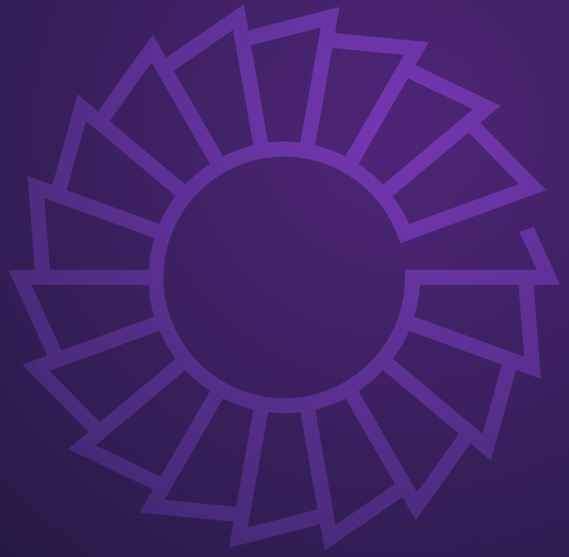
Efficiency: More value to your facility

Industrial steam turbines



siemens-energy.com/steamturbines

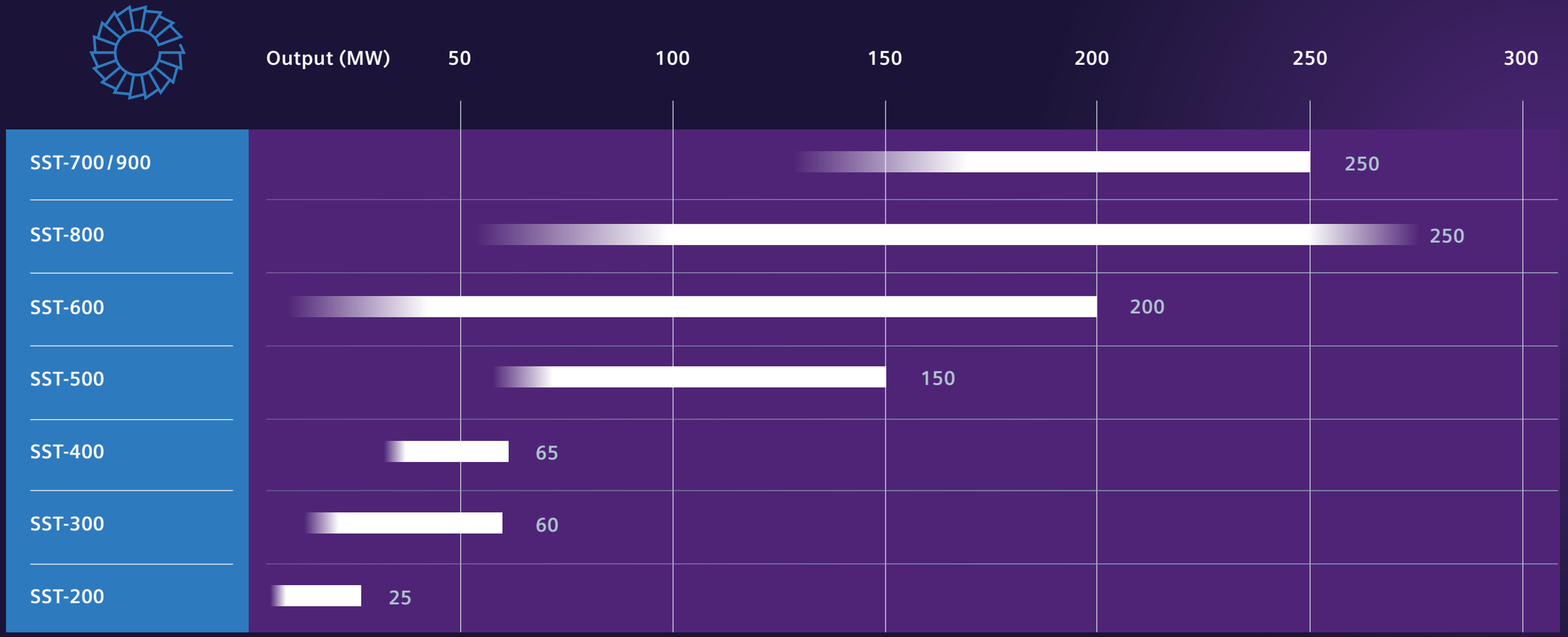
Reliable Steam Turbines



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 60,000 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.

Industrial Steam Turbines—overview





Industrial steam turbines from 2 to 250 MW

As a market leader for industrial steam turbines, we offer a comprehensive range of reliable and versatile steam turbines for the power output range from 2 to 250 MW. Our industrial steam turbines are designed for easy constructability, fast start-up and economical operation.

SST-200 5
SST-300 7
SST-400 10
SST-500 xx
SST-600 12
SST-800 15
SST-700/900 20

Performance data overview 23

SST-200

Industrial steam turbine

The ability to combine standardized casing modules enable optimal design flexibility. This allows the turbine series to achieve high performance in combination with an optimal cost position.

Each steam path is customized for optimal fit to the specific thermal cycle requirements providing high efficiency over the entire operating range.

The inlet and exhaust sections are configured to cover different plant configuration needs and are used in condensing configurations as well as in backpressure applications.

With this flexible approach the SST-200 covers the range of both industrial mechanical drive and industrial power generation applications.

The product design closely follows API 612 requirements.





At a glance

- **Customized steam path**
- **Modular design for short delivery time**
- **Thermoflexible design**
- **Fast and early layout planning**
- **Compact design minimizes space requirements of installation**

SST-200

Power output	**≤ 25 MW**
Speed	**up to 13,500 rpm**
Live steam parameters	
Inlet pressure	120 bar(a) / 1,740 psi
Inlet temperature	540 °C / 1,004 °F
Exhaust steam parameters	
Exhaust pressure for backpressure	20 bar(a) / 290 psi
Exhaust pressure for condensing	0.7 bar(a) / 10.2 psi
Steam extraction parameters	
Controlled extraction pressure	16 bar(a) / 232 psi
Controlled extraction temperature	350 ° C / 662 ° F
Number of extraction valves for controlled extraction	up to 1
Uncontrolled extraction pressure	60 bar(a) / 870 psi
Number of extraction valves for uncontrolled extraction	up to 4

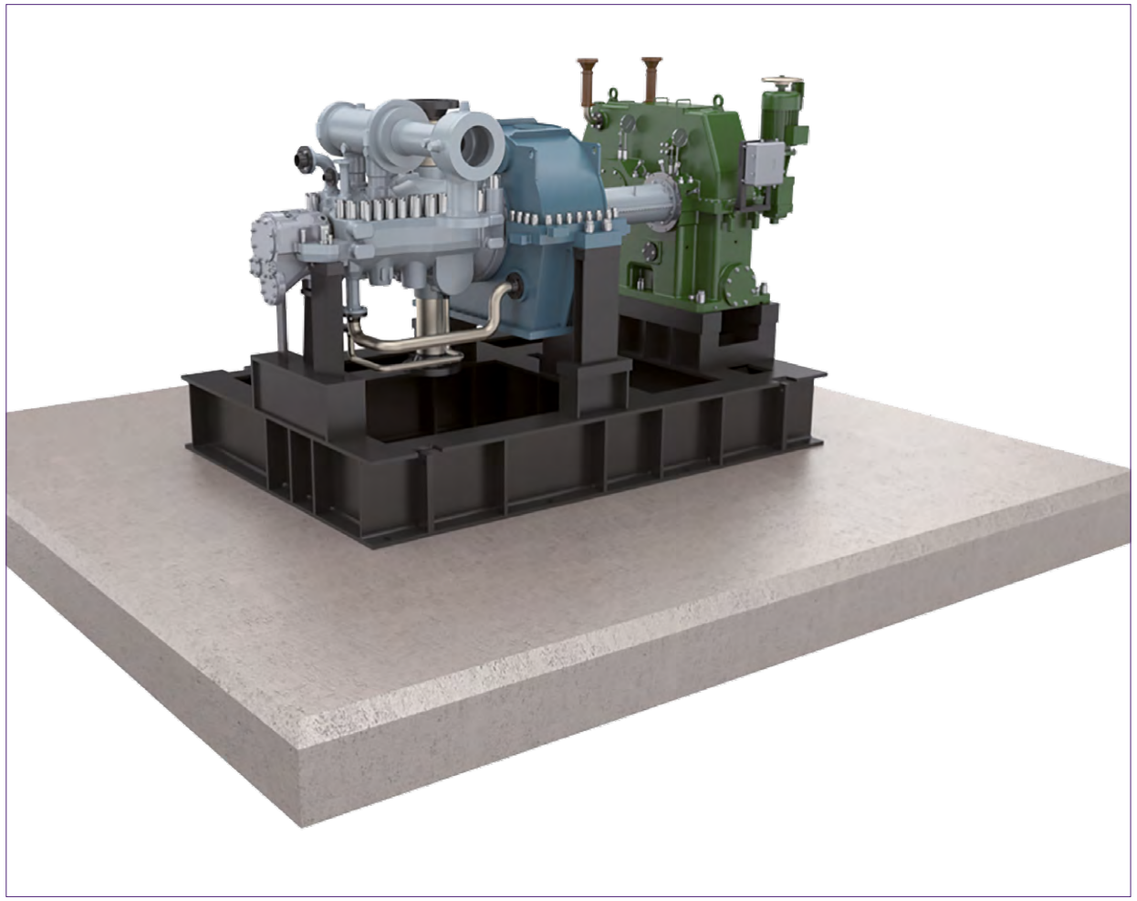
SST-200

Tamoil, Switzerland

2 turbines producing on average 5 MW each in mechanical drive application

Steam turbine:
2 × SST-200

Power output:
5 MW each
Mechanical drive



Typical applications

- Biomass plants
- Chemical and petrochemical industry
- Cement industry
- Combined cycle power plants and combined heat and power plants
- Concentrated solar power plants
- District heating
- Waste-to-energy plants (waste incineration)
- Pulp and paper mills
- Sugar industry
- Steel works and mines

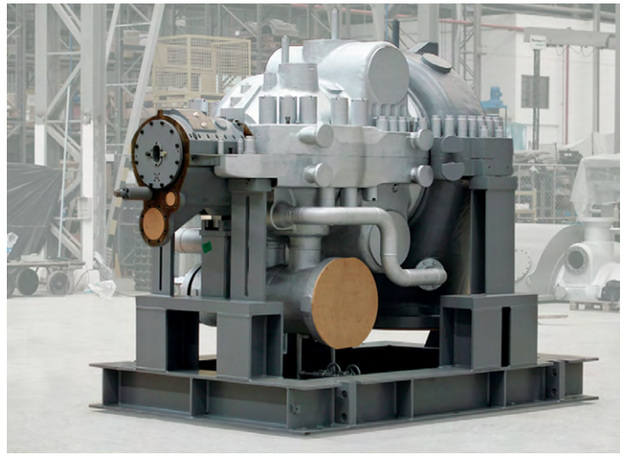
SST-300

Industrial steam turbine

The SST-300 is an optimal solution for a wide range of applications due to the implementation of the best technology combined with over 20 years of experience. In the last decade alone, this turbine has been installed in over 500 industrial and power applications by customers all over the world.

The flexible configuration of the SST-300 enables it to be used in diverse applications such as waste-to energy, chemical processing, pulp and paper, cement and many more.

All components and auxiliaries including the lube oil system are mounted on a common base frame. The turbine can be configured with either an upward, downward or axial exhaust orientation depending on the layout of the plant. The turbine can also accommodate multiple steam extraction / steam induction points as well. The compact design and simple layout of the turbine significantly reduce the cost and time associated with its construction, inspection and maintenance.





At a glance

- **All components and auxiliaries can be mounted on a common base frame or skid**
- **Short erection time at site due to a "plug and play" system**
- **Fast, early and flexible layout planning**

SST-300

Power output	**140 bar(a) / 2,030 psi**
Speed	**up to 12,000 rpm**
Live steam parameters	
Inlet pressure	140 bar(a) / 2,030 psi
Inlet temperature	540 °C / 1,004 °F
Exhaust steam parameters	
Exhaust pressure for backpressure	20 bar(a) / 290 psi
Exhaust pressure for condensing	0.7 bar(a) / 10.2 psi
Steam extraction parameters	
Controlled extraction pressure	30 bar(a) / 435 psi
Controlled extraction temperature	400 °C / 752 °F
Number of extraction valves for controlled extraction	up to 2
Uncontrolled extraction pressure	60 bar(a) / 870 psi
Number of extraction valves for uncontrolled extraction	up to 5

SST-300

Waste-to-energy plant, Lincoln / UK

In operation since 2014, the Lincolnshire Waste-to-energy facility provides a safe, sustainable and affordable waste treatment solution to dispose of household waste, with a useful and profitable by-product: electricity. It burns 150.000 t of waste a year

Power output:
25.15 MW

Speed:
5,300 rpm

Live steam pressure:
58 bar / 841 psi

Live steam temperature:
397 °C / 746 °F

Exhaust steam pressure:
0.07 bar / 1 psi



Typical applications

- Biomass plants
- Chemical and petrochemical industry
- Cement industry
- Combined cycle power plants and combined heat and power plants
- Concentrated solar power plants
- District heating
- Waste-to-energy plants (waste incineration)
- Pulp and paper mills
- Sugar industry
- Steel works and mines

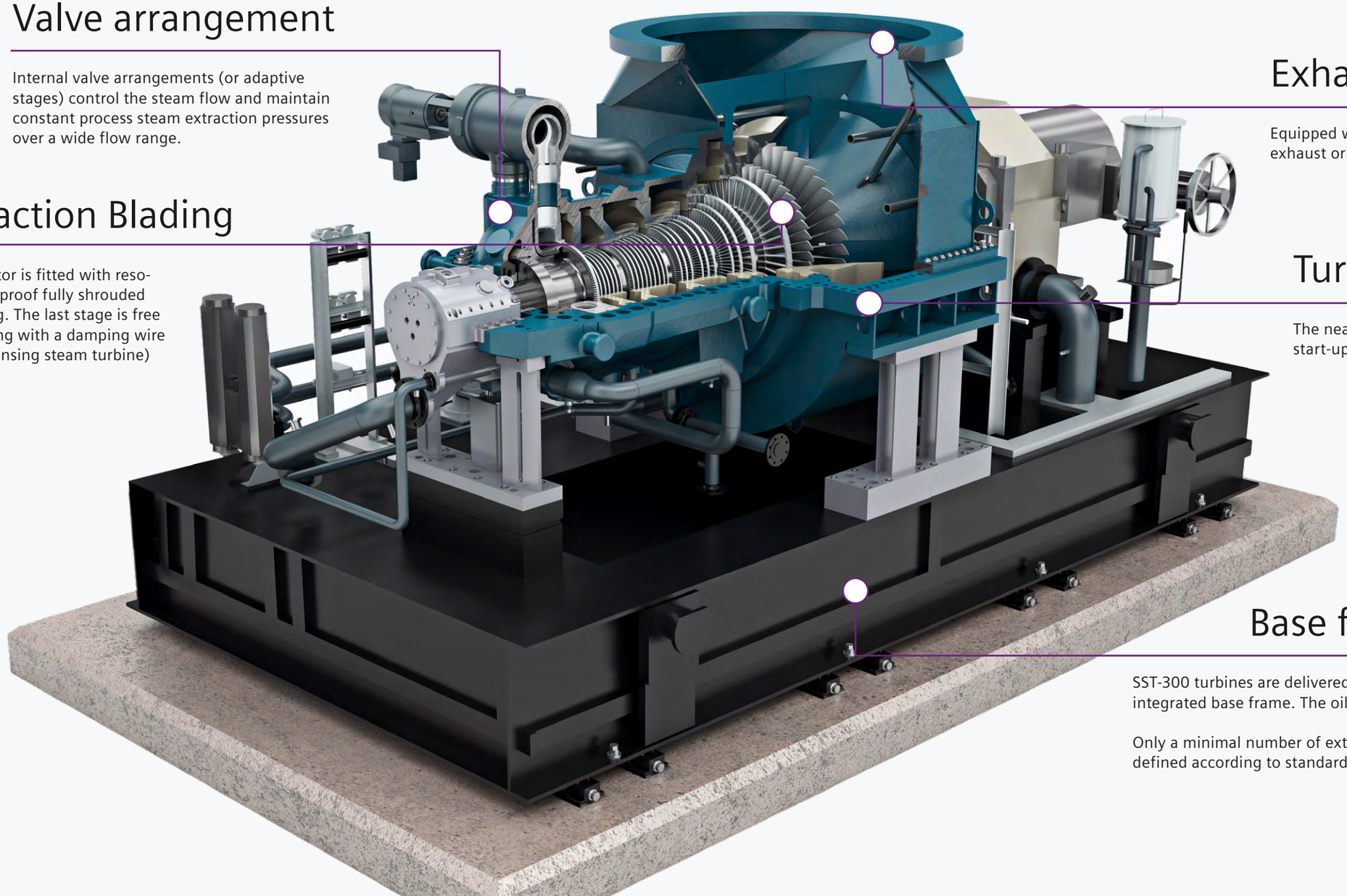
SST-300

Valve arrangement

Internal valve arrangements (or adaptive stages) control the steam flow and maintain constant process steam extraction pressures over a wide flow range.

Reaction Blading

The rotor is fitted with resonance-proof fully shrouded blading. The last stage is free standing with a damping wire (condensing steam turbine)



Exhaust

Equipped with upward, downward or axial exhaust orientation

Turbine Casing

The nearly symmetrical casing allows short start-up times and quick load changes.

Base frame

SST-300 turbines are delivered as packaged units with simple or integrated base frame. The oil tank is inside the base frame.

Only a minimal number of external connections, which are clearly defined according to standards, ensure fast and easy installation.

SST-400

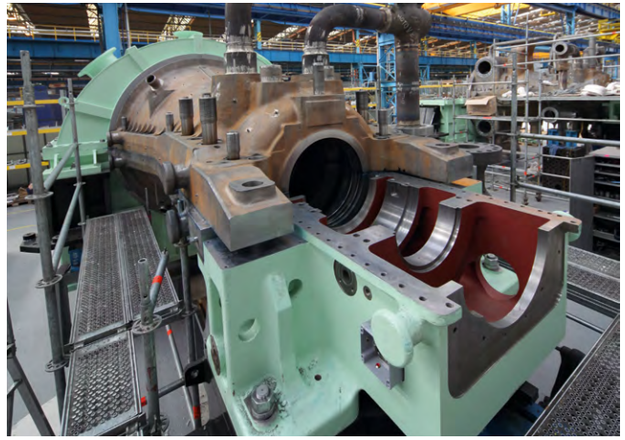
Industrial steam turbine

The SST-400 is a single casing steam turbine, providing geared or direct drive to 50 and 60 Hz generators, or to compressors and pumps. The symmetrical casing with horizontal joint flange enables the SST-400 to achieve short start-up times and rapid load changes.

The modular package design allows a wide variety of configurations to satisfy the customer's individual needs in the most economical way. The utilization of selected proven components assures high reliability and easy maintenance.

The SST-400 can be equipped with upward, downward or axial exhaust to fit with the selected installation. The turbine skid can be combined with standardized gearbox-oil units and generators to a turboset, according to the customer's needs.

The turbine skid and gearbox / oil unit are fully assembled in the workshop before being shipped to the site. Our proven installation and maintenance concept lowers maintenance cost by enabling easy access to the installed components, the turbine, gearbox, and generator.





At a glance

- **Fast and early layout planning**
- **Short delivery time**
- **Compact design minimizes space requirements of installation**
- **Easy access to mechanical components facilitates maintenance**

SST-400

Power output	**≤ 65 MW**
Speed	**up to 7,100 rpm**
Live steam parameters	
Inlet pressure	140 bar(a) / 2,030 psi
Inlet temperature	up to 540 °C / 1,004 °F
Exhaust steam parameters	
Exhaust pressure for backpressure	25 bar(a) / 365 psi
Exhaust pressure for condensing	0.5 bar(a) / 7.1 psi
Steam extraction	
Controlled extraction pressure	40 bar(a) / 580 psi
Controlled extraction temperature	450 °C / 842 °F
Number of extraction valves for controlled extraction	up to 2
Uncontrolled extraction pressure	60 bar(a) / 870 psi
Number of extraction valves for uncontrolled extraction	up to 5

SST-400

Waste-to-energy plant, Mallorca / Spain

Tourism drives the local development and welfare of the Mediterranean island. The significant number of island guests causes the population to vary between about 1 million in winter and 6 million in summer. This poses a challenging task for the proper disposal of daily waste. The EfW-plant in Palma de Mallorca has a capacity of about 430,000t per year. Mallorca reached zero landfill waste

Power output:
38 MW (steam turbine)

Speed:
4,500 rpm

Inlet temperature:
397 °C / 746 °F

Inlet pressure:
50 bar / 725 psi



Typical applications

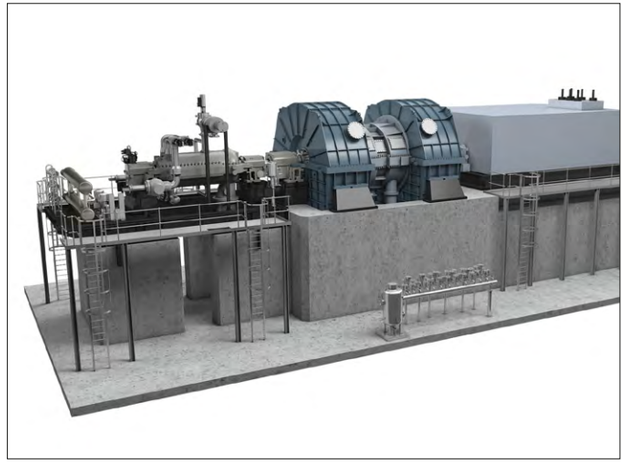
- Power generation industrial power plants
- Biomass & waste
- District heating
- Combined cycle power plants
- Mechanical drive
- Waste heat recovery

SST-500

Double exhaust flow steam turbine in a single or multi-casing solution

The SST-500 is a single casing, double exhaust flow steam turbine, which can be used as an entire drive or as the low-pressure module of a multiple-casing turboset, directly driven or geared. This turbine, with its capacity to operate over a wide range of speed and power, is ideal for large steam volume flows.

Steam flows into the turbine via two tangential inlets to equalize thermal loading and blade stress. Emergency stop valves and control valves are installed in the steam inlet pipes. The steam flows tangentially into the inner casing and then axially to both exhausts. The customized design of the steam path allows exact adjustment to surpass general physical limitations of the last stage blades. Double-end drive is available, if required, e. g. for booster pump drive.





At a glance

- **Double-casing reheat or non-reheat solution**
- **Customized steam path**
- **Short delivery time due to extensive pre-design**
- **Easy access to mechanical components facilitates maintenance**

SST-500	
Power output	≤ 150 MW
Speed	3,000 / 3,600 – up to 15,000 rpm
Live steam parameters	
Inlet pressure	30 bar(a) / 435 psi
Inlet temperature	400 °C / 750 °F
Exhaust steam parameters	
Exhaust pressure for backpressure	up to 3.0 bar(a) / 43.5 psi
Exhaust pressure for condensing	0.7 bar(a) / 10.1 psi
Exhaust pressure for district heating	up to 3 bar(a) / 43 psi
Steam extraction parameters	
Uncontrolled extraction pressure	8 bar(a) / 116 psi
Number of extraction valves for uncontrolled extraction	up to 4

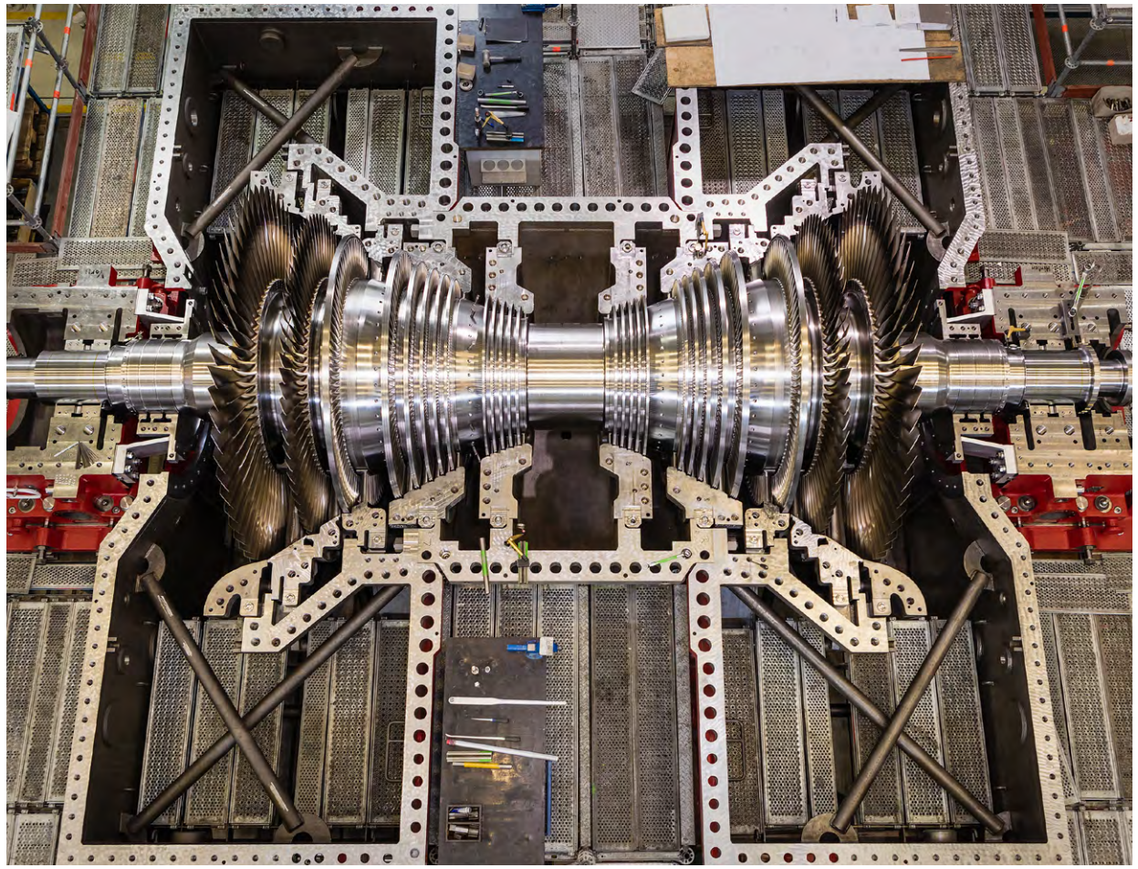
SST-500

Solarthermal power plant, Dubai

Dubai's new CSP plant is designed to collect heat from the sun and store it in molten salt or convert it directly into electricity via a steam generator set – an ideal solution for providing round-the-clock renewable electricity in unpredictable conditions. Noor Energy 1, the 950 MW Hybrid Concentrated Solar Power (CSP) and PV plant, is the largest single-site CSP and single hybrid solar power project in the world. Four steam turbine generator sets deliver power to it, three of which are a SST-800/500 combination

Customer:
Noor Energy 1, Dubai

Scope of supply:
- 3 × SST-800/500 steam turbine in parabolic trough, each 206 MW power output
- 1 × SST-700/900 steam turbine for a solar tower application, 108 MW power output
- Steam turbine auxiliaries (lube and control oil unit, seal steam supply)
- 4 × SGen5-100A-2P generators
- T3000 turbine control system



Typical applications

- Solarthermal power plants
- Combined cycle plants
- Pump drive (e.g. feedwater pump for large boilers)
- Generator drive
- Compressor drive
- Chemical industry
- Steel works
- Waste to energy, e.g. waste incinerators
- Waste heat from chemical processes

SST-600

Flexible condensing or back-pressure steam turbine

Generator drive in various packages

The standard steam turbine generator set includes the SST-600 (with or without gearbox), a generator, oil system, piping and instrumentation and the control system. The standard package can be extended to include a condenser, condensing plant or pre-heating system.

The SST-600 with its reliable and flexible design is available with axial or radial exhaust.

Mechanical drive

The SST-600 is also an efficient and economic mechanical drive. Since the 1970s, hundreds of projects have been successfully implemented all over the world using the SST-600 to directly drive everything from the smallest boiler feedwater pump just as reliably as the largest compressor even in the most complex processes. The SST-600 complies with regulations including the API standard.





At a glance

- Soft reheat up to 400°C
- Outstanding efficiency
- Fast start-up times
- Highest reliability
- Economic installation and operation
- Flexibility for complex, industrial processes

SST-600

Power output	**≤ 200 MW**
Speed	**3,000 / 3,600 – up to 18,000 rpm**
Live steam parameters	
Inlet pressure	165 bar(a) / 2,393 psi
Inlet temperature	565 °C / 1,050 °F
Exhaust steam parameters	
Exhaust pressure for backpressure	72 bar(a) / 1,044 psi
Exhaust pressure for condensing	up to 1.2 bar(a) / 16 psi
Exhaust pressure for district heating	up to 3 bar(a) / 43 psi
Steam extraction parameters	
Controlled extraction pressure	72 bar(a) / 1,044 psi
Controlled extraction temperature	480 °C / 895 °F
Number of extraction valves for controlled extraction	up to 2
Uncontrolled extraction pressure	85 bar(a) / 1,233 psi
Number of extraction valves for controlled extraction	up to 6

SST-600

Biomass district heating plant, Västergötland / Sweden

The district heating plant operated by Mölndal Energie supplies 91MWth thermal power and 23 MWe electricity.

It has been in operation since 2009 and uses wood as fuel.
Delivery of the complete turboset (SST-600 and generator).

Power output:
25 MW

Live steam temperature:
519 °C / 966 °F

Live steam pressure:
122 bar / 1,769.5 psi

Exhaust steam pressure:
0.5 bar / 7.3 psi

Speed:
5,000 rpm



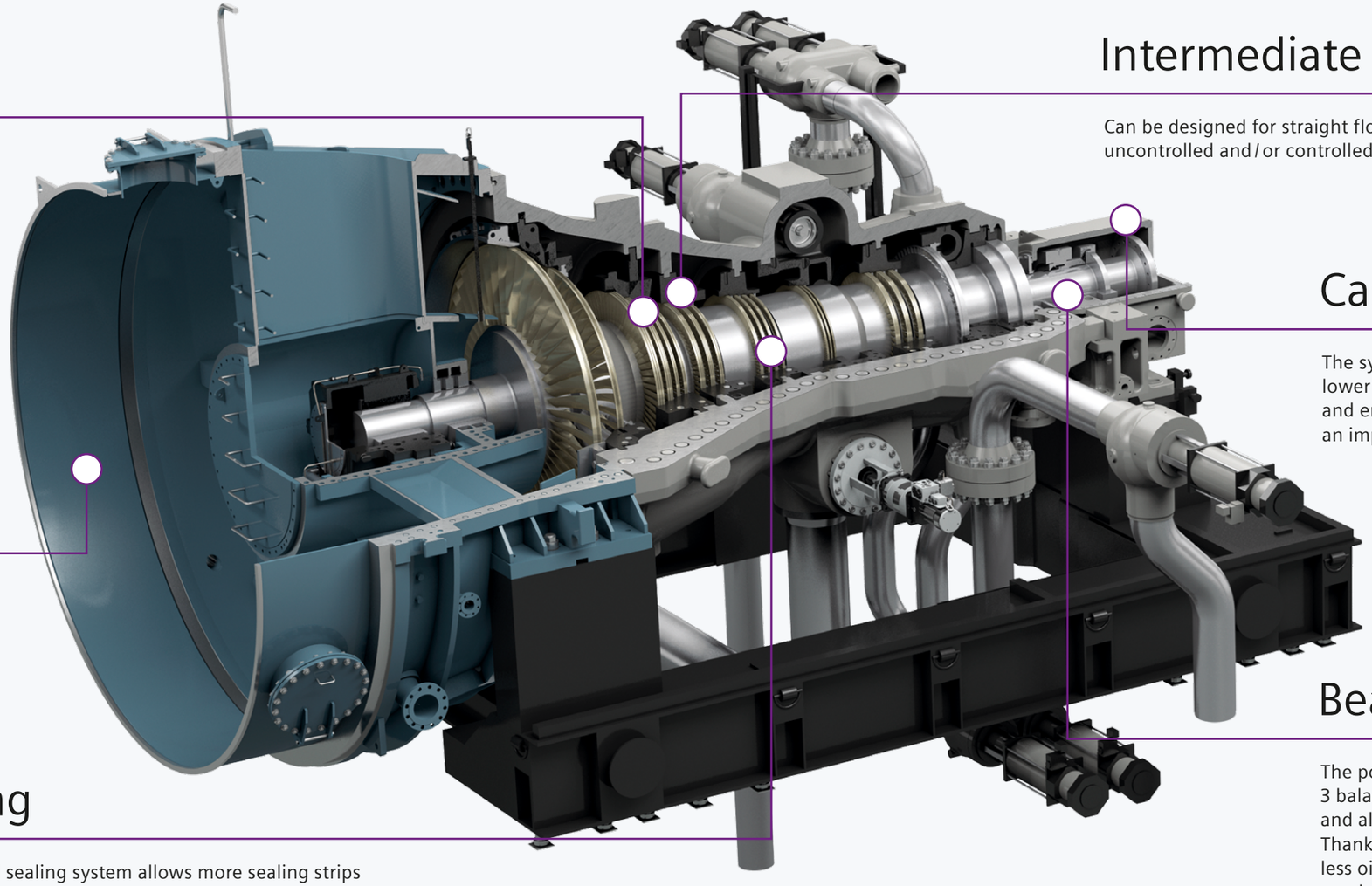
Typical applications

- Chemical and petrochemical industry
- Pulp and paper mills
- Steel works
- Mines
- Power plants
- Seawater desalination plants
- Biomass and Waste-to-energy plants (waste incineration)
- District heating plants

SST-600

Blades

The improved cylindrical high pressure blades and tapered intermediate pressure blades allow longer airfoils and contribute to the overall high efficiency.



Intermediate section

Can be designed for straight flow, or equipped with uncontrolled and / or controlled extractions.

Casing

The symmetrical design of the upper and lower halves avoids material concentrations and ensures improved thermal behavior and an improved start up time.

Exhaust section

A wide range of exhaust sizes and types is available for back-pressure and condensing applications.

Bearing

The possibility of applying up to 3 balancing pistons minimizes thrust and allows smaller axial bearings. Thanks to improved journal bearings less oil and a smaller oil tank are needed.

Sealing

The improved sealing system allows more sealing strips per blade row at both moving and stationary blades.

SST-800

Steam turbine with center steam admission

Generator drive in various packages

The SST-800 is a single casing steam turbine with center steam admission and reverse steam flow inner casing, designed for a direct coupled generator or mechanical drive. The power output with dual casing solution is up to 250 MW.

The highly customized turbine provides for an outstanding efficiency, fast start-up times and high reliability and availability. It supports all requirements for economical installation and operation in combination with highest flexibility for complex industrial processes. A double or even multicasing solution can also be provided.

The SST-800 steam turbine can be used for both condensing and back-pressure applications. It is built up from pre-designed modules combined into a single unit for optimum matching of the required parameters. Turbine auxiliary systems are also designed as pre-engineered modules covering the complete range of turbine sizes.

The SST-800 turbine is equipped with impulse control stage and reaction blading fixed in blade carriers. Furthermore the turbine is offered with throttle controlled inlets. The turbine can be arranged on a foundation or as a package (includung oil system and on a base frame). The SST-800 steam turbine design is in accordance with DIN or API standards.





At a glance

- Single casing with or withouth reheat
- Outstanding efficiency
- Fast start-up times
- Highest reliability
- Economic installation and operation
- Flexibility for complex, industrial processes

SST-800

Power output	**≤ 250 MW**
Speed	**3,000 / 3,600 – up to 7,100 rpm**
Live steam parameters	
Inlet pressure	165 bar(a) /2,393 psi
Inlet temperature	565 °C / 1,050 °F
Exhaust steam parameters	
Exhaust pressure for backpressure	72 bar(a) / 1,044 psi
Exhaust pressure for condensing	up to 1.2 bar(a) / 16 psi
Exhaust pressure for district heating	up to 3 bar(a) / 43 psi
Steam extraction parameters	
Reheat temperature	565 °C / 1,050 °F
Controlled extraction pressure	72 bar(a) / 1,044 psi
Controlled extraction temperature	480 °C / 895 °F
Number of extraction valves for controlled extraction	up to 2
Uncontrolled extraction pressure	140.0 bar(a) / 2030.5 psi
Number of extraction valves for uncontrolled extraction	up to 7

SST-800

Steam Turbines for Pulp & Paper Industry SST-800, Klabin / Brazil

Two SST-800 steam turbines are supplying electricity and process steam to a pulp factory in Brazil. The SST-800 has a capacity of 190 megawatts (MW), making it among the largest steam turbines in use in the pulp and paper industry worldwide.

Power output:
190 MW

Speed:
3,600 rpm

Inlet steam pressure:
100 bar / 1,450 psi

Inlet steam temperatue:
498 °C / 928 °F



Typical applications

- Combined cycle power plants (CCPP)
- Combined heat and power plants (CHP)
- Oil & Gas industries
- Industrial power plants (e. g. captive power plants in chemical and petrochemical industries, manufacturing industries, paper mills, mines, metal and cement plants, waste heat recovery)
- District heating plants
- Biomass plants and waste-to-energy plants (WtE)
- Concentrated solar power plants (CSP)

SST-800

Center steam admission

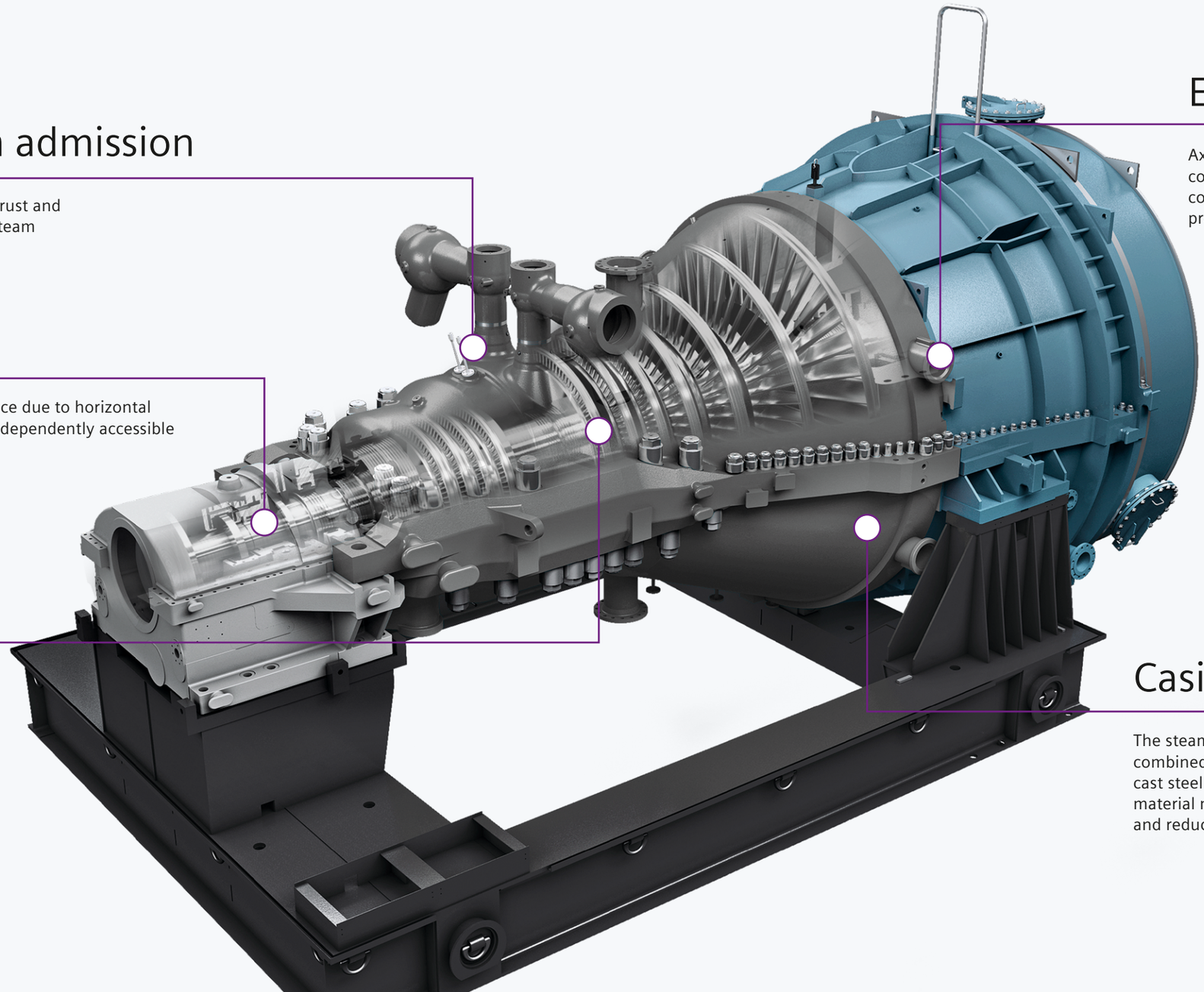
The reverse flow adjusts the thrust and relieves the bearings of large steam turbines

Bearings

Simplified maintenance due to horizontal casing split and / or independently accessible bearings

Steam path

Highly customized section with up to 2 internally or externally controlled extractions and up to 7 uncontrolled extractions.



Exhaust section

Axial or downward connection for condensing, upward or downward connection for backpressure is provided

Casing

The steam turbine casing is based on a combined housing concept featuring a cast steel and welded design. The material mix ensures high availabilty and reduced delivery times.

SST-700/900

Industrial steam turbine

Economical dual casing steam turbine for reheat applications

The SST-700/900 is a standard turbine solution with short delivery time due to its fixed pre-engineered design. Predefined modules enable a short manufacturing period, cost-efficient material supply and a fast ex-works delivery. The straight flow turbine solution with power output of up to 250 MW consists of a geared high-pressure steam turbine (backpressure), an intermediate/low-pressure steam turbine (condensing), both driving a generator installed in between.

The dual casing reheat turbine configuration with inner casing is a competitive and optimized product for combined cycle power plants and concentrated solar power plants.



At a glance

- Fast load changes
- Short start up times
- Highest efficiency thanks to reheat
- Increased life cycle
- Low level arrangement
- Reheat application

SST-700/900

Power output	**≤ 250 MW**
Speed	**3,000/3,600 rpm**
Live steam parameters	
Inlet pressure	180 bar(a)/2,611 psi
Inlet temperature	565 °C/1,050 °F
Exhaust steam parameters	
Exhaust pressure for condensing	0.7 bar(a)/10.1 psi
Steam extraction parameters	
Reheat temperature	565 °C/1,050 °F
Controlled extraction pressure	72 bar(a)/1,044 psi
Controlled extraction temperature	480 °C/895 °F
Number of extraction valves for controlled extraction	up to 3
Uncontrolled extraction pressure	85 bar(a)/1,233 psi
Number of extraction valves for uncontrolled extraction	up to 7

SST-700/900

Parabolic trough technology in Morocco

On February 4, 2016, the King of Morocco, Mohammed VI, inaugarated the Noor I unit of Ouarzazate Solar Power Station. This is the first of four phased Noor projects at Ouarzazate site which are expected to provide a total electrical generating capacity of 580 megawatts, making it the largest complex of its kind in the world. Delivery of three turbine-generator sets for the power station.

Steam turbine:
SST-700 / 900

Power output:
160 MW

Inlet steam temperature:
380 °C / 716 °F

Inlet steam pressure:
168 bar(a) / 2,437 psi

Exhaust pressure:
0.06 bar(a) / 0.87 psi



Steam turbine SST-900 for the CSP-plant NOOR III, Morocco

Typical applications

- Combined cycle power plants
- Concentrated solarthermal power plants
- Biomass-fired power plants

Performance data overview

Steam turbine type	SST-700/900	SST-800	SST-600	SST-500	SST-400	SST-300	SST-200
Output SPP *MW*	≤250	≤250	≤200	≤150	≤65	≤60	≤25
Rotational Speed *rpm*	3,000/3,600	3,000/3,600 – up to 7,100	3,000/3,600 – up to 18,000	3,000/3,600 – up to 15,000	up to 7,100	up to 12,000	up to 13,500
Inlet pressure *bar/psi*	180/2,611	165/2,393	165/2,393	30/435	140/2,030	140/2,030	120/1,740
Inlet temperature *°C/°F*	565/1,050	565/1,050	565/1,050	400/750	540/1,004	540/1,004	540/1,004
Exhaust Pressure (back) *bar/psi*		72/1,044	72/1,044	up to 3.0/43.5	25/365	20/290	20/290
Exhaust Pressure (cond.) *bar/psi*	0.7/10.1	up to 1.2/16	up to 1.2/16	0.7/10.1	0.5/7.1	0.7/10.2	0.7/10.2
Exhaust Pressure (distr.) *bar/psi*		up to 3/43	up to 3/43	up to 3/43			
Reheat temperature *°C/°F*	565/1,050	565/1,050					
Controlled extraction pressure *bar/psi*	72/1,044	72/1,044	72/1,044		40/580	30/435	16/232
Controlled extraction temperature *°C/°F*	480/895	480/895	480/895		450/842	400/752	350/662
Number of extraction valves for controlled extraction	up to 3	up to 2	up to 2		up to 2	up to 2	up to 1
Uncontrolled extraction pressure *bar/psi*	85/1,233	140.0/2030.5	85/1,233	8/116	60/870	60/870	60/870
Number of extraction valves for uncontrolled extraction	up to 7	up to 7	up to 6	up to 4	up to 5	up to 5	up to 4

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