LNG SHIPPING
Cost-cutting dual fuel engine solutions
MAN Diesel & Turbo is the world’s leading provider of large-bore diesel engines and turbomachinery. Our portfolio includes two-stroke and four-stroke engines for marine and stationary applications, turbochargers and propellers, as well as gas and steam turbines, compressors and chemical reactors.

Our commitment to minimizing fuel consumption while meeting even the most advanced emission regulations plays a vital role in safeguarding the environment for future generations.

In the competitive field of liquefied natural gas (LNG) shipping, with its fluctuating fuel prices, we offer cost-effective propulsion systems that comply with all emission legislations and meet strict safety requirements.
Getting a good return on your investment

Although the market for LNG keeps on growing, building a vessel for the LNG supply industry is a major investment in complex technology that has to be amortized with a maximum of yearly operating hours. You also have to factor competition from other carriers, environmental regulations, and unpredictable fuel costs.

Success factors

Maritime transport of LNG has proven safe thanks to very high safety standards. However, LNG is a highly valuable freight and delivery delays are costly. Good marine cargo tank management is essential. The engines have to be capable to cope with different boil off gas (BOG) qualities and quantities, in line with charter requirements.

Flexible propulsion solutions

Different LNG shipping applications have comparable requirements with different technical emphasis on reliability, flexibility, capital expenditures (CAPEX) and operating expenses (OPEX), emission regulations, and the energy efficiency design index (EEDI). Our dual fuel propulsion solutions can be tailored to meet every requirement.
FOUR-STROKE DUAL FUEL ENGINES FOR LNG VESSELS
LNG carriers have to deliver highly valuable freight on time, which means they require operational flexibility. Sailing globally through environmentally sensitive waters demands low emissions and the operational safety of the propulsion system is paramount.

Navigating operational, contractual and environmental challenges

Modern LNG tankers need highly reliable propulsion systems and service support that can ensure constant reserve availability. Operational challenges include the fulfillment of all safety norms (IGF, IGC Codes) and high load flexibility. Careful management is necessary to maintain correct pressure in the cargo tanks and to handle the boil-off gas. Furthermore, the engines have to cope with varying power demands.

The new IMO regulations impose tough limits on nitrogen oxide (NOx) and sulfur oxide (SOx) emissions. In the future, even stricter standards will apply in the Emissions Control Areas (ECAs). In order to deliver their very valuable freight on time and cost effectively, the owners and operators of LNG carriers also have to factor the fluctuating costs of HFO and LNG as fuels. Our multi-fuel engines and propulsion systems with fuel flexibility answer all these challenges.
MAN 51/60DF: Dual fuel genius

In a multiple dual fuel engine plant the MAN 51/60DF ensures high reliability and vessel speed flexibility. The engines within a multiple engine concept can be switched on and off according to the power demand. You can thus operate at highest efficiency with the lowest possible fuel consumption and best load dynamics.

The low-pressure gas supply system is proven and easy to handle. The fuel quality manager optimizes the engine’s combustion according to the quality of the boil-off gas.

Benefits
- Full environmental compliance
  - IMO Tier III in gas mode and liquid mode (with optional MAN SCR)
- High power output
  - Up to 1,050 kW per cylinder
- Safe engine operation
  - In accordance with latest standards and regulations
- Operating stability and flexibility
  - Seamless switch from HFO to gas mode and vice versa; gas operation even above 100% MCR
- Lower maintenance costs
  - Intelligent use of the engines enables the minimization of yearly maintenance costs. Additional benefits derive from the use of the same engines (with the same technologies) for propulsion and onboard power generation.

Further power solutions

MAN 35/44DF

Safety beyond the standards

The MAN 51/60DF comes fully equipped with safety and control systems developed for full compliance with classification society standards. Safety-related features include the option of safe engine operation in liquid fuel or gas mode, offering optimum fuel consumption and very low emissions. In addition to all safety-relevant engine features, we offer an integrated safety concept for the whole engine room, tailor-made for each specific application.

Flexible fuel sharing

The capability to operate the engine in gas-, liquid- or fuel-sharing mode with HFO, MDO, MGO or natural gas (LNG) leads to highest fuel flexibility. It also offers maximum usage of boil-off gas under the most efficient engine operation.
Floating Storage and Regasification Unit (FSRU)

The FSRU turns the LNG fuel to gas, which can be pumped straight into the gas grid. It is a clever alternative to building a regasification plant on land and thus a key element in the LNG supply chain. An FSRU is a promising business opportunity for owners and operators but it involves many technical, contractual and environmental issues.

Working with clean power

The FSRU has to comply with coastal environmental regulations as well as the emission requirements of the ship’s flag state. In terms of engine operation, safety comes first. Service support is important for high operational availability.

In terms of engine output, the operation of the regasification equipment usually requires less power than the propulsion. Careful cargo tank management is important to maintain pressure in the cargo tanks and handle the boil-off gas. Our dual fuel solutions make it easy.
MAN 51/60DF: Clean, clever and versatile

In a multiple dual fuel engine plant the MAN 51/60DF ensures high reliability and vessel speed flexibility. The engines within a multiple engine concept can be switched on and off according to actual power demand, allowing the highest efficiency with the lowest possible fuel consumption and load dynamics. Intelligent engine utilization also makes possible the minimization of yearly maintenance costs.

The MAN 51/60DF complies with IMO Tier III regulations in gas mode. In liquid mode it complies with the help of the SCR (Selective Catalytic Reduction) exhaust gas-cleaning system.

**Benefits**

- Full environmental compliance
  - IMO Tier III in gas mode and liquid mode (with optional MAN SCR)
- High power output
  - Up to 1,050 kW per cylinder
- Safe engine operation
  - In accordance with latest standards and regulations
- Operating stability and flexibility
  - Seamless switch from HFO to gas mode and vice versa; gas operation even above 100% MCR
- Easy to operate
  - The low-pressure gas supply system is proven and easy to handle. The fuel quality manager optimizes the engine’s combustion according to the quality of the boil-off gas. Our PrimeServ training academy offers a tailored training program for FSRU crew.

**Dual fuel technology**

- Pioneering hardware and software for engine control, monitoring, and diagnostics. Enables full fuel flexibility (HFO, MDO, MGO and natural gas). Seamless switch from HFO to gas mode and vice versa; gas operation even above 100% MCR.
- Ease of maintenance
  - Segmented gas and charge air manifold for individual and simple removal of cylinder head.
  - Safety and control system on engine

**Further power solutions**

MAN 35/44DF

**LNG Shipping**

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FSRU
LNG Feeders & Bunkering Vessels

Low gas prices are increasing popularity of LNG as a maritime fuel. This in turn is driving the demand for feeder and bunker vessels that can efficiently deliver LNG to the ships that use it as fuel.

High performance with low consumption

Delivering LNG to marine clients is a challenging operation. Feeders and bunker vessels need high maneuverability to perform safely. They have to be available 365 days a year and must have low overall energy consumption – the less cargo they burn, the better. They should also be suitable for operating in noise sensitive areas and comply with emissions regulations.

With their outstanding fuel economy, our dual fuel engines offer excellent solutions for operators who are looking for low CAPEX and OPEX and worldwide logistic support.
MAN 35/44DF: Highest power output with lowest emissions

The MAN 35/44DF allows you to harness all the benefits of dual fuel flexibility. It is ideal for mechanical and electric propulsion, and auxiliary GenSet applications. In gas mode, it complies fully with IMO Tier III standards. In liquid fuel mode, it fulfills IMO Tier II regulations.

The engine is equipped with a Common Rail injection system with injection pressures of up to 1,600 bar. With 530 kW/cyl, the engine yields the highest power output in its segment. The solid design is based on the MAN 32/44CR. Its reliable technology reduces daily maintenance and maximizes TBOs while ensuring safe operation in all fuel modes. Its success is demonstrated by the increased vessel resale value.

Benefits
- Compliance with IMO Tier II and IMO Tier III standards
- No after-treatment needed in gas mode. SCR option for liquid mode
- Based on established technology: Design based on proven MAN 32/44CR engine
- Full fuel flexibility: HFO, MDO, MGO and natural gas

More intelligent ways to save costs

The HyProp Eco is a hybrid solution that results in higher propeller efficiency and lower fuel consumption. The MAN 35/44DF is also available with MAN Cryo fuel gas supply and bunkering equipment as part of system supply.

Further power solutions

MAN 23/30DF GENSET  MAN 28/32DF GENSET
MAN 35/44DF  MAN 51/60DF

Conversion from MAN 32/44CR

This is an economical retrofit solution that adds lean-burn technology from the MAN 51/60DF. Due to the high level of component compatibility, the engine can be easily re-machined on board.

saC64ec (safety and control system on engine)

Combines all functions of modern engine management into one complete system. It controls the additional pilot injection system as well as the gas admission system assembly.
LNG expertise

With the acquisition of Cryo AB in February 2016, MAN Diesel & Turbo became one of the world’s leading manufacturers of cryogenic equipment for the storage, distribution and handling of Liquefied Natural Gases (LNG).

For more than 50 years Cryo AB has put skills and advanced technology at the service of the gas industry. As such, MAN Cryo products are available for demanding marine and industrial gas companies when it comes to selecting the most efficient and economical cryogenic equipment for marine gas fuel systems as well as for offshore and onshore bunkering systems.

MAN Cryo has a broad product line of equipment for LNG, both on-shore and off-shore applications. It includes marine LNG fuel gas systems with more than 30 systems operating to-date, LNG bunkering systems for bunker vessels and for on-shore installation. Our experience and product portfolio allows us to supply equipment for all your marine LNG needs. We have the expertise to customize designs to your requirements.

Our main products for LNG applications are:

- Marine fuel gas systems
- Off-shore and on-shore bunkering systems
- Stationary distribution system for regasification or fuel filling
MAN PrimeServ

MAN PrimeServ is the dedicated MAN Diesel & Turbo 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.

MAN PrimeServ’s aims is to provide:
- 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 PrimeServ

We offer retrofitting and upgrade services to bring engines 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.

Our service does not vary according to location. A vessel may be built in Asia, operate in Europe and then move to Africa. That does not alter our focus on dedicated training, especially in the developing field of LNG, fast delivery of strategic spare parts, a comprehensive approach, or our tailored maintenance contracts.

For more information please visit: www.man.eu/primeserv
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Download our MAN Brochure Store app from the App Store. Use its exciting interactive features to explore our complete range of products and services. Suitable for iPhone or iPad.

Explore our latest news via an app
DieselFacts brings you the most recent news from the world of two-stroke and four-stroke engines, including the latest technical papers, in-depth features and videos.