

# Efficiency: More value to your facility

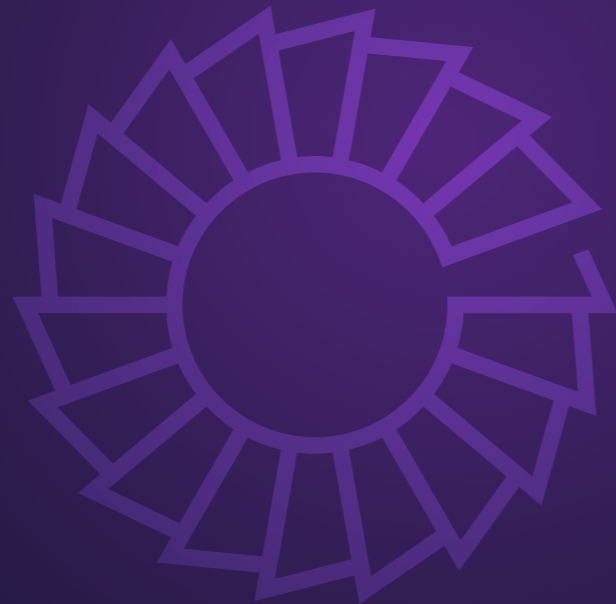
Utility Steam Turbines  
from 90 to 1,900 MW



[siemens-energy.com/steamturbines](https://www.siemens-energy.com/steamturbines)



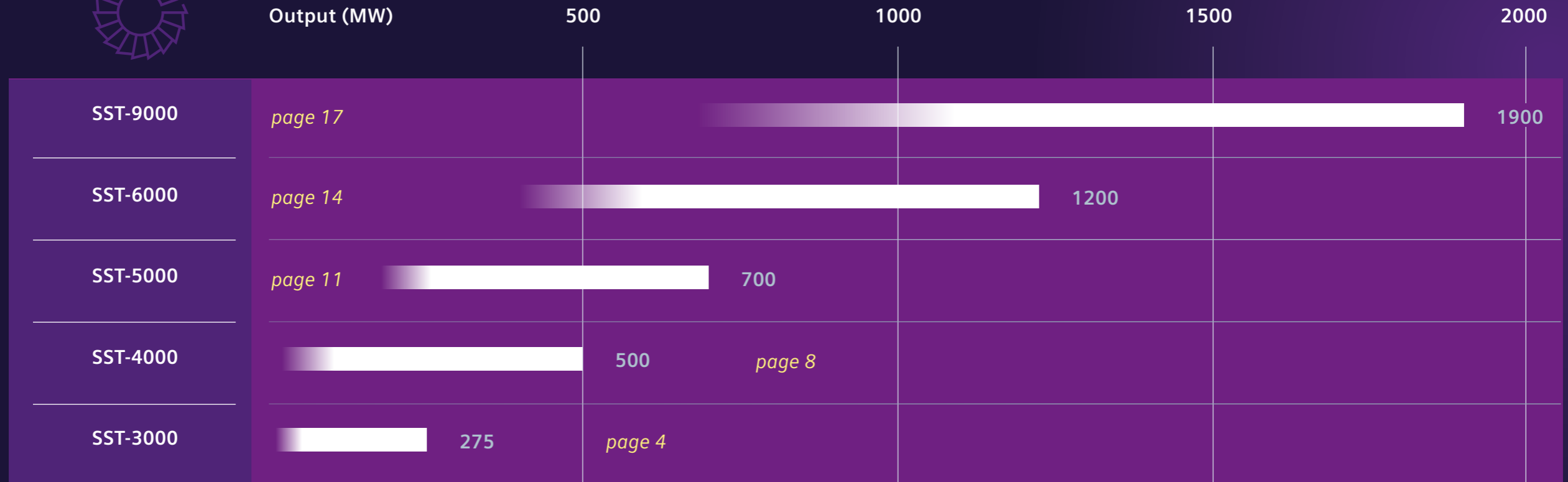
# Reliable Steam Turbines



With over a century of experience and continuous development in steam turbine technology, Siemens Energy has stayed at the forefront of development and is a prime partner for your business. With a fleet of more than 8,000 steam turbines world wide, Siemens Energy is a reliable and experienced partner.

Siemens Energy Steam Turbines are an essential piece of turbomachinery to many power plants worldwide. They are applied either as a generator drive or a mechanical drive for pumps and compressors. The modular design concept of all steam turbines ensures high flexibility, availability and a reduction of time-to-market.

# Utility Steam Turbines—overview





# Utility steam turbines from 90 to 1,900 MW

Siemens Energy offers a comprehensive range of steam turbine products in the power output range from 90 to 1,900 MW. These are used in steam power plants as well as in nuclear and combined cycle power plants. With more than 8,000 steam turbines in service worldwide we provide proven technology, adapted to the specific local conditions.

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# SST-3000

## Utility steam turbine package

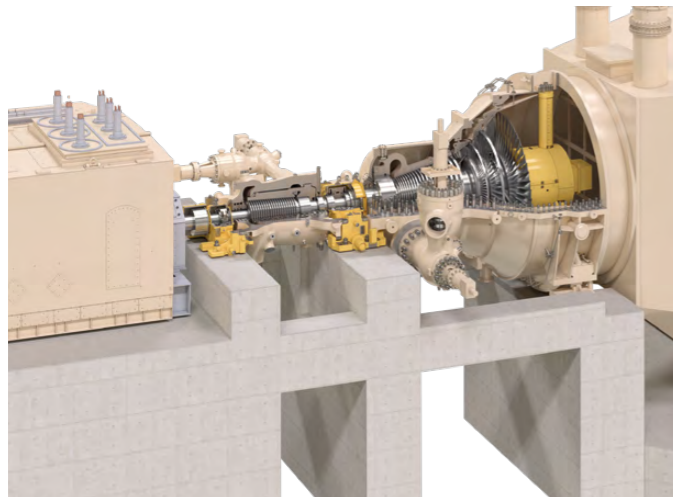
### Flexible steam turbine for applications in single-shaft and multi-shaft combined cycle configurations

In our Siemens Energy Steam Turbine portfolio, we offer with the SST-3000 series steam turbine a compact arrangement, that features a two-cylinder design with an axial exhaust for use in combined cycle power plants.

Steam turbines of SST-3000 series are exceptionally compact machines for use in combined cycle

power plants. The SST-3000 series covers the power output range from 90 to 275 MW.

It features a separate high-pressure (HP) turbine and combined intermediate-pressure / low-pressure (IP/LP) turbine with single flow axial exhaust for 50 and 60 Hz applications.



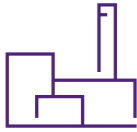
### At a glance

- High turbine efficiency
- Enhanced operational flexibility, high availability and long lifetime
- Low complexity and low total plant costs
- Short project schedule and installation time

### SST-3000

Power output	90 MW up to 275 MW
Frequency	50 or 60 Hz
<b>Main steam conditions</b>	
Inlet pressure	up to 177 bar / 2,567 psi
Inlet temperature	600 °C / 1,110 °F
<b>Reheat steam conditions</b>	
Temperature	up to 610 °C / 1,130 °F
<b>Last stage blade length</b>	
50 Hz	80 cm to 124 cm / 31 inches to 49 inches
60 Hz	76 cm to 103 cm / 30 inches to 41 inches

# SST-3000



Ribatejo, Portugal

The Ribatejo power plant was one of the most technologically advanced combined cycle power plants at the time of construction.

In operation:  
unit 1: 02/2004, unit 2: 10/2004;  
unit 3: 03/2006



**Net plant output:**  
3 × 390 MW

**Steam turbine output:**  
3 × 142 MW

**Scope of supply:**  
3 × SGT5-4000F,  
3 × SST5-3000,  
3 × SGen5-2000H

**Main steam conditions:**  
125 bar / 1,813 psi  
565 °C / 1,049 °F

**Reheat steam conditions:**  
555 °C / 1,031 °F

# SST-3000

## Bearing

Single bearing arrangement between IP and LP turbine cylinders for simple alignment and stable operation.

## Intermediate pressure / low pressure turbine

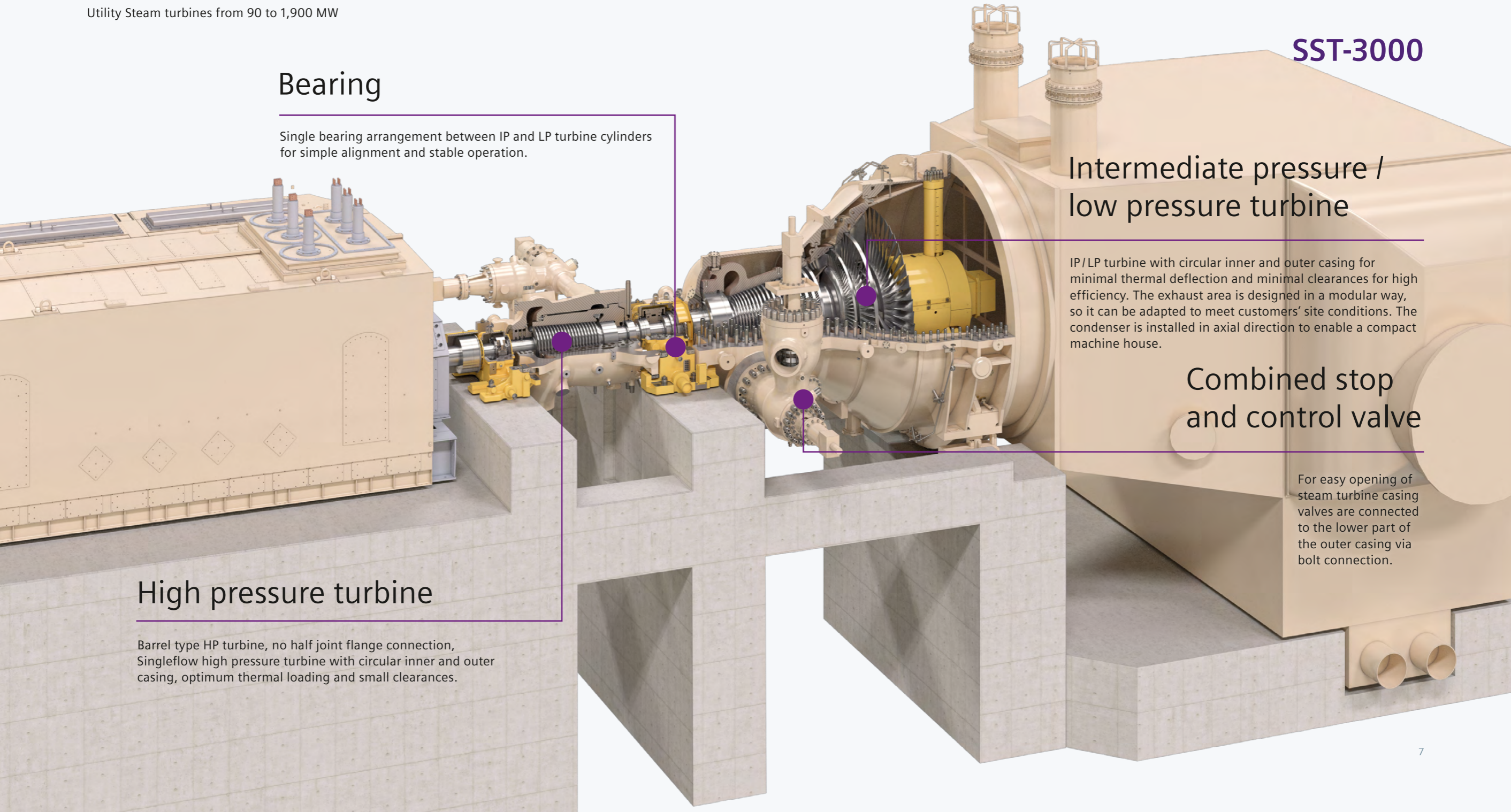
IP/LP turbine with circular inner and outer casing for minimal thermal deflection and minimal clearances for high efficiency. The exhaust area is designed in a modular way, so it can be adapted to meet customers' site conditions. The condenser is installed in axial direction to enable a compact machine house.

## Combined stop and control valve

For easy opening of steam turbine casing valves are connected to the lower part of the outer casing via bolt connection.

## High pressure turbine

Barrel type HP turbine, no half joint flange connection, Singleflow high pressure turbine with circular inner and outer casing, optimum thermal loading and small clearances.



# SST-4000

## Utility steam turbine package

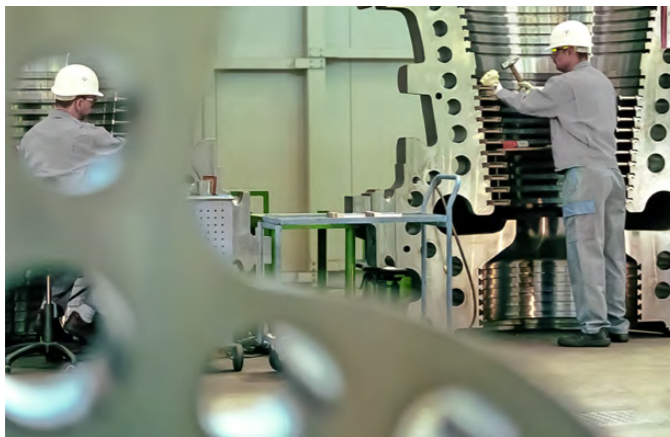
### Powerful and reliable – thanks to proven design for high efficiency

The SST-4000 series is our specialized turbine for non-reheat, combined cycle applications. With the specialized design of the blade path, the entire power range from 100 to 500 MW can be covered with the highest reliability and availability. More than 40 turbines of this type are already in operation or in the commissioning stage, with a total installed capacity of approximately 8,200 MW.

The SST-4000 series consists of an intermediate-pressure and a low-pressure turbine. The installation is either high or low level arrangement

with down, double-side or single-side exhaust. The turbine is able to provide process steam e.g. for industries or sea water desalination and can provide industrial heating.

Thanks to its systematically modular design, the SST-4000 series can easily be adapted to the individual operating conditions and thermal cycle design of the plant. Its fast installation, thanks to prefabricated, tested modules delivered ready for connection, is of additional advantage.



### At a glance

- Suitable for operations in condensation and back-pressure mode
- Proven designs for highly efficient, continuous operation
- Low space requirement due to compact design, low investment costs
- Short start-up times
- Blading of variable-reaction type
- Long service intervals lead to low maintenance costs and high availability

### SST-4000

Power output	100 up to 500 MW
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Frequency	50 or 60 Hz
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#### Main steam conditions

Inlet pressure	up to 105 bar / 1,523 psi
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Inlet temperature	up to 565°C / 1,050°F
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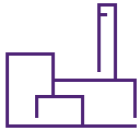
#### Last stage blade length

50 Hz	80 cm to 115 cm / 31 inches to 45 inches
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60 Hz	76 cm to 95 cm / 30 inches to 38 inches
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# SST-4000



Al Ezzel, Bahrain

The power plant makes an important contribution towards meeting the country's growing power demand in an economic and environmentally compatible manner.

In operation:  
unit 1: 04/2006, unit2: 05/2007



**Customer:**  
Al Ezzel Power Company

**Plant type:**  
SCC5-2000E multi shaft 2 × 1

**Power output:**  
2 × 475 MW (power plant)

## Single crossover pipe

Crossover pipe designed to minimize losses, reduces plant complexity and minimizes footprint.

## Bearing

Single bearing arrangement between IP and LP turbine cylinders for simple alignment and stable operation.

## Low pressure turbine

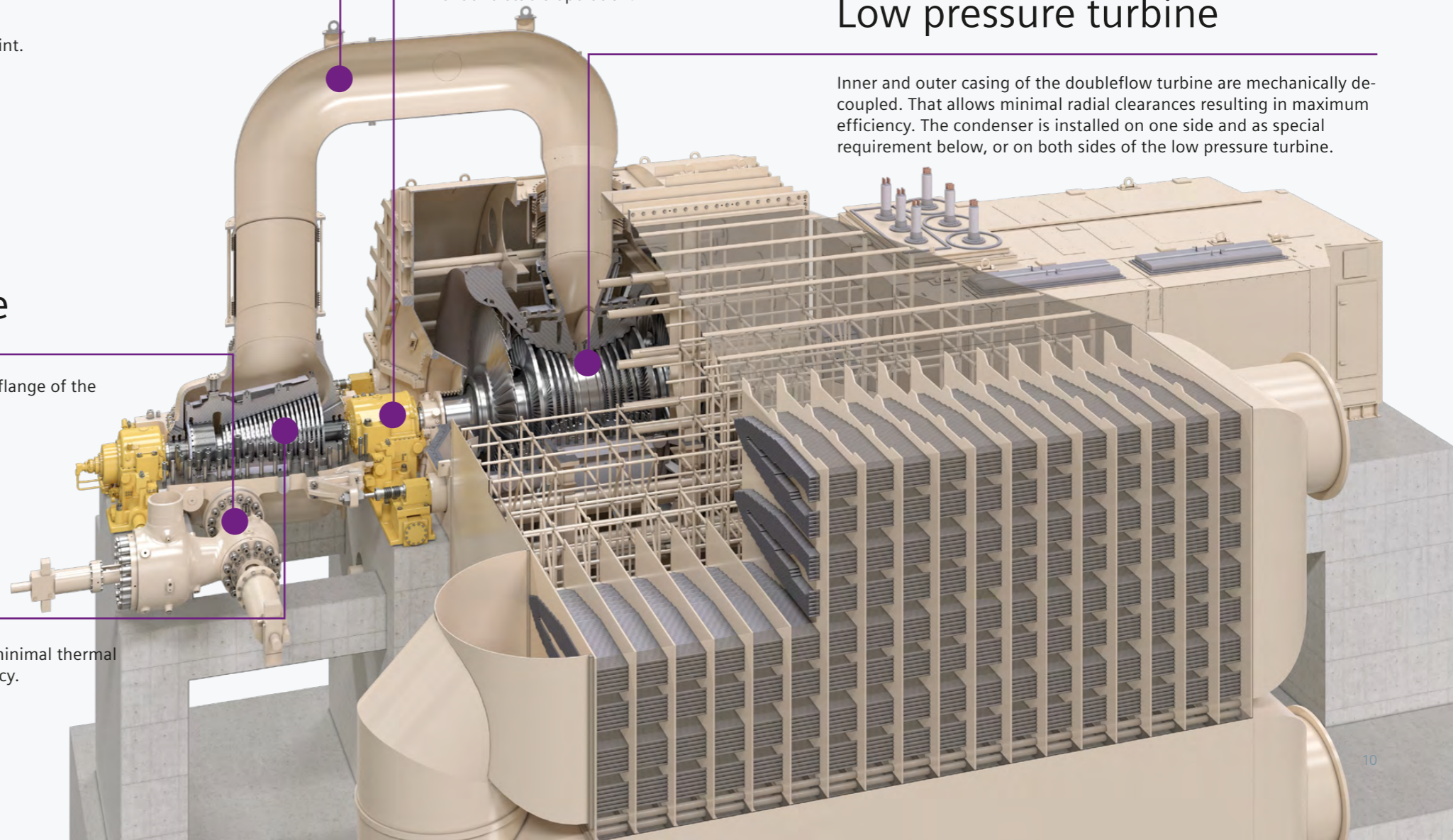
Inner and outer casing of the doubleflow turbine are mechanically decoupled. That allows minimal radial clearances resulting in maximum efficiency. The condenser is installed on one side and as special requirement below, or on both sides of the low pressure turbine.

## Combined stop and control valve

Valve connection below the horizontal flange of the IP turbine for easy maintenance

## Intermediate pressure turbine

IP turbine with circular inner and outer casing for minimal thermal deflection and minimal clearances for high efficiency.



# SST-5000

## Utility steam turbine package

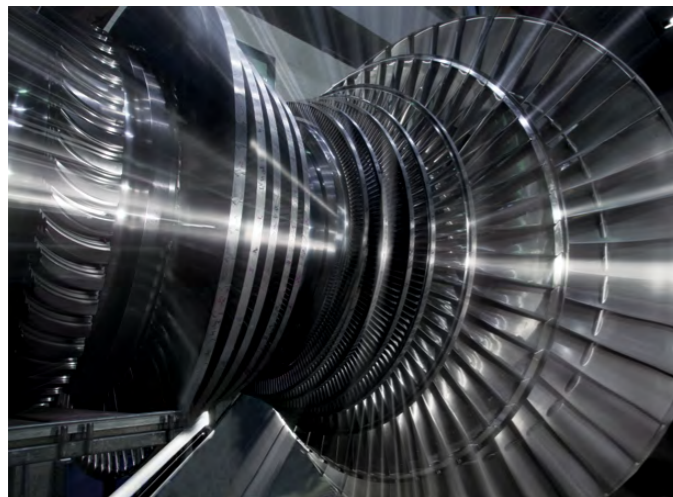
### A steam turbine with short start-up times and variable start-up modes to ensure grid stability

Siemens Energy Steam Turbines of the SST-5000 series are operated in combined cycle power plants (CCPP) and in steam power plants (SPP). The SST-5000 steam turbine combined with a gas turbine, is able to achieve a net plant efficiency of more than 64 percent in combined cycle applications.

The SST-5000 is suitable for supercritical and ultra-supercritical steam power plants. Due to its higher pressure and temperature ratings, power plant

efficiency increases to more than 46 percent and overall performance is improved.

In steam power plants the SST-5000 consists of a combined high pressure/intermediate pressure turbine, and one or two low pressure turbines with down exhaust, single sided or double sided exhaust. It is installed in a low- or high-level arrangement. Various extractions (up to 9 stages) contribute to an optimized plant efficiency.

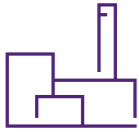


### At a glance

- Class record efficiency in combined cycle applications
- Option for combined heat and power
- Long maintenance intervals to reduce lifecycle costs
- Flexible steam extractions
- Short start-up times and flexible start-up modes
- Highest reliability and availability
- Remote performance control

SST-5000	CCPP	SPP
Power output	120 MW up to 700 MW	200 MW to 500 MW
Efficiency	64% in combined cycle	43% for subcritical 46,4% for supercritical
Frequency	50 or 60 Hz	50 or 60 Hz
<b>Main steam conditions</b>		
Inlet pressure	up to 177 bar/2,567 psi	up to 260 bar/3,770 psi
Inlet temperature	up to 565°C/1,050°F	up to 600°C/1,112°F
<b>Reheat steam conditions</b>		
Temperature	up to 610°C/1,130°F	up to 610°C/1,130°F
<b>Last stage blade length</b>		
50 Hz	66 cm to 142 cm/26 inches to 56 inches	
60 Hz	66 cm to 103 cm/26 inches to 41 inches	

# SST-5000



Lausward "Fortuna",  
Germany

The combined cycle power plant set three world records: in the acceptance test a maximum electrical net output of 603.8 MW was achieved and the net energy conversion efficiency was around 61.5 percent.

In operation:  
01/2016



- overall plant efficiency considering thermal extraction was above 85%
- 300 MW thermal power extraction through one steam turbine train

**Plant type:**  
SCC5-8000H 1S  
(single shaft)

**Power output:**  
604 MW

**Efficiency:**  
61.5%

## Single crossover pipe

Crossover pipe designed to minimize losses, reduces plant complexity and minimizes footprint.

## Combined stop and control valve

Valve connection below the horizontal flange of the HP-IP turbine for easy maintenance.

## High-pressure / intermediate-pressure turbine

Combined HI turbine with circular inner and outer casing for minimal thermal deflection and minimal clearances for high efficiency.

## Low pressure turbine

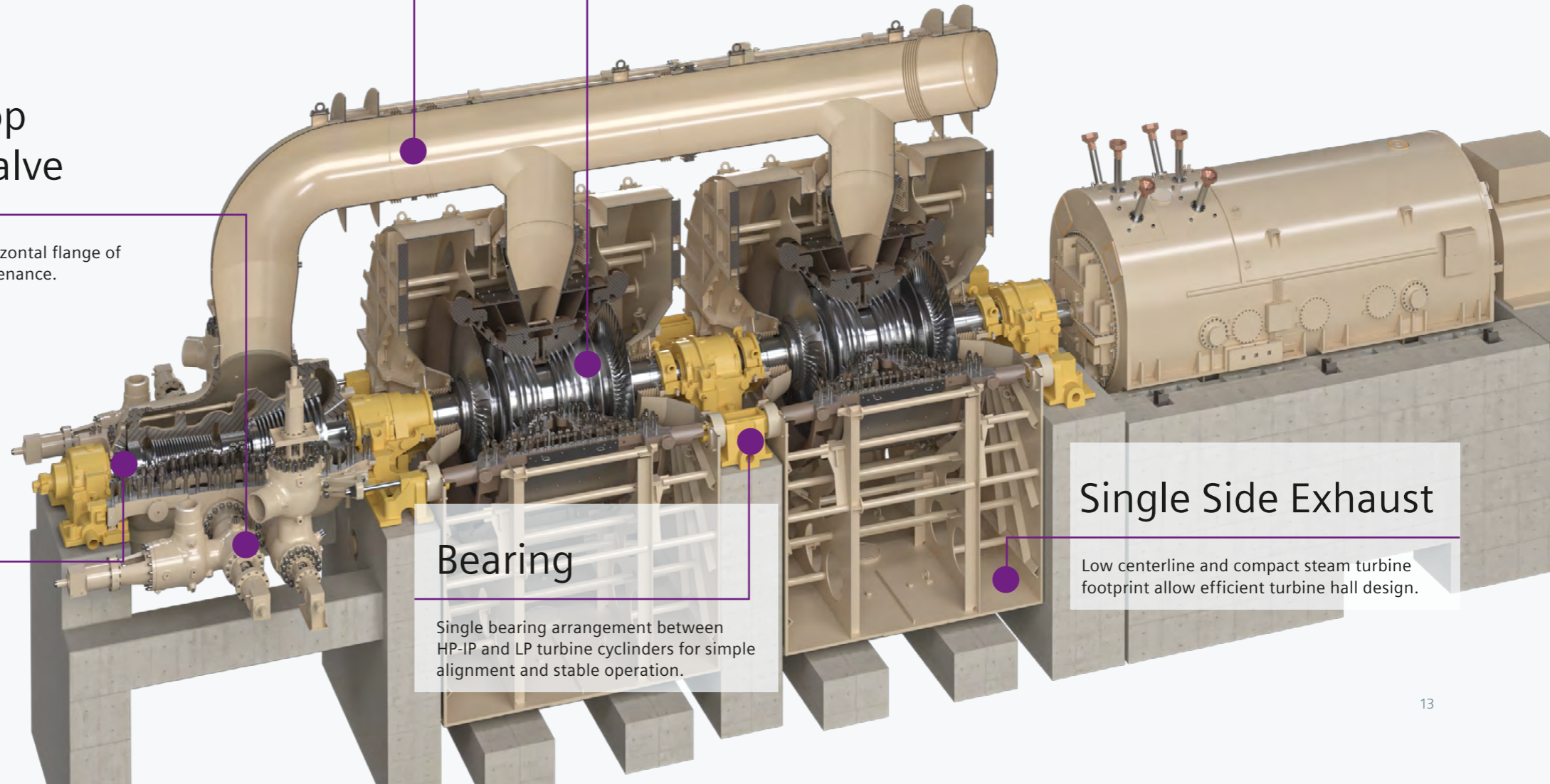
Inner and outer casing of the double-flow turbine are mechanically decoupled. That allows minimal radial clearances resulting in maximum efficiency. The condenser is installed either below, on one side or on both sides of the low-pressure turbine.

## Bearing

Single bearing arrangement between HP-IP and LP turbine cylinders for simple alignment and stable operation.

## Single Side Exhaust

Low centerline and compact steam turbine footprint allow efficient turbine hall design.



# SST-6000

## Utility steam turbine package

### Reduced lifecycle costs with the SST-6000 steam turbine

Siemens Energy Steam Turbines of the SST-6000 series are widely operated in steam power plants with a power output up to 1,200 MW and net plant efficiencies of more than 46 percent.

Turbine trains of the SST-6000 series consist of a high-pressure turbine, an intermediate-pressure turbine, and up to three low-pressure turbines for 50 and 60 Hz.

The SST-6000 is installed in a high-level arrangement with down exhaust. Various extractions (up to 10 stages) are available for feed water preheating, process steam, and district heating.

The globally installed capacity of the SST-6000 fleet is more than 100,000 MW.



### At a glance

- Long maintenance intervals to reduce lifecycle costs
- Proven performance throughout the entire product lifetime
- Short start-up times and flexible start-up modes
- Highest reliability and availability

### SST-6000

Power output	300 MW to 1,200 MW
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Efficiency	46,5 % (Double reheat: 48 %)
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Frequency	50 or 60 Hz
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#### Main steam conditions

Inlet pressure	up to 330 bar / 4,786 psi
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Inlet temperature	up to 610°C / 1,130°F
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#### Reheat steam conditions for single and double reheat

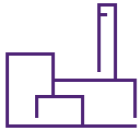
Temperature	630°C / 1,166°F
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#### Last stage blade length

50 Hz	66 cm to 142 cm / 26 inches to 56 inches
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60 Hz	66 cm to 103 cm / 26 inches to 41 inches
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# SST-6000



Eemshaven, Netherlands

Thanks to a highly efficient power plant process the Eemshaven steam power plant consumes less fuel compared to the average of power plants. This leads to a reduction in CO<sub>2</sub> emissions of 2.5 million metric tons per year.

In operation:  
02/2015



**Power output:**  
2 × 800 MW

**Efficiency:**  
46.2 %

**Main Steam:**  
275 bar / 597 °C  
3,989 psi / 1,107 °F

**Reheat Steam:**  
609 °C / 1,128 °F

## Intermediate-pressure turbine

### Double-flow intermediate-pressure turbine

- Circular inner and outer casing for minimum thermal deformation and minimum clearances for high efficiency
- Shipped to site fully assembled for smooth erection and start

## Crossover pipe

### Single crossover pipe

Large diameter pipe to minimize losses and to reduce plant complexity and steam turbine footprint.

## Low pressure turbines

### Double-flow low-pressure turbines

Inner and outer casing are mechanically decoupled preventing displacement and deformation of the inner casing. That allows minimal radial clearances resulting in maximum efficiency.

The outer casing is directly welded on the condenser under-neath the low pressure turbine casing.

## High-pressure turbine

### Barrel type HP turbine, no half joint flange connection

Single-flow high-pressure turbine with circular inner and outer casing, optimum thermal loading and small clearances.

## Bearing

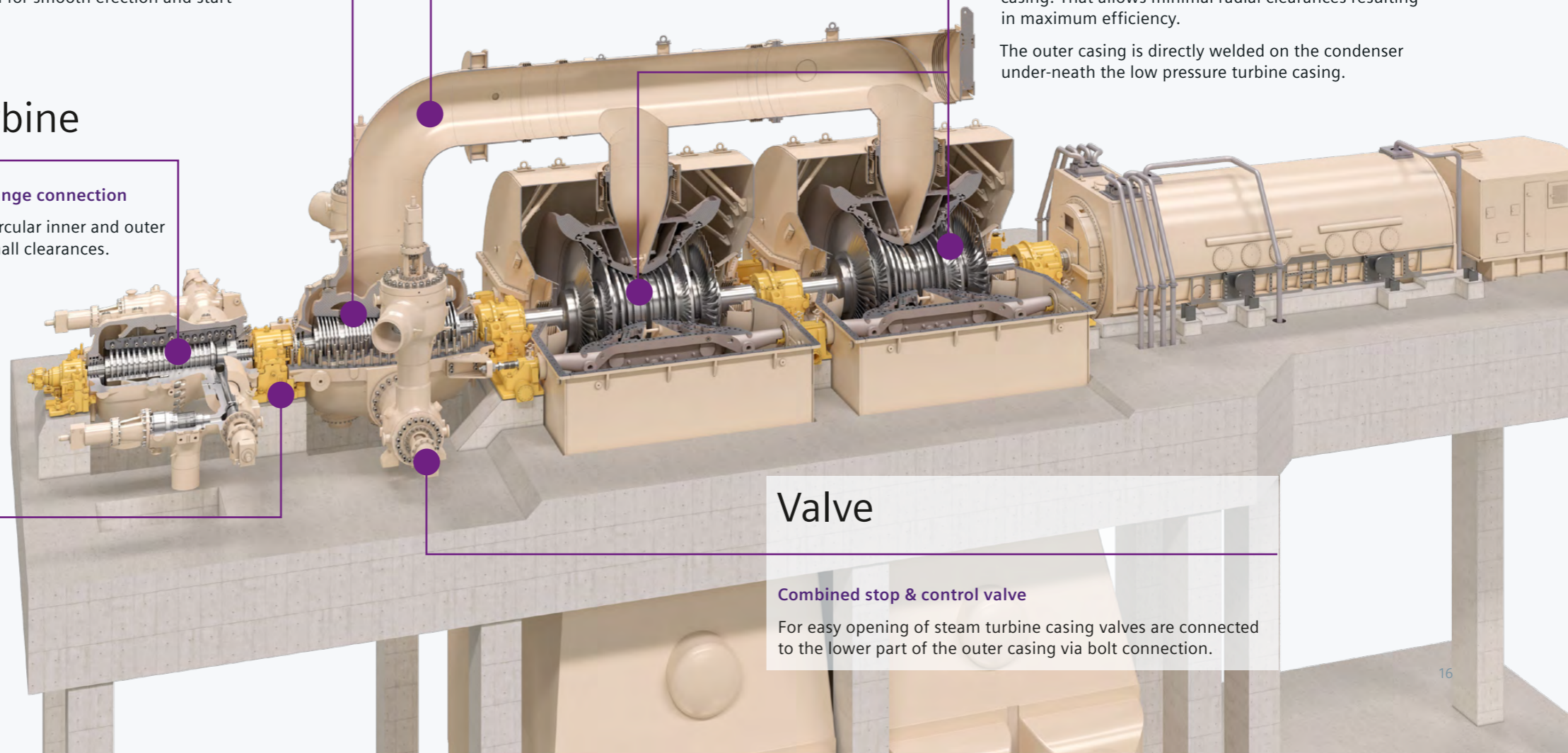
### Fixed bearing

Single, fixed bearing arrangement between HP and IP turbine cylinders for simple alignment and stable operation. Fixed bearing pedestals on foundation crossbeams.

## Valve

### Combined stop & control valve

For easy opening of steam turbine casing valves are connected to the lower part of the outer casing via bolt connection.





# SST-9000

## Utility steam turbine package

### Leading technology for efficient, flexible and reliable power generation

Siemens Energy Steam Turbines of the SST-9000 series are highly reliable for the application in conventional islands of advanced pressurized water reactors in nuclear power plants, with a power output up to 1,900 MW.

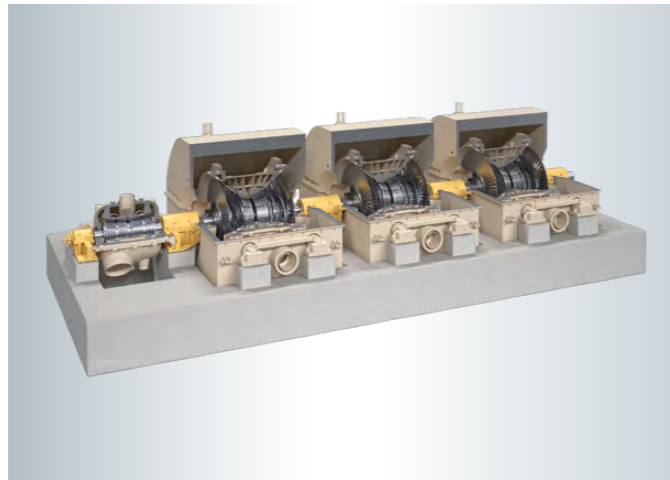
The half-speed SST-9000 series features a double-flow saturated steam high-pressure (HP) turbine

and up to three double-flow low-pressure (LP) turbines with shrunk-on disk rotors.

Shrunk-on disk design features proven technology: eliminating stress-corrosion cracking and replacement of the low-pressure rotors or disks during the design life-time.

### At a glance

- Maximum reliability and availability
- High operational flexibility
- Low life cycle costs due to long inspection intervals
- Extended lifetime, thanks to state-of-the-art engineering and proven service concepts



### SST-9000

Power output	1,000 up to 1,900 MW
Frequency	50 or 60 Hz

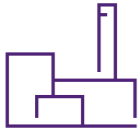
#### Main steam conditions

Inlet pressure	up to 80 bar / 1,161 psi
Inlet temperature	up to 310°C / 590°F

#### Last stage blade length

50 Hz	117 cm to 183 cm / 46 inches to 72 inches
60 Hz	107 cm to 142 cm / 42 inches to 56 inches

# SST-9000



Olkiluoto, Finland

Olkiluoto 3, Finland  
Nuclear Power Plant

**Customer:**  
Teollisuuden Voima Oyj (TVO)



**Scope of supply:**  
Conventional Island

**Commercial Operation:**  
03/2022 (planned)

**Power Output:**  
Approx. 1.600 MW (net)

**Grid Frequency:**  
50 Hz

**Turbine Frequency:**  
25 Hz

# Performance data overview

Steam turbine type	Output SPP MW	Output CCPP MW	Net efficiency SPP %	Net efficiency CCPP %	Grid Frequency Hz	Inlet pressure bar/psi	Inlet temperature °C/°F	Reheat temperature °C/°F	Rotational Speed rpm	Last stage blade length 50 Hz cm/inches	Last stage blade length 60 Hz cm/inches
SST-9000	1,000–1,900				50/60	80/1,160	310/590		1,500–1,800	117 to 183/46 to 72	107 to 142/42 to 56
SST-6000	300–1,200		46,5 (Double reheat 48)		50/60	330/4,786	610/1,130	630/1,166	3,000–3,600	66 to 142/26 to 56	66 to 103/26 to 41
SST-5000	200–500	120–700	43 (subcritical) 46,4 (supercritical)	64	50/60	260/3,771 (SPP) 177/2,567 (CCPP)	600/1,112 (SPP) 600/1,112 (CCPP)	610/1,130 (SPP) 610/1,130 (CCPP)	3,000–3,600	66 to 142/26 to 56	66 to 103/26 to 41
SST-4000		100–500			50/60	105/1,523	600/1,112		3,000–3,600	80 to 115/31 to 45	76 to 95/30 to 38
SST-3000		90–275			50/60	177/2,567	600/1,112	610/1,130	3,000–3,600	80 to 124/31 to 49	76 to 103/30 to 41



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