Power and Gas – We bring power to the people
Table of contents

Rising challenges

Setting the pace

Powering the world
Rising challenges
Global trends are creating our market’s challenges

Global trends lead to increased energy demand

<table>
<thead>
<tr>
<th>Global trend</th>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic change</td>
<td>9.6 BN</td>
<td>Increase in the earth’s population in 2050 from 7.3 billion people today. Average life expectancy will then be 82 years.</td>
</tr>
<tr>
<td>Urbanization</td>
<td>70%</td>
<td>70% of the world’s population will live in cities by 2050 (2009: 50%).</td>
</tr>
<tr>
<td>Climate change</td>
<td>2013</td>
<td>Scientists measured the highest CO₂ concentration in the atmosphere in the last 800,000 years.</td>
</tr>
<tr>
<td>Digitalization</td>
<td>44 ZB</td>
<td>Will be reached by the digital universe by 2020 – a 10-fold increase from 2013.</td>
</tr>
<tr>
<td>Globalization</td>
<td>2x</td>
<td>Since 2000, the volume of world trade has nearly doubled.</td>
</tr>
</tbody>
</table>

Lead to our market’s challenges

- Acceptance
- Reliable power supply
- Economic efficiency
- Resource efficiency
- Climate protection

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The global demand for electricity will continuously increase

World electricity generation, gross (1,000 TWh)

Fossil Power Generation will continue to be the mainstay of power generation in 2030

Source: IHS Rivalry CMM 2015
Setting the pace
Power and Gas at a glance
We are where our customers are

Performance in FY 2015*

~ €13.2 bn
Revenue

~ €1.4 bn
Division profit

~ 50,000
Employees

~ €15.7 bn
New orders

Germany 21 Locations

6 Gas turbines/generators
4 Steam turbines
5 Dresser-Rand
2 Energy solutions
4 Instrumentation and electrical

Americas 69 Locations

8 Gas turbines/generators
2 Steam turbines
57 Dresser-Rand
1 Energy solutions
1 Instrumentation and electrical

Europe (excluding Germany), CIS, Africa, Middle East 42 Locations

4 Gas turbines/generators
4 Steam turbines
33 Dresser-Rand
1 Energy solutions

Asia, Australia 36 Locations

7 Gas turbines/generators
5 Steam turbines
20 Dresser-Rand
3 Energy solutions
1 Instrumentation and electrical

* including Service
## Financial performance Q2/FY16 vs Q2/FY15
**PG external view**

### Orders (€bn)

<table>
<thead>
<tr>
<th></th>
<th>Q2 FY 15</th>
<th>Q2 FY 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orders</td>
<td>3.1</td>
<td>6.2</td>
</tr>
</tbody>
</table>

+86%\(^1\)

*Sharply higher order intake driven by large orders totaling €3.1 billion for combined-cycle power plants, including service, in Egypt*

### Revenue (€bn)

<table>
<thead>
<tr>
<th></th>
<th>Q2 FY 15</th>
<th>Q2 FY 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>3.1</td>
<td>3.9</td>
</tr>
</tbody>
</table>

+15%\(^1\)

*Higher revenue in the large gas turbine and steam turbine businesses, due mainly to the ramp-up for execution of orders from Egypt*

### Profit (€m) and margin in %\(^2\)

<table>
<thead>
<tr>
<th></th>
<th>Q2 FY 15</th>
<th>Q2 FY 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit</td>
<td>382</td>
<td>535</td>
</tr>
<tr>
<td>Margin</td>
<td>12.3%</td>
<td>13.6%</td>
</tr>
</tbody>
</table>

12.3%\(^1\)

*Overcapacities and continuing challenges resulting in increased price pressure in most regional markets*
Power and Gas
Increasing R&D investments to capture future technology trends

R&D spending

<table>
<thead>
<tr>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
</tr>
<tr>
<td>2015</td>
</tr>
</tbody>
</table>

+28%

Efficiency
Next-generation gas turbine @ 63% combined cycle efficiency

Flexibility
Future portfolio extensions for customer optimization

Big data
Cross-Divisional application of digitalization

1) w/o PG DG AGT
Siemens turns big data into digital service offerings and new business opportunities for its customers

- **Utilize global fleet experience**
  - Data Analytics Platform Architecture
  - Sinalytics
  - Example: Gas turbine data transfer

- **Develop new digital services**
  - Suite of Digital Services
  - Example: Power Boost wind turbine
  - Optimize blade position based on current weather conditions
  - +5% nominal power output

- **Partner with Customer**
  - Total plant performance optimization
  - Example: CCPP power plant, U.S.
  - Maximize turbine utilization and fuel savings based on total plant digital analytics
  - Up to $2 million fuel cost savings potential per year per plant

50GB gas turbine data per day

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Power and Gas –
Powerhouse in power generation

Power and Gas Division

- Portfolio expansion through Dresser-Rand’s acquisition
- Entry into growing LNG market

Power Generation

- Products and turnkey solutions
- Small decentral to largest utility applications

Service

- Game-changing service technologies
- Data-driven services
- Large installed fleet (7,800 gas turbines, 72,000 steam turbines, 44,100 compressors, 3,200 automation systems)
Powering the world
### Portfolio

- **Aeroderivative gas turbines**  
  (4 MW to 66 MW)
- **Industrial gas turbines**  
  (5 MW to 53 MW)
- **Pre-designed and industrial steam turbines**  
  (45 kW to 250 MW)
- **Industrial power plant solutions (IPPS)**
- **Instrumentation and electrical solutions**
- **Electric motors up to 100 MW**
- **Diesel and gas engines up to 1.5 MW**

### Innovation highlights

- **Dry low emission (DLE) combustion system for industrial gas turbines**
  - Achieve legislative and permit requirements for low NO\textsubscript{x} (mostly < 15ppm NO\textsubscript{x}) emissions without driving up emissions of CO  
  - No additional operational limitations on engine operation – for example, maintaining stable engine operation through load shed and load acceptance
- **Enhanced platform design for industrial steam turbines**
  - Higher steam parameters  
  - Reduced start-up time  
  - Improved efficiency and flexibility  
  - Best technology features  
  - Long lifecycle – increased lifespan  
  - Improved CO\textsubscript{2} footprint
Industrial power plant Diamantina in Australia – reliable power for North West Queensland

Customer
Diamantina Power Station Pty Limited
Location
Queensland, Australia
Date
2014

Most eco-friendly power generation

**Electrical efficiency:** > 50%

242 MW el electrical output

Challenges

- High efficiency, low emissions, and part-load capability
- High availability in start-ups and operation

Solution

- Four SGT-800 gas turbines
- Two SST-400 steam turbines
- Four NEM heat-recovery steam generators
- SPPA-T3000 instrumentation and control system

Customer benefits

- Siemens turnkey power plant solution with efficiency well exceeding 50%
- Installed base-load capacity of 242 MW with no significant “turn down” or efficiency loss in part load
- One of the most efficient and eco-friendly fossil fuel-fired plants in Australia
### Central power generation (50 Hz and 60 Hz)

#### Portfolio

<table>
<thead>
<tr>
<th>Product</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy-duty gas turbines</td>
<td>(100 MW to 400 MW)</td>
</tr>
<tr>
<td>Generators</td>
<td>(25 MVA to 2,235 MVA)</td>
</tr>
<tr>
<td>Utility steam turbines</td>
<td>(90 MW to 1,900 MW)</td>
</tr>
<tr>
<td>Power plant solutions</td>
<td></td>
</tr>
<tr>
<td>• Gas turbine power plant solutions</td>
<td></td>
</tr>
<tr>
<td>• Combined cycle power plants (CCPP)</td>
<td>Single-shaft and multi-shaft configuration</td>
</tr>
<tr>
<td>• Integrated solar combined cycle power plants</td>
<td></td>
</tr>
<tr>
<td>• Integrated gasification combined cycle</td>
<td></td>
</tr>
<tr>
<td>• Combined heat and power (CHP)</td>
<td></td>
</tr>
</tbody>
</table>

#### Innovation highlights

- **SGT-8000H heavy-duty gas turbine series**
  - Low investment costs per kW
  - Low lifecycle costs
  - High reliability and availability
  - Fast start-up and high operational flexibility
  - High efficiency: > 60% in combined cycle operation

- **Siemens FACY technology for faster start-up time and flexible operation of combined cycle power plants**
  - Maximum load ramp-up after starting power plant
  - Maximized plant lifecycle with daily start-ups and shut-downs
  - Highest start-up reliability
### Challenges
- Profitable operation despite high gas prices (vs. coal)
- High resource efficiency
- Fast start-up for balancing energy

### Solution
- The highest efficiency combined heat and power station in Germany with core components from Siemens: SGT5-8000H gas turbine, SST5-5000 steam turbine, SGen5-3000W generator, I&C system, BENSON® HRSG

### Customer benefits
- Electrical efficiency of around 61.5% and a record power generating capacity of 603.8 MW during test run
- Plant can supply around 300 MW of heat for district heating
- Handover to customer 19 days ahead of schedule

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### CHP “Fortuna” in Germany – new performance and efficiency world record

<table>
<thead>
<tr>
<th>Customer</th>
<th>Stadtwerke Düsseldorf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Düsseldorf, Germany</td>
</tr>
<tr>
<td>Date</td>
<td>2016</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>~ 61.5% net efficiency</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>603.8 MW$_{el}$ electrical output</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>300 MW$_{th}$ maximum district heating capacity</th>
</tr>
</thead>
</table>

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LNG CCPP in South Korea – highly flexible fast-start capability

Customer
POSCO  
Location
South Korea
Date
2014–2015

1,262 MWel installed electrical capacity

Fast-start capability – only 30 minutes for a hot start

Solution

- Three SGT6-8000H gas turbines
- Three SST6-5000
- Three SGen6-2000H
- SPPA-T3000 instrumentation and control system

Customer benefits

- Net efficiency of > 60%
- These units are listed among the country’s top power plants in South Korea
- Commercial operation six weeks ahead of the scheduled completion date

Challenges

- Due to space limitations, plant is designed so that the three units can all be constructed in a single building

Due to space limitations, plant is designed so that the three units can all be constructed in a single building
Increased power generation capacity and reliability of power supply
Reduced CO₂ emissions and diversification of the energy mix
Supports economic growth
Increases the number of jobs and benefits for education and training

Three natural gas-fired combined cycle power plants including 24 H-Class gas turbines and 12 steam turbines

Outages and electricity cuts hamper industrial production and affect private households
Energy demand is rising
More electrification of urban and rural areas needed

Customer benefits

14.4 GW total combined capacity

24 H-Class gas turbines

14.4 GW total combined capacity

Customer
Egyptian government
Location
Beni Suef, Burullus, New Capital
Date
2017

Challenges

Solution

Customer benefits
## Oil & Gas

### Portfolio

- **Most extensive range of compression equipment**
  - Vertically and horizontally split centrifugal and axial flow compressors for oil and gas and other applications
  - Versatile integrally geared turbomachinery for air separation and chemicals
  - Gas field and process reciprocating compressors applied throughout the oil and gas value stream

- **Industrial and aeroderivative gas turbines**
  (up to 100 MW)

- **Steam turbines**
  (up to 250 MW)

- **Electric motors**
  (up to 100 MW)

- **Diesel and gas engines**
  (up to 1.5 MW)

### Innovation highlights

- **DATUM I compressor technology**
  - Integrates rotary separator technology with a high-speed, close-coupled, gas-cooled motor; magnetic bearing rotor system – all packaged in a compact modular design

- **LNGo**
  - Enables the “distributed” production of LNG on a small scale
  - Eliminates the need for the costly trucking of LNG long distances from large, centralized plants to LNG fueling depots
Dresser-Rand Offshore FPSO – lower costs, reduced footprint and weight

Customer  
Petroleo Brasileiro S.A. (Petrobras)  
Location  
Offshore Brazil  
Date  
In operation since 2009

Reduced CAPEX

Challenges
- Reduce CAPEX, OPEX, footprint, and weight
- Increase reliability by eliminating the need to install, operate, and maintain high-pressure injection pumping systems downstream of the compression system

Solution
- Two single-lift offshore modules for export and injection
- Each module has one compression train consisting of:
  - DATUM D6R6B driven by a mix of constant- and variable-speed motors
- Auxiliary systems
- Unit control buildings
- Installation and commissioning
- Spare-part package
- Radially split barrel-type compressor back-to-back design

Reduced OPEX

Customer benefits
- Machine can use either the hydro-carbon-rich or CO₂-rich gases, or a blend of the gases to more than 580 bar
- Discharge density of 556 KG/M³
- Solution eliminated an entire pumping system, a compressor train, and a separate injection manifold
- Market requirements were achieved

Reduced footprint and weight

Customer
- Petrobras
Location
- Offshore Brazil
Date
- In operation since 2009
Cornerstones of Siemens Power Generation Services

We put our resources where our customers are located so we can understand and address their unique needs. More than 80 service facilities around the world offer quick and comprehensive services when you need them.

A customer-centric approach to innovation and R&D results in game-changing service technologies and value-added solutions.

Our in-depth industry expertise and advanced data analytics capabilities enable accurate and responsive service for maximum lifecycle performance for your assets.
We are ambitious to be …

... a safe and reliable partner with a global presence and financial strength
... the most innovative company, to make your business more competitive
... the provider of the broadest high quality portfolio and a proven track record
... a trusted partner for joint value creation in a sustainable environment
... ONE global Service team wherever you are

A world-class partner you can trust!
We are committed to Power and Gas

With our innovative products, solutions, and services, we bring power to the people and help them enhance their economic growth. That’s how we at Siemens Power and Gas understand “Ingenuity for life”

Willi Meixner, CEO of Power and Gas
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