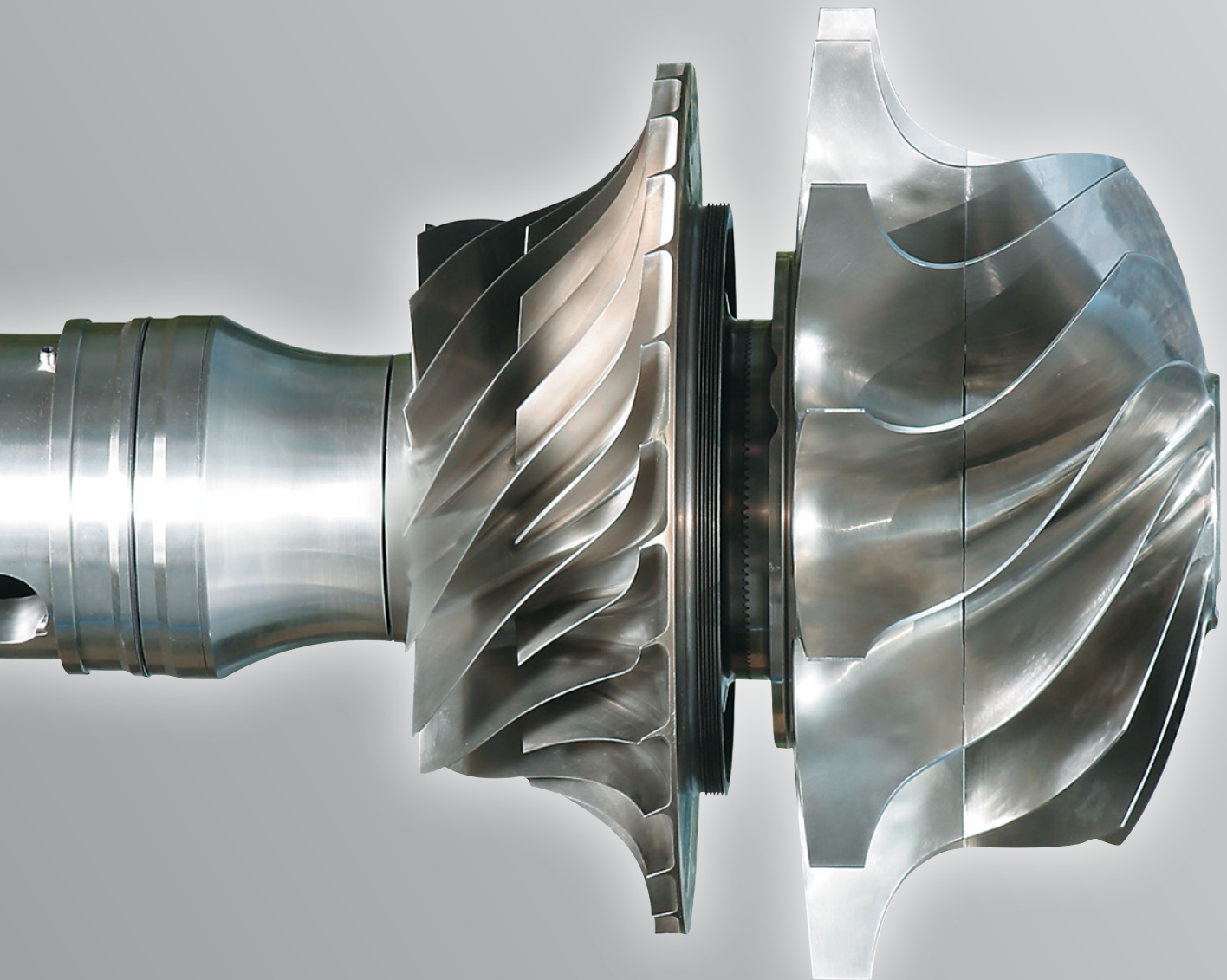
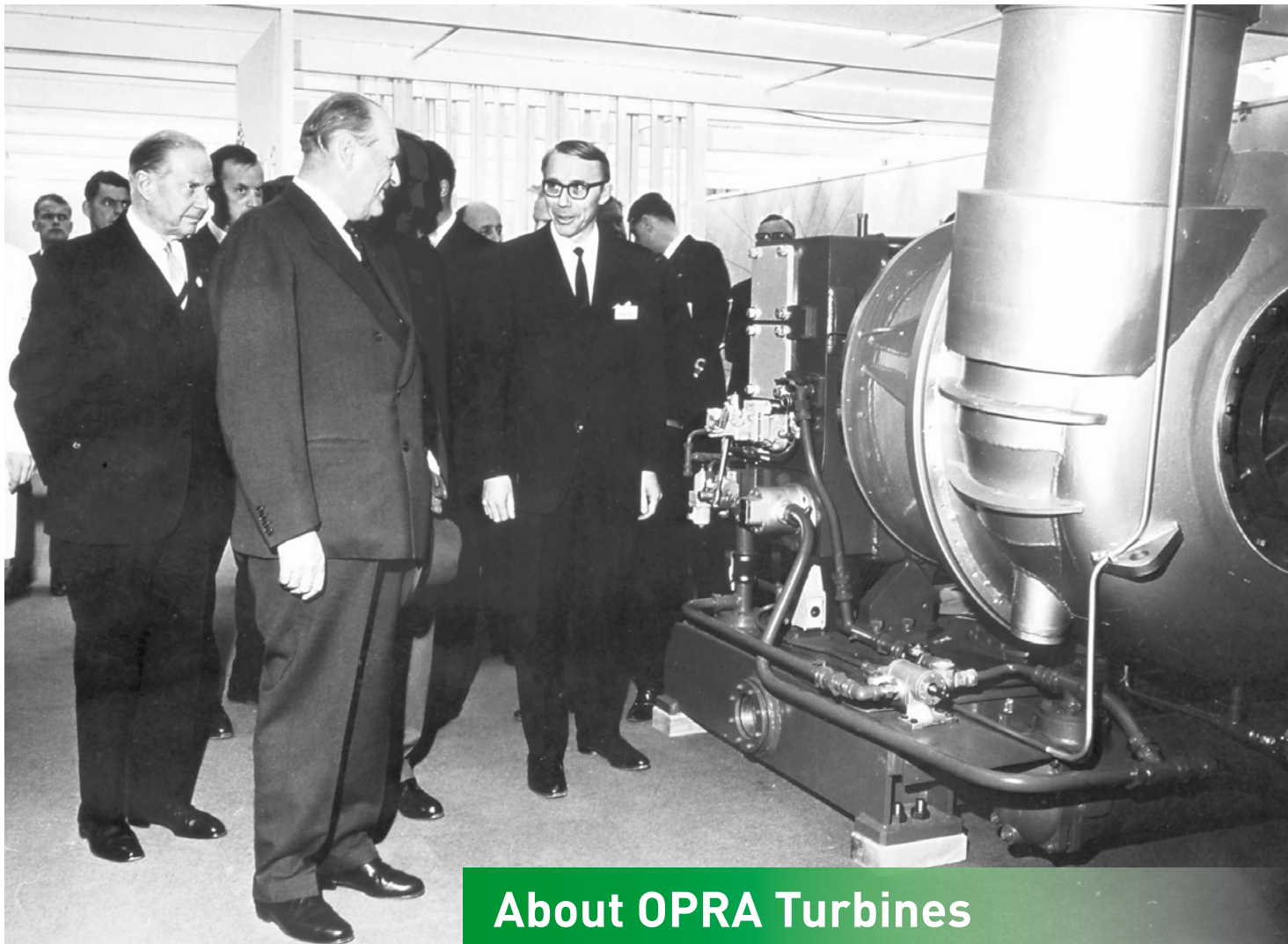


Gas Turbine Power

COMPACT, EFFICIENT, RELIABLE





About OPRA Turbines

King Olav V of Norway with Jan Mowill and the first radial gas turbine for industrial use in 1969

Production of OP16 generating sets in Hengelo, The Netherlands

THE COMPANY

OPRA Turbines is a leading global provider of turbine powered energy solutions. We develop, manufacture, market and service turbine generating sets for use in single or multiple installations in the 1.5 – 10 MW power range.

The OP16 powered generator sets can be provided in configurations to meet specific customer requirements and have enjoyed great market success worldwide.

THE HISTORY

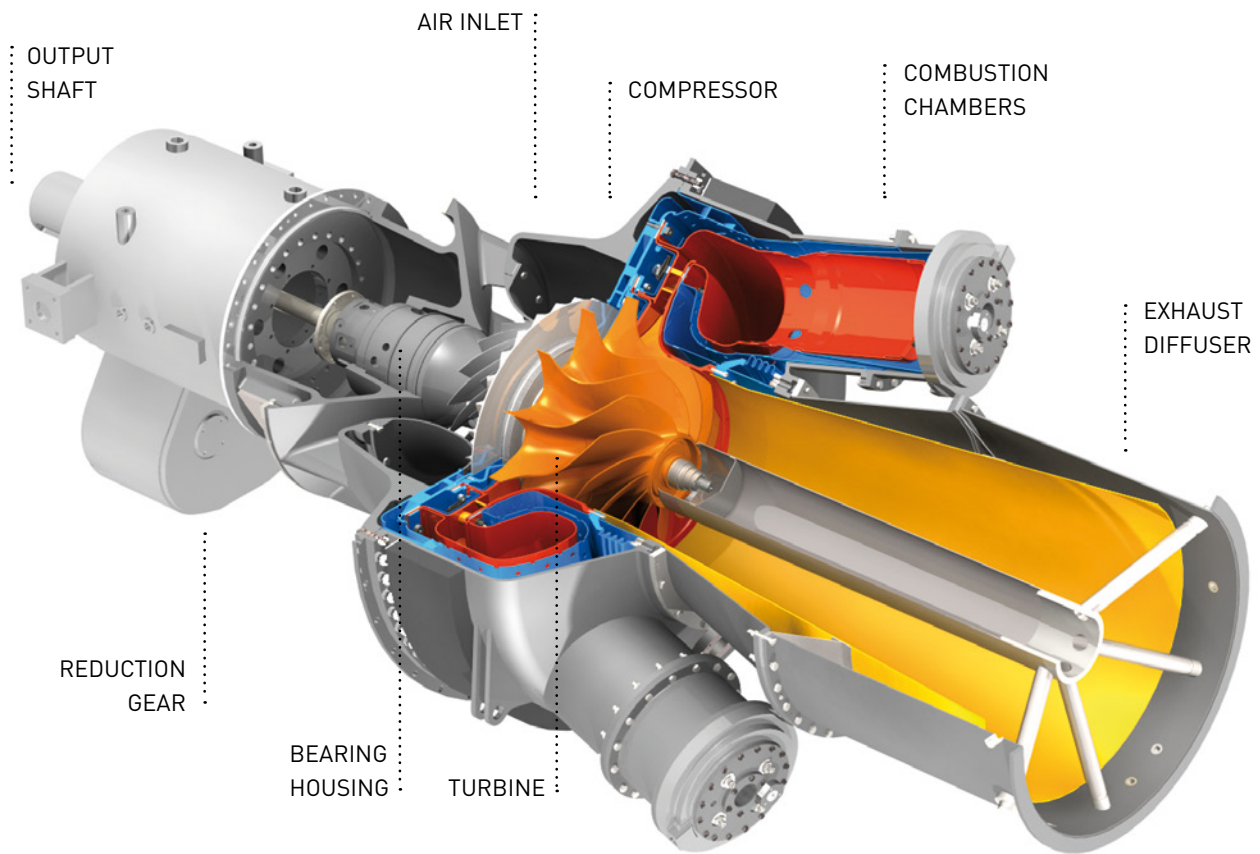
OPRA Turbines was founded by Jan and Hiroko Mowill in 1991. Jan Mowill previously founded and led the gas turbine division at a major Norwegian industrial conglomerate. Here Mowill developed and commercialized the world's first radial gas turbine engine for industrial applications in 1964. For his achievements he was awarded the Royal Norwegian Science Council Honorary Prize by King Olav V of Norway, in 1976.

OPRA has a team of professionals covering all aspects of a global gas turbine business. OPRA is dedicated to being a highly competitive company in its market segment by providing innovative products and maximum customer satisfaction. Continued improvement of products, processes and the organisation is an integral part of OPRA's strategy and quality policy.

OP16 PRODUCTS

The 2MW class OP16 engine exhibits world-class efficiency, low emissions combustion and multi-fuel capability and is unique in its power range. The all radial configuration offers superior robustness and performance compared to conventional axial turbines. The OP16 is a versatile, compact and reliable engine suitable for the oil and gas, marine, industrial and commercial power markets.





OP16 Innovations

SIMPLE AND ROBUST

The all-radial turbine rotor is sophisticated simplicity at its best, resulting in a robust design for high reliability and dependability. Its unique configuration, efficient flow path and advanced metallurgy results in a compact gas turbine suitable for the harshest conditions.

EFFICIENT

The OP16 industrial turbine offers the highest fuel efficiency in its power range. When used in a Combined Heat and Power system overall thermal efficiency of 90% can be achieved.

COMPACT

The turbine's compact size is a direct result of the all-radial rotor design and a much shorter flow path through the engine. The compact rotor allows a smaller generator set footprint and reduced installation requirements.

FUEL FLEXIBILITY

The turbine operates equally well on liquid and gaseous fuels and can switch under full load when specified as a dual fuel unit. The turbine runs well on low calorific value fuels such as bio gas.

CANTILEVERED ROTOR SYSTEM

The cantilevered rotor system places both bearings in the cold part of the engine. This results in extended bearing life and virtually zero oil consumption.

LOW EMISSIONS

Advanced combustion technology allows the turbine to achieve guaranteed NO_x exhaust levels of 25 ppm or less. Optional equipment may provide even lower levels when required.

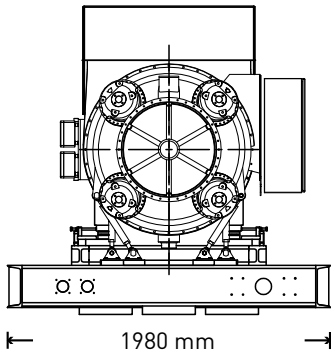
MODERATE PRESSURE RATIO

The turbine's moderate pressure ratio of 6.7:1 reduces the requirement for gas fuel boost compressors compared to other gas turbines

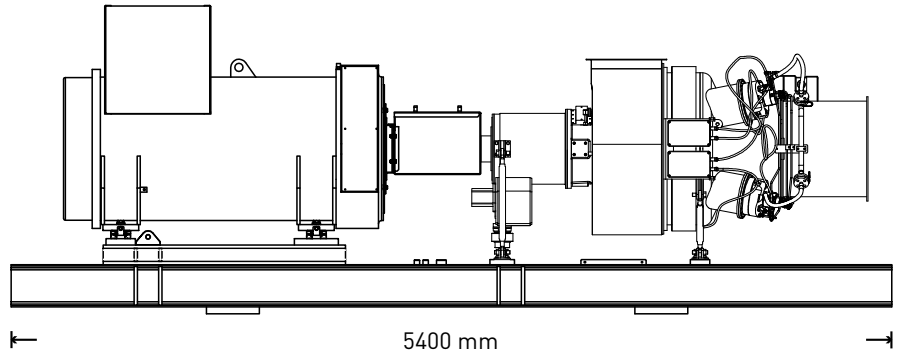
ECONOMICAL

With a high fuel efficiency, compact installation, and excellent reliability, the generator set offers both low installation and operating costs.

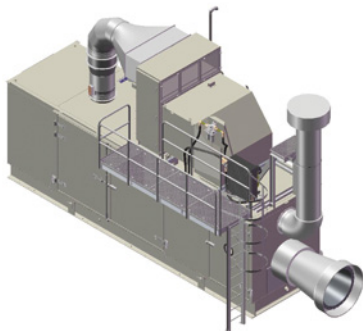
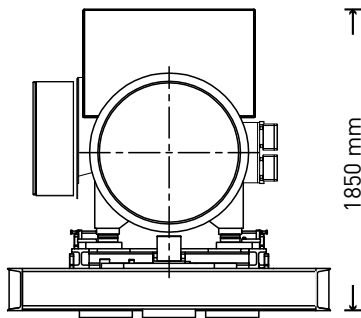
REAR VIEW



SIDE VIEW



FRONT VIEW



STANDARD OUTDOOR PACKAGE

Package Specifications

OP 16 GAS TURBINE

- Single shaft
- Single stage centrifugal compressor
- Single stage radial turbine
- 4 can combustion system
- Dual fuel and DLE combustion system
- High energy spark ignition system

GEAR REDUCTION

- Integral epicyclical gear
- 1500 or 1800 rpm
- Acceleration vibration transducer
- Ancillary drive shafts
- Shear pin drive shaft protection

STANDARD GENERATOR PACKAGE

- Steel base frame
- Hydroelectric starting system
- Natural gas fuel system
- Lubrication oil system
- Gear driven main oil pump
- AC pre/post lube oil pump
- Air - oil cooler
- Integrated lube oil tank
- Lube oil tank heater
- Simplex oil filter
- Unit control system
- Microprocessor based PLC
- Package sequencing and turbine governing
- Generator auto synchronizing and protection
- Vibration Monitoring
- 24 VDC Batteries and charging system
- Online water wash system

GENERATOR

- Synchronous 4-pole, 3 phase
- Open drip proof construction
- Integral brushless exciter
- 2250 kVA, 50/60 Hz, 400/480V
- Acceleration vibration transducer
- Integrated solid state AVR
- H-class insulation,
- H-class temperature rise

OPTIONAL EQUIPMENT

- Generator options
- Alternative voltages
- Standby ratings
- Fuel systems
- Dual fuel system
- Bi fuel system
- Dry Low Emission system
- Alternative fuels like biogas, synthetic gas, etc.
- Oil System Options
- Oil demister
- Duplex oil filter
- Weatherproof acoustic enclosure (85 dBa 1m)
- F&G detection system
- Fire extinguishing system
- Engine intake filtration
- Package ventilation
- Silencers and ducting
- Anti-icing
- Fully pre-wired on-skid control room
- Exhaust or WHR options



Applications and Markets

Two OP16 turbines installed at Venture Production's Hummingbird FPSO in the North Sea

POWER SOLUTIONS FOR THE OIL AND GAS AND MARINE MARKETS

The OP16 is compact, efficient and reliable and therefore ideally suited for oil and gas and marine applications where reliability, space and environmental criteria are high priorities.

The OP16 standard marine generating set meets the most common standards required for operation in marine environments and is delivered with Class certification as required. The OP16 can also be provided in customized configurations to meet specific customer requirements.

COGENERATION (CHP) APPLICATIONS FOR THE INDUSTRIAL AND COMMERCIAL MARKET

The hot exhaust gas of the OPRA gas turbine is ideally suited for process and heating applications.

Depending on the application an OP16 turbine-based cogeneration plant can reach an overall fuel utilisation of 90%.

Cogeneration is an economical, practical and environmentally friendly way to generate heat and power. The OP16 can be depended upon as a reliable, low emissions power source that efficiently generates both heat and electricity. Possible applications for use of the exhaust heat include:

- Absorption cooling and air conditioning
- Hot water for district heating
- Steam generation for process industry

At full load the OPRA power generation set can typically generate 6 tons per hour of high pressure steam.

The low emissions and high exhaust temperature of the OP16 allows for direct use of the exhaust heat. Possible applications are:

- Preheating of the inlet for a furnace, oven or conventional boiler
- Drying applications, such as brick production
- Direct drying of animal feed

At full load, approximately 5MW of heat is available in the clean exhaust gases.

OIL AND GAS

- Offshore fields
- Onshore fields
- Pipelines

MARINE

- Cruise ships
- Tankers
- Special vessels

INDUSTRIAL

- Food processing
- Ceramics
- Textiles
- Speciality chemicals

COMMERCIAL

- Hotels
- Hospitals
- District heating and cooling
- Bio fuel applications



Six OP16 turbines installed at the 2014 Olympic Winter Games site in Russia



Extensive Field Experience

THE OP16 IS A PROVEN AND RELIABLE POWER SOURCE

- OP16 gas turbines have been purchased by customers across the world.
- OPRA's diverse customer base ranges from the 2014 Winter Olympic Games in Sochi to major oil and gas companies operating offshore in the North Sea and Brazil.
- The OP16 has proven itself as a reliable power source onshore and offshore, from the extreme colds of Siberia to the hot and dusty environments in the Middle East.



Six OP16 turbines installed at a TNK-BP oil field in Russia



Global Customer Service

24HR ON-CALL SERVICE

In times of emergency, quick response and availability of service is critical. OPRA guarantees availability of service 24 hours per day, 365 days per year.

SPARE PARTS

OPRA provides a complete range of spare parts for OP16 gas turbine generator equipment. Standard spares packages can be provided for each specific application, tailored to the end user's requirement. OPRA maintains a comprehensive inventory of spares which ensures quick delivery.

OVERHAUL AND RECONDITIONING

OPRA offers complete overhauls, starting from assessment and engine removal at site to the repair work at the OPRA work shop, including by installation and startup.

MODIFICATIONS AND UPGRADES

OPRA is at the forefront of gas turbine research and development. Ongoing product improvements and innovations are available to existing customers to help increase performance and enhance reliability.

LONG TERM SERVICE AGREEMENTS

A service agreement ensures that maintenance is executed in accordance with OPRA guidelines. This improves the safety, reliability and availability of the unit and reduces total cost of ownership.

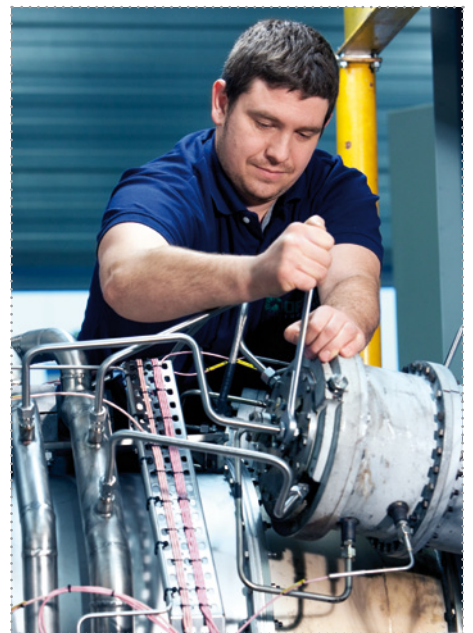
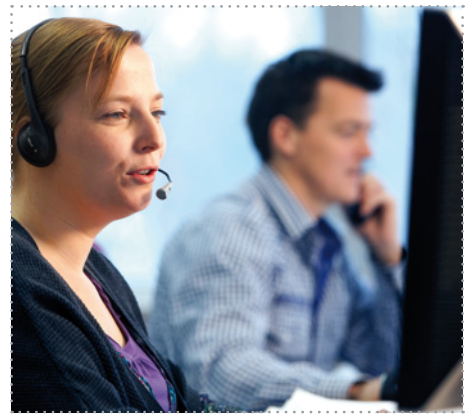
DEDICATED TRAINING PROGRAMS

OPRA offers a wide range of training programs for operation and maintenance of the OP16 units. Training sessions can also be tailored to suit each customer's requirements.

RENTAL PROGRAM

OPRA offers mobile OP16 gas turbine generator sets for short or long term rent.

Rental engines can be provided during scheduled or unscheduled outages thereby reducing down time and operational costs.



OPRA SERVICE SUPPORT CENTRE
24/7 HOTLINE +31(0)74 245 2127



Location and Facilities

HENGELO, The Netherlands
Turbine package engineering, manu-
facturing, R&D, testing, and service
activities are located in Hengelo.

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OPRA's Quality Management System
is ISO 9001:2008 certified

