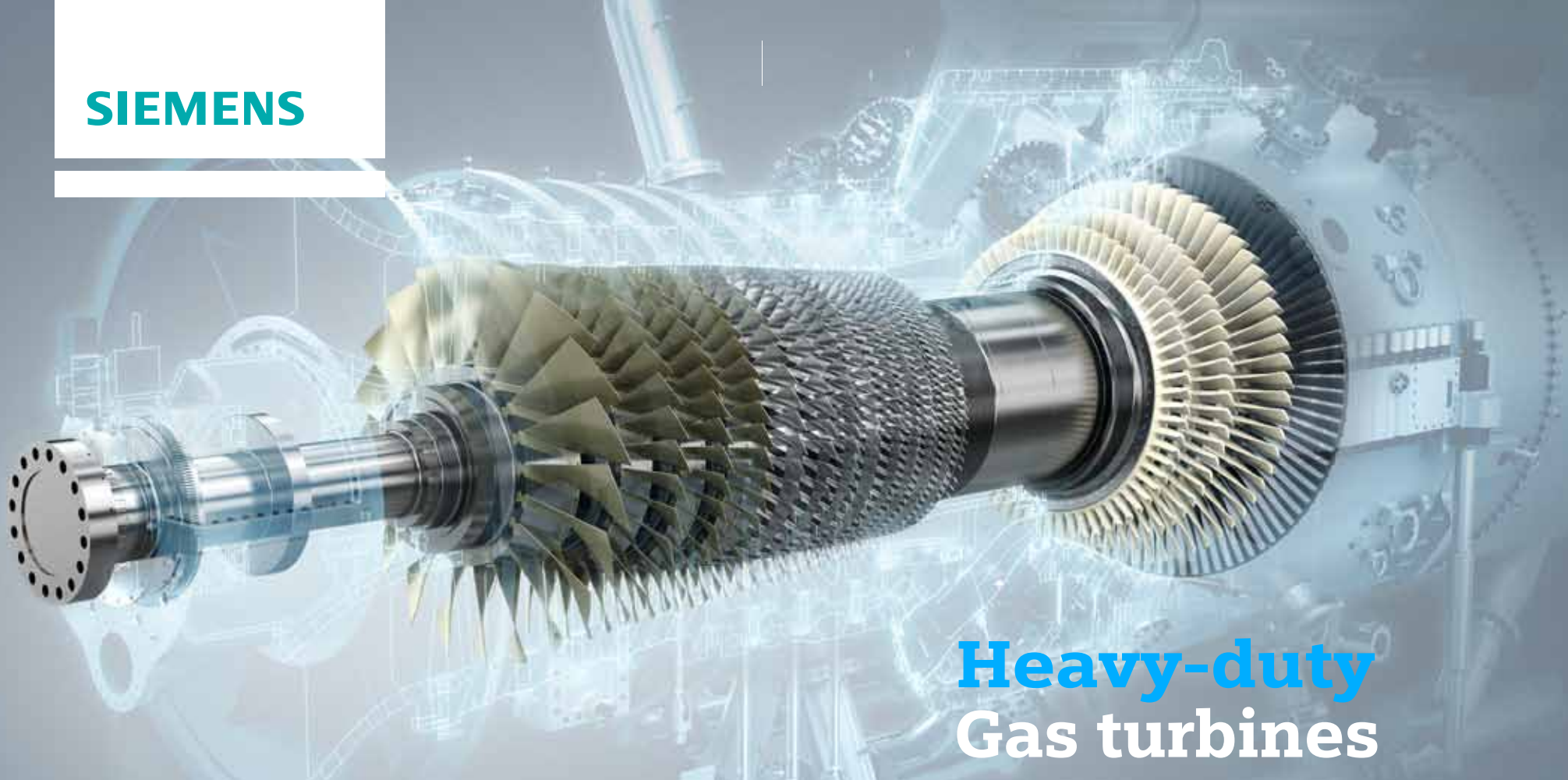


SIEMENS



Heavy-duty Gas turbines

Power and Gas

We power the world with innovative gas turbines

SOAR ENERGY TECHNOLOGY CO.,LTD

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URL:<http://www.soarpower.com>







斯奥动力集团
SOAR POWER GROUP

Heavy-duty gas turbines

Siemens heavy-duty gas turbines are robust and flexible engines, designed for large simple or combined cycle power plants. They are suitable for peak, intermediate, or base load duty, as well as for cogeneration applications.

Customers benefit from our extensive validation and testing capabilities.

Our engines are proven in commercial operation and provide outstanding efficiency.

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SGT5-8000H

Heavy-duty gas turbine

The SGT5-8000H offers outstanding performance and high flexibility. With a gross power output of 400 MW, it is the world's most powerful gas turbine in commercial operation today.

The turbine is the core component of highly efficient gas-fired power plants, designed for 600 MW in combined cycle operation, and combined cycle efficiencies of more than 60%.

With more than 180,000 fired hours, the SGT-8000H series provides mature technology with verified reliability and availability.

References

■ Düsseldorf Lausward, Germany

Turnkey combined cycle power plant
Power output: 595 MW(e) and up to 300 MW(th)
Customer: Stadtwerke Düsseldorf AG
Scope: SCC5-8000H 1S with 1 x SGT5-8000H gas turbine package

■ Bandirma II, Cengiz, Turkey

Combined cycle power plant
Power output: 583 MW
Customer: Cengiz Enerji Samsun
Scope: SCC5-8000H with 1 x SGT5-8000H gas turbine package for power island installation



Düsseldorf Lausward, Germany



The SGT5-8000H achieves a world-class efficiency of more than 60% in combined cycle operations



High operational flexibility due to world class fast cold start and hot restart capability

Power output: 400 MW

- Outstanding performance
- High flexibility, short start-up times
- Proven in commercial operations

Simple cycle power generation	
Power output	400 MW
Fuel	Natural gas, LNG, distillate oil, Arabian Super Light crude oil, kerosene, condensate; other fuels on request
Frequency	50 Hz
Gross efficiency	40.0%
Heat rate	8,999 kJ/kWh (8,530 Btu/kWh)
Turbine speed	3,000 rpm
Pressure ratio	19.2 : 1
Exhaust mass flow	869 kg/s (1,915 lb/s)
Exhaust temperature	627 °C (1,161 °F)
NO _x emissions	< 25 ppmvd at 15% O ₂ on fuel gas (without water injection for NO _x control), < 42 ppmvd at 15% O ₂ on fuel oil (with water injection for NO _x control)

Combined cycle power generation		
Siemens combined cycle power plant	1 × 1	2 × 1
Net plant power output	600 MW	1,200 MW
Net plant efficiency	> 60%	> 60%
Net heat rate	< 6,000 kJ/kWh (< 5,687 Btu/kWh)	< 6,000 kJ/kWh (< 5,687 Btu/kWh)
Number of gas turbines	1	2
Pressure/reheat	Triple/Yes	Triple/Yes

Physical dimensions	
Approx. weight	445,000 kg (981,000 lb)
Length	12.6 m (41 ft)
Width	5.5 m (18 ft)
Height	5.5 m (18 ft)



SGT6-8000H

Heavy-duty gas turbine

The SGT6-8000H offers outstanding performance and high flexibility. The air-cooled turbine with a gross power output of 296 MW is designed for simple and fast combined cycle integration and short start-up times.

The turbine is the core component of highly efficient gas-fired power plants, designed for 440 MW in combined

cycle operation with combined cycle efficiencies of more than 60%.

With more than 180,000 fired hours, the SGT-8000H series provides mature technology with verified reliability and availability.

References

■ Riviera Beach, Florida, USA

Supply of gas turbine packages
Power output: 3 × 274 MW
Customer: Florida Power & Light
Scope: 3 × SGT6-8000H gas turbine packages

■ Andong, South Korea

Power block for combined cycle power plant
Power output: 416 MW
Customer: Korea Southern Power Co. Ltd.
Scope: SCC6-8000H 1S with 1 × SGT6-8000H gas turbine



Dangjin 3, South Korea



The blade design provides high efficiency and is designed to ensure high reliability with low outage risk



Valves allow for controlled cooling air supply, to cover the needs of different operating conditions



The SGT6-8000H can be easily integrated in single-shaft or multi-shaft combined cycle plants

Power output: 296 MW

- Outstanding performance
- High flexibility, short start-up times
- Proven in commercial operations

Simple cycle power generation

Power output	296 MW
Fuel	Natural gas, LNG, distillate oil, Arabian Super Light crude oil, kerosene, condensate; other fuels on request
Frequency	60 Hz
Gross efficiency	40%
Heat rate	8,999 kJ/kWh (8,530 Btu/kWh)
Turbine speed	3,600 rpm
Pressure ratio	19.5:1
Exhaust mass flow	640 kg/s (1,410 lb/s)
Exhaust temperature	630°C (1,166°F)
NO _x emissions	< 25 ppmvd at 15% O ₂ on fuel gas (without water injection for NO _x control), < 42 ppmvd at 15% O ₂ on fuel oil (with water injection for NO _x control)

Physical dimensions

Approx. weight	289,000 kg (637,000 lb)
Length	10.5 m (34 ft)
Width	4.3 m (14 ft)
Height	4.3 m (14 ft)

Combined cycle power generation

Siemens combined cycle power plant	1 × 1	2 × 1	3 × 1
Net plant power output	440 MW	880 MW	1,320 MW
Net plant efficiency	> 60%	> 60%	> 60%
Net heat rate	< 6,000 kJ/kWh (< 5,687 Btu/kWh)	< 6,000 kJ/kWh (< 5,687 Btu/kWh)	< 6,000 kJ/kWh (< 5,687 Btu/kWh)
Number of gas turbines	1	2	3
Pressure/reheat	Triple/Yes	Triple/Yes	Triple/Yes

SGT-8000H series: Key features

Rotor

- Proven rotor design (Hirth serration, central tie rod, internal cooling air passages): For world class fast (cold) start and hot restart capability
- Easy rotor destacking on-site: Disc assembly with Hirth serration and central tie rod

Turbine

- High cycling capability due to fully internally air cooled turbine section
- 3D four stage turbine with advanced materials and thermal barrier coating
- Shorter outages: All turbine vanes and blades replaceable without rotor lift; vane 1, blade 1 and 4 replaceable without cover lift

Compressor

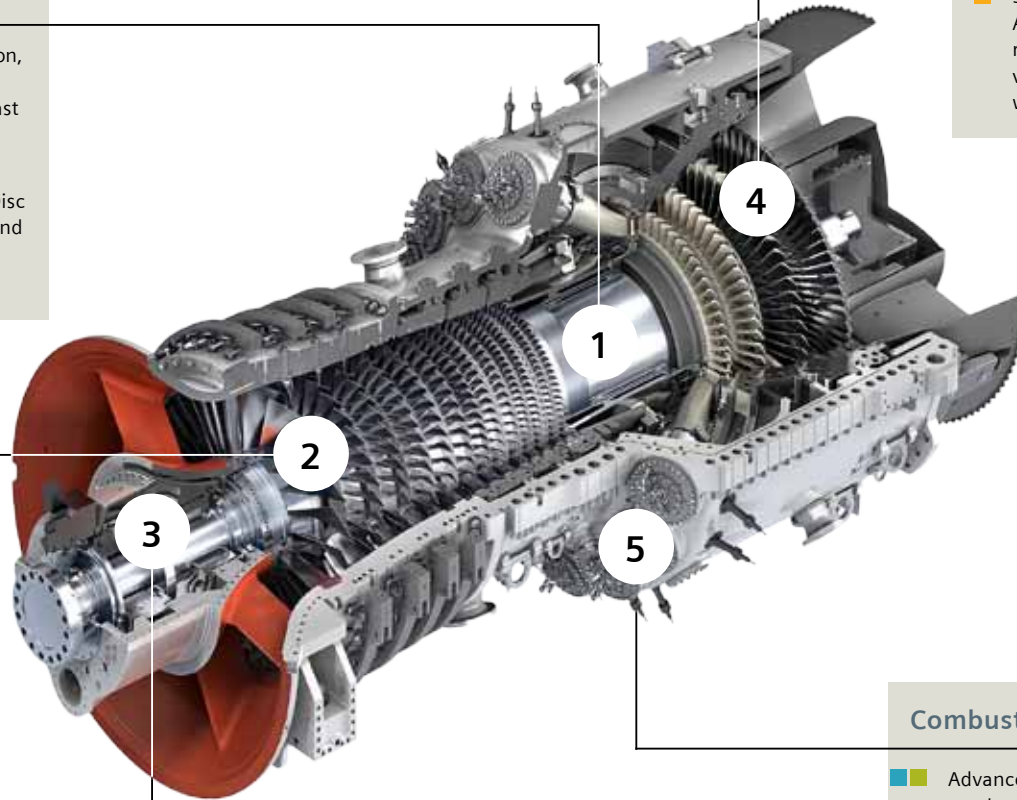
- Four stages of fast acting variable-pitch guide vanes (VGV) allowing for improved part load efficiency and high load transients
- Evolutionary 3D blading
- Rotating blades replaceable without rotor destack or lift

Bearings

- Hydraulic Clearance Optimization (HCO) for reduced clearance losses
- Transient protection of clearances for reduced degradation with HCO active clearance control

Combustion

- Advanced can annular combustion system
- More than 60% combined cycle efficiency



■ Flexibility ■ Performance ■ Serviceability



SGT5-4000F

Heavy-duty gas turbine

The proven SGT5-4000F gas turbine has a robust design with internal cooling air passages for trusted long-term operation and fast start-up capability. The advanced annular combustion chamber with individually replaceable heat shields allows for easy and fast walk-in maintenance. Hydraulic Clearance Optimization (HCO) reduces clearance losses to increase the gas turbine efficiency and minimize degradation at start-up and shut down.

Today, around 340 turbines have been sold. The installed fleet has accumulated an impressive fleet experience of 11.5 million equivalent operating hours, and a fleet reliability of 99.2%.

References

■ Kirishi, Russia

Supply of gas turbine packages
Power output: 800 MW
Customer: OGK-2 JSC, a subsidiary of Gazprom Energo Holding OOO/LLC
Scope: Repowering project with 2 × SGT5-4000F gas turbine packages

■ Shuweihat S2, Abu Dhabi

Turnkey combined cycle power plant
Power output: 1,500 MW
Customer: Suez Energy Middle East
Scope: 2 × SCC5-4000F 2 × 1 with 4 × SGT5-4000F gas turbine packages



Al Taweelah, United Arab Emirates



The SGT5-4000F is a well-proven 50 Hz gas turbine with an outstanding reliability and availability



Easy plant integration: Proven package concepts for early power generation in simple cycle operation; fast project execution



For combined cycle applications, the SGT5-4000F is offered in single-shaft or multi-shaft (2x1) arrangements

Power output: 307 MW

- Proven design, large fleet experience
- Easy maintenance, high availability
- High operational flexibility

Simple cycle power generation	
Power output	307 MW
Fuel	Natural gas, LNG, ethane, propane, distillate oil (dual fuel option); other fuels on request
Frequency	50 Hz
Gross efficiency	40.0%
Heat rate	9,001 kJ/kWh (8,532 Btu/kWh)
Turbine speed	3,000 rpm
Pressure ratio	18.8 : 1
Exhaust mass flow	723 kg/s (1,595 lb/s)
Exhaust temperature	579 °C (1,074 °F)
NO _x emissions	< 25 ppmvd at 15% O ₂ on fuel gas (without water injection for NO _x control), < 42 ppmvd at 15% O ₂ on fuel oil (with water injection for NO _x control), < 58 ppmvd at 15% O ₂ on fuel oil (without water injection for NO _x control)

Combined cycle power generation		
Siemens combined cycle power plant	1S	2 x 1
Net plant power output	445 MW	890 MW
Net plant efficiency	58.7%	58.7%
Net heat rate	6,133 kJ/kWh (5,812 Btu/kWh)	6,133 kJ/kWh (5,812 Btu/kWh)
Number of gas turbines	1	2
Pressure/reheat	Triple/Yes	Triple/Yes

Physical dimensions	
Approx. weight	312,000 kg (688,000 lb)
Length	10.8 m (35 ft)
Width	5.2 m (17 ft)
Height	4.8 m (16 ft)

SGT5-4000F: Key features

Rotor

- Robust design with internal cooling air passages for trusted long term operation and fast start-up capability
- Easy de-stacking on-site due to Hirth serration and central tie rod

HCO

- Improved performance and minimized degradation by active control of clearances at start-up and shut down

Compressor

- Proven design
- Rotating blades of all 15 stages replaceable without rotor lift

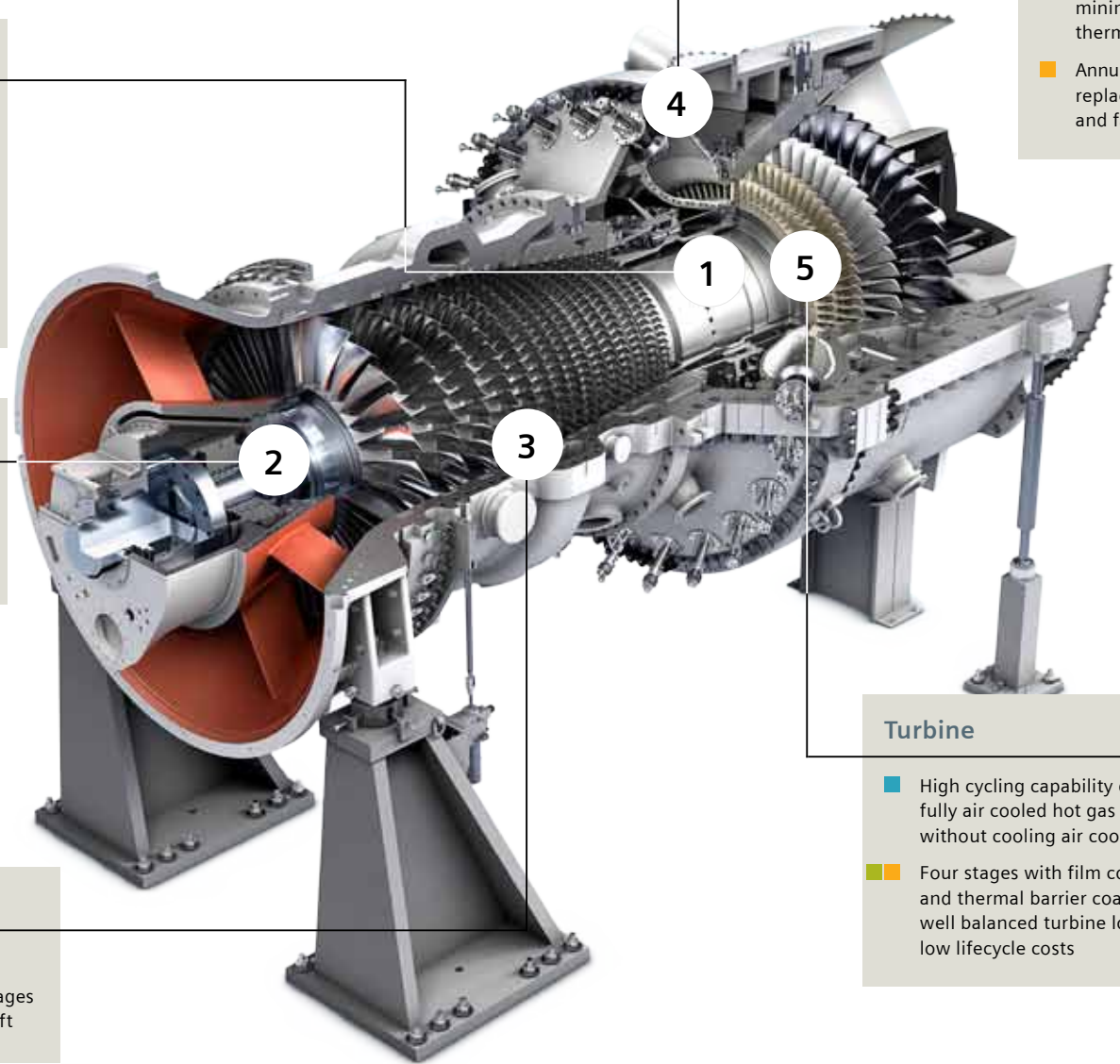
Combustion System

- Low NO_x burners, for dry operation with gaseous & liquid fuels
- Homogeneous outlet profile for minimized mechanical and thermal turbine stress
- Annular chamber with individually replaceable heat shields for easy and fast walk-in maintenance

Turbine

- High cycling capability due to fully air cooled hot gas path without cooling air coolers
- Four stages with film cooling and thermal barrier coatings for well balanced turbine load and low lifecycle costs

■ Flexibility ■ Performance ■ Serviceability





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HER
15t



SGT6-5000F

Heavy-duty gas turbine

The SGT6-5000F gas turbine offers economical power generation with fast start-up for peak, intermediate, or base load duty. It achieves peak values for reliability and continuous operation with highest performance values in its class.

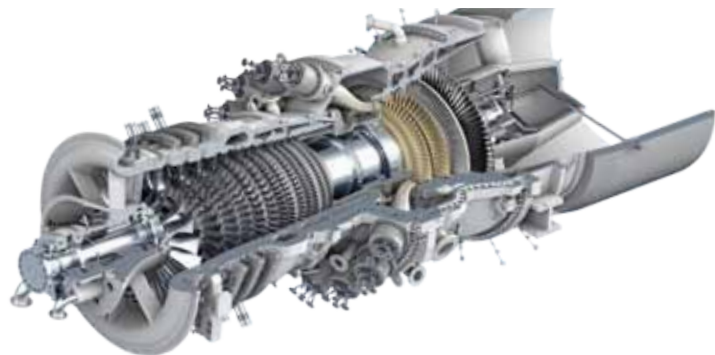
Today, around 370 turbines have been sold. The installed fleet has accumulated more than 11 million equivalent operating hours, with a fleet reliability of 99.2%.

References

- **Ras Al-Khair, Saudi Arabia**
Supply of gas turbine packages
Power output: 2,400 MW
Customer: Consortium comprising Al Arrab Contracting Company, Saudi Arabia and the Chinese Sep-coll Electric Power Construction Corporation
Scope: 12 × SGT6-5000F gas turbine packages
- **Marsh Landing, USA**
Power block for open cycle power plant
Power output: 720 MW
Customer: NRG Energy
Scope: SCC6-5000F with 4 × SGT6-5000F gas turbine packages



La Caridad, Sonora, Mexico



The SGT6-5000F offers world class reliability and best in class emission values



The SGT6-5000F is the first choice for reliable simple or combined cycle operation in the 60 Hz market

Power output: 242 MW

- Highest power output for 60 Hz F-class
- Fast start-up and load changing capabilities
- Low emissions with NO_x emissions of <9 ppm on gas and <25 ppm on oil

Simple cycle power generation	
Power output	242 MW
Fuel	Natural gas, LNG, syngas, ethane, propane, condensate, distillate oil, Arabian Super Light crude oil, Arabian Extra Light crude oil, biodiesel, alcohols, Jet-A oil, kerosene
Frequency	60 Hz
Gross efficiency	39.0%
Heat rate	9,230 kJ/kWh (8,748 Btu/kWh)
Turbine speed	3,600 rpm
Pressure ratio	18.9 : 1
Exhaust mass flow	576 kg/s (1,270 lb/s)
Exhaust temperature	600 °C (1,113 °F)
NO _x emissions	<9 ppmvd at 15% O ₂ on fuel gas (without water injection for NO _x control), <25 ppmvd at 15% O ₂ on fuel oil (with water injection for NO _x control) Gas turbine turn down in emissions compliance to 30% load. Fast start-up capable of generating 200 MW in 10 minutes from turning gear speed. Gas turbine ramp rate up to 40 MW/min.

Combined cycle power generation		
Siemens combined cycle power plant	1 × 1	2 × 1
Net plant power output	360 MW	725 MW
Net plant efficiency	58.1%	58.6%
Net heat rate	6,193 kJ/kWh (5,870 Btu/kWh)	6,138 kJ/kWh (5,817 Btu/kWh)
Number of gas turbines	1	2
Pressure/reheat	Triple/Yes	Triple/Yes

Physical dimensions	
Approx. weight	219,000 kg (482,000 lb)
Length	10.1 m (33 ft)
Width	4.0 m (13 ft)
Height	4.6 m (15 ft)

Combined cycle plant turn down in emissions compliance to 20% load.

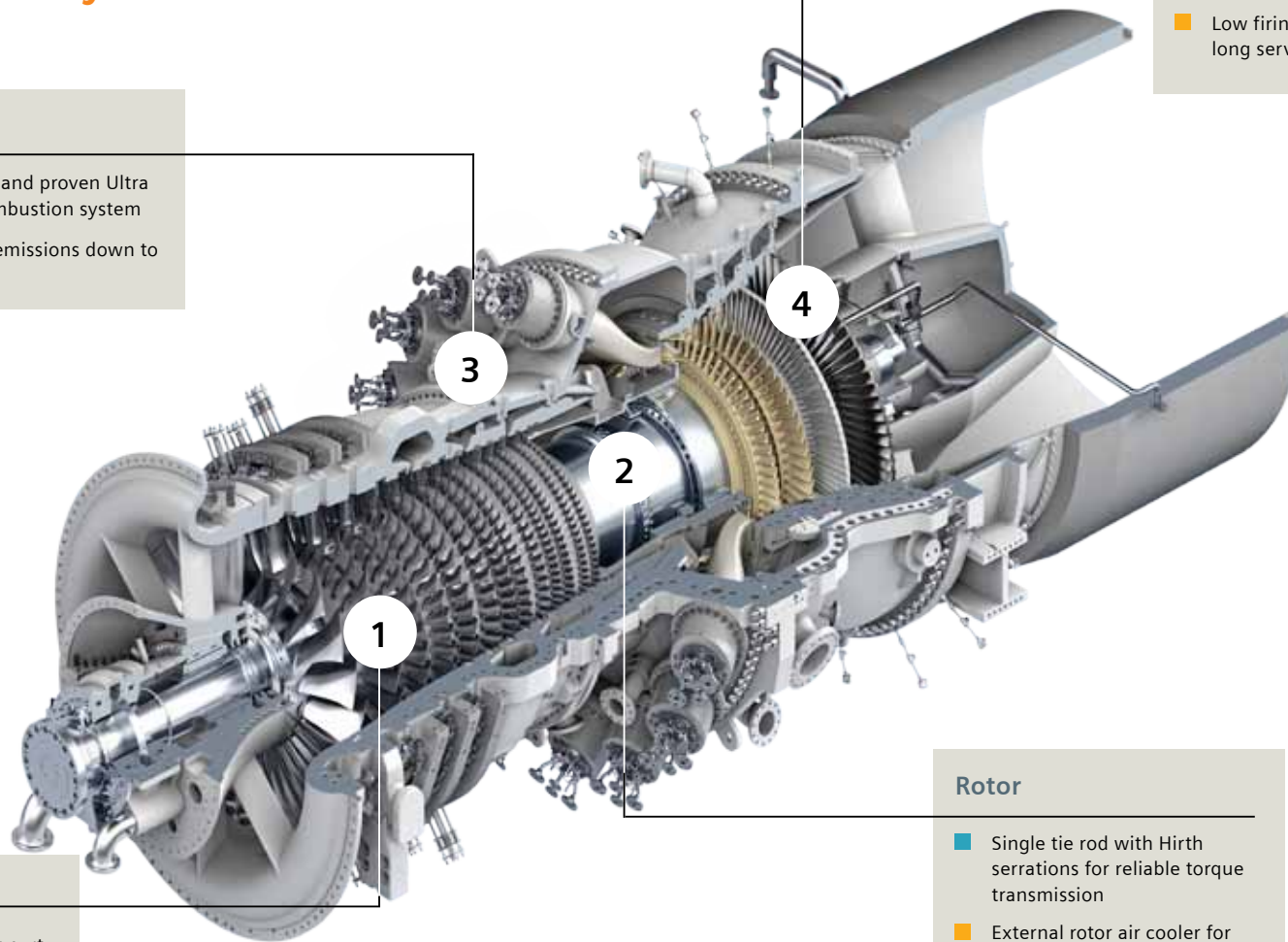
SGT6-5000F: Key features

Combustion

- Fuel flexible and proven Ultra Low NO_x combustion system
- Single digit emissions down to 30% load

Turbine

- Four stage turbine with proven conventionally cast turbine alloys
- Low firing temperature for long service intervals



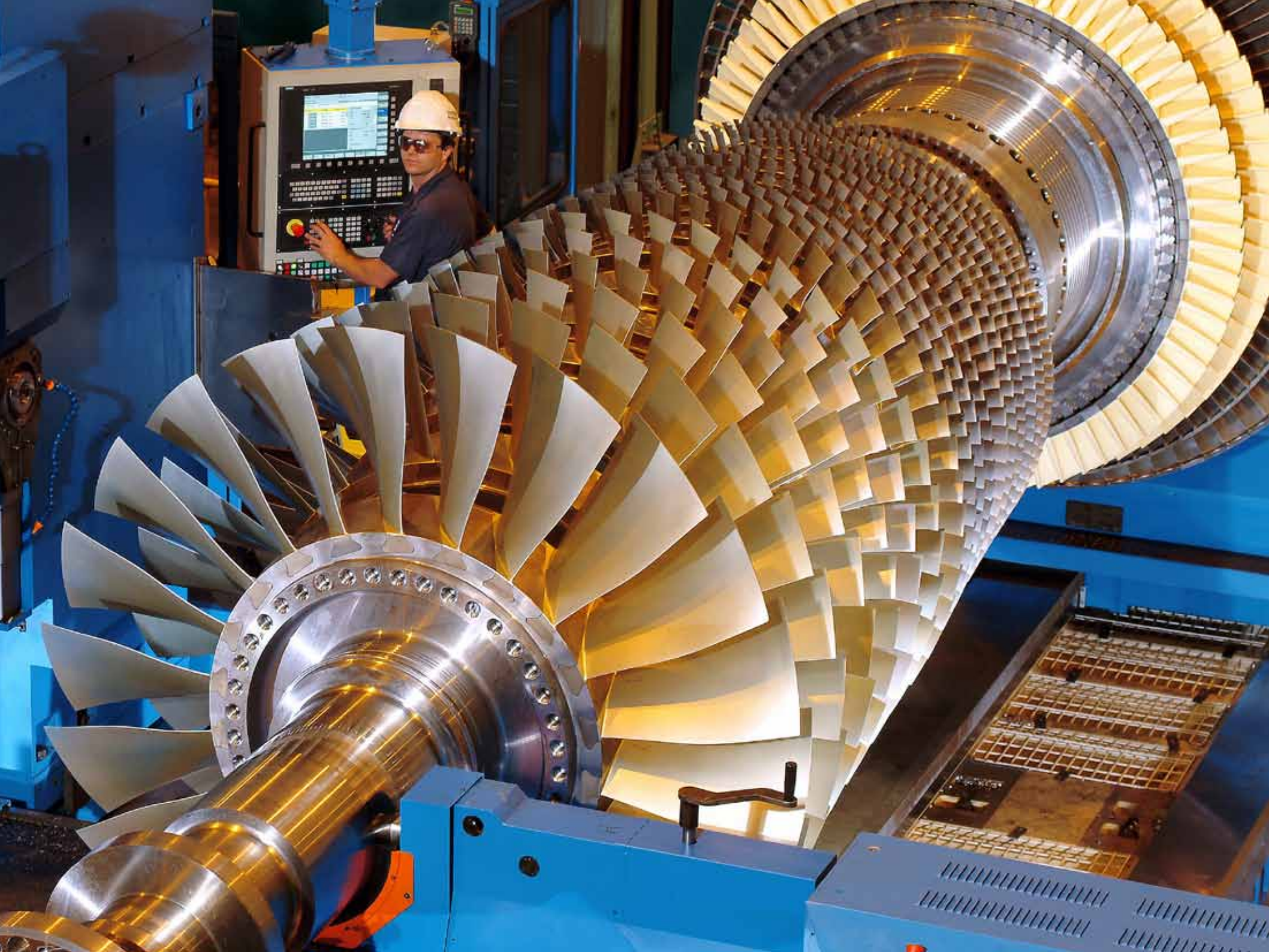
Compressor

- Variable guide vanes for part load efficiency and transient operation
- Blades and vanes removable without a rotor de-stack or lift

Rotor

- Single tie rod with Hirth serrations for reliable torque transmission
- External rotor air cooler for constant cooling air temperature across the ambient range

■ Flexibility ■ Performance ■ Serviceability



SGT5-2000E

Heavy-duty gas turbine

The SGT5-2000E gas turbine is a proven, robust engine for the 50 Hz market which is used in simple cycle or combined cycle processes with or without combined heat and power. It is suitable for all load ranges, including peak load.

The SGT5-2000E offers outstanding fuel flexibility. It can be fired with low calorific gases or gases containing CO₂, H₂S and N₂, as well as with crude oil and other liquid fuels with

high viscosity. It provides low NO_x emissions, even in the part load range.

Today, around 480 turbines have been sold (approx. 220 under license). Our installed fleet has accumulated more than 17 million equivalent operating hours. The SGT-2000E series fleet's overall best-in-class reliability exceeds 99%.

References

■ Braemar 2, Australia

Power block for open cycle power plant
Power output: 450 MW
Customer: ERM Power
Scope: 3 × SGT5-2000E gas turbine packages

■ Geregu 2, Nigeria

Turnkey open cycle power plant
Power output: 434 MW
Customer: Niger Delta Power Holding Company
Scope: 3 × SGT5-2000E gas turbine packages



Az-Zour, Kuwait



Best-in-class reliable technology; robust and flexible performance



Service-friendly design and customer-focused maintenance intervals help to keep life cycle costs down

Power output: 187 MW

- Best-in-class reliability
- High operational and fuel flexibility
- Easy maintenance

Simple cycle power generation	
Power output	187 MW
Fuel	Natural gas, LNG, syngas, blast furnace gas, biogas, ethane, propane, condensate, distillate oil, heavy and crude oils, bio-diesel, alcohols, naphtha, kerosene
Frequency	50 Hz
Gross efficiency	36.2%
Heat rate	9,945 kJ/kWh (9,427 Btu/kWh)
Turbine speed	3,000 rpm
Pressure ratio	12.1 : 1
Exhaust mass flow	558 kg/s (1,230 lb/s)
Exhaust temperature	536 °C (997 °F)
NO _x emissions	< 25 ppmvd at 15% O ₂ on fuel gas (without water injection for NO _x control), < 42 ppmvd at 15% O ₂ on fuel oil (with water injection for NO _x control)

Combined cycle power generation		
Siemens combined cycle power plant	1 × 1	2 × 1
Net plant power output	275 MW	551 MW
Net plant efficiency	53.3%	53.3%
Net heat rate	6,755 kJ/kWh (6,403 Btu/kWh)	6,755 kJ/kWh (6,403 Btu/kWh)
Number of gas turbines	1	2
Pressure/reheat	Dual/No	Dual/No

Physical dimensions	
Approx. weight	189,000 kg (417,000 lb)
Length	10.3 m (34 ft)
Width	4.0 m (13 ft)
Height	4.0 m (13 ft)

SGT6-2000E

Heavy-duty gas turbine

The SGT6-2000E gas turbine is a proven, robust engine for the 60 Hz market which is used in simple cycle or combined cycle processes with or without combined heat and power supply. It is suitable for all load ranges, including peak load. The SGT6-2000E offers outstanding fuel flexibility.

It can be fired with low calorific gases or gases containing CO₂, H₂S and N₂, as well as with crude oil and other liquid

fuels with high viscosity. It provides low NO_x emissions, even in the part load range.

Today, around 110 turbines have been sold, resulting in a fleet experience of nearly 7 million equivalent operating hours. The SGT-2000E series fleet's overall best-in-class reliability constantly exceeds 99%.

References

■ Hsinta, Taiwan

Combined cycle power plant
Power output: 2,200 MW
Customer: Taiwan Power Company
Scope: 5 × SCC6-2000E 3 × 1 with
15 × SGT6-2000E gas turbine
packages

■ Shoiba, Saudi Arabia

Most powerful and efficient crude
oil plant in the world
Power output: 1,200 MW
Customer: Saudi Electricity Company
Scope: 2 × SCC6-2000E 5 × 1 with
10 × SGT6-2000E gas turbine
packages



Charles D. Lamb Energy Center, Oklahoma, USA



Two accessible silo combustion chambers for easy maintenance; ceramic tiles can be replaced individually



Variable inlet guide vanes (IGV); all rotating blades replaceable without rotor de-stack or lift



Excellent start-up and part load behavior, at 30 MW/min ramp rate

Power output: 116 MW

- Best-in-class reliability
- High operational and fuel flexibility
- Easy maintenance

Simple cycle power generation

Power output	116 MW
Fuel	Natural gas, LNG, syngas, blast furnace gas, biogas, ethane, propane, condensate, distillate oil, heavy and crude oils, bio-diesel, alcohols, naphtha, kerosene
Frequency	60 Hz
Gross efficiency	34.3%
Heat rate	10,496 kJ/kWh (9,949 Btu/kWh)
Turbine speed	3,600 rpm
Pressure ratio	12.1 : 1
Exhaust mass flow	367 kg/s (809 lb/s)
Exhaust temperature	537 °C (999 °F)
NO _x emissions	< 25 ppmvd at 15% O ₂ on fuel gas (without water injection for NO _x control), < 42 ppmvd at 15% O ₂ on fuel oil (with water injection for NO _x control)

Combined cycle power generation

Siemens combined cycle power plant	1 × 1	2 × 1
Net plant power output	171 MW	342 MW
Net plant efficiency	51.3%	52.0%
Net heat rate	7,018 kJ/kWh (6,651 Btu/kWh)	6,923 kJ/kWh (6,561 Btu/kWh)
Number of gas turbines	1	2
Pressure/reheat	Dual/No	Dual/No

Physical dimensions

Approx. weight	108,000 kg (239,000 lb)
Length	9.1 m (30 ft)
Width	3.3 m (11 ft)
Height	3.3 m (11 ft)

SGT-2000E series: Key features

Combustion

- Full fuel flexibility, ranging from heavy fuel oil to low calorific gases
- Two easily accessible silo combustion chambers for fast maintenance
- Lining with ceramic tiles which can be replaced individually

Rotor and Bearings

- Transient protection of clearances for reduced degradation with Hydraulic Clearance Optimization (HCO) active clearance control
- Light-weight, highly rigid design with excellent start-up performance
- Built disc-type rotor with radial Hirth serrations and one central tie rod, rotor de-stacking on-site

Compressor

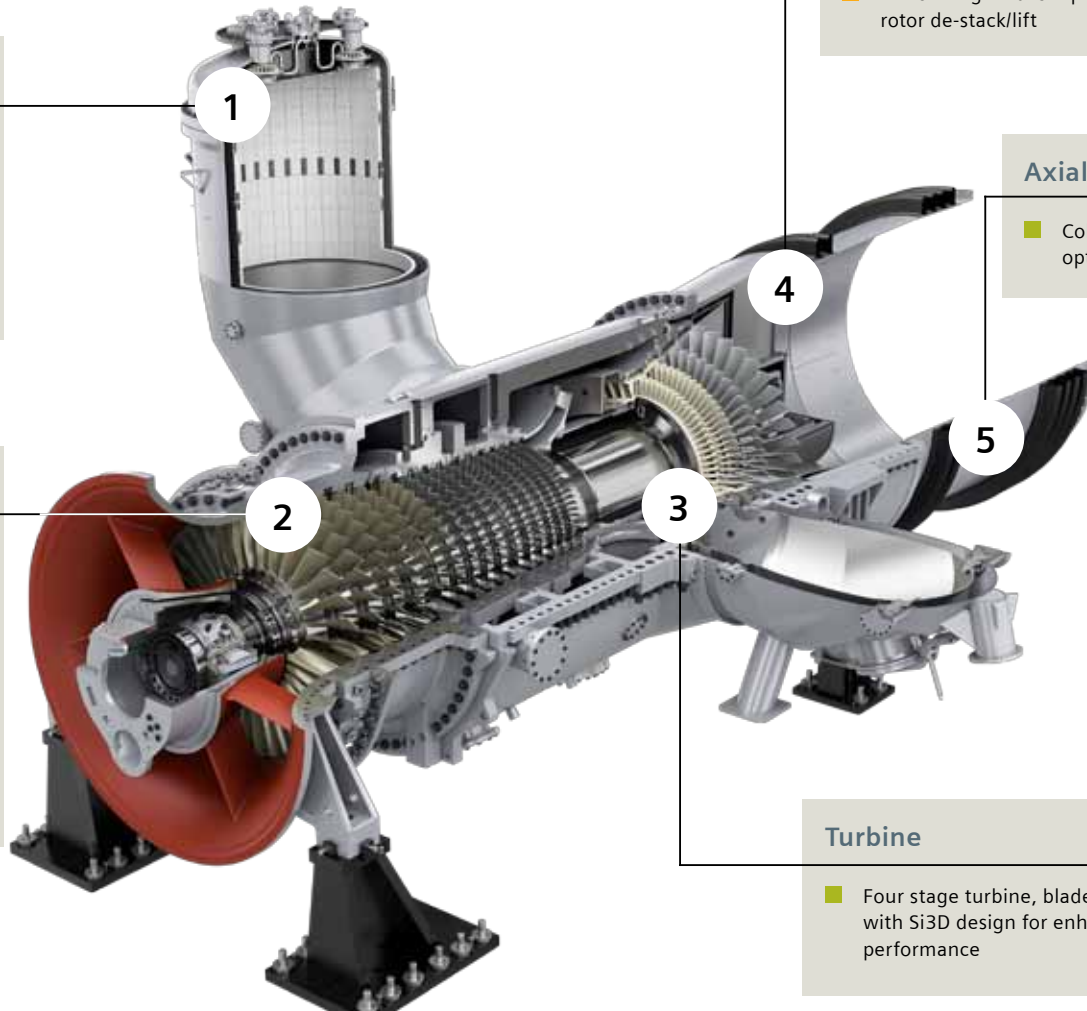
- Emission-compliant operation down to 45% at constant exhaust temperature
- Fast-acting variable inlet guide vanes for grid frequency stabilization
- All rotating blades replaceable without rotor de-stack/lift

Axial Exhaust

- Cold end generator drive for optimal flow pattern

Turbine

- Four stage turbine, blades and vanes with Si3D design for enhanced performance



■ Flexibility ■ Performance ■ Serviceability



The End

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