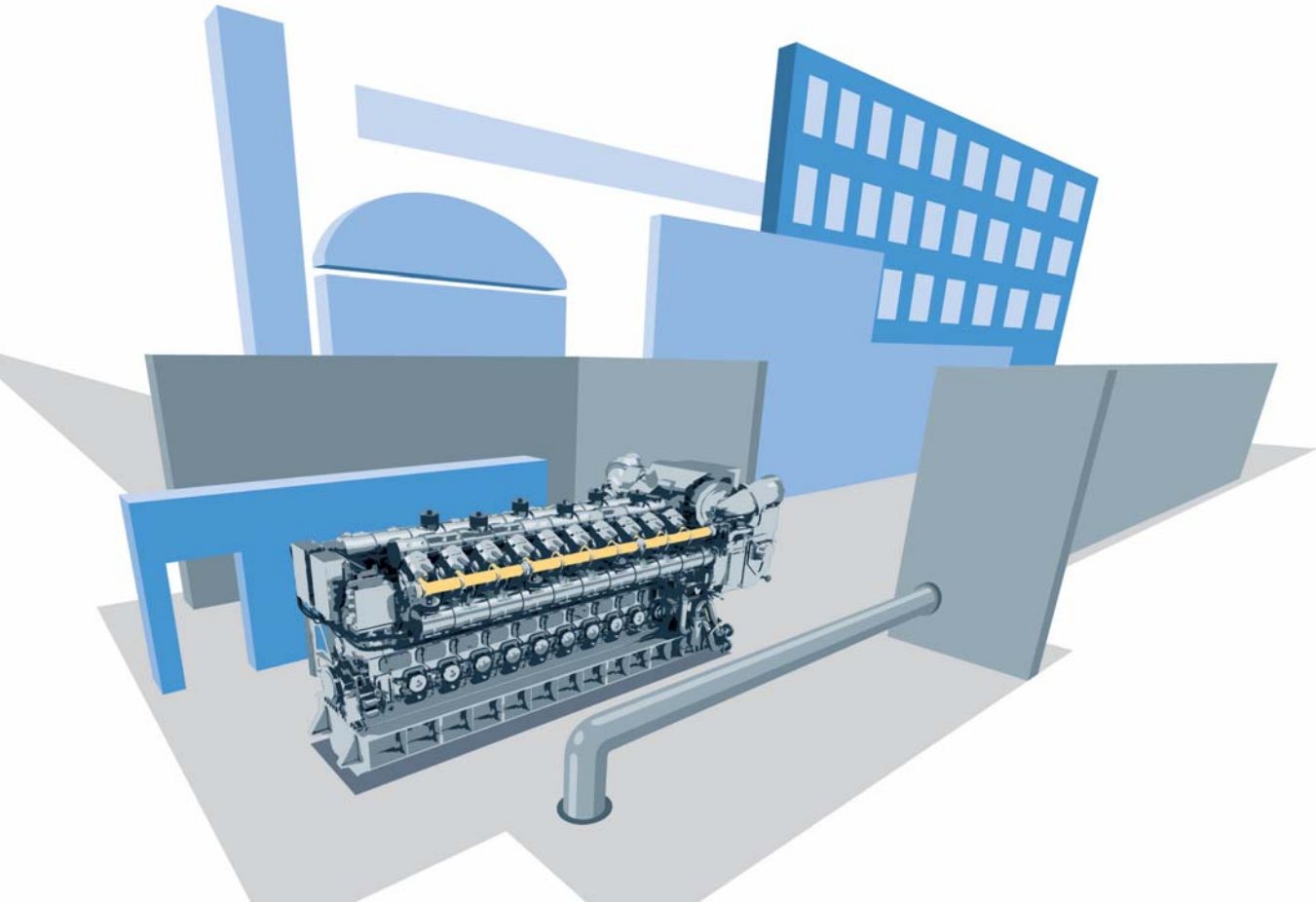
Megatrend: Climate Change and Environmental Protection

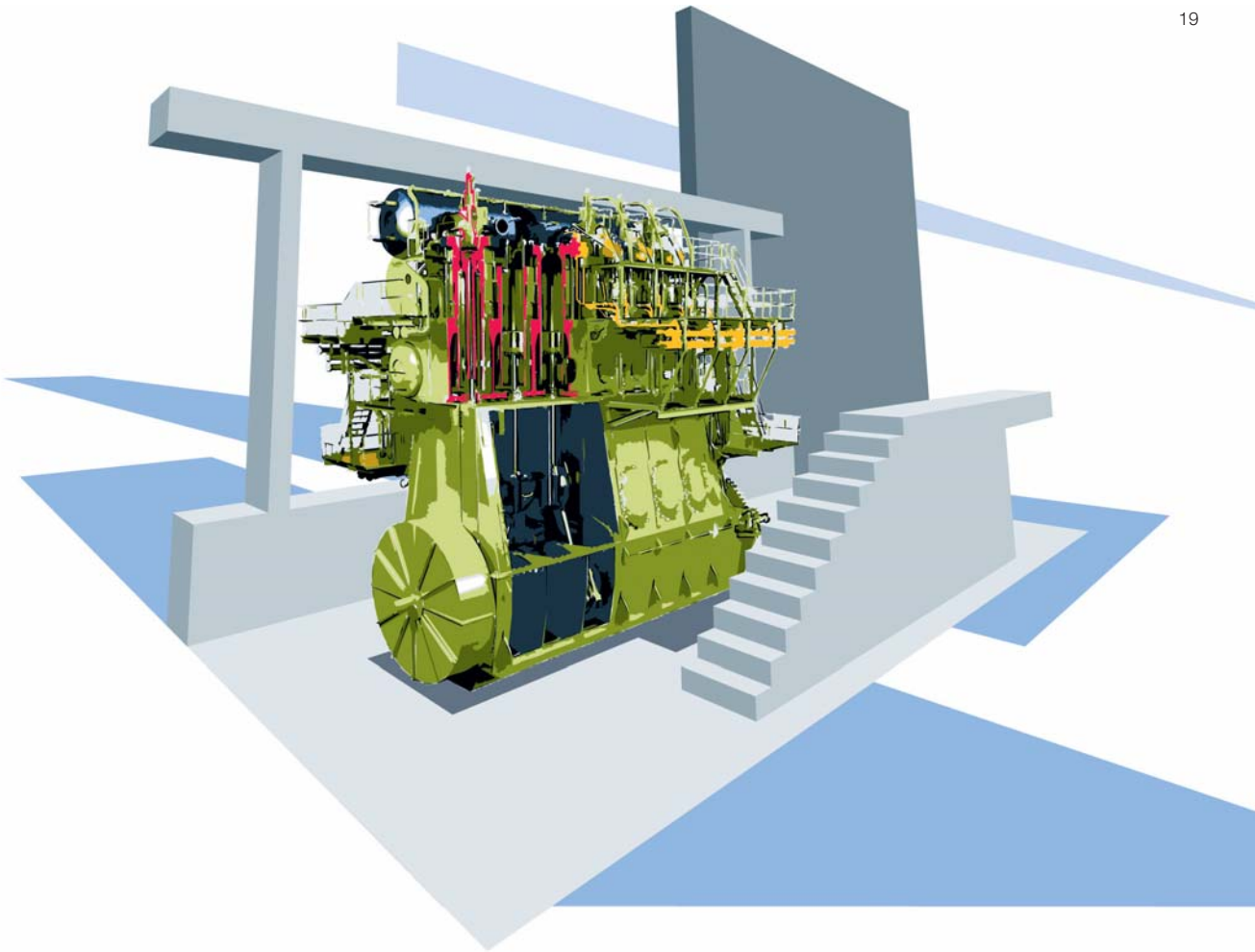
Gas: Fuel of the future

MAN 35/44G (four-stroke engine) — gas engine for energy generation

- Efficiency benefits: 47% efficiency
- Market launch date: 2012
- Application: power plants (including CHP plants)

This gas-only engine has a mechanical output of almost 11 megawatts. Installed in a CHP plant, its waste heat can be utilized as well — without additional fuel consumption.





MAN ME-GI dual-fuel engine (two-stroke engine) – flexible and environmentally compatible

- Efficiency benefits: substantially reduced CO₂ and nitrogen oxide emissions when operating on gas
- Market launch date: 2011
- Application: maritime shipping

This two-stroke engine with gas injection ranks among the most eco-friendly on the market. When operating on gas, the benefits include substantially reduced CO₂ and nitrogen oxide emissions and virtually non-existent emissions of oxides of sulfur, soot, and particulates. In addition, the dual-fuel engine offers ship owners and operators a high level of flexibility and economic efficiency.



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