Efficiency: More value to your facility

Siemens steam turbine portfolio
Steam turbines from 10 kW to 1,900 MW
With over a century of experience and continuous development in steam turbine technology, Siemens 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 worldwide, Siemens is a reliable and experienced partner.

Siemens Steam Turbines are an essential piece of turbo-machinery in 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.

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Steam turbines
from 10 kW
to 1,900 MW
### Steam Turbines Overview

<table>
<thead>
<tr>
<th>Output (MW)</th>
<th>SST-9000</th>
<th>SST-6000</th>
<th>SST-5000</th>
<th>SST-4000</th>
<th>SST-3000</th>
<th>SST-700/900</th>
<th>SST-800/1500</th>
<th>SST-800</th>
<th>SST-600</th>
<th>SST-400</th>
<th>SST-300</th>
<th>SST-200</th>
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</thead>
<tbody>
<tr>
<td>10</td>
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<td>page 8</td>
<td>page 40</td>
<td>page 44</td>
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<td>page 34</td>
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<td>100</td>
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<tr>
<td>1000</td>
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**Utility Steam Turbines**

**Industrial Steam Turbines**
### Steam Turbines Overview

<table>
<thead>
<tr>
<th>Output (kW)</th>
<th>100</th>
<th>1,000</th>
<th>5,000</th>
<th>10,000</th>
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<tbody>
<tr>
<td>D-R RL / RLVA</td>
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<td>page 52</td>
<td></td>
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</tr>
<tr>
<td>D-R RLH</td>
<td>1,865</td>
<td>page 54</td>
<td></td>
<td></td>
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<tr>
<td>D-R SST 350</td>
<td>750</td>
<td>page 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-R SST 500</td>
<td>2,600</td>
<td>page 50</td>
<td></td>
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<tr>
<td>D-R SST 700</td>
<td>3,000</td>
<td>page 50</td>
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<tr>
<td>D-R 2TA</td>
<td>3,750</td>
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<tr>
<td>D-R AVTTW/GTW</td>
<td>4,500</td>
<td>page 58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-R C</td>
<td>3,600</td>
<td>page 59</td>
<td></td>
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</tr>
<tr>
<td>D-R GAF</td>
<td>4,000</td>
<td>page 60</td>
<td></td>
<td></td>
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<tr>
<td>D-R K</td>
<td>4,850</td>
<td>page 65</td>
<td></td>
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<tr>
<td>D-R R / RS</td>
<td></td>
<td></td>
<td></td>
<td>25,000</td>
</tr>
<tr>
<td>D-R B</td>
<td></td>
<td></td>
<td></td>
<td>11,000</td>
</tr>
<tr>
<td>D-R Tandem (B-B, B-C)</td>
<td></td>
<td></td>
<td></td>
<td>12,500</td>
</tr>
</tbody>
</table>
Siemens offers a comprehensive range of steam turbine products in the power output range from 90 to 1,900 MW. These are used in conventional fossil-fired 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.

Utility steam turbines from 90 to 1,900 MW

- SST-3000 ........................................ 8
- SST-4000 ........................................ 12
- SST-5000 ........................................ 16
- SST-6000 ........................................ 20
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Flexible steam turbine for applications in single-shaft and multi-shaft combined cycle configurations

In our Siemens 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 250 MW.

The Ribatejo power plant was one of the most technologically advanced combined cycle power plants at the time of construction. In operation: unit1: 02/2004, unit2: 10/2004, unit3: 03/2006

Net plant output:
3 x 390 MW

Steam turbine output:
3 x 142 MW

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

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

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

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

Ribatejo, Portugal

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Short project schedule and installation time

Ribatejo, Portugal
Bearing

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

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 minimal clearances.

Intermediate pressure / low pressure turbine

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

Combined stop and control valve

For easy opening of steam turbine using valves are connected to the lower part of the outer casing via bolt connection.
**SST-4000**

Utility steam turbine package

- 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
- Widely variable reaction type
- Long service intervals lead to low maintenance costs and high availability

**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.

---

**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.

**Customer:**
Al Ezzel Power Company

**Plant type:**
SCE5-2000E multi shaft 2 × 1

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

**Commercial operation:**
unit 1: 04 / 2006
unit 2: 05 / 2007

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**Technical Data**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant output</td>
<td>100 up to 500 MW</td>
</tr>
<tr>
<td>Frequency</td>
<td>50 or 60 Hz</td>
</tr>
<tr>
<td>Mainsteam conditions</td>
<td>500 bar / 7,250 psi</td>
</tr>
<tr>
<td>Inlet pressure</td>
<td>up to 105 bar / 1,523 psi</td>
</tr>
<tr>
<td>Inlet temperature</td>
<td>up to 565° C / 1,049° F</td>
</tr>
<tr>
<td>Last stage blade length</td>
<td>50 Hz: 80 cm to 115 cm (31 inches to 45 inches)</td>
</tr>
<tr>
<td>60 Hz: 76 cm to 95 cm (30 inches to 38 inches)</td>
<td></td>
</tr>
</tbody>
</table>

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Al Ezzel Power Company

**Plant type:**
SCE5-2000E multi shaft 2 × 1

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

**Commercial operation:**
unit 1: 04 / 2006
unit 2: 05 / 2007
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.

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

Single crossover pipe
crossover pipe designed to minimize losses, reduces plant complexity and minimizes footprints.

Bearing
Single bearing arrangement between IP and LP turbine cylinders for simple alignment and stable operation.
A steam turbine with short start-up times and variable start-up modes to ensure grid stability

Siemens Steam Turbines of the SST-5000 series are operated in combined cycle power plants (CCPP) and in coal-fired steam power plants (SPP). The SST-5000 steam turbine combined with an SGT-8000H gas turbine, achieves a class record net plant efficiency of more than 63 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.

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. Overall plant efficiency considering thermal extraction was above 85%-100% thermal power extraction through one steam turbine train.

Los Angeles Power Plant

Plant type: SCS-8000H 1S (single shaft)
Power output: 604 MW
Efficiency: 61.5%

<table>
<thead>
<tr>
<th>SST-5000 CCPP</th>
<th>MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
<td>128 MW to 650 MW</td>
</tr>
<tr>
<td>Efficiency</td>
<td>61.5% for subcritical</td>
</tr>
<tr>
<td>Temperature</td>
<td>60 to 1266 °C</td>
</tr>
<tr>
<td>Main steam conditions</td>
<td>up to 200 bar (3000 psi)</td>
</tr>
<tr>
<td>Reheat steam conditions</td>
<td>up to 610 °C (1130 °F)</td>
</tr>
<tr>
<td>Temperature</td>
<td>up to 610 °C (1130 °F)</td>
</tr>
<tr>
<td>Length blade length</td>
<td>56 cm to 142 cm (26 inches to 56 inches)</td>
</tr>
</tbody>
</table>
High-pressure / intermediate-pressure turbine

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

Combined stop & control valve

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

Low-pressure turbine

Inner and outer casing of the double-flow turbine are mechanically decoupled. This ensures 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 crossover pipe

Crossover pipe designed to minimize losses, reduce plant complexity and minimize footprint.
Reduced lifecycle costs with the SST-6000 steam turbine

Siemens 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.

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

Eemshaven, Netherlands

Thanks to a highly efficient power plant process the Eemshaven steam power plant consumes less hard coal compared to the average of coal-fired power plants. This leads to a reduction in CO₂ emissions of 2.5 million metric tons per year.

Power output: 2 × 800 MW
Efficiency: 46.2 %
Main Steam: 275 bar/597 °C / 3,989 psi / 1,107 °F
Reheat Steam: 629 °C / 1,163 °F
Commissioning: 2014
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

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

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 underneath the low pressure turbine casing

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

The SST-9000 is a highly reliable steam turbine for applications in the conventional islands of advanced pressurized water reactors in nuclear power plants, with a power output up to 1,900 MW. The half-speed SST5-9000 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.

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

Olkiluoto 3, Finland
Nuclear Power Plant

Customer: Teollisuuden Voima Oyj (TVO)
Scope of supply: Conventional Island
Commercial Operation: Jan 2020 (planned)
Power Output: Approx. 1,600 MW (net)
Grid Frequency: 50 Hz
Turbine Frequency: 25 Hz

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

High operational flexibility

Extended lifetime, thanks to state-of-the-art engineering and proven service concepts

Turbine Frequency

<table>
<thead>
<tr>
<th>Power output</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000 to 1,900 MW</td>
<td>50 Hz</td>
</tr>
</tbody>
</table>

Inlet pressure

- up to 80 bar / 1,160 psi

Inlet temperature

- up to 310 °C / 590 °F

Extended lifetime, thanks to state-of-the-art engineering and proven service concepts

Olkiluoto, Finland

Photo: ©TVO
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.
The Siemens SST-200 Siemens industrial steam turbine product line is based on the reaction blade technology. The turbine series follows a modular product philosophy, ensuring a high level of performance and reliability. The ability to combine standardized casing modules enables 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 back pressure 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.

**Technical Data**

- **Maximal output** up to 20 MW
- **Speed** up to 14,600 rpm
- **Inlet pressure** up to 120 bar (a) / 1,740 psi
- **Inlet temperature** up to 540 °C / 1,004 °F
- **Exhaust pressure**
  - Water-Cooled Condenser: 0.05–0.15 bar (a)
  - Air-Cooled Condenser: 0.15–0.50 bar (a)
  - Backpressure Turbine: 2–20 bar (a)
- **Steam extraction**
  - Controlled (up to 4) up to 16 bar / 230 psi
  - Uncontrolled: 60 bar / 870 psi

**Typical applications**

- Generator and mechanical drive
- Chemical and petrochemical industry, such as Ethylene plants, Ammonia and fertilizer plants, Methanol plants
- Sugar mills
- Biomass plants
- Metals & mining
- Energy from waste plants

**Tamoil, Switzerland**
2 turbines producing: average 5 MW each in mechanical drive application

**Steam turbine:**
- SST-200

**Power output:**
- 5 MW each
- Mechanical drive

**SST-200**
Industrial steam turbine

**Modular design for short delivery time**
**Thermoflexible design**
**Fast and early layout planning**
**Compact design minimizes space requirements of installation**
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 can be mounted on a common base frame or skid**

**Short erection time at site due to a “plug and play” system**

**Fast, easy and flexible layout planning**

Waste-to-energy plant, Lincolnshire/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

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.

Waste-to-energy plant, Lincolnshire/UK

### SST-300

**Industrial steam turbine**

<table>
<thead>
<tr>
<th>Power output</th>
<th>up to 45 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>up to 12,000 rpm</td>
</tr>
<tr>
<td>Water pressure</td>
<td>140 bar / 2,030 psi</td>
</tr>
<tr>
<td>Inlet temperature</td>
<td>540 °C / 1,004 °F</td>
</tr>
<tr>
<td>Exhaust steam parameters</td>
<td>Back pressure up to 16 bar / 232 psi</td>
</tr>
</tbody>
</table>
<br>Condensing up to 0.3 bar / 4.4 psi |
<br>District heating up to 3.0 bar / 43 psi |
| Controlled extractions (up to 2) | Single or double adaptive stage, nozzle control, throttle control |
| Pressure | up to 25 bar / 362 psi |
| Temperature | 400 °C / 752 °F |
| Uncontrolled extractions (up to 6) | Pressure | up to 60 bar / 870 psi |
<br>Temperature | 600 °C / 1,112 °F |

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

Base frame
SST-300 turbines are delivered as packaged units with simple or integrated base frames. The airside 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-300

Exhaust
Equipped with upward, downward or axial exhaust orientation

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

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)
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.

### Waste-to-energy plant, Mallorca / Spain

Tourism drives the local development and welfare of the Mediterranean island. The significant number of visitors 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 430,000 t per year. Mallorca reached zero landfill waste in 2020.

- **Power output:** 38 MW (steam turbine)
- **Speed:** 4,500 rpm
- **Inlet temperature:** 397 °C / 746 °F
- **Inlet pressure:** 50 bar / 725 psi

### SST-400 Specifications

- **Power output:** up to 60 MW
- **Speed:** up to 8,000 rpm
- **Inlet pressure:** up to 140 bar / 2,030 psi
- **Inlet temperature:** up to 540 °C / 1,004 °F
- **Exhaust steam parameters:**
  - **Back pressure:** up to 25 bar / 363 psi
  - **Condensing:** up to 0.3 bar / 4.4 psi
- **Steam extraction:**
  - Controlled (up to 4): up to 45 bar / 653 psi
  - Uncontrolled: up to 60 bar / 870 psi

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**Typical applications**

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

**SST-600**

Flexible condensing or back-pressure steam turbine

**Generator drive in various packages**

We deliver a standard steam turbine generator set including the SST-600 (with or without reheat), 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.

**SST-600**

- Power output up to 200 MW
- Speed 3,000 to 18,000 rpm
- Inlet parameters
  - Pressure up to 165 bar / up to 2,393 psi
  - Temperature up to 565 °C / 1,050 °F
- Exhaust steam parameters
  - Pressure up to 80 bar / 1,160 psi
  - Temperature up to 1.0 bar / 15 psi
  - District heating up to 3.0 bar / 43 psi
- Controlled extractions (up to 2)
  - Pressure, ext. valve up to 72 bar / 1,044 psi
  - Pressure, int. valve up to 45 bar / 798 psi
- Temperature up to 480 °C / 895° F
- Uncontrolled extractions (up to 6)
  - Pressure up to 85 bar / 1,233 psi

**Biomass district heating plant, Västergötland / Sweden**

The district heating plant operated by Bihedral Energia supplies 19,600 thermal power and 22,500 tonnes. It has been in operation since 2009 and uses wood as fuel. Siemens delivered 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

**Biomass district heating plant, Västergötland / Sweden**

The district heating plant operated by Mölndal Energie supplies 91 MWth thermal power and 23 MWe electricity. It has been in operation since 2009 and uses wood as fuel. Siemens delivered 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

**Soft reheat up to 400°C**

- Outstanding efficiency
- Fast start-up times
- Highest reliability
- Economic installation and operation
- Flexibility for complex, industrial processes


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.

Intermediate section

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

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.

Sealing

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

Blades

The improved cylindrical high pressure blades and tapered intermediate pressure blades allow longer airfoils and contribute to the overall high efficiency.
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 nozzle 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 customised 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 (including oil system and or a base frame). The SST-800 steam turbine design is in accordance with DIN or API standards.

The SST-800 steam turbine for the pulp plant Klabin, Brazil

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

Two Siemens 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 temperature: 498 °C / 928 °F

Two Siemens 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 temperature: 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.

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

Exhaust section
Axial or downward connection for condensing, upward or downward connection for back pressure is provided.
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 non-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.

### SST-800 / 500

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

The SST-800 / 500 is suitable for use in a single or multi-casing solution. It 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**
- Tangentially into the inner casing
- Axially to both exhausts

**Steam path customization**
- Exact adjustment to surpass general physical limitations of the last stage blades

**Double-end drive**
- Available if required, e.g. for booster pump drive

**BSolarthermal power plant, Morocco**

- **Customer**: Masen, Ouarzazate Solar Power Station
- **Project**: Three dual-casing steam turbines put into service at the Noor II (a solar tower plant) in a SST-500/800
- **Power output**: 200 MW
- **Inlet temperature**: 380°C / 716°F
- **Inlet pressure**: up to 105 bar (1,522 psi)

**SST-500/800 Double-exhaust reheat solution**

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

### Specification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>SST-500</th>
<th>SST-800</th>
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<tbody>
<tr>
<td>Power output</td>
<td>up to 100 MW</td>
<td>up to 200 MW</td>
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<tr>
<td>Speed</td>
<td>up to 15,000 rpm</td>
<td>up to 3,000 to 3,600 rpm</td>
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<td>Steam parameters</td>
<td>Variable</td>
<td>Variable</td>
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<tr>
<td>Steam pressure</td>
<td>up to 30 bar (435 psi)</td>
<td>up to 165 bar (2,393 psi)</td>
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<td>Steam temperature</td>
<td>up to 395°C (743°F)</td>
<td>up to 565°C (1,050°F)</td>
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<td>Exhaust steam parameters</td>
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<td>Variable</td>
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<td>District heating</td>
<td>up to 1.5 bar (21.75 psi)</td>
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<td>Condensing</td>
<td>up to 0.5 bar (7.25 psi)</td>
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<td>Steam extraction</td>
<td>Uncontrolled (up to 2)</td>
<td>Variable pressure limits</td>
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<tr>
<td></td>
<td>Variable pressure limits</td>
<td>Variable pressure limits</td>
</tr>
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</table>
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 preengineered 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.

Parabolic trough technology in Morocco
On February 4, 2016, the King of Morocco, Mohammed VI, inaugurated 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. Siemens is supplying 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

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

Typical applications
• Combined cycle power plants
• Concentrated solar thermal power plants
• Biomass-fired power plants
With the D-R steam turbine portfolio Siemens has the most comprehensive range of API turbines available on the market, including:

- Standard single stage turbines for pump, fan & small compressor drives according to API 611 General Purpose (GP) standard
- Standard and engineered single stage turbines as generator drives for waste heat recovery applications
- Engineered single stage turbines for applications according to API 611 (General Purpose—GP) or API 612 (Special Purpose—SP) standards
- Standard multistage turbines for larger pumps, fans & compressors to API 611 or API 612 standards, or for power generation
- Turbines for geothermal plants
- Turbines for expansion of ORC and process fluids

As required either bare ST drivers to OEMs, or complete packages including gears, lube oil systems and controls are supplied

Benefits:

- Highest levels of quality & reliability for the most critical services in the business
- All units factory tested in accordance with API and customer requirements
- Units with modular designs, but engineered to order, according to customer project specifications & standards and local environmental requirements
D-R SST 350 / 500 / 700

Standard single stage steam turbine

Typical applications
- Refineries
- Petrochemical plants
- Palm oil plants
- Food processing
- Steel industry
- Pulp & Paper
- Institutional
- Process waste heat recovery
- Replacement of steam pressure reduction valve
- Feed water pumps
- Process pump drives
- Cooling water pumps
- Fans
- Compressors
- Generators

- Rugged, versatile design
- Woodward TG Oil Relay NEMA Class A constant speed governor or electronic governor
- Horizontally split casing with centerline support
- Overspeed mechanical trip valve, separated from governor valve
- Carbon ring or labyrinth sealing glands
- Built-in, removable steam strainer
- API style blanket lagging/insulation (API applications)
- Oil ring lubricated with forced pressure lubrication or circulating oil cooling options
- Rolling element or Tiltpad thrust bearings
- Broad range of controls and accessories available
- WORTHINGTON heritage

Technical Data

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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</thead>
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<tr>
<td>Power Output</td>
<td>2,460 kW / 3,500 HP</td>
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<td>Turbine Speed</td>
<td>≤ 12,000 rpm</td>
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<tr>
<td>Inlet Steam Temperature</td>
<td>≤ 482°C / 900°F</td>
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<tr>
<td>Inlet Steam Pressure</td>
<td>≤ 63 bar(695 psi)</td>
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<tr>
<td>Back pressure</td>
<td>21 bar(315 psi)</td>
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<tr>
<td>Type of wheel / blades</td>
<td>Curtis/Impulse</td>
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<tr>
<td>API 611 and API 612</td>
<td>Yes</td>
</tr>
<tr>
<td>Bearings</td>
<td>Sleeve, Ball or Tiltpad</td>
</tr>
</tbody>
</table>

50 51

50 51
D-R RLA / D-R RLVA

Standard single stage steam turbine

Rugged, versatile design
Radially split casing with centerline support
Woodward TG Oil Relay NEMA Class A constant speed governor
API 611 compliant, positive seating, mechanical overspeed trip valve
Separate double seated governor valve

Built-in removable steam strainer
Removable carbon ring sealing glands
API style blanket lagging/insulation (API applications)
Oil ring lubricated
Separate double seated governor valve

Built-in removable steam strainer
Removable carbon ring sealing glands
API style blanket lagging/insulation (API applications)
Oil ring lubricated
Separate double seated governor valve

Rugged, versatile design
Radially split casing
Woodward TG Oil Relay NEMA Class A constant speed governor
API 611 compliant, positive seating, mechanical overspeed trip valve
Separate double seated governor valve

Built-in removable steam strainer
Removable carbon ring sealing glands
API style blanket lagging/insulation (API applications)
Oil ring lubricated
Separate double seated governor valve

Rugged, versatile design
Radially split casing
Vertical shaft design with NEMA motor mounting flange & various ball thrust bearing configurations
Woodward TG Oil Relay NEMA Class A constant speed governor
API 611 compliant, positive seating, mechanical overspeed trip valve
Separate double seated governor valve

Built-in removable steam strainer
Removable carbon ring sealing glands
API style blanket lagging/insulation (API applications)
Grease lubricated with circulating oil options
Separate double seated governor valve

API 611 compliant, positive seating, mechanical overspeed trip valve
Separate double seated governor valve

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API 611 compliant, positive seating, mechanical overspeed trip valve
Separate double seated governor valve

Technical Data

<table>
<thead>
<tr>
<th>D-R RLA/RLVA</th>
<th>Power (kW)</th>
<th>745 (1000 HP)</th>
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<tbody>
<tr>
<td>Turbine speed</td>
<td>6000 rpm</td>
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<td>Inlet steam temperature</td>
<td>≤ 440 °C / 825 °F</td>
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<td>Inlet steam pressure</td>
<td>≤ 47 bar(a) / 682 psi</td>
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<tr>
<td>Back pressure</td>
<td>≤ 12 bar(a) / 179 psi</td>
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<td>Type of wheel / blades</td>
<td>Curtis / Impulse</td>
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<tr>
<td>API 611 compliant</td>
<td>Yes</td>
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<tr>
<td>Bearings</td>
<td>Ball bearing journal &amp; thrust</td>
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</tr>
</tbody>
</table>

Typical applications

- Refineries
- Petrochemical and chemical plants
- Food processing
- Institutional
- Process pump drives
- Lube oil pump drives
- Fan driven

Typical applications

- Refineries
- Petrochemical and chemical plants
- Food processing
- Institutional
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- Lube oil pump drives
- Fan driven

Typical applications

- Refineries
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- Fan driven

Typical applications

- Refineries
- Petrochemical and chemical plants
- Food processing
- Institutional
- Process pump drives
- Lube oil pump drives
- Fan driven

Typical applications

- Refineries
- Petrochemical and chemical plants
- Food processing
- Institutional
- Process pump drives
- Lube oil pump drives
- Fan driven
D-R RLH

Standard single stage steam turbine

**Technical Data**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
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<tbody>
<tr>
<td>Power output</td>
<td>1,865 kW/2,500 HP</td>
</tr>
<tr>
<td>Turbine speed</td>
<td>6,000 rpm</td>
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<tr>
<td>Inlet steam temperature</td>
<td>≤ 482°C/900°F</td>
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<tr>
<td>Inlet steam pressure</td>
<td>≤ 97 bar(a)/1.414 psi</td>
</tr>
<tr>
<td>Back pressure</td>
<td>≤ 22 bar(a)/314 psi</td>
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<tr>
<td>Type of wheel / blades</td>
<td>Curtis / Impulse</td>
</tr>
<tr>
<td>API 611 compliant</td>
<td>Yes</td>
</tr>
<tr>
<td>Bearings</td>
<td>Ball and sleeve bearing designs</td>
</tr>
</tbody>
</table>

**Typical applications**

- Refineries
- Petrochemical plants
- Food processing
- Institutional
- Process steam heat recovery
- Replacement of steam pressure reduction valve
- Process pump chokes
- Feed water pumps
- Lube oil pumps

- Rugged, versatile design
- Woodward TG-Oil Relay NEMA Class A constant speed governor or electronic governor
- Horizontally split casing with centerline support
- API 611 compliant, positive seating, mechanical overspeed trip valve
- Separate double seated governor valve

- Built-in removable steam strainer
- Carbon ring sealing glands
- API style blanket lagging/insulation (API applications)
- Carbon ring sealing glands
- Oil ring lubricated with forced pressure lubrication or circulating oil cooling options
- Broad range of controls and accessories available
- COPPUS heritage

**D-R RLH**

- Standard single stage steam turbine

**Power output**: 1,865 kW / 2,500 HP
**Turbine speed**: 6,000 rpm
**Inlet steam temperature**: ≤ 482°C / 900°F
**Inlet steam pressure**: ≤ 97 bar(a) / 1.414 psi
**Back pressure**: ≤ 22 bar(a) / 314 psi
**Type of wheel / blades**: Curtis / Impulse
**API 611 compliant**: Yes
**Bearings**: Ball and sleeve bearing designs

**Typical applications**

- Refineries
- Petrochemical plants
- Food processing
- Institutional
- Process steam heat recovery
- Replacement of steam pressure reduction valve
- Process pump chokes
- Feed water pumps
- Lube oil pumps

- Rugged, versatile design
- Woodward TG-Oil Relay NEMA Class A constant speed governor or electronic governor
- Horizontally split casing with centerline support
- API 611 compliant, positive seating, mechanical overspeed trip valve
- Separate double seated governor valve

- Built-in removable steam strainer
- Carbon ring sealing glands
- API style blanket lagging/insulation (API applications)
- Carbon ring sealing glands
- Oil ring lubricated with forced pressure lubrication or circulating oil cooling options
- Broad range of controls and accessories available
- COPPUS heritage
D-R 2TA

Single stage steam turbine

- Horizontally split casings
- Between bearing design
- Multi-Valve or Single Valve Inlet
- Solid or built-up rotor
- Carbon ring or labyrinth glands
- Electronic governor

- Electronic overspeed trip
- Separate mechanical or hydraulic trip and throttle valves (option w/o exerciser)
- Auto / quick start capability
- Terry heritage

Typical applications
- Pumps and fans drives
- Compressors drives

Technical Data

<table>
<thead>
<tr>
<th>Model</th>
<th>D-R 2TA</th>
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</thead>
<tbody>
<tr>
<td>Power output</td>
<td>3,640 kW / 4,880 HP</td>
</tr>
<tr>
<td>Turbine speed</td>
<td>≤ 12,500 rpm</td>
</tr>
<tr>
<td>Inlet steam temperature</td>
<td>≤ 530 °C / ≤ 986 °F</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
<td>≤ 104 bar(a) / ≤ 1,515 psi</td>
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<tr>
<td>Back pressure (back)</td>
<td>≤ 33 bar(a) / ≤ 480 psi</td>
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<tr>
<td>Type of wheel / blades</td>
<td>Curtis / Rateau impulse</td>
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<tr>
<td>API 611 &amp; 612 compliant</td>
<td>Yes</td>
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</tbody>
</table>
| Bearings | Tilting / Sleeve

Material: 316L, 316LN

Inlet Steam temperature: ≤ 530 °C / ≤ 986 °F
Inlet Steam pressure: ≤ 104 bar(a) / ≤ 1,515 psi
Back pressure: ≤ 33 bar(a) / ≤ 480 psi
Bearings: Tilting / Sleeve

Single stage steam turbine

D-R 2TA

Power output 3,640 kW / 4,880 HP
Turbine speed ≤ 12,500 rpm
Inlet steam temperature ≤ 530 °C / ≤ 986 °F
Inlet steam pressure ≤ 104 bar(a) / ≤ 1,515 psi
Back pressure ≤ 33 bar(a) / ≤ 480 psi
Type of wheel / blades Curtis / Rateau impulse
API 611 & 612 compliant Yes
Bearings Tilting / Sleeve

D-R 2TA

Power output 3,640 kW / 4,880 HP
Turbine speed ≤ 12,500 rpm
Inlet steam temperature ≤ 530 °C / ≤ 986 °F
Inlet steam pressure ≤ 104 bar(a) / ≤ 1,515 psi
Back pressure ≤ 33 bar(a) / ≤ 480 psi
Type of wheel / blades Curtis / Rateau impulse
API 611 & 612 compliant Yes
Bearings Tilting / Sleeve

D-R 2TA

Power output 3,640 kW / 4,880 HP
Turbine speed ≤ 12,500 rpm
Inlet steam temperature ≤ 530 °C / ≤ 986 °F
Inlet steam pressure ≤ 104 bar(a) / ≤ 1,515 psi
Back pressure ≤ 33 bar(a) / ≤ 480 psi
Type of wheel / blades Curtis / Rateau impulse
API 611 & 612 compliant Yes
Bearings Tilting / Sleeve

D-R 2TA

Power output 3,640 kW / 4,880 HP
Turbine speed ≤ 12,500 rpm
Inlet steam temperature ≤ 530 °C / ≤ 986 °F
Inlet steam pressure ≤ 104 bar(a) / ≤ 1,515 psi
Back pressure ≤ 33 bar(a) / ≤ 480 psi
Type of wheel / blades Curtis / Rateau impulse
API 611 & 612 compliant Yes
Bearings Tilting / Sleeve
D-R AVTTW / GTW

Single stage steam turbine

- Radially split casings
- Direct drive or Integral Gear operation
- Overhung rotor design
- Multi-Valve or Single Valve Inlet
- Marine Classification approval
- Auto/Quick start ability
- Carbon ring or labyrinth glands
- Nadrowski heritage

Technical Data

<table>
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<tr>
<th>D-R AVTTW / GTW</th>
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<td>Power output</td>
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<td>Turbine speed</td>
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<td>Inlet steam temperature</td>
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<tr>
<td>Inlet / exhaust pressure</td>
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<td>Back pressure</td>
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<tr>
<td>Type of wheel / blades</td>
</tr>
<tr>
<td>API 611 compliant</td>
</tr>
<tr>
<td>Bearings</td>
</tr>
</tbody>
</table>

Typical applications

- Pump and fan drives
- Compressor drives

D-R C

Single stage steam turbine

- Radially split casings
- Direct drive or Integral Gear operation
- Overhung rotor design
- Multi-Valve or Single Valve Inlet
- Marine Classification approval
- Auto/Quick start ability
- Carbon ring or labyrinth glands
- Nadrowski heritage

Technical Data

<table>
<thead>
<tr>
<th>D-R C</th>
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<tbody>
<tr>
<td>Power output</td>
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<td>Turbine speed</td>
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<td>Inlet steam temperature</td>
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<tr>
<td>Inlet steam pressure</td>
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<tr>
<td>Back pressure</td>
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<tr>
<td>Type of wheel / blades</td>
</tr>
<tr>
<td>API 611 &amp; 612 compliance</td>
</tr>
<tr>
<td>Bearings</td>
</tr>
</tbody>
</table>

Typical applications

- Waste to Energy
- Biomass Plants
- Marine Applications
- Chemical Industries
- Paper / Sugar Mills
- ORC
- Waste heat recovery
D-R GAF

Typical applications

- API mechanical drive (e.g. pump fans)
- Turbogenerator sets

Technical Data

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<thead>
<tr>
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<td>Power output</td>
<td>3,500 kW / 4,690 HP</td>
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<td>Inlet steam temperature</td>
<td>≤ 440 °C / 825 °F</td>
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<td>Inlet steam pressure</td>
<td>≤ 49 bar(a) / 715 psi</td>
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<tr>
<td>Back pressure</td>
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<td>Condensing pressure</td>
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<td>Type of Blading</td>
<td>Impulse</td>
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<td>API 611 &amp; 612 compliance</td>
<td>Yes</td>
</tr>
<tr>
<td>Bearings</td>
<td>Tilting / Sleeve</td>
</tr>
</tbody>
</table>

Standard multi-stage steam turbine

- Condensing or back pressure steam turbine
- Horizontal casing split
- Between bearings rotor design
- Max. 6 stages
- Single valve inlet
- API 611 or 612 design
- Terry heritage
D-R B

Standard multi-stage steam turbine

- Low cost design for high efficiency
- Multivalve inlets
- Multiple uncontrolled bleeds
- External controlled induction
- Double shaft end

Available as single casing or multiple (tandem) casing machine
Compact integral package designs
Multiple externally controlled bleeds

D-R B Tandem

- Multivalve inlets
- Multiple uncontrolled bleeds
- Single automatic controlled extraction/induction
- Extraction pressure up to 40 bar
- Nadrowski heritage

Typical applications
- Turbogenerator sets
- Mechanical drives
- Sugar mills
- Pulp and paper mills
- Metal & Steel
- Waste to energy plants
- Marine applications
- Waste heat recovery

Technical Data

<table>
<thead>
<tr>
<th></th>
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<th>D-R B Tandem</th>
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<tbody>
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<td>Max. Power output</td>
<td>11,5 MW</td>
<td>12,5 MW</td>
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<td>Turbine speed</td>
<td>≤ 5,000 rpm</td>
<td>≤ 5,000 rpm</td>
</tr>
<tr>
<td>Inlet steam temperature</td>
<td>≤ 530°C / 986°F</td>
<td>≤ 530°C / 986°F</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
<td>≤ 121 bar(a) / 1,750 psi</td>
<td>≤ 121 bar(a) / 1,750 psi</td>
</tr>
<tr>
<td>Back pressure</td>
<td>10 bar(a) / 145 psi</td>
<td>≤ 10 bar(a) / 145 psi</td>
</tr>
<tr>
<td>Condensing pressure</td>
<td>vacuum</td>
<td>vacuum</td>
</tr>
</tbody>
</table>

Type of wheel blades
- Impulse
- Impulse

API 611 & 612 compliant
- No
- No

Bearings
- Tilting pad / sleeve
- Tilting pad / sleeve
**D-R R/RS**

Standard multi-stage steam turbines

- Single valve or multi-valve inlets
- Multiple uncontrolled bleeds
- Dual-acting, hydrodynamic, Tiltpad thrust bearing
- Spherically seated or Tiltpad type journal bearings
- Interchangeable parts
- Standard assemblies and components
- API and non-API options
- Condensing or back pressure
- Up to 15 stages
- Murray heritage

**Typical applications**
- API 611/612 compressor, fan and pump drives
- Hydrogenerator sets, oil & gas and industrial
- Oil & gas, refineries
- Chemical plants
- Food and beverage
- Sugar mills
- Pulp & paper mills
- Waste to energy plants
- Biomass / palm oil plants
- Waste heat recovery

**Technical Data**

<table>
<thead>
<tr>
<th>Feature</th>
<th>API 611/612</th>
<th>API non-611/612</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
<td>25,000 kW / 33,500 HP</td>
<td>4,850 kW / 6,500 HP</td>
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<tr>
<td>Turbine speed</td>
<td>≤ 15,000 rpm</td>
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<tr>
<td>Inlet steam temperature</td>
<td>≤ 510 °C / 950 °F</td>
<td>≤ 389 °C / 750 °F</td>
</tr>
<tr>
<td>Inlet steam pressure</td>
<td>≤ 67 bar(a) / 972 psi</td>
<td>≤ 28.5 bar(a) / 415 psi</td>
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<tr>
<td>Back pressure</td>
<td>≤ 19 bar(a) / 415 psi</td>
<td>≤ 6 bar(a) / 90 psi</td>
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<tr>
<td>Condensing pressure</td>
<td>vacuum</td>
<td>vacuum</td>
</tr>
</tbody>
</table>

**Type of Blading**

- Impulse

**API 611 & 612 compliance**

- Yes

**Bearings**

- Tiltpad / sleeve

**Murray heritage**

**Pressure capability increases above 900 psig at reduced temperature.**

**D-R K**

Standard multi-stage steam turbine

- Condensing or back pressure
- Low cost applications
- Single valve inlet
- For wide range of speeds throughout continuous operation
- Up to 12 stages
- Murray heritage

**Typical applications – K**

- Non-API mechanical drive (e.g. pump fans)
- Air conditioning chiller / compressor drives
- Small, low pressure turbogenerator sets

**Technical Data**

<table>
<thead>
<tr>
<th>Feature</th>
<th>API 611/612</th>
<th>API non-611/612</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output</td>
<td>4,850 kW / 6,500 HP</td>
<td>1,000 kW / 1,300 HP</td>
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<tr>
<td>Turbine speed</td>
<td>≤ 10,000 rpm</td>
<td>≤ 7,000 rpm</td>
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<td>Inlet steam temperature</td>
<td>≤ 389 °C / 750 °F</td>
<td>≤ 243 °C / 490 °F</td>
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<td>Inlet steam pressure</td>
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<td>Back pressure</td>
<td>≤ 6 bar(a) / 90 psi</td>
<td>≤ 1.5 bar(a) / 22 psi</td>
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<tr>
<td>Condensing pressure</td>
<td>vacuum</td>
<td>vacuum</td>
</tr>
</tbody>
</table>

**Type of Blading**

- Impulse

**API 611 & 612 compliance**

- No

**Bearings**

- Tiltpad / sleeve

**Pressure capability increases above 900 psig at reduced temperature.**
Our steam turbines meet customer requirements for economic installation and operation as well as providing excellent flexibility for complex processes.

Worldwide, hundreds of successfully installed generator drives for power generation or a mechanical drives for compressors, blowers and pumps are in operation and reliably provide power.
Lünen is the cleanest and most efficient hard-coal-fired power plant in Europe. It provides electricity for around 1.5 million households. It also supplies the city of Lünen with district heating. Using leading-edge Siemens technology makes it possible to save up to a million tons of CO₂ every year.

**Lünen, Germany**

- **Power output:** 812 MW
- **Efficiency:** 46%
- **Commercial operation:** 2013

Since startup in 2008, Waigaoqiao III has compared to an average Chinese coal-fired power plant saved 900,000 million metric tons of raw coal. The plant reaches an efficiency of up to 45% making it a highly efficient coal plant. In 2009, Waigaoqiao III was “Asian Power Plant of the Year”, and got an “Asian Power Award”.

**Waigaoqiao III, China**

- **Power output:** 2 × 1,000 MW
- **Efficiency:** 43%
- **Commercial operation:** 2008

At the time, Siemens was the first company to supply a machine for this temperature range.

**Isogo, Japan**

- **Power output:** 600 MW
- **Steam conditions:** 600 °C/610 °C
- **Commercial operation:** 2002

In 2008, Yuhuan was China’s most advanced coal-fired power plant and got the “Asian Power Award”.

**Yuhuan, China**

- **Power output:** 4 × 1,000 MW
- **Efficiency:** 45%
- **Commercial operation:** 2007
Reference examples  Combined Cycle Power Plants

**Combined cycle power plant Dangjin III**
South Korea

Siemens turbines are making Dangjin III the most efficient combined cycle power plant currently operating in Asia.

- **Power output:** 400 MW
- **Efficiency:** 60%
- **Commercial operation:** 2013

**Combined cycle power plant for the mining industry**
Diamantina, Australia

Two Power Islands each performing at well in excess of 51% efficiency. The plant provides a total capacity of 242 MW to supply environmentally friendly electricity to local mines and to people living in the region.

- **Power output:** 242 MW
- **Commercial operation:** 2013

**Combined cycle power plant**
Panda Sherman Power Project, Texas, USA

The Panda Sherman Power Project utilizes the latest, most advanced emissions control technology, making it one of the cleanest, natural gas-fueled power plants in the United States. The 758 MW combined cycle generating facility can supply the energy needs of up to 750,000 homes.

- **Plant type:** SCC6-5000F 2 x 1 Flex-Plant™
- **Power Output:** 758 MW

**Combined cycle power plant**
Diamantina, Australia

Two Power Islands each performing at well in excess of 51% efficiency. The plant provides a total capacity of 242 MW to supply environmentally friendly electricity to local mines and to people living in the region.

- **Power output:** 242 MW
- **Commercial operation:** 2013

**Combined cycle power plant for the mining industry**
Nhon Trach 2, Vietnam

The power plant reaches an efficiency of over 57 percent and has very low nitrogen oxide emissions. It entered commercial operation after just 28.5 months.

- **Power output:** 760 MW
- **Efficiency:** 57%
- **Commercial operation:** 2011
**Igelsta, Södertälje, Sweden**

**SST-800: Biomass District Heating Plant**

Sweden’s largest biomass plant

Inaugurated in March 2010, the plant uses a biomass fuel mix consisting of about 90% renewable fuels like forest refuse, wood chips, tree bark, and 10% non-recyclable waste paper and plastic. It produces 200 MW heat and 85 MW electricity, the equivalent of heating 50,000 households and generating electricity for 100,000 residences.

- **Steam turbine:** SST-800
- **Power output:** 90 MW
- **Inlet pressure:** 85 bar / 1,305 psi
- **Inlet temperature:** 540 °C / 1,004 °F

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**Afval Energie Bedrijf, Amsterdam/Netherlands**

**AEB**

Afval Energie Bedrijf (AEB: Waste and Energy Company Amsterdam) burns 1.7 million tonnes of waste per year and has recently increased its energy generation efficiency from 22% to 30%. This 8% increase resulted from installing a new SST-700 with a steam reheat system.

AEB not only generates power from Amsterdam’s municipal waste, but also recovers and sells materials from the waste stream such as metals and gypsum.

- **Steam turbine:** SST-700, Reheat
- **Power output:** 74 MW
- **Inlet pressure:** 120 bar / 1,740 psi
- **Inlet temperature:** 440 °C / 824 °F
- **Fuel:** Municipal solid waste

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**Biomass Power Plant Simmering, Vienna, Austria**

The Simmering biomass power plant, owned by the Viennese utility Wien Energie, is exclusively fed with fresh wood from the forest. Producing 23.4 MWe electricity in summer and 15.06 MWe plus 37 MWth for district heating in winter, the plant reduces Vienna’s CO₂ emissions by 144,000 tons per annum. In operation with heat extraction, total efficiency is 83%.

- **Steam turbine:** SST-400, Reheat
- **Power output:** 23.4 MW
- **Inlet pressure:** 120 bar / 1,740 psi
- **Inlet temperature:** 520 °C / 968 °F
- **Fuel:** Fresh wood

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**SST-300 North Hykeham, Lincoln, UK**

“...we would definitely recommend Siemens. First because we would work again with them, they have proved a machine that is hard to make and hard to integrate into such a kind of plant, and they have been successful with this project.”

- **Power output:** 25.15 MW
- **Speed:** 5,300 rpm
- **Live steam pressure:** 58 bar(a)
- **Live steam temperature:** 317 °C
- **Customer:** CNIM
- **Operator:** FCC Environment
ANDASOL 1 + 2, Granada, Spain
The two CSP plants are located in the Granada area, each covering a field of 1.95 km², of which the mirror field size is about 510,000 m². Both Andasol plants have a thermal storage system using molten salt to absorb part of the heat produced in the solar field during the day. This process almost doubles the number of operational hours per year at the solar thermal power plant. Andasol I went online in 2008 and Andasol II in 2009.

Parabolic trough (Ost)
50 MW(e) each

Steam turbine: 2 × Siemens SST-700
Power output: 2 × 50 MW(e)
Inlet steam pressure: 100 bar / 1,450 psi
Inlet steam temperature: 377 °C / 711 °F

IVANPAH SOLAR POWER COMPLEX, California, USA
BrightSource Energy, a privately-owned energy company, developed the Ivanpah Solar Energy Generating System in California’s Mojave Desert in 2010. It consists of three separate plants using tower technology and provides approximately 400 MW electricity to the US Southern California Edison. The whole complex generates enough electricity to power more than 140,000 homes.

Solar Power Tower (Water/Direct Steam)
3 plants, 392 MW(e) in total
Steam turbine: 3 × Siemens SST-120
Power output: 1.4 MW(e)
Inlet steam pressure: 160 bar / 2,321 psi
Inlet steam temperature: 540 °C / 1,004 °F

NOOR/Quarzazate, Morocco
On February 4, 2016, the King of Morocco, Mohammed VI, dedicated the Noor 1 unit of Quarzazate Solar Power Station. This is the first of four phased Noor projects at Quarzazate 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. Siemens is supplying three turbine-generator sets for the power station.

Steam turbine: Siemens 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: 0.86 bar(a) / 0.127 psi

PUERTO ERRADO 1 (PE1), Calasparra, Spain
The PE1 Linear Fresnel demonstration plant, developed by Novatec Biosol AG, commenced selling power to the Spanish grid in March 2009. The 1.4 MW plant, located in Calasparra in the region of Murcia, Spain, has two rows of mirrors, each with a length of 860 m, providing direct steam to the steam turbine. Each receiver uses 16 parallel lines of mirrors with a total surface of 18,662 m². A Ruth heat storage system, which utilizes hot water and saturated steam, is used for steam buffering.

Linear Fresnel (Water/Direct Steam)
1.4 MW(e)
Steam turbine: Siemens SST-120
Power output: 1.4 MW(e)
Inlet steam pressure: 55 bar / 798 psi
Inlet steam temperature: 270 °C / 518 °F (saturated steam)

Reference examples
Concentrated solar plants
Khanh Hoa (Cam Ranh), Sugar Plant, Vietnam

The Khanh Hoa Sugar Plant is located in the Cam Lam District in central coastal Khanh Hoa Province. It handles roughly 3,000 tons of sugarcane per day.

Technology: SST-300
Complete: 1999
Power output: 25 MW
Speed: 7,161 rpm
Inlet steam pressure: ≤ 46 bar(a) / 667 psi
Inlet steam temperature: ≤ 450 °C / 842 °F
Exhaust pressure: 2.5 bar(a) / 36.3 psi

Grupo Delta Sucroenergia / Brazil

Biggest turbine in the sugar-ethanol sector

The efficiency of the SST-600 steam turbine convinced the customer Grupo Delta Sucroenergia. Siemens installed the biggest steam turbine in the sugar-ethanol sector with an power output of 73.5 MW. It is also the first turbine in Brazil to waive the use of gears with direct drive for the generator.

Power output: 73.5 MW
Inlet steam temperature: 520°C
Inlet steam pressure: 67 bar(a)
Exhaust steam pressure: radial downward
Length: 8.5 m
Weight: 130 t

Simbhaoli Sugar, Sugar Plant, India

Simbhaoli Sugars is a technology company with a business mix that spans specialty sugars, quality liquor, technology consultancy, co-generated power, extra neutral alcohol (ENA), ethanol, and bio-manure. As India’s largest integrated sugar refinery, the Company has pioneered path-breaking innovations in sugar refining (Defeco Remelt Phosphotation and Ion Exchange technology), high value, niche products (specialty sugars) and clean energy (ethanol).

Power output: 18 MW
Speed: 6,900 rpm
Inlet steam pressure: 86 ata
Inlet steam temperature: 510 °C / 950 °F
Exhaust steam pressure: 0.1 ata

Reference examples Sugar Mills
Steam Turbines for Pulp & Paper Industry SST-800, Hainan Island / China

Siemens Industrial Technologies was appointed as general contractor for the entire electrical engineering, while Siemens Energy won the order for the Hainan Pulp Mill’s power plant.

**Technology** 2 × SST-800

**Complete** 2004

**Power output:** 120 MW (each)

**Inlet steam temperature:** 475 °C / 887 °F

**Inlet steam pressure:** 80.5 bar / 1,167.5 psi

**Speed:** 3,000 rpm

**Extraction steam pressure:** 6.5 bar / 94.3 psi

**Exhaust steam pressure:** 0.13 bar / 1.88 psi

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

Two Siemens 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.

The plant has a total capacity of 270 MW. The customer is Klabin, a leading manufacturer and exporter of paper and packaging.

**Technology** SST-300

**Power output:** 190 MW

**Speed:** 3,600 rpm

**Inlet steam pressure:** 100 bar / 1,450 psi

**Inlet steam temperature:** 498 °C / 928 °F

**Extraction pressure:** 10 bar / 145 psi

**Exhaust pressure:** 5.4 bar / 78.3 psi

Steam Turbines for Pulp & Paper Industry SST-800, UPM Caledonian, Scotland / United Kingdom

UPM’s mill is responsible for a third of all industrial and commercial electricity consumed across Scotland. With huge amounts of electricity and heat required to drive processes in the pulp and paper industry, UPM was keen to explore ways of reducing its energy costs while improving site competitiveness.

Siemens custom designed its SST-300 steam turbine to meet UPM’s specific requirements at the plant and also provide the control systems. The plant incorporating Siemens technologies has enabled the mill to meet all its steam requirements involved in the production of coated papers – and in particular, drying of the paper.

**Technology** SST-300

**Power output:** 27 MW

**Speed:** 6,800 rpm

**Inlet steam pressure:** 90 bar / 1,305 psi
Kuwait is forging ahead with a new refinery project costing 4 billion Kuwaiti dinars (Dh49.7bn) despite the oil price slump, Kuwaiti officials said.
The construction of Al Zour refinery is part of plans to boost refining capacity to 1.4 million barrels per day (bpd) by 2019 from 940,000 bpd at present.

Scope of Supply:  57 SSTs for process and water pump drives

Model:  Variety of models to meet power and steam condition

Const. year:  2018 expected completion

Morning Star Packing, 24 Single Stage Steam Turbines California, USA

Application: Mechanical drive for feed water pumps, boiler fans, hydraulics, generators, slurry pumps, fire systems.
The tomato processing window in the US is May through October. Six months of non-stop production requires rugged, reliable equipment which the RH24 has earned over the years.

Scope of Supply:  24 Single Stage Turbines

Model:  RH24

Shipped:  2014

Steam Turbine Applied as a Gas Expander Emergency Shut Down Drive

Approximately 85 world wide

Dresser-Rand supplied special expander turbines which operate only when a power outage or other mechanical fault causes tripping of the process compressor and/or the main motor drive. When a “kill cycle” is initiated propylene- or polypropylene reactor gases are routed from the compressor discharge to the turbine inlet (the turbine exhausts to flare) which starts and drives the compressor train through an SSS clutch at reduced speed and load for 10 minutes or less. This is adequate time for the process to be poisoned by a “kill gas” which is injected into the reactor vessel thus preventing “solidification” of which would require personnel with jackhammers to enter and clean the reactor vessel at a cost of millions in lost production.

Reference examples  Dresser Rand
<table>
<thead>
<tr>
<th>Steam turbine type</th>
<th>Output SPP (MW)</th>
<th>Net efficiency SPP (%)</th>
<th>Steam turbine type</th>
<th>Output CCPP (MW)</th>
<th>Net efficiency CCPP (%)</th>
<th>Frequency (Hz)</th>
<th>Inlet pressure (bar / psi)</th>
<th>Inlet temperature (°C / °F)</th>
<th>Reheat temperature (°C / °F)</th>
<th>Rotational speed (rpm)</th>
<th>Controlled extraction pressure (bar / psi)</th>
<th>Controlled reheat temperature (°C / °F)</th>
<th>Uncontrolled extraction pressure (bar / psi)</th>
<th>Exhaust Pressure (bar / psi)</th>
<th>Exhaust Pressure (bar / psi) Cond.</th>
<th>Exhaust Pressure (bar / psi) Distr.</th>
<th>Last stage blade length (Bar / Psi)</th>
<th>Last stage blade length (Bar / Psi)</th>
<th>Last stage blade length (Bar / Psi)</th>
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</thead>
<tbody>
<tr>
<td>SST-9000</td>
<td>1,000–1,900</td>
<td>50 / 60</td>
<td>80 / 1,160</td>
<td>3,000–3,600</td>
<td>66 to 99 / 26 to 56</td>
<td>66 to 87 / 26 to 38</td>
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<tr>
<td>SST-6000</td>
<td>300–1,200</td>
<td>46 / 65 (Double reheat 48)</td>
<td>50 / 60</td>
<td>330 / 4,786</td>
<td>600 / 1,112</td>
<td>600 / 1,112</td>
<td>3,000–3,600</td>
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<td>SST-5000</td>
<td>200–500</td>
<td>120–700</td>
<td>43 (subcritical)</td>
<td>46,4 (supercritical)</td>
<td>50 / 60</td>
<td>260 / 3,771</td>
<td>177 / 2,567</td>
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<td>66 to 99 / 26 to 56</td>
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<td>100–500</td>
<td>50 / 60</td>
<td>105 / 1,523</td>
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<td>SST-3000</td>
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<td>SST-700 / 900</td>
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<td>≤ 230</td>
<td>50 / 60</td>
<td>180 / 2,611</td>
<td>585 / 1,085</td>
<td>565 / 1,049</td>
<td>3,000–3,600</td>
<td>72 / 1,044</td>
<td>0.3 / 4.4</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
<td>76.2 to 95.4 / 30 to 37.6</td>
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<td>SST-800</td>
<td>≤ 200</td>
<td>≤ 200</td>
<td>50 / 60</td>
<td>165 / 2,393</td>
<td>565 / 1,049</td>
<td>3,000–18,000</td>
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<td>79.8 to 114.6 / 31.4 to 45.1</td>
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<tr>
<td>SST-600</td>
<td>≤ 200</td>
<td>≤ 200</td>
<td>50 / 60</td>
<td>165 / 2,393</td>
<td>565 / 1,049</td>
<td>3,000–18,000</td>
<td>72 / 1,044</td>
<td>0.3 / 4.4</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
<td>76.2 to 95.4 / 30 to 37.6</td>
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<td>SST-500</td>
<td>≤ 100</td>
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<td>1.5 / 21.75</td>
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<tr>
<td>SST-400</td>
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<td>140 / 2,030</td>
<td>540 / 1,004</td>
<td>3,000–8,000</td>
<td>45 / 653 (up to 4)</td>
<td>450 / 842</td>
<td>610 / 1,130</td>
<td>3 / 43</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
<td>76.2 to 95.4 / 30 to 37.6</td>
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<tr>
<td>SST-300</td>
<td>≤ 45</td>
<td>140 / 2,030</td>
<td>540 / 1,004</td>
<td>12,000</td>
<td>25 / 363 (up to 2)</td>
<td>400 / 752</td>
<td>610 / 1,130</td>
<td>3 / 43</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
<td>76.2 to 95.4 / 30 to 37.6</td>
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<tr>
<td>SST-200</td>
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<td>120 / 1,740</td>
<td>540 / 1,004</td>
<td>14,600</td>
<td>1</td>
<td>350 / 562</td>
<td>20 / 290</td>
<td>±0.5 / 7.3</td>
<td>79.8 to 114.6 / 31.4 to 45.1</td>
<td>76.2 to 95.4 / 30 to 37.6</td>
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# Performance data overview

<table>
<thead>
<tr>
<th>Steam Turbine Type</th>
<th>Power output (HP)</th>
<th>Inlet Pressure (bar / psi)</th>
<th>Rotational Speed (rpm)</th>
<th>Uncontrolled Extraction (bar / psi)</th>
<th>Exhaust Pressure (back) (bar / psi)</th>
<th>Exhaust Pressure (cond.) (bar / psi)</th>
<th>Bearings</th>
<th>Type of wheel / blades</th>
<th>API compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-R BLACKMAX</td>
<td>1,000</td>
<td>671 / 972</td>
<td>3,000–6,000</td>
<td>22 / 325</td>
<td>Ball-bearing (journal &amp; thrust)</td>
<td>Impeller</td>
<td>9T1</td>
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<tr>
<td>D-R RUSH</td>
<td>1,865</td>
<td>581 / 831</td>
<td>12,200</td>
<td>21 / 315</td>
<td>Ball and sleeve bearing designs</td>
<td>Impeller</td>
<td>9T5 / 9T2</td>
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<tr>
<td>D-R SST 350/500/750</td>
<td>4,500</td>
<td>334 / 485</td>
<td>25,000</td>
<td>21 / 315</td>
<td>Ball-bearing (journal &amp; thrust)</td>
<td>Impeller</td>
<td>9T5 / 9T2</td>
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<tr>
<td>D-R STN</td>
<td>5,600</td>
<td>432 / 624</td>
<td>12,200</td>
<td>21 / 315</td>
<td>Ball-bearing (journal &amp; thrust)</td>
<td>Impeller</td>
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<tr>
<td>D-R KIT/STN/STW</td>
<td>7,500</td>
<td>421 / 602</td>
<td>14,500</td>
<td>43 / 632</td>
<td>Ball-and-sleeve bearing designs</td>
<td>Impeller</td>
<td>9T5 / 9T2</td>
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<tr>
<td>D-R 2TA</td>
<td>1,000</td>
<td>612 / 907</td>
<td>12,000</td>
<td>21 / 315</td>
<td>Tilting-pad / Sleeve</td>
<td>Impeller</td>
<td>9T5 / 9T2</td>
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<tr>
<td>D-R AVTTW/GTW</td>
<td>1,865</td>
<td>581 / 831</td>
<td>25,000</td>
<td>21 / 315</td>
<td>Tilting-pad / Sleeve</td>
<td>Impeller</td>
<td>9T5 / 9T2</td>
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<tr>
<td>D-R C</td>
<td>3,000–5,200</td>
<td>462 / 680</td>
<td>8,500</td>
<td>21 / 315</td>
<td>Tilting-pad / Sleeve</td>
<td>Impeller</td>
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<tr>
<td>D-R GAF</td>
<td>6,500</td>
<td>483 / 692</td>
<td>6,500</td>
<td>6 / 90</td>
<td>Tilting-pad / Sleeve</td>
<td>Impeller</td>
<td>9T5 / 9T2</td>
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<tr>
<td>D-R K/L/R/C/STN</td>
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<td>510 / 750</td>
<td>15,000</td>
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<tr>
<td>D-R K/L/R/C/STN</td>
<td>12,500</td>
<td>650 / 942</td>
<td>9,500</td>
<td>1 / 167</td>
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<tr>
<td>D-R 2TA-14/15</td>
<td>15,000</td>
<td>595 / 855</td>
<td>12,000</td>
<td>1 / 167</td>
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<td>Impeller</td>
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<tr>
<td>D-R 2TA-14/15</td>
<td>17,500</td>
<td>630 / 915</td>
<td>12,500</td>
<td>1 / 167</td>
<td>Vacuum</td>
<td>Impeller</td>
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<tr>
<td>D-R 2TA-14/15</td>
<td>20,000</td>
<td>660 / 965</td>
<td>13,000</td>
<td>6 / 102</td>
<td>Vacuum</td>
<td>Impeller</td>
<td>9T5 / 9T2</td>
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<tr>
<td>D-R 2TA-14/15</td>
<td>22,500</td>
<td>690 / 1,015</td>
<td>13,500</td>
<td>6 / 102</td>
<td>Vacuum</td>
<td>Impeller</td>
<td>9T5 / 9T2</td>
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<tr>
<td>D-R 2TA-14/15</td>
<td>25,000</td>
<td>720 / 1,065</td>
<td>14,000</td>
<td>1 / 167</td>
<td>Vacuum</td>
<td>Impeller</td>
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<tr>
<td>D-R 2TA-14/15</td>
<td>27,500</td>
<td>750 / 1,115</td>
<td>14,500</td>
<td>1 / 167</td>
<td>Vacuum</td>
<td>Impeller</td>
<td>9T5 / 9T2</td>
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</tbody>
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