



SIEMENS



Answers for Energy

# Power Generation for Heavy Oil Applications

Crude oil as a fuel for the SGT-500

# Power Generation for Heavy Oil Applications

For upstream oil operations, making use of locally available fuels to generate the power required is a key requirement, as facilities are often located in remote onshore locations or offshore with no or limited access to an electricity grid system, and transportation of large quantities of expensive premium fuels to the site location is problematic and uneconomic. In most instances associated gas is used as the fuel for power generation, but in some heavy oilfields, there is insufficient associated gas available to fuel the power plant over the lifetime of the project. Therefore it is necessary to use the crude oil produced as the main fuel for power generation.



Two SGT-500 gas turbines powering a FPSO

## Crude Oil-fuelled Power Generation

While there are several possible power generation technologies that can use a treated crude oil as a fuel, there are often also space and weight considerations, especially on offshore platforms, that need to be taken into account when considering the power plant options. The ability of



SGT-500 installations with HRSG in a cogeneration plant

the Siemens SGT-500 gas turbine to operate on crude oil fuels, including heavy crude oil, offers a reliable, compact, lightweight solution for power generation applications with high availability and low environmental impact, that also facilitates transportation and frees up deck space on platforms and FPSOs that can then be used for processing modules.

## Cogeneration Solutions

With high quality heat recoverable from the exhaust gas stream, the SGT-500 also offers good cogeneration potential. The recovered heat can be used to produce steam or hot water, or heat thermal oil, to provide the process heat necessary for oilfield operations. This capability greatly increases the overall energy efficiency of oil field and refinery operations, and helps to reduce the global CO<sub>2</sub> footprint of heavy oil production.

# The SGT-500 Gas Turbine

The SGT-500 has served the oil & gas and power generation industries for over 50 years, delivering power with outstanding operational reliability both onshore and offshore. While like other Siemens gas turbines offering great fuel flexibility on both gaseous and liquid fuels, the SGT-500 is unique within the Siemens portfolio in its ability to operate on non-premium liquid fuels, including relatively viscous fuels such as heavy fuel oil (HFO), crude oil, refinery residual oils and bio-oils. With around 500,000 operating hours experience achieved both in onshore and offshore environments on crude oil and HFO, the SGT-500 has demonstrated both high reliability and high availability.



SGT-500 gas turbine in the workshop in Sweden

### Outstanding Crude Oil Capability

The burner design is able to accept liquid fuels with viscosities up to 20cSt, more than twice the permissible viscosity of most gas turbines. Combined with the pressurised fuel system that allows the fuel to be pre-heated to as high as 150°C to reduce the fuel viscosity, it is possible to use fuels with viscosities of 750cSt at 50°C or higher in the SGT-500. This allows the operator to use common heavy fuel oils such as IM380, as well as crude oils and residual oils from refining processes, including some medium heavy crude oils and extra heavy crude oils with API gravities as low as 12° or 13°API. Where it is necessary to comply with strict environmental regulations, water injection can be used to reduce NO<sub>x</sub> emissions. Depending on the carbon residue value of the fuel, it is possible to achieve NO<sub>x</sub> emissions below 50 ppm across the whole load range.

### Bi-Fuelling (Mixed Fuel Operation)

Dual fuel operation – operation on 100% gas fuel or 100% liquid fuel, with the ability to switch between fuels while in operation – is a standard feature on Siemens gas turbines. In instances where associated gas is present in quantities too small to permit 100% gas fuel operation, the SGT-500 also has the ability to bi-fuel – to operate on a mixture of both gas and liquid fuels. The minimum permissible gas fuel flow is dependent on load, but in case of insufficient gas fuel flow, the turbine will revert to operation on 100% liquid fuel. This feature reduces the need to flare associated gas, or allows the gas to be used for other process purposes, such as gas lift.

### Compact Package Designs

In remote onshore locations and on offshore installations, size and weight are import factors in project design, both for transportation purposes and for allocating space in restricted areas. The SGT-500 generator set is a compact package design, requiring a footprint of just 20.6m by 4m, and weighing around 205 tonnes. Modular, single-lift and 3-point mounted package designs are available to help meet project-specific needs.

### Maximized Production Uptimes

Like all other Siemens light industrial gas turbines, the SGT-500 can be maintained on-site or off-site, employing a core exchange concept. The modular design of

the core engine simplifies on-site maintenance, while a core exchange can be undertaken in less than 48 hours.



The SGT-500 has an availability in excess of 97%

No matter what the fuel used, security of supply of power is critical to upstream oil operations. The low firing temperature of the SGT-500 not only helps give some inherent corrosion resistance to contaminants commonly found in crude oil, but also helps prolong component life and hence extended intervals between inspections and overhauls.

### High Reliability and Availability

Operation at part-loads, with still lower firing temperatures, also contributes to longer component life. Operating on crude oil fuels at 90% of full load or less, the SGT-500 offers high reliabilities and availabilities, with an expected 80,000 hours operation between overhauls, 10,000 hours between inspections and, by employing core exchange program rather than on-site maintenance, potentially less than 50 days scheduled downtime in 18 years – an availability in excess of 97%.

With the features described above, the SGT-500 offers a lightweight, compact, efficient and reliable solution for crude oil-fuelled power generation applications worldwide.

SGT-500 Gas Turbine	Power Generation	Mechanical Drive
Power output	19.1MW(e)	19.52MW (26,177bhp)
Electrical efficiency	33.8%	34.5%
Heat rate	10,664kJ/kWh (10,107Btu/kWh)	10,432kJ/kWh (7,373Btu/bhph)
Power turbine speed	3,600rpm	3,450rpm
Compressor pressure ratio	13:1	13:1
Exhaust gas flow	97.9kg/s (215.9lb/s)	97.9kg/s (215.9lb/s)
Exhaust temperature	369°C (697°F)	369°C (697°F)



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