Siemens Steam Turbines for coal-fired Steam Power Plants (SPP)
Siemens Steam Turbines for coal-fired Steam Power Plants

**SST-5000 series**
for coal-fired Steam Power Plants and Combined Cycle Power Plants

Various extractions for feed water preheating (up to 9 stages), process steam & district heating possible

<table>
<thead>
<tr>
<th>Power output</th>
<th>120 MW to 700 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. steam parameters</td>
<td>Main steam / Hot reheat steam</td>
</tr>
<tr>
<td></td>
<td>177 bar / 600 ºC / 620 ºC</td>
</tr>
<tr>
<td></td>
<td>2,570 psi / 1,110 ºF / 1,150 ºF</td>
</tr>
</tbody>
</table>

**SST-6000 series**
for coal-fired Steam Power Plants

Various extractions for feed water preheating (up to 10 stages), process steam & district heating possible

<table>
<thead>
<tr>
<th>Power output</th>
<th>300 MW to 1,200 MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. steam parameters</td>
<td>Main steam / Hot reheat steam</td>
</tr>
<tr>
<td></td>
<td>300 bar / 600 ºC / 630 ºC</td>
</tr>
<tr>
<td></td>
<td>4,350 psi / 1,110 ºF / 1,166 ºF</td>
</tr>
</tbody>
</table>
We are dedicated to grow your business

...by continuous improvement of your economic value

Availability

- Less outage time
- Higher reliability

Flexibility

- Less start-up time
- Flexible start-up modes
- Additional start-up features

Performance

- Higher efficiency
- Less degradation

Trusted Partner
You can expect quality with no compromises - to ensure highest reliability and availability

For us, reliability means living up to what we promise

- Long maintenance intervals
- Reduced outage time and costs
- Forced Cooling
- Reduced outage time
- Flexible start-up modes
  - Fast/Normal/Slow
- Strict quality control
  - Highest requirement on tolerances
  - Reduced spare parts need
  - Reduced forced outage rate

Highest standard regarding maintenance intervals

Major overhaul (open casing) after 100,000 EOHs, ~12 years

Majority of customers have no findings at major overhauls

Benchmark defining reliability

1.8% higher reliability compared to NERC\textsuperscript{1)} statistics 2007-2011\textsuperscript{2)}
You can expect flexibility from our turbines and beyond

For us, flexibility means fulfilling your requirements

- Bypass cooling
- Fast thermal loading capability
- Barrel type HP turbine
- Fast thermal loading capability
- Flexible start-up modes fast/normal/slow
- Optimized start-up time based on demand
- Real time EOH consumption monitoring
- Reduction of start-up EOH consumption
- Remaining EOHs → faster start-up

**Hot start “on the fly”**
Reduction of hot start-up time of up to ~30 minutes without additional investment

**Integrated boiler partner concept to ensure fast plant ramp-up**
Founded boiler expertise as licensor of Benson boiler technology
You can expect world record efficiency and lifetime proven performance

For us, efficiency means the optimum for your RoI

- IP-admission blade ring w/ vortex cooling
- Highest possible steam parameters
- Barrel type HP turbine
- Push rod arrangement
- LP turbine erosion protection
- Customized blade path design
- Best heat rate
- Lowest degradation

Powered by leading efficiency and tailored solutions

Live steam pressure up to 300 bar and reheat temperature up to 630°C

Lünen: the most efficient and the cleanest hard coal-fired power plant in Europe

Powered by life time performance

Proven life time performance
Low degradation
You can except a dedicated trusted partner - reliable, experienced and flexible

We offer more than just Turbine-Generator sets:

- We can consult you at early planning stage to evaluate the **best concept for your application**
- We can go hand in hand with you to **convince your end customers**
- We can optimize the entire water-steam cycle for you, ensured by our well-founded engineering expertise
- We can **reduce the interfaces for you** by providing an integrated boiler partner concept
- We can provide local **on-site support** for you to ensure smooth communication
- We can support you in finding a **financing solution**
“We would definitely recommend Siemens, because we would work again with them.”

UK Warranty Manager, CNIM

“Siemens does an excellent job of executing EPC type projects.”

Anonymous customer interview

“(…) For us, cooperation with Siemens for Jaworzno 910MW project is one of the most important factors for a successful execution of the project. We are looking forward to our smooth and efficient collaboration”

Krzysztof Burek, member of the management board of Rafako.

“Lünen is the cleanest and most efficient hard-coal-fired power plant in Europe. Using leading-edge Siemens-technology makes it possible to save up to a million tons of CO2 every year.”

Editorial team Penn Energy
Innovation
The Driver for Steam Power Plant Efficiency

<table>
<thead>
<tr>
<th>Year</th>
<th>Technology</th>
<th>SPP (MW)</th>
<th>Pressure (bar)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>SPP Bergkamen</td>
<td>747</td>
<td>190</td>
<td>530/530</td>
</tr>
<tr>
<td></td>
<td>SPP efficiency</td>
<td>39%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>SPP Boxberg</td>
<td>906</td>
<td>260</td>
<td>540/580</td>
</tr>
<tr>
<td></td>
<td>SPP efficiency</td>
<td>45%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>SPP Luenen</td>
<td>750</td>
<td>270</td>
<td>600/610</td>
</tr>
<tr>
<td></td>
<td>SPP efficiency</td>
<td>46%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>Double Reheat</td>
<td></td>
<td>330</td>
<td>610/630/630</td>
</tr>
<tr>
<td></td>
<td>technology</td>
<td></td>
<td></td>
<td>&gt; 50%* SPP</td>
</tr>
<tr>
<td>&gt; 2020</td>
<td>700 °C technology</td>
<td></td>
<td>350</td>
<td>700/720</td>
</tr>
</tbody>
</table>

* Net efficiency achievable with this technology - project specific efficiencies may vary.

Innovation: The Driver for Steam Power Plant Efficiency.
Since start-up in 2008, Waigaoqiao III has, compared to an average Chinese coal-fired power plant, saved 1.1 million metric tons of coal and reduced CO₂ output by 2.8 million metric tons annually. The plant reaches an efficiency (net) of up to 45 %, making it one of the most efficient coal power plants in the world.

<table>
<thead>
<tr>
<th>Com. operation:</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power output:</td>
<td>2x 1,000 MW</td>
</tr>
<tr>
<td>Efficiency:</td>
<td>45.03 %</td>
</tr>
</tbody>
</table>
| Main steam:    | 270 bar / 3,916 psi  
                 | 600 ºC / 1,110 ºF |
| Reheat steam:  | 600 ºC / 1,110 ºF |
The Lünen plant can provide electricity for around 1.5 million households and supplies the city of Lünen with district heating. With an efficiency of almost 46 %, Lünen is the cleanest and most efficient hard-coal-fired power plant in Europe. Using leading-edge Siemens-technology makes it possible to save up to a million tons of CO₂ every year.

**Up to 1 million tons less CO₂ emissions**

- **Com. operation:** 2013
- **Power output:** 750 MW
- **Efficiency:** 46 %
- **Main steam:** 270 bar / 3,916 psi
  - 600 ºC / 1,110 ºF
- **Reheat steam:** 610 ºC / 1,130 ºF

**Lünen, Germany**
Contact us directly

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E-mail: support.energy@siemens.com / Tel.: +49 180 524 70 00

siemens.com/steamturbines