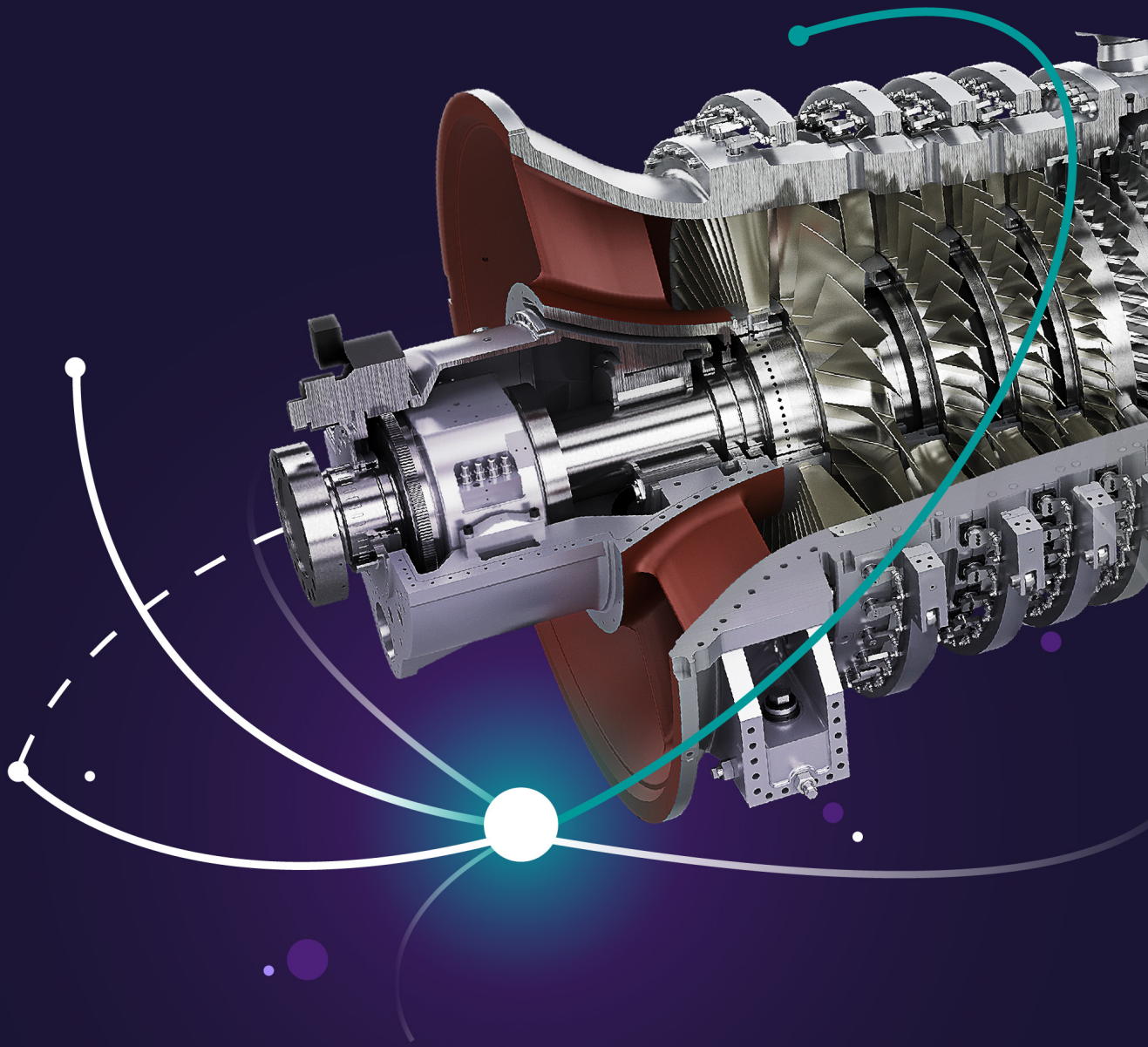
SIEMENS energy

SGT5-8000H modernization portfolio

A highly efficient and flexible gas turbine



SGT-8000H series

Our extensive operating experience has yielded

Excellent operational flexibility

Powerful gas turbine for highly efficient combined cycle applications

Excellent serviceability and easy maintenance

Outstanding fast start and hot restart capability

High efficiency

Enabling reliable, affordable & sustainable energy

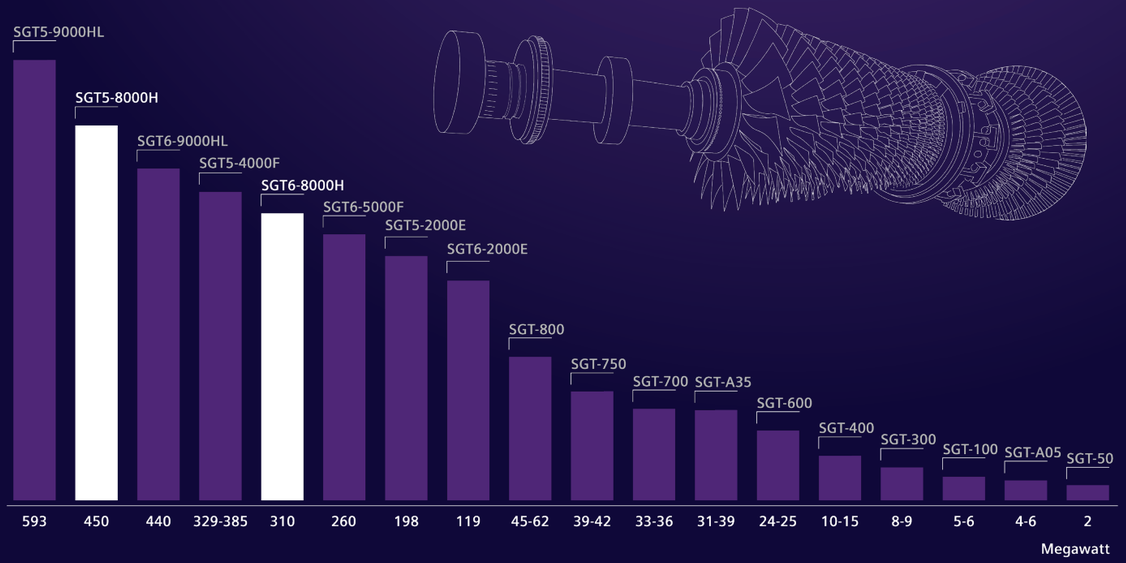


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Your success is our top priority.

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01 Frame evolution

Continuous & ongoing development

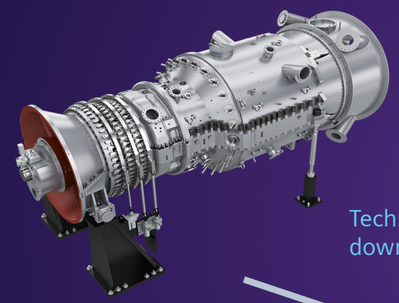
The SGT-8000H design concept is primarily based on the proven features of its predecessor gas turbines, particularly the SGT5-4000F and SGT6-5000F models. It was developed to achieve the highest efficiency by incorporating the best design features from both. It was validated through a comprehensive test program at the Siemens Energy testing facility in Berlin, as well as demanding prototype testing at the Irsching power plant in Germany.

The SGT5-8000H gas turbine commenced its first operation in 2009. The evolution from the ring combustion system to the can-annular technology in the SGT5-8000H turbine design enhances operational flexibility, improves fuel efficiency, and reduces emissions by allowing for better temperature control and more uniform combustion, ultimately leading to increased overall performance and reliability.

Potential for technology download is given by latest frame developments

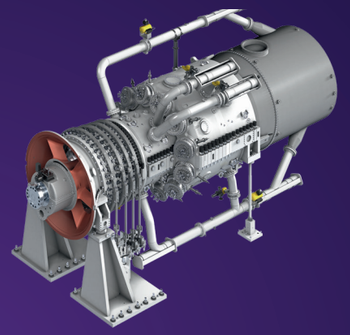


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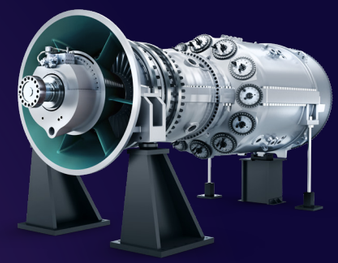
Technology download

4000F



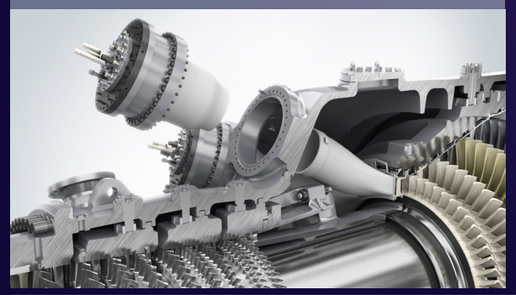
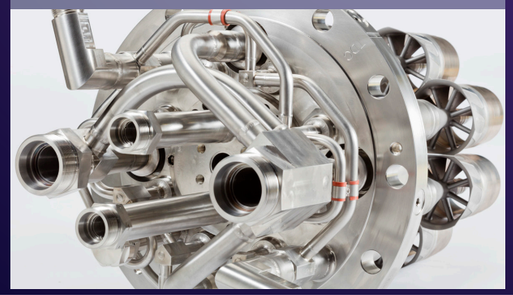
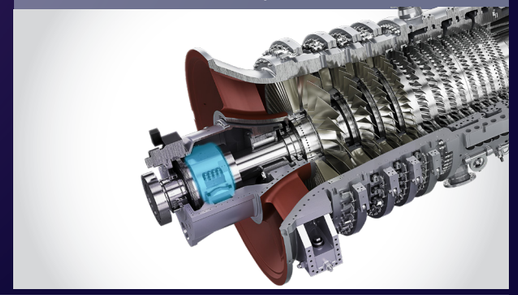
Technology download

8000H



9000HL

Based on technology experience

Advanced combustion system	Advanced burner design	Removable blades design	Advanced hydraulic clearance optimization
			

8000H features

02 Gas turbine development

The SGT5-8000H delivers outstanding performance and exceptional operational flexibility. This air-cooled turbine generates a power output of 450 MW. With short start-up times and the ability to handle high load variations, the turbine ensures low lifecycle costs and effectively meets fluctuating power demands.

The turbine serves as the core component of highly efficient gas-fired power plants, designed to produce 675 MW with an efficiency exceeding 62% in combined cycle operation.

With more than 4 million fired fleet hours, the SGT-8000H series provides mature technology with verified reliability and availability.

- Outstanding performance
- High operational flexibility
- Proven in commercial operations
- H_2- ready

- Increased TIT capability (TCLA improvement)
- Improved combustion

- Scaled design from 60 Hz

- Enhanced compressor airflow
- Increased TIT capability (TCLA improvement)
- Improved combustion
- Efficiency improvement

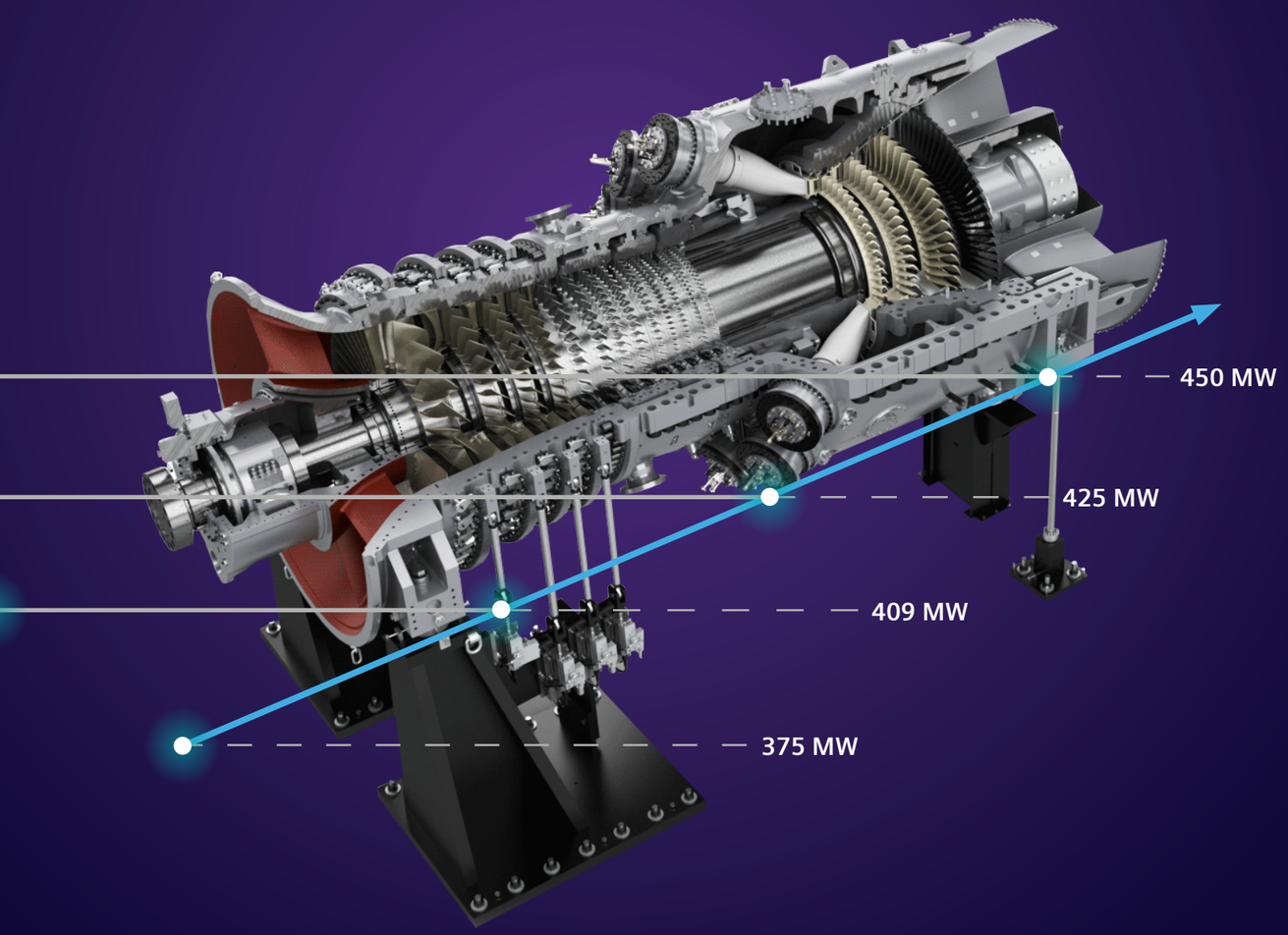
TIT = Turbine inlet temperature
TCLA = Turbine cooling and leakage air
DLE = Dry low emission

SGT5-8000H
55 units
installed worldwide

fuel can contain up to
30%
hydrogen (by volume) with DLE burner

more than
4.000.000
fired fleet hours with H-class gas turbines

62%
combined cycle efficiency



SGT5-8000H: Performance data for simple cycle power generation

Power output	450 MW
Fuel (examples)	Natural gas, LNG, sour gases, distillate oil, biodiesel, Arabian Super Light crude oil (ASL), kerosene, jet fuel, condensate, other fuels on request
Frequency	50 Hz
Gross efficiency	41.2%
Heat rate	8,740 kJ/kWh (8,284 Btu/kWh)
Turbine speed	3,000 rpm
Pressure ratio	21.0 : 1
Exhaust mass flow	935 kg/s (2,061 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)

SGT5-8000H: Performance data for combined cycle power generation

Siemens combined cycle power plant	SCC5-8000H 1S / 1x1	SCC5-8000H 2x1
Gross plant power output	675 MW	1,350 MW
Gross plant efficiency	62.4%	62.4%
Gross plant heat rate	5,770 kJ/kWh (5,469 Btu/kWh)	5,770 kJ/kWh (5,469 Btu/kWh)
Number of gas turbines	1	2
Pressure/reheat	Triple/Yes	Triple/Yes

Rotor

- Proven rotor design with internal cooling air passages for outstanding fast (cold) start and hot restart capability
- Rotor de-stacking on site possible due to disc assembly with Hirth serration and central tie rod

Compressor

- Variable inlet guide vanes and three stages of fast acting variable-pitch guide vanes (VGV) for improved part load efficiency and high load transients
- High efficiency due to evolutionary 3D blading
- All rotating compressor blades replaceable without rotor lift or rotor de-stacking

Bearing

- Active clearance control with Hydraulic Clearance Optimization (HCO) for reduced degradation and clearance losses



Combustion

- Advanced can annular combustion system

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 & 4 replaceable without cover lift

Flexibility Performance Serviceability

Enabling reliable, affordable & sustainable energy

Highest efficiency

- In combined cycle operation, the SGT5-8000H gas turbine provides a power output up to 675 MW and an efficiency exceeding 62%.



Efficiency

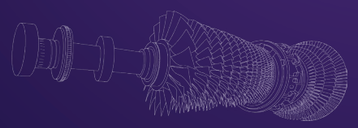
Operational flexibility

- The gas turbine is capable of outstanding fast starts due to its light and stiff rotor with internal cooling air passages, advanced can-annular combustion system, and Hydraulic Clearance Optimization (HCO) active clearance control. Combined cycle base load can be achieved within 30 minutes for hot starts.
- Four stages of fast-acting Variable-pitch Guide Vanes (VGV) provide optimized performance over a wide range of operating conditions, improved part-load efficiency, low part-load emissions, and high load transients.

Combined cycle base load within **30 minutes** (applies for hot starts)

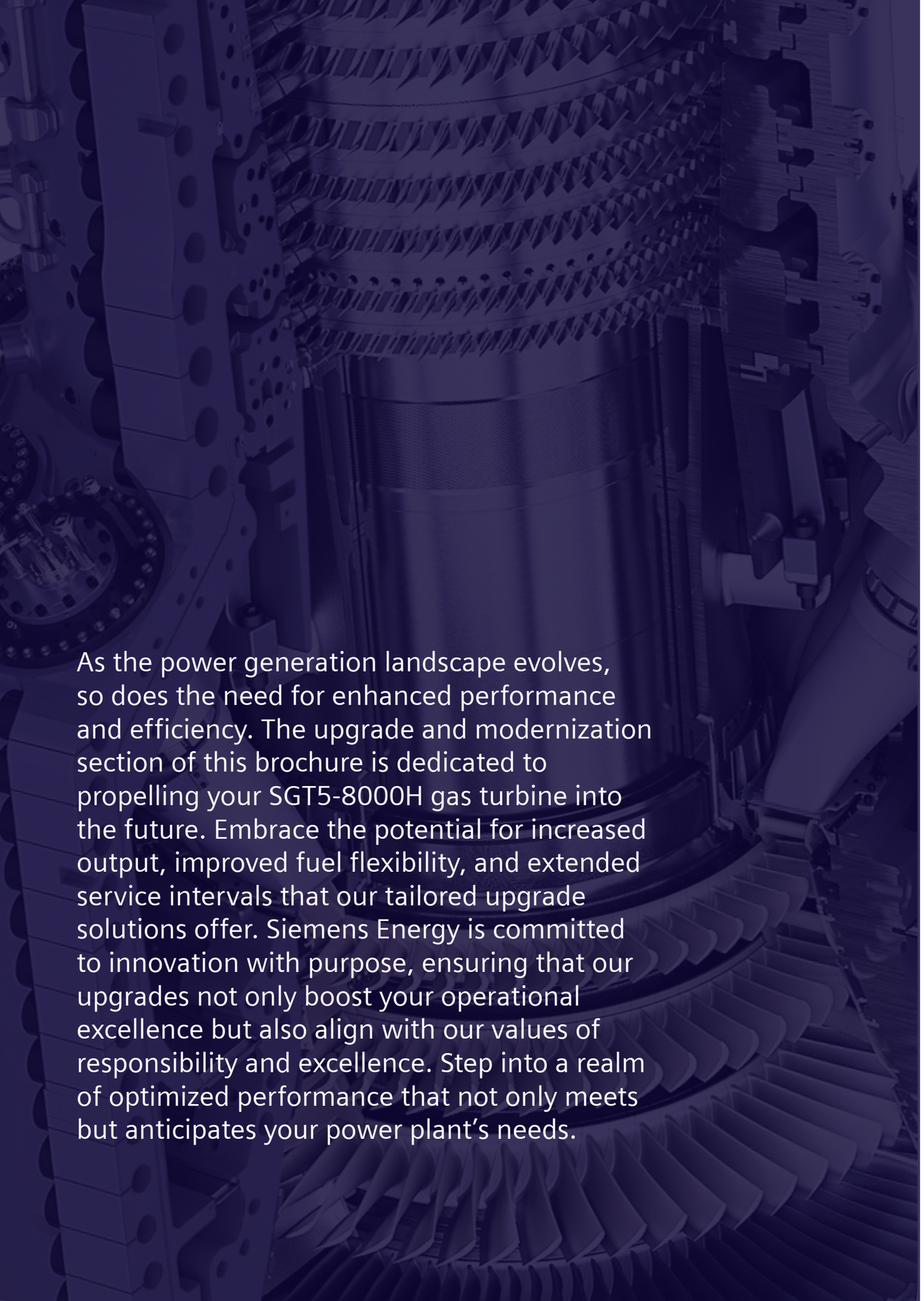
Excellent serviceability

- The SGT5-8000H is optimized for short outages. Due to the robust advanced service technology the combustion system can be serviced in a smooth and efficient way.
- On-site rotor maintenance, including rotor de-stacking and balancing, eliminates the need for a spare rotor as well as transport costs for workshop maintenance. All compressor blades are replaceable without rotor de-stack or lift.



Optimized outage time





As the power generation landscape evolves, so does the need for enhanced performance and efficiency. The upgrade and modernization section of this brochure is dedicated to propelling your SGT5-8000H gas turbine into the future. Embrace the potential for increased output, improved fuel flexibility, and extended service intervals that our tailored upgrade solutions offer. Siemens Energy is committed to innovation with purpose, ensuring that our upgrades not only boost your operational excellence but also align with our values of responsibility and excellence. Step into a realm of optimized performance that not only meets but anticipates your power plant's needs.

03 Modernization & upgrade solutions

The SGT5-8000H modernization product portfolio is categorized under the following market drivers:

Power & efficiency increase

- Service Package 1.6
- Service Package 1.6 (Partial Upgrade)
- GT Auto Tuner
- Power augmentation

Sustainability

- H_2 co-firing (~30% vol)
- Compressor Monitoring (CCPM)

Serviceability

- Power Diagnostics® Services (PDS)
- Service programs

Operational flexibility

- Advanced operational flexibility
- Load gradient optimization

Power & efficiency increase

Our solution

The Service Package 1.6 is applicable to the SGT5-8000H (1.2 & 1.3) gas turbine fleet. This package is designed to improve gas turbine performance (power & efficiency) and potentially reduce CO_2 emissions per generated megawatt hour (MWh) at base load.

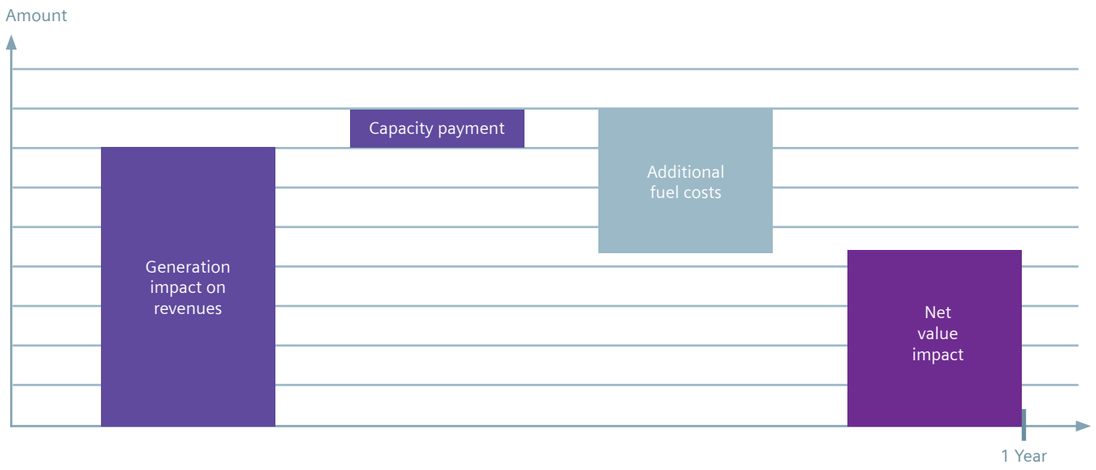
This upgrade targets power plants that seek extra generation or an overall plant capacity re-rate, especially at elevated ambient temperatures. For power increase targeted at lower ambient temperatures (below 20°C), the Service Package 1.6 (Partial Upgrade) is available requiring less hardware.

Economic value

For the full upgrade (Service Package 1.6), the power output for a combined cycle (with a 1x1 configuration) can reach up to 36 MW additional plant capacity and 288,000 MWh additional generation annually.

With 8,000 operational hours per year and a power price of €80/MWh, this could potentially yield up to €23 million in additional revenue annually. In a capacity-favorable market, the potential for incremental revenue may be even higher.

Actual values are ambient and site dependent and are subject to engineering evaluation. Site specific results may vary scope.



The typical features of the Service Package 1.6 (Partial Upgrade) are as follows:

Technical background

The Service Package 1.6 (Partial Upgrade) is a technology download from Siemens Energy's latest SGT5-8000H design of the combustion and turbine section that allows to improve performance. Thus, the Service Package 1.6 (Partial Upgrade) can be implemented during a hot gas path inspection.

Enhanced Platform Combustion System

Enhancements to the Platform Combustion System (PCS) are designed to help enable stable emission combustion at the advanced operating conditions. The combustion system upgrade may include:

- Support housings
- Baskets
- Transitions
- Seals

Turbine

Turbine stage 1 to stage 3 have been enhanced with new cooling concept and coating modifications which are designed to increase robustness of these components.
Turbine stage 4 airfoils have been aerodynamically optimized.

Secondary air system

Modification of the secondary air system will accommodate changed cooling air needs of the turbine.

A site-specific engineering evaluation is necessary to define the final upgrade scope. All values presented on this page are dependent on ambient conditions and site characteristics, and are subject to thorough engineering assessment. Results may vary based on specific site conditions, and IGV positioning and unit-specific restrictions may apply.

Power increase up to	Efficiency improvement up to	Power Limit Increase (PLI) up to	CO_2 reduction
+ 26 MW	**+ 0.3%-pts**	**+ 20 MW**	**- 4 kg CO_2**
Gas turbine in simple cycle for additional generation	efficiency improvement in simple cycle	Gas turbine during off-ambient (cold) temperatures	per MWh reduction in simple cycle base load operation

The typical features of the Service Package 1.6 are as follows:

Compressor section

Advanced 3D blades and vanes airfoils are designed to deliver increased compressor mass flow. The compressor upgrade may include:

- Compressor blades (stages 1-5) (1.3 baseline)
- Inlet guide vane
- Variable guide vanes (stages 1-3)
- Compressor stator rings (stages 4-13)

Turbine

Turbine stage 1 to stage 3 have been enhanced with new cooling concept and coating modifications, which are designed to increase robustness of these components.

Turbine stage 4 airfoils have been aerodynamically optimized for the increased mass flow of the compressor upgrade.

Power Limit Increase (PLI) up to

+ 20 MW

Gas turbine during off-ambient (cold) temperatures

Efficiency improvement up to

+ 0.4%-pts

efficiency improvement in simple cycle

Power increase up to

+ 36 MW

Gas turbine in SC for additional generation

CO_2 reduction

- 5 Kg CO_2

MWh reduction in simple cycle base load operation

Enhanced platform combustion system

Enhancements to the Platform Combustion System (PCS) are designed to help enable stable emission combustion at the advanced operating conditions. The combustion system upgrade may include:

- Support housings
- Baskets
- Transitions
- Seals

Secondary air system

Modification of the secondary air system will accommodate changed cooling air needs of the turbine.

Rotor

To accommodate for higher compressor pressure ratio and exit temperature as a result of the higher mass flow, the rotor needs to be checked for temperature capability and may require material upgrade. This typically will be applicable to the following components:

- Compressor disc 12 and 13
- Torque disc 1 to 3
- Turbine disc 3, 4 and rear hollow shaft

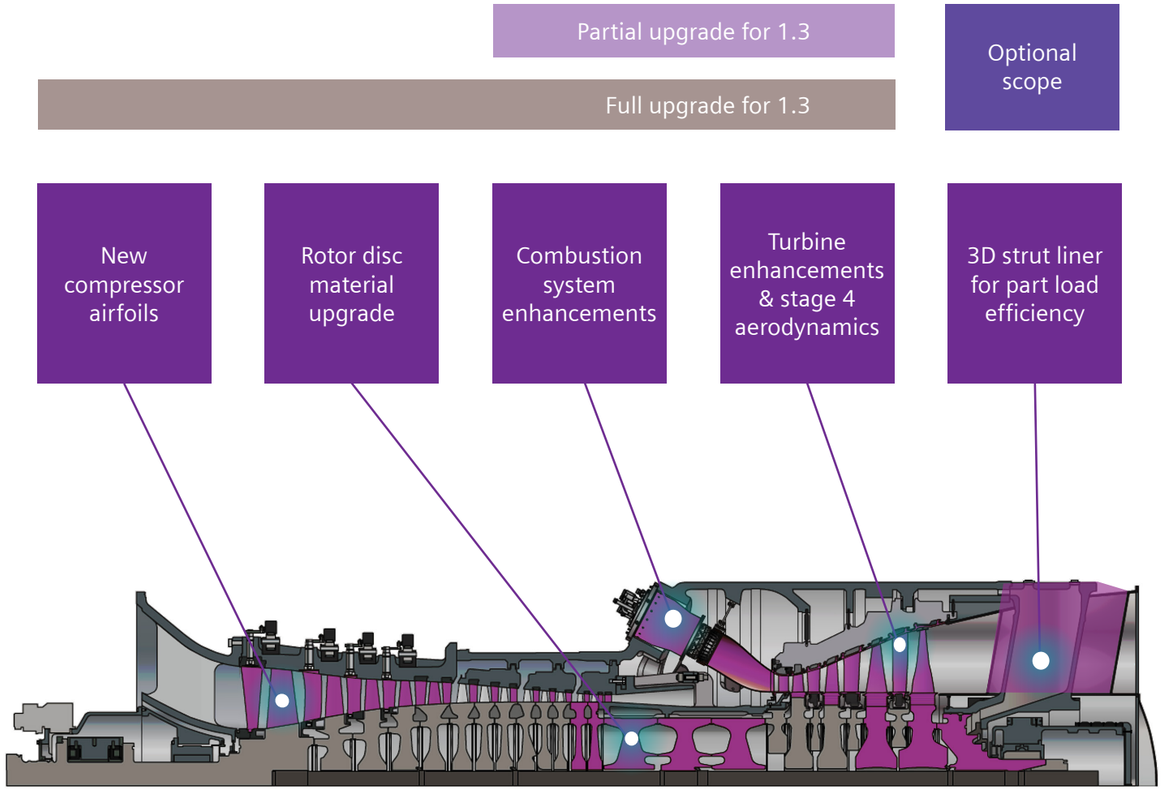
A site-specific engineering evaluation is necessary to define the final upgrade scope. All values presented on this page are dependent on ambient conditions and site characteristics, and are subject to thorough engineering assessment. Results may vary based on specific site conditions, and IGV positioning and unit-specific restrictions may apply.

Optional scope

- Inlet guide vane position may be adjusted to allow for higher mass flow and maximum benefit
- The Turbine Exhaust Casing (TEC) can be upgraded to an aerodynamically improved profile. A new 3D design has been developed for the liner of 5 struts that is intended to improve diffusor efficiency in part load operation

Other related Siemens Energy products could be considered depending on plant needs such as:

- Power augmentation for peaking power at base load and high ambient temperatures above 10°C
- Compressor Condition Performance Monitoring (CCPM)
- Gas turbine Auto Tuner is a solution for gas turbines designed to compensate for power degradation (performance recovery) and optimize the NO_x emissions and combustor dynamics



Power & efficiency increase

Increased performance due to reduced degradation by using a thermal Digital Twin

Lower base load NO_x emissions using artificial intelligence

Intended benefits

The GT Auto Tuner significantly compensates for degradation using controllers that leverage a thermal digital twin and artificial intelligence, allowing power plants to:

- Increase electricity revenues at base load
- Reduce NO_x emissions

Power

- Power output

Sustainability

- Carbon footprint

Scope

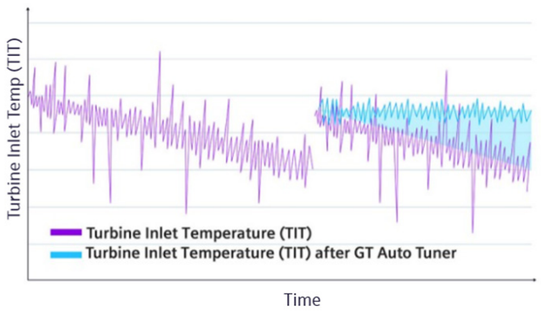
GT Auto Tuner contains two modules:

- Performance module for continuous significant degradation recovery
- Emissions module for base load NO_x optimization by adaptation of gas turbine fuel distribution

The scope includes:

- Server, interface to control system* software
- Performance module and/or
- Emissions module and
- Additional instrumentation*

*Exact scope is site specific





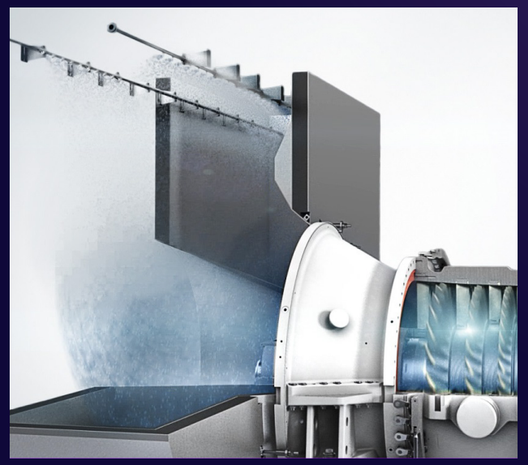
Power & efficiency increase

Service Package 1.6 (Partial upgrade) | Service Package 1.6 | GT Auto Tuner | **Power augmentation**

On-demand power upgrade throughout broad range of ambient conditions

Siemens Energy's power augmentation upgrades are designed to help customers maximize power plant revenue in capacity markets, peak markets, and hot ambient environments. These upgrades are proven methods to generate additional power during base load operations. They can help capitalize on high peak electricity prices and to compensate for lower power during hot ambient conditions.

The upgrades increase gas turbine power output above base load by reducing compressor inlet temperature, thus increasing the mass flow through the engine. Wet compression in addition adds intercooling of the air mass flow within the compressor section that further increases gas turbine efficiency.



Evaporative cooler
is situated upstream outside of the filter house. The inlet air is saturated by natural evaporation. Creation of droplets as a result of over-saturation is impossible.

Inlet fogging
systems spray water into the air flow for evaporation. Siemens Energy standard is to add the spray directly behind the air filter in order to avoid wetting and clogging of the filters and resulting increased permanent pressure drop and related performance loss during operation. The Siemens Energy design also ensures that all water evaporates on its way to the compressor, so overspray does not harm the gas turbine.

Wet compression
systems spray water directly into the gas turbine compressor inlet and work with controlled overspray. Evaporation of the overspray and resulting cooling of the airflow within the compressor improves the thermodynamic efficiency of the compressor section. Adjusting the water quantity allows generating „power on demand". Additional compressor coating prevent harm to the gas turbine as well as sensors and integration of these into the gas turbine I&C system with advanced operational settings.

Evaporative cooler

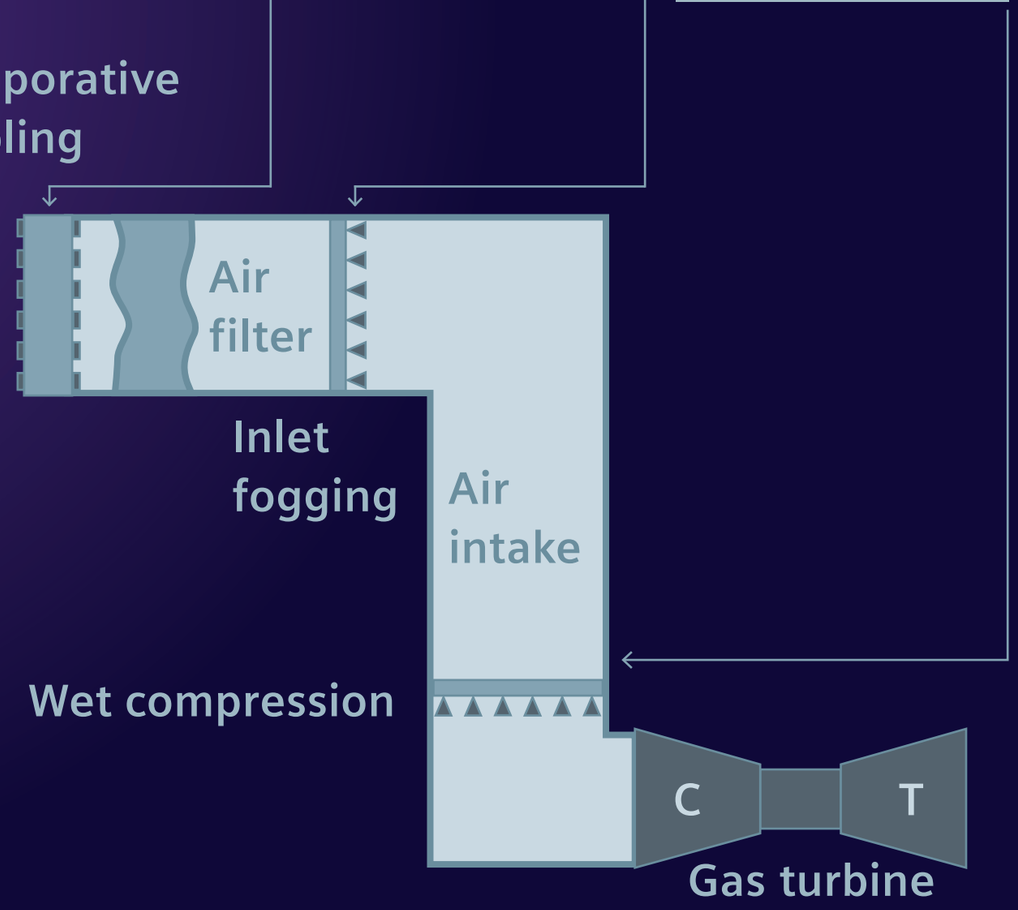
Advantages
+ Up to 15% power increase at 0% ambient humidity
+ Higher effectiveness of adiabatic cooling
+ No demin water required

Inlet fogging

Advantages
+ Up to 15% power increase at 0% ambient humidity
+ Easy to install
+ Easy to maintain

Wet compression (WetC)

Advantages
+ Up to 15% power increase
+ Power increase independent of ambient conditions
+ Higher effectiveness of adiabatic cooling
+ Can be combined with other cooling solutions such as EVAP/Upstream to gain more power



Sustainability

H_2 co-firing (~30% vol) | Compressor Monitoring (CCPM)

Intended benefits

Reduction of carbon footprint

Co-firing of hydrogen is one path to reduce CO_2 emissions in fossil power generation by reducing consumption of natural gas. Due to the difference in molar mass and heating value between methane and hydrogen the relationship between percentage volume of hydrogen savings of CO_2 and natural gas is not linear.

Co-firing 15%vol H_2 would reduce the natural gas consumption and related CO_2 emissions by approximately 5%, while 30%vol H_2 would lead to a CO_2 reduction of approximately 11%. For a combined cycle plant with an efficiency of 60%, 15%vol H_2 would result in a reduction of specific CO_2 emissions from approximately 330kg/MWh to approximately 314kg/MWh, respectively 295kg/MWh for 30%vol H_2.

Hydrogen readiness

The capability to operate with hydrogen may be of significant value, even if there may be still no hydrogen available. Societies have clear expectations towards decarbonization, and investors increasingly require adherence to Environmental, Social, and Governance (ESG) standards. In such an environment, investments in existing fossil assets may only be approved with a perspective of CO_2 reduction. Hydrogen readiness potentially provides such perspective. The special properties of hydrogen mainly require modifications to combustion, fuel forwarding system and protection concepts to fulfill a hydrogen readiness requirement.

Service Package 1.6

By adding a H_2 co-firing capability to the Service Package 1.6 power- and efficiency upgrade, synergies can be leveraged, especially if new burners are required for V1.6 upgrade.

Up to 183,000t annual CO_2 reduction
Up to 920 GWh natural gas savings per year

*30%vol H_2 co-firing at combined cycle 1x1, 630 MW, 8000 OH/year, 60% efficiency

H_2 gas turbines have the potential to play an important role in future energy systems.
Competitivity of the technology includes factors such as:

- **Availability and cost of H_2**
- **Cost of natural gas**
- **CO_2 certificate prices or taxes**

Compressor Condition Index (CCI)

Intended benefits

- Preventing consequential damage through early damage detection and potential automated engine shutdown
- Potential savings in repair
- Increased plant availability

Scope

- Additional instrumentation & I&C update

Sectoral Efficiency Monitoring (SEM)

Intended benefits

- Compressor degradation monitoring
- Recommendation for compressor washing, instead of rigid cycles
- Enhancement of efficiency degradation by compressor washing

Scope

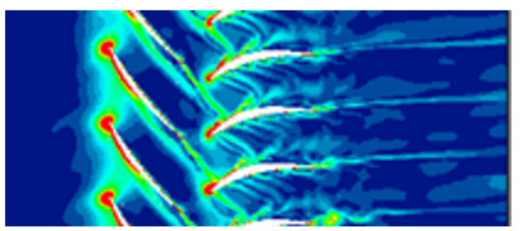
- Additional sensors at compressor casing
- Monitoring & analysis via Power Diagnostics® center

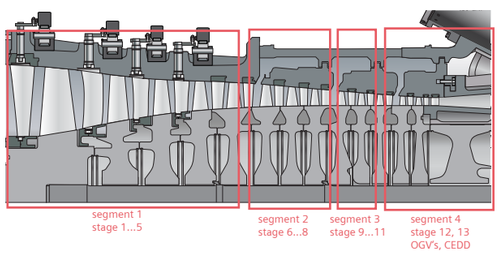
Reliability
- Operational reliability

Availability
- Avoid compressor consequential damage

Cost optimization
- Operating expense
- Part life

Frequency domain method





Serviceability of SGT-8000H

Power Diagnostics® Services (PDS) | Service programs

Outstanding maintainability

In times of widely fluctuating energy prices, market instability, and a highly competitive environment, Siemens Energy remains a consistent and reliable partner. Highly qualified power plant engineers, technicians, and service specialists are at work all over the world keeping our technology running. The SGT-8000H series is designed for outstanding serviceability. All blades are designed to be removable without rotor lift. To make inspections more comfortable, stage 1 vanes as well as stage 1 and 4 blades are removable without cover lift. Also a large number of special tools, e.g. for combustor removal and handling, are available for efficient maintenance and reduced scheduled down time throughout the lifecycle. Optimized outage times mean higher reliability and availability.

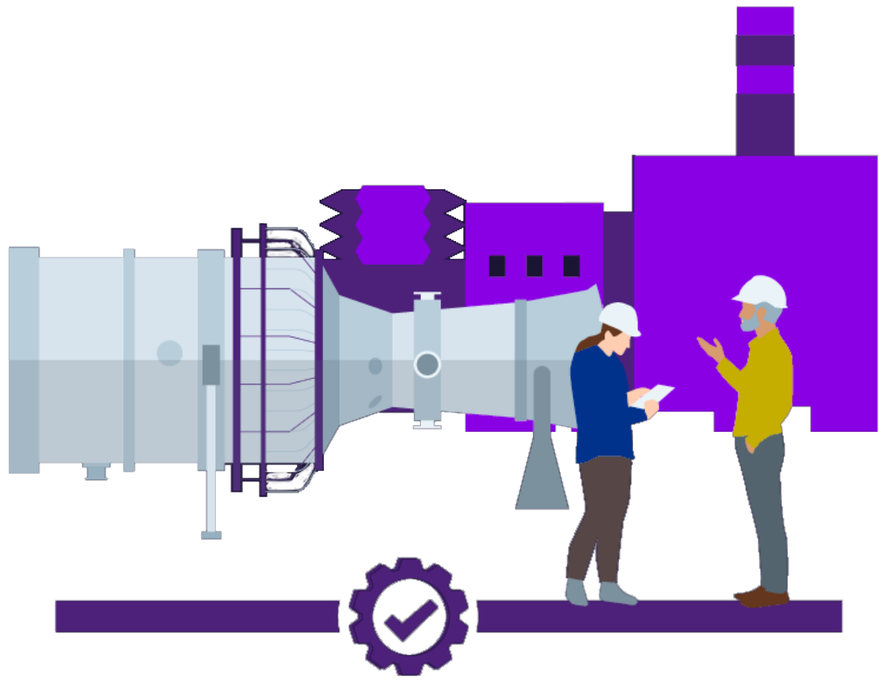
Continuous improvements

Our customized performance enhancement programs help prepare power plants for tomorrow and beyond. Many options for power increase are available e.g. increasing the gas turbine's firing temperature or upgrading the power train including boiler, generator and steam turbine. In parallel, the services to all these assets are being continuously improved and new servicing technologies are being developed. This is to maximize the benefits of the plant investments. And Siemens Energy will continue to develop and implement complex new power plant technologies, services and solutions to define milestones in advanced technology.

Every step matters

A service contract is the best way to plan ahead and to support your target achievement. Siemens Energy provides programs to ensure highest power output as well as outstanding plant availability with state-of-the-art service solutions.

We offer customized service options based on large service fleet experience including preventive maintenance, scheduled inspections, replacement part programs, on-site support and much more.



SGT-8000H modernization & upgrades mission

Siemens Energy modernizations & upgrades developments mission:

- Maximize competitiveness of fleet units by introducing modernizations & upgrades based on customer needs
- This is done by an integrated product development strategy frame family approach SGT5-8000H / SGT6-8000H
- Customer driven upgrades enhance new apparatus version

Key benefits of SGT-8000H

- High efficiency (up to 41% SC, >62% CC)



- Fast start-up capability, high operational flexibility
- Low lifecycle costs
- High reliability and availability
- High serviceability
- Reduced emissions per kWh
- High efficiency and low emission also in part-load operation
- Future fit: capable of burning up to 30% hydrogen



Siemens Energy provides a holistic approach to maintain and enhance your operations, ensuring optimized efficiency, reliability, and availability.



Other services (e.g. Power Diagnostics® Service, unscheduled maintenance service)

With a dedicated program management service in place you benefit from a single point of contact for a range of activities e.g. the efficient procurement of new program parts to keep your operations running smoothly, expert repair services of program parts, and comprehensive management of scheduled outages to minimize downtime. Our services include remote monitoring to ensure optimal performance, and an early detection of potential issues.

We provide skilled personnel at the site for scheduled outages, ensuring these critical activities are managed and executed efficiently.

From repairs to seamless maintenance, we are committed to deploying the optimal solutions for your power generation facility.

We offer a reliable supply of essential program parts to maintain operational efficiency and provide access to the latest upgrades, to enhance performance and efficiency. Additionally, we offer comprehensive term warranty coverage for all program parts, including parts replacement or refurbishment, to ensure long-term reliability and performance.

Service flexibility

The Siemens Energy program service intervals are tailored to the customers unique operational requirements, whether operating hours-driven, starts-driven, prioritizing peak performance, or leaning towards extended maintenance intervals. The maintenance intervals can be adjusted and focused based on optimized availability or optimized performance.

Digitalization in field service

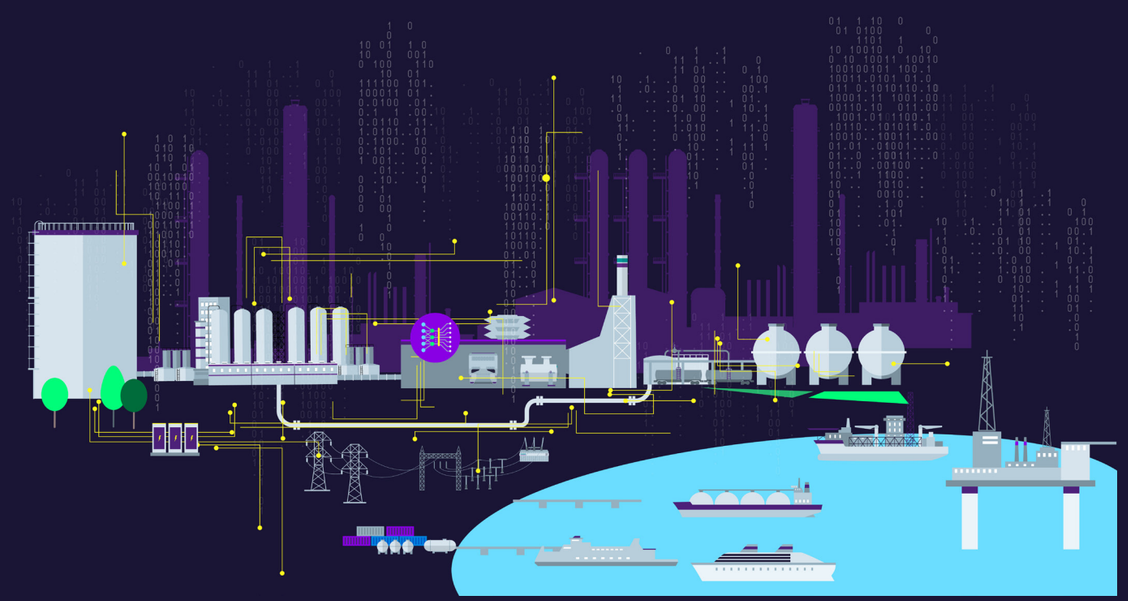
Where applicable, digitalization within field service has significantly enhanced productivity by optimizing uptime, creating a more reliable and efficient work environment overall, e.g. a robotic arm for combustor part assembly can significantly increase the availability of the power plant.

In the future, autonomous robots and drones will play an important role in ensuring that power plants can be operated autonomously. Our inspection robots already go where no human can go and with remote field service assistance your staff onsite engages in real-time interaction with OEM experts.

Power Diagnostics® Services

Our Power Diagnostics® Services (PDS) help you detect issues early and reduce downtime by using analytics and diagnostics tools and processes.

It provides actionable insights and recommendations to help you protect and optimize your assets. With over 800 units connected, we support customers across various industries and applications.



Serviceability of SGT-8000H

Power Diagnostics® Services (PDS) | Service programs

Power Diagnostics® Basic Package

Power Diagnostics® Live
Premium Service

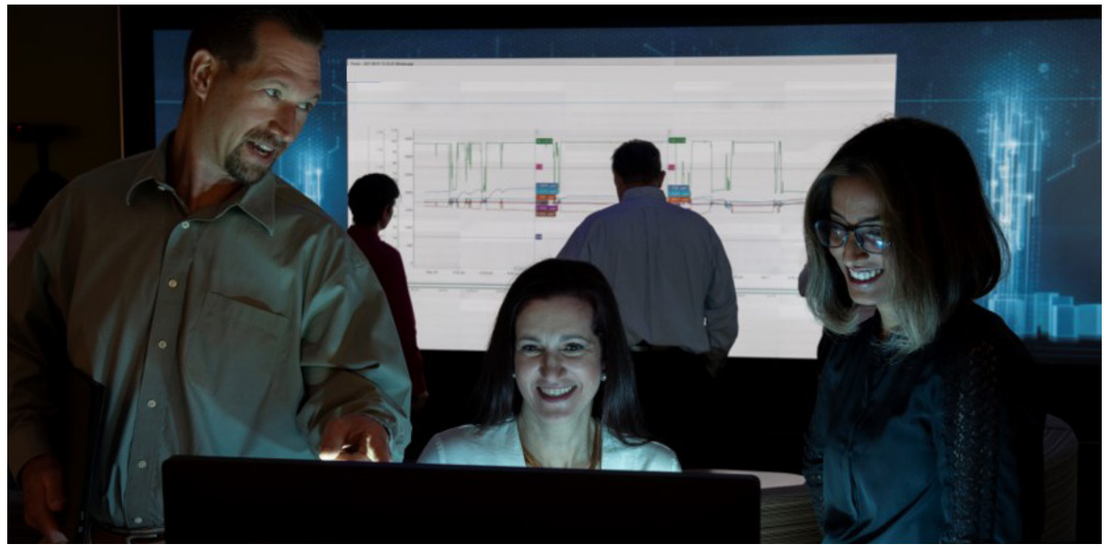
Power Diagnostics® Advanced Analytics
Premium Service

Power Diagnostics® Performance Service: Part of Omnivise Performance Monitoring
Premium Service

In an era where operational efficiency and asset reliability are paramount, the foundation of effective plant management begins with the comprehensive oversight provided by Power Diagnostics® Services (PDS), meticulously crafted for long-term health and performance of your power generation assets.

This service safeguards assets, provides actionable insights, and optimizes investments. Power Diagnostics® Services (PDS) enables operators to proactively address issues and reduce downtime through advanced analytics and diagnostics tools. With over 800 connected units, our expertise spans various industries, including simple cycle, combined cycle, nuclear, and coal-fired power plants. PDS can be tailored as a standalone, multiyear support service or integrated into total plant monitoring for comprehensive oversight.
The PDS Basic package serves as the first line of defense against unplanned outages, designed to identify symptoms before they escalate. To enhance The PDS Basic Package, Siemens Energy offers premium add-ons like PDS Advanced Analytics and Omnivise Performance Monitoring, providing greater control over power generation reliability and efficiency.

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Power Diagnostics® Web Application

Power Diagnostics® Web App is an interactive digital application which grants remote access to key operating details. Through Power Diagnostics® Services integration, the application displays data analytics results and provides digital access to Power Diagnostics® Services reports. Its digital dashboards offer data transparency to historical data, unit specific statistics, behavior trending, fleet comparisons and benchmarking. Power Diagnostics® Web App helps facilitate the decision-making process by allowing you to evaluate asset health through customized visualization. Current features support improved asset availability with continued application enhancements released through future software updates.

Availability

Unit 2023-05	Unit Since Commercial thru 2023-05	Frame family Since Commercial thru 2023-05
100.00 %	91.25 %	94.31 %

Reliability

Unit 2023-05	Unit Since Commercial thru 2023-05	Frame family Since Commercial thru 2023-05
100.00 %	98.37 %	98.45 %

Power Diagnostics® Basic Package

Proactive monitoring and expert support to keep your plant running reliably and minimize unplanned outages

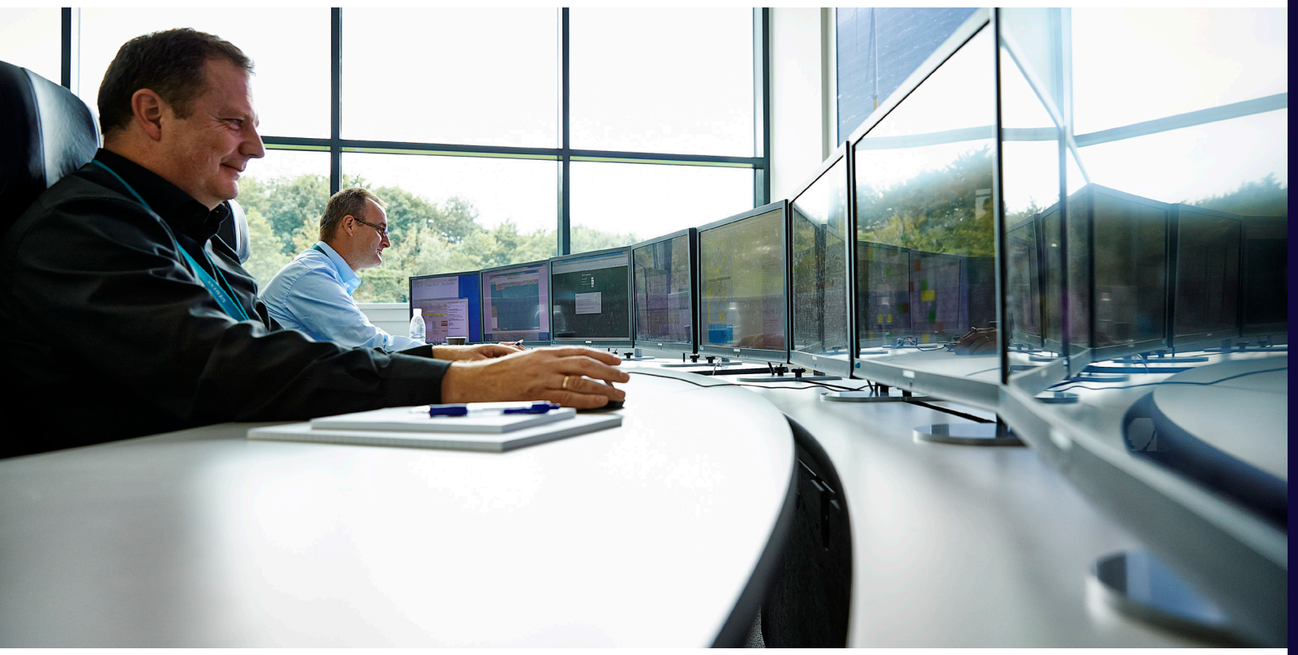
The PDS Basic Package analyzes long-term trends and detects subtle deviations in operating data, minimizing unplanned shutdowns. With over 20 years of fleet knowledge, it offers actionable insights and recommendations for large gas turbines, generators, and HRSGs.

Key deliverables:

- Anomaly identification & reporting, historical data analysis, and OEM engineering support
- Access to Siemens Energy specialists through 24/7 Hotline
- Secure transfer of data and remote access via Siemens Energy common Remote Service Platform (cRSP)
- Fleet statistics and notification system
- Interactive access to Power Diagnostics® Services features in the Power Diagnostics® Web Application or Mobile App, when applicable

Intended benefits:

- Faster return to service with 24/7 operational support
- Early anomaly detection and targeted inspection recommendations
- Reduced trips and downtime through direct collaboration with specialists
- Remote troubleshooting and expert assistance
- Data-driven decisions supported by fleet analysis from Siemens Energy specialists
- Transparent asset insights via digital dashboards and analytics



Power Diagnostics® Live Package

Live data analysis of power train data which is intended to identify operational anomalies which could result in plant trips

Our Solution

Power Diagnostics® Live Package is a real time monitoring and diagnostics service. It is designed to assist the site by potentially identifying detectable symptoms that may lead to an unplanned event in less than 24 hours.

A mobile app is included with the service to provide access to live data and alerts which allows increased visibility to power diagnostics insights & fleet operation.

Mobile App

The mobile app, included with the Power Diagnostics® Live service, helps plant personnel assess the plant's key operational indicators, from any location by providing asset data and alerts in real time.

Solutions tailored to your needs



Power Diagnostics® Advanced Analytics

Combining domain expertise and advanced analytics to provide integrated solutions

PDS Advanced Analytics combines domain expertise with advanced analytics for integrated solutions. It streamlines remote surveillance of machinery, offering expert support for interpreting alarms from monitoring systems like GenAdvisor® and Blade Vibration Monitoring (BVM) for steam turbines. This service allows for preemptive detection of anomalies and continuous access to specialists.

GenAdvisor® monitoring platform:

- GenAdvisor® Monitoring Platform provides five specialized monitors for: Partial Discharge (PDM), End Winding Vibration (EWVM), Flux Monitoring (FM), Shaft Grounding Current (SVCM) and Torsional Vibration (TVM) Monitoring
- GenAdvisor® functions independently or synergistically with other monitors

Blade Vibration Monitoring (BVM) & Blade Health Monitoring (BHM):

- BVM is a standalone solution that is designed to allow flexible operation and potentially extend the operating life of blades
- Blade Health Monitoring (BVM) assesses changes in blade frequency which may indicate crack development in free-standing blades, as well as monitors growth of those cracks over time



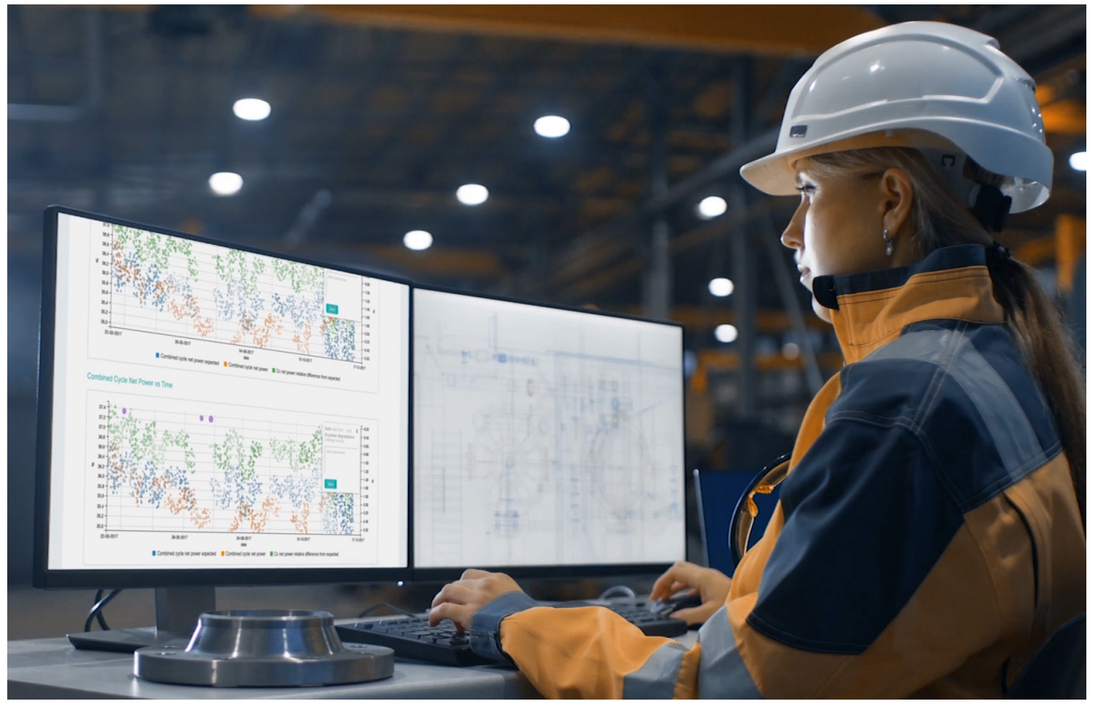
Power Diagnostics® Performance Service

Leverage advanced analytics, thermal twin and expert services to enable increased revenue and fuel cost savings

Power Diagnostics® Performance Service actively monitors thermal performance to maximize gas turbine efficiency, enhancing heat rate and power output. This service helps minimize emissions and recover lost performance, leading to significant cost savings and increased revenue generation. By identifying performance shortfalls and providing actionable recommendations for recovering thermodynamic degradation, Power Diagnostics® Performance Service is a vital component of effective plant management.

How it works:

1. The “digital thermal twin” enables us to model “actual” vs “expected” plant performance
2. Fast detection is done by an intelligent “alert” database. Our specialists analyze the anomaly and recommend actions directly to your performance team
3. Financial benefit: Potential to recover MW and/or heat rate sooner



Serviceability of SGT-8000H

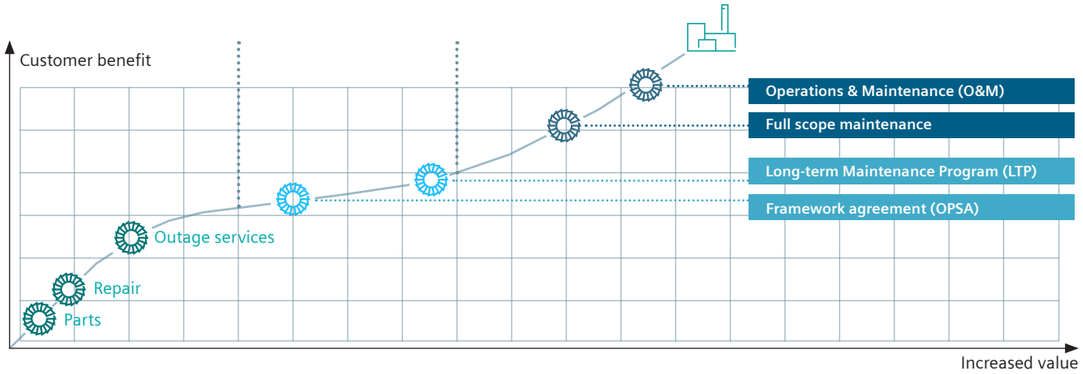
Power Diagnostics® Services (PDS)

Service programs

Short-term budget focus versus **long-term value focus**

Transactional | Expanded scope | Performance driven

Combinations available to address individual customer needs



Expertise you can count on

The Siemens Energy service programs are designed to help minimize outage duration, provide high availability, and ensure smooth operation, even in the face of unforeseen challenges.

Our experience has shown that even the most robust machine isn't immune to the effects of site conditions and mechanical stress and might need maintenance.

As an Original Equipment Manufacturer (OEM), Siemens Energy has the fleet expertise and technical proficiency to provide reliable support and access to the latest upgrades and developments.

As a Siemens Energy service customer, you receive priority treatment, and premium service programs tailored to your needs.

Our dedicated service engineers are continuously trained on the latest advances within the service market to apply this knowledge on-site.

Our vast fleet experience and remote monitoring enable the identification of any issues at the earliest possible time.

You can benefit from

Improved revenue streams

Optimized insurance premiums

Lower energy generation cost

Better parts availability

Reduced logistics cost

Reduced supply chain risks

Should your LTP require an extension, Siemens Energy Service is ready to work on extending the security of a long-term project commitment with no lapse in coverage or benefits.

Our experienced service team is ready to assist you in deciding which solution is the right one for you. With our experts in engineering, manufacturing, and field service in close collaboration, we can offer optimum service solutions for your power plant to match your specific demands.

Operational flexibility

Advanced operational flexibility | Load gradient optimization

Renewable energy is becoming a significant role in power generation. The integration of such energy sources is leading to increased grid volatility.

Your combined cycle power plant can play a vital role in this transition. Imagine proactively supporting the energy shift while boosting your business through timely grid assistance. Siemens Energy offers a solution with highly flexible plant operations and a fully integrated portfolio.

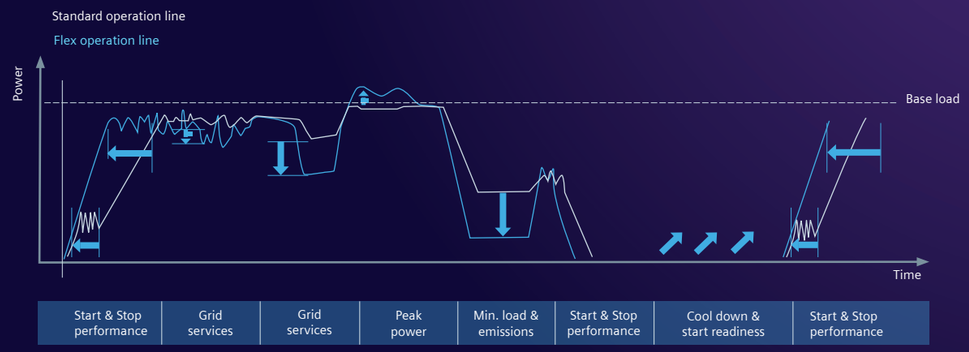
Our latest technical developments, enhanced by digital performance services, focus on key improvement areas.

Scope

Leveraging the fully integrated advanced operational flexibility portfolio, Siemens Energy experts implement tailored solutions with the following benefits:

- Improved start/stop performance, enhancing dispatch ranking and achieving fuel and emissions savings
- Advanced cool-down capabilities to reduce outage time and enable fast restarts after extended downtime
- Quick demand response to increase income from the grid
- Comprehensive energy management for the entire fleet
- Enhanced emissions control and efficiency across various load regimes

To maximize benefits, we recommend conducting a technical plant assessment before implementation.



Operational profiles standard vs. flex operation line (conceptual illustration only ; not to scale; actual may vary)

Advanced operational flexibility for SGT-8000H

- Fuel flexibility
- Operational flexibility

- Base load efficiency
- Transient efficiency

- Operational reliability
- Starting reliability

Intended benefits

A volatile grid demands enhanced operational flexibility and sustainability at both the plant and fleet levels. Implementing a tailored holistic flexibility solution can optimize your plant's performance, improve revenue streams and profitability, and enhance competitiveness.

You can find more information on our webpage: Flex-Power Services™ for fossil power plants





Operational flexibility

Advanced operational flexibility | **Load gradient optimization**

Our start and load gradient optimization products enhance your power plant's power-on-demand capability and grid support. By implementing higher starting gradients for gas turbines, you achieve faster start-up times, reducing fuel consumption and improving competitiveness.

The optimized start gradient parameters vary based on your gas turbine and site conditions. Faster load changes also save fuel during transient operations and enable quick responses to grid demands. This upgrade offers significant performance benefits and potential additional revenue for your power plant.

Economic value

Depending on the operational limitations, requirements of your power plant, and other factors, the benefits of Start and Load Gradient Optimization can include:

Extended flexibility

Combined cycle start time reductions are possible if start gradient Optimization is combined with other Flex-Power Services™, such as Hot Start on the Fly. Power plants may miss out on additional revenue opportunities during periods of power price peaks.
These price peaks may be short in duration but can generate substantial revenues if your power plant is equipped to capture them.

Loading the gas turbine from synchronization to baseload can be achieved in less than 10 minutes with Load Gradient Optimization. Such fast loading enables participation in primary, secondary and tertiary frequency response operations, which can be highly beneficial in some markets.

Start-Up efficiency increase

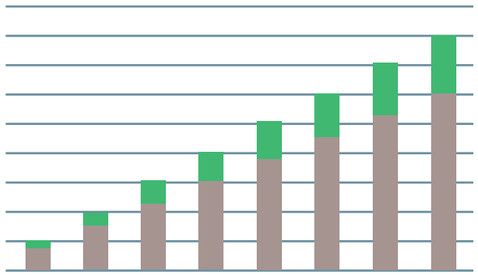
This can enable a highly efficient start-up procedure with significant fuel savings during start-up.

CO_2 emission reduction

This can help avoid costs for emission-related certificates per start, caused by start-up efficiency improvements.
Grid services fast load gradients enable efficient support of grid services, such as primary or secondary frequency response operations. This is, and may become even more, important in markets with high penetration of renewables.

Potential annual saving depending on no. of starts

Gas price / Carbon CO_2 certificate price



No. of starts

	SGT5-8000H
Standard load gradient	15 MW/min
Fast load gradient	35 MW/min
Shut down hot restart	Up to 55 MW/min
Fast load gradient	Up to 80 MW/min
PFR capability	(Significant) improvement

Note: site specific results may vary

Intended benefits

- Improved start-stop cycle times
- Reduced start-up & shut-down emissions
- Improved PFR, SFR & TFR capability
- Improved revenues from ancillary services compensation

Scope

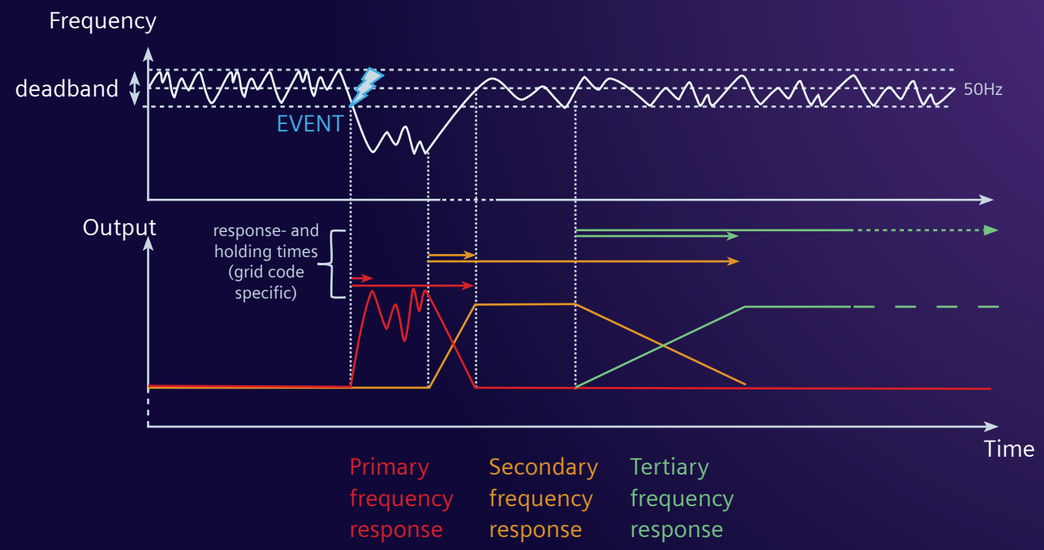
- Plant assessment
- Load gradient increase

Sustainability

- Carbon footprint

Flexibility

- Operational flexibility



04 Experience

Siemens Energy is a global leader in energy technology. The company works with its customers and partners on energy systems for the future, thus supporting the transition to a more sustainable world. With its portfolio of products, solutions and services, Siemens Energy covers virtually the entire energy value chain.

Today, around 110 SGT-8000H have been sold. Our installed fleet has accumulated over 4 million equivalent operating hours. The SGT-8000H series fleet's overall best-in-class efficiency exceeds 62%.

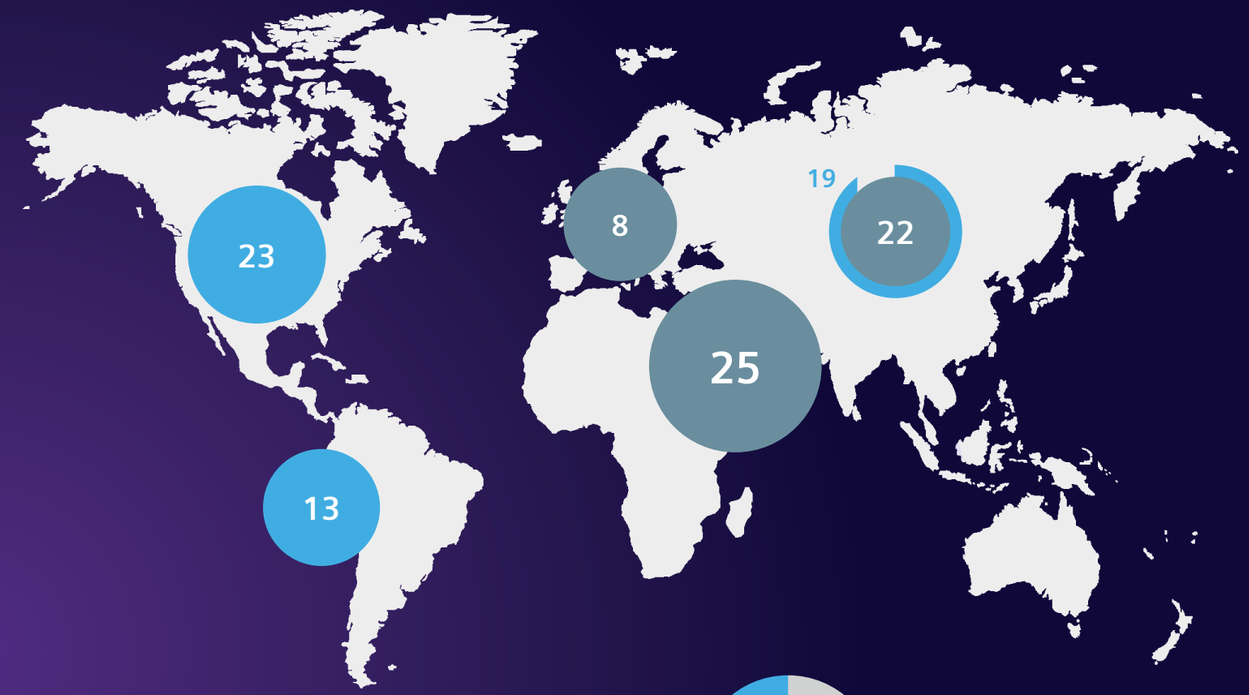


more than
110
SGT-8000H sold worldwide

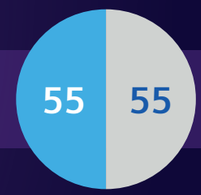
more than
4 million
fired fleet hours of experience

fuel can contain up to
30%
hydrogen (by volume) with DLE burner

SGT-8000H series



Operating fleet
50 Hz vs. 60 Hz



- SGT5-8000H
- SGT6-8000H

50 Hz

Europe	8
Middle East	25
Asia	22

60 Hz

North America	23
Latin America	13
Asia	19

Increase competitiveness through technology leadership

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