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Siemens Energy Sector

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Energy is an essential part of our daily lives



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Energy supply in the future will place major challenges on the infrastructure

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Three global megatrends in the energy sector

Demographic dynamics



- **Population growth:**
7.5 bn in 2020 (+1.1 bn)
- **Power consumption:**
+5.2% p.a. in emerging regions and 1.4% in developed world
- **Megacities (>10 million):**
22 new megacities in 2015

Resource scarcity



- **Geopolitics:**
70% of world oil and gas supplies only in a few countries
- **Fuel diversity:**
100% increase in oil prices over last 2 years accelerates shift to broader fuel mix

Environmental focus



- **Global emissions:**
40% increase in air pollution over past 20 years
- **Climate change:**
Global warming limited to an average increase of 2 degrees Celsius

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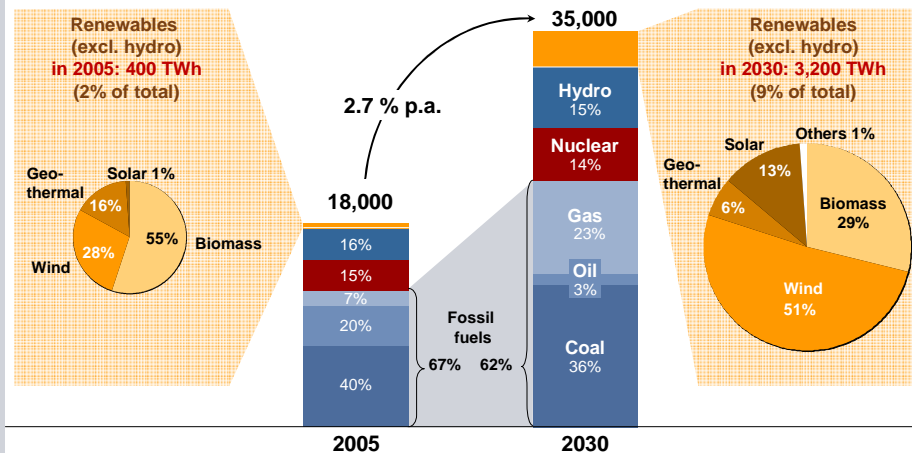
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Renewables are gaining in importance – but fossil fuels will continue to be the mainstay

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Power generation (in TWh¹⁾)



Source: Siemens Energy Sector, GS4 base case

1) Terrawatt-hours

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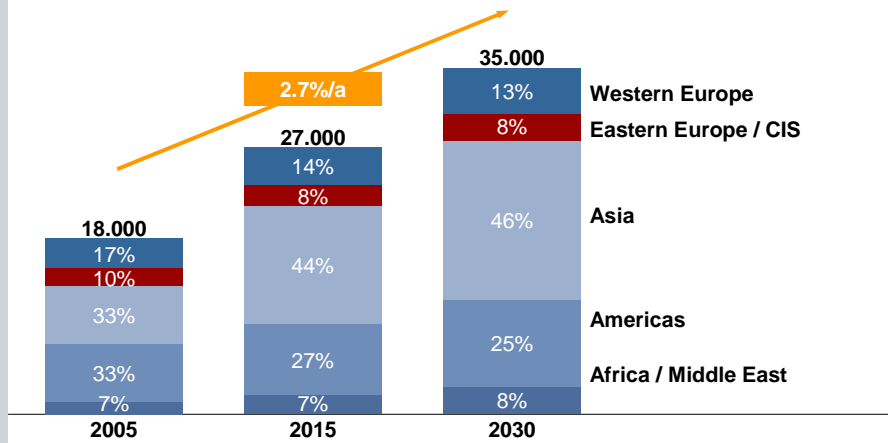
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**There are major regional differences
in the growth of power demand**

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Development of power demand by region (in TWh¹)



Source: Siemens Energy Sector, GS4 base case 1) Terrawatt-hours

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**Siemens Energy Sector –
Answers for energy supply**

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Energy products and solutions - in 6 Divisions



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Oil & Gas Division

Portfolio

- Gas turbines (< 50 MW)
- Steam turbines(≤ 200 MW)
- Compressors and compression solutions for the process industries
- Oil & gas solutions incl. power supply systems (Up-, Mid- and Downstream)
- Municipal and industrial power generation

Innovation highlight

- The ECO-II compressor is the only centrifugal compressor with gas-tight casing currently available.

CEO

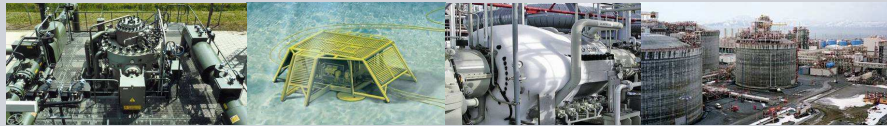
Dr. Frank Stieler

Employees

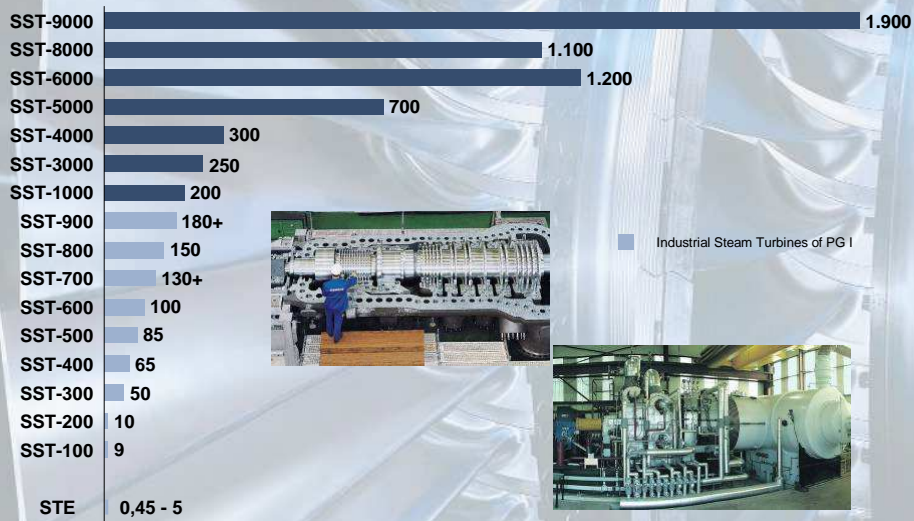
10,740 (fiscal 2007)

References

Siemens is the world market leader for compressors with extremely low intake temperatures like those required in LNG (liquefied natural gas) plants.



Broad range for 50- and 60-Hz-grids and drive application



STE - Turbines
→ Portfolio

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STE - Turbines
→ Technical basic values

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Live steam pressure:	3 – 131 bar _a
Live steam temperature:	dry sat. - 530°C
Exhaust steam pressure:	0,08 – 29 bar _a
Speed:	500 – 23 000 1/min
Power:	up to 10 000 kW

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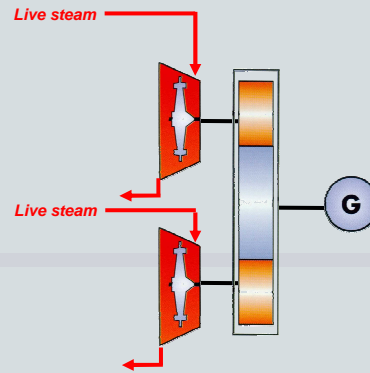
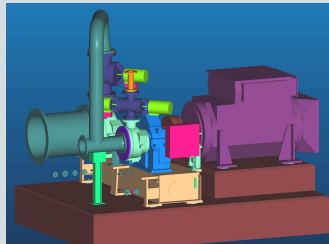
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STE - Turbines
→ Products & markets

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SST-110 (TWIN-type) ⇒ example

Power generation from biomass (Munksjö Paper)



Operating data:
 Live steam pressure: 36,0 bar a
 Live steam temperature: 400°C
 Condensing pressure: 10,0 / 4,0 bar a
 Electrical output: 4 100 kWe

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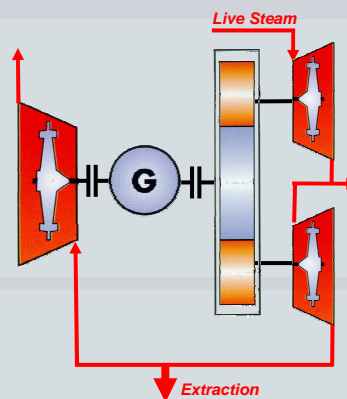
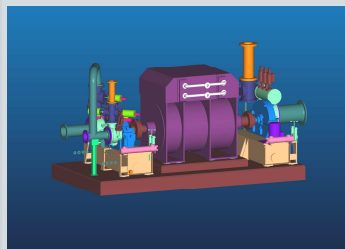
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STE-Turbines
→ Products & markets

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Tandem ⇒ example

Cogeneration (Kemira)



Operating data:
 Live steam pressure: 46,0 bar a
 Live steam temperature: 450°C
 Back pressure: 26,0 / 6,0 / 0,7 bar a
 Electrical output: 7 235 kWe

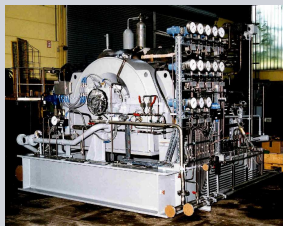
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SST-200



General:

Geared or direct drive turbine suited to both generator and mechanical drives for standardized applications for industry and power generation

Technical Data:

Power output:	up to 10 MW
Inlet pressure:	80 bar / 1,160 psi
Inlet temperature:	480 °C / 896 °F
Controlled extractions:	up to 16 bar / 232 psi
Exhaust pressure:	vacuum up to 10 bar / 145 psi
Rotational speed:	up to 14,600 rpm

Features:

- Backpressure / condensing type
- Package unit design
- Downward exhaust
- API - conforming
- Customized steam path
- High speed

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SST-300



General:

Geared turbine for generator drive – compact and flexible design with a high degree of standardization for industry and power generation applications

Technical Data:

Power output:	up to 50 MW
Inlet pressure:	120 bar / 1,740 psi
Inlet temperature:	520 °C / 968 °F
Double controlled extraction:	up to 16 bar / 232 psi
Exhaust pressure:	vacuum up to 16 bar / 232 psi
Rotational speed:	up to 12,000 rpm

Features:

- Backpressure / condensing type
- Package unit design
- Pre-engineered turbine modules, modular peripherals
- API-conforming
- Radial/axial exhaust
- Customized steam path

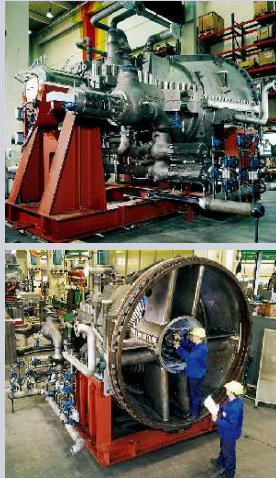
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SST-400



General:

Geared turbine for generator drive – compact and flexible design with a high degree of standardization for industry and power generation applications

Technical Data:

Power output:	up to 65 MW
Inlet pressure:	120 bar / 1,740 psi
Inlet temperature:	520 °C / 968 °F
Double controlled extraction:	up to 45 bar / 653 psi
Exhaust pressure:	vacuum up to 25 bar / 363 psi
Rotational speed:	3000 – 8,000 rpm

Features:

- Backpressure / condensing type
- Semi-package unit design
- Pre-engineered turbine modules, modular peripherals
- Double extraction
- Radial/axial exhaust
- Customized steam path

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SST-500



General:

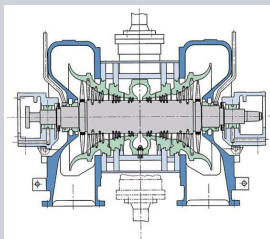
Geared or direct drive turbine suited to both generator and mechanical drives to accommodate large volume flows; typical used as low pressure casing in two cylinder applications – tailor made applications for industry and power generation

Technical Data:

Power output:	up to 85 MW
Inlet pressure:	30 bar / 435 psi
Inlet temperature:	350°C / 662°F
Rotational speed:	3,000 – 15,000 rpm

Features:

- Double-flow condensing turbine
- Standard turbine modules, modular peripherals
- Throttle controlled
- With or without uncontrolled extractions
- Highly customized design



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SST-600

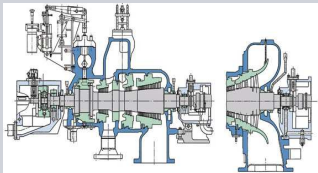


General:

Geared or direct drive turbine suited to both generator and mechanical drives; tailor-made applications for most complex processes in industry and power generation

Technical Data:

Power output:	up to 100 MW
Inlet pressure:	up to 140 bar / 2,031psi
Inlet temperature:	540 °C / 1,004 °F
Double controlled extraction:	up to 45 bar / 653 psi
Exhaust pressure:	vacuum up to 55 bar / 798 psi
Rotational speed:	3,000 – 16,000 rpm



Features:

- Backpressure / condensing type
- Package unit design
- Inner casing for high inlet steam parameters
- Steam injection possible
- API-conforming

SST-700

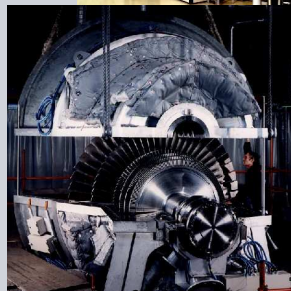


General:

Dual-casing turbine; consisting of geared HP module and LP, each module can be used independently or can be combined for optimal configuration – used for power generation applications, especially in combined cycle

Technical Data:

Power output:	up to 130 MW
Inlet pressure:	165 bar / 2393 psi
Inlet temperature:	585 °C / 1,085 °F
Reheat temperature:	415 °C / 779 °F
Exhaust pressure:	vacuum up to 40 bar / 580 psi
Rotational speed:	3,000 – 13,200 rpm



Features:

- Backpressure / condensing type
- Parallel arrangement possible
- Customized steam path
- simple extraction in crossover pipe
- Axial/downward exhaust

SST-800



General

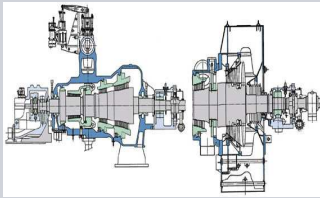
Direct drive turbine with reverse flow design for generator drive; tailor-made applications for most complex processes in industry and power generation

Technical Data:

Power output:	up to 150 MW
Inlet pressure:	140 bar / 2031 psi
Inlet temperature:	540 °C / 1,004 °F
Double controlled extraction:	up to 40 bar / 580 psi
Exhaust pressure:	vacuum up to 14 bar / 203 psi
Rotational speed:	3000 / 3600 rpm

Features

- Backpressure / condensing type
- Package unit design
- Inner casing for high inlet steam parameters
- Steam induction possible
- Radial and axial exhaust



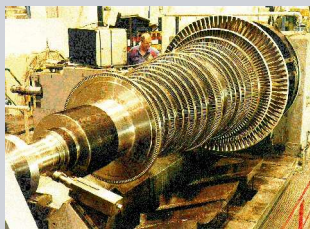
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SST-900



General:

Single casing turbine for 2-pole-generators for power generation and industry; SST-900 RH – dual casing turbine for reheat applications

Technical Data:

Power output:	up to 180 MW
Inlet pressure:	165 bar / 2,393 psi (with reheat)
Inlet temperature:	585 °C / 1085 °F (with reheat)
Double controlled extraction:	up to 55 bar / 798 psi
Exhaust pressure:	vacuum up to 16 bar / 232 psi
Rotational speed:	3,000 / 3,600 rpm HP up to 13,200 rpm

Features:

- Backpressure / condensing type
- Pre-engineered turbine modules
- Customized steam path
- Axial/downward exhaust



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Renewable Energy Division

Portfolio

- Wind turbines (on- and offshore) and services
- Stake in Voith-Siemens Hydro (35%)

Innovation highlight

- SWT-3.6-107 with a capacity of 3.6 MW, the world's most powerful series-produced wind power system for offshore applications

CEO

Dr. René Umlauf

Employees

3,290 (fiscal 2007)

References

With the Siemens wind power systems installed since 2003 (combined capacity of 3300 MW) as much as 8 million t CO₂ can be saved annually. That is approximately equivalent to the emissions in Latvia.



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Energy Service Division

Portfolio

- Services for oil & gas and industrial applications
- Operating power plant services
- e.g. spare parts, long-term service agreements, maintenance and repairs, modernization and upgrades

Location in Sweden Finspång

- Offers service for both steam and gas turbines

CEO

Randy Zwirn

Employees

11,780 (fiscal 2007)

References

Servicing more than 550 GW of the Siemens fleet plus licensee. Business operated through 48 regional offices worldwide with over 4,000 employees in field service.



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