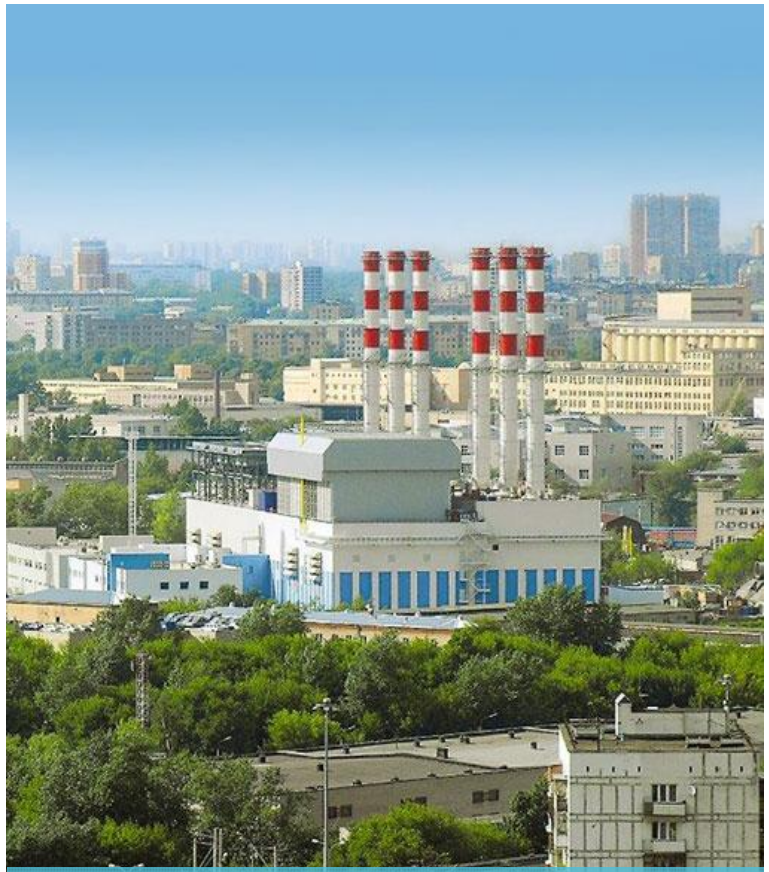
SIEMENS
Ingenuity for life

Power and Gas – We bring power to the people

siemens.com/power-gas

Table of contents



Rising challenges

Setting the pace

Powering the world

Rising challenges

Global trends are creating our market's challenges

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Global trends lead to increased energy demand

Demographic change

9.6 BN

increase in the earth's population in 2050 from 7.3 billion people today. Average life expectancy will then be 82 years.

Urbanization

70%

of the world's population will live in cities by 2050 (2009: 50%).

Climate change

2013

Scientists measured the highest CO_2 concentration in the atmosphere in the last 800,000 years.

Digitalization

44 ZB

will be reached by the digital universe by 2020 – a 10-fold increase from 2013.

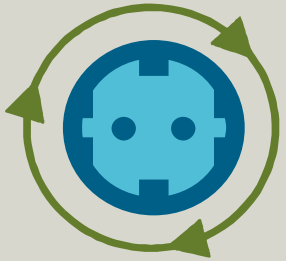
Globalization

2x

Since 2000, the volume of world trade has nearly doubled.

Lead to our market's challenges

Acceptance



Reliable power supply

Economic efficiency

Resource efficiency

Climate protection

The global demand for electricity will continuously increase

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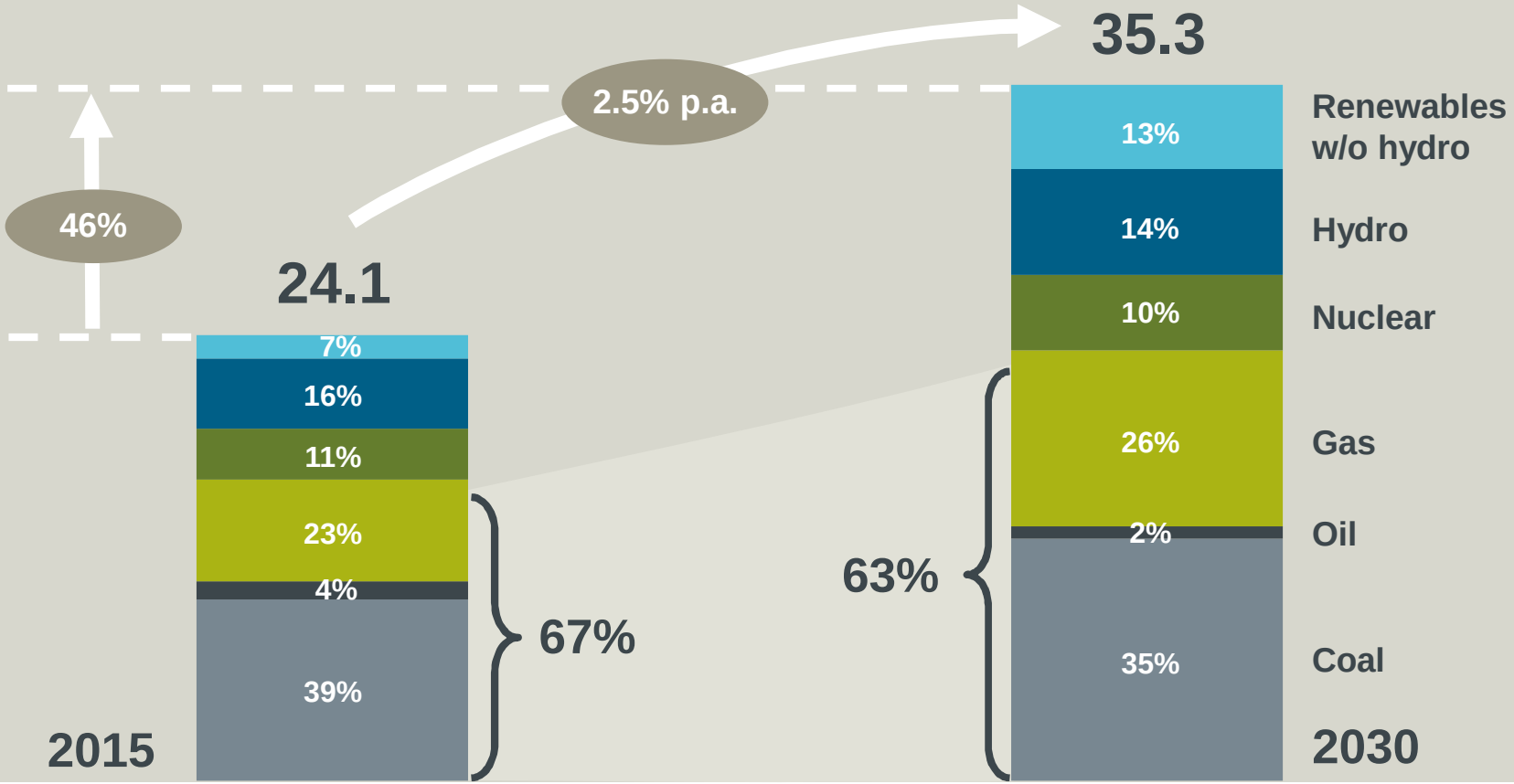
World electricity generation, gross (1,000 TWh)



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

Source: IHS Rivalry CMM 2015

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Setting the pace

Power and Gas – a powerful player within Siemens

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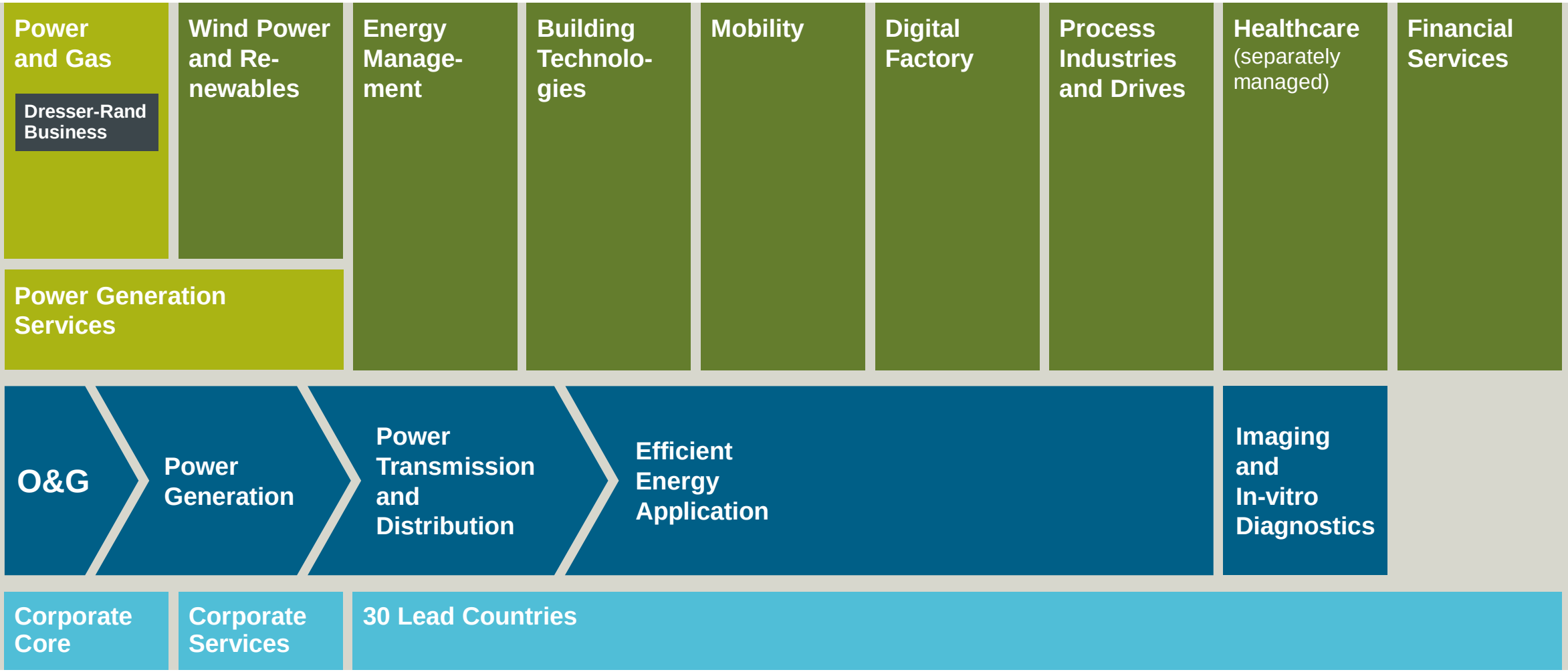

Power and Gas at a glance
We are where our customers are

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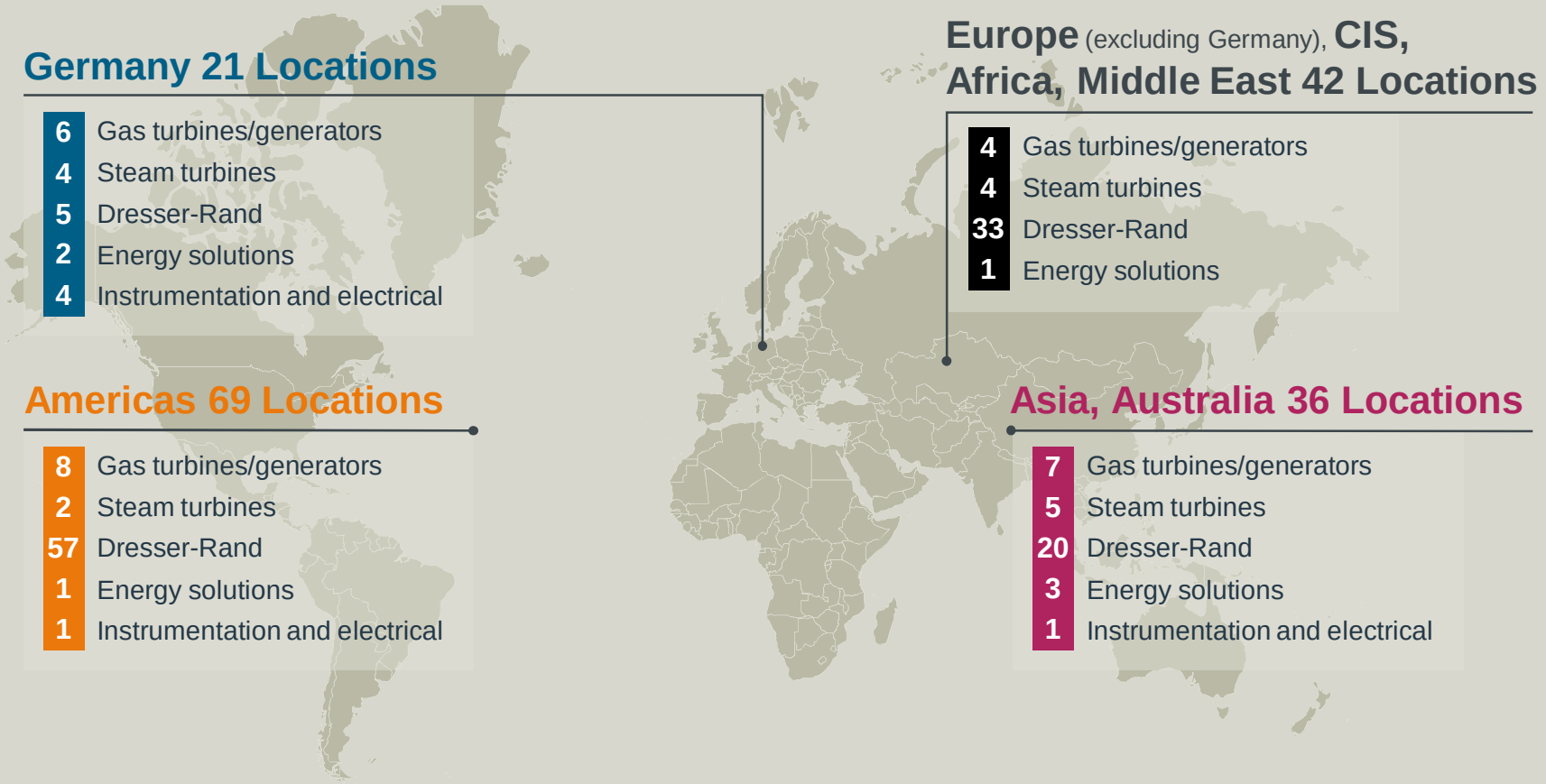
Performance in FY 2015*

~ €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

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

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

Americas 69 Locations

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

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

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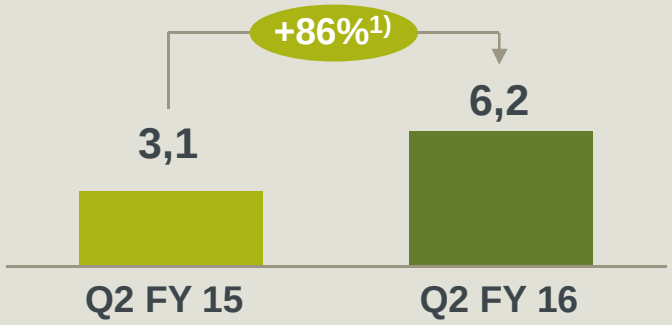
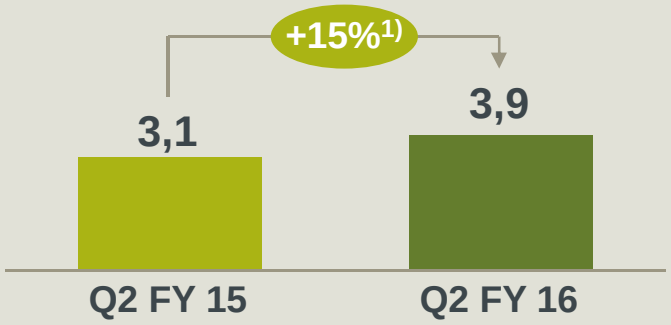
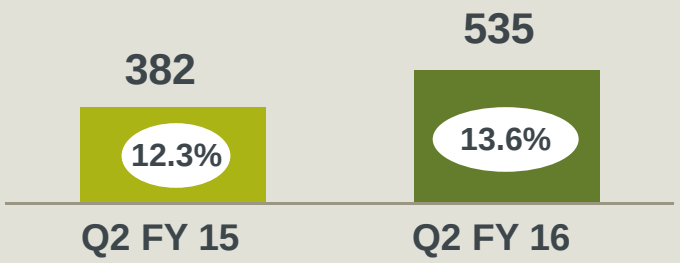
Orders (€bn)



Revenue (€bn)



Profit (€m) and margin in %2)



- **Sharply higher order intake driven by large orders totaling €3.1 billion for combined-cycle power plants, including service, in Egypt**
- **Higher revenue in the large gas turbine and steam turbine businesses, due mainly to the ramp-up for execution of orders from Egypt**
- **Overcapacities and continuing challenges resulting in increased price pressure in most regional markets**

1) Comparable, i.e. adjusted for currency translation and portfolio effects 2) as reported

Power and Gas
Increasing R&D investments to capture future technology trends

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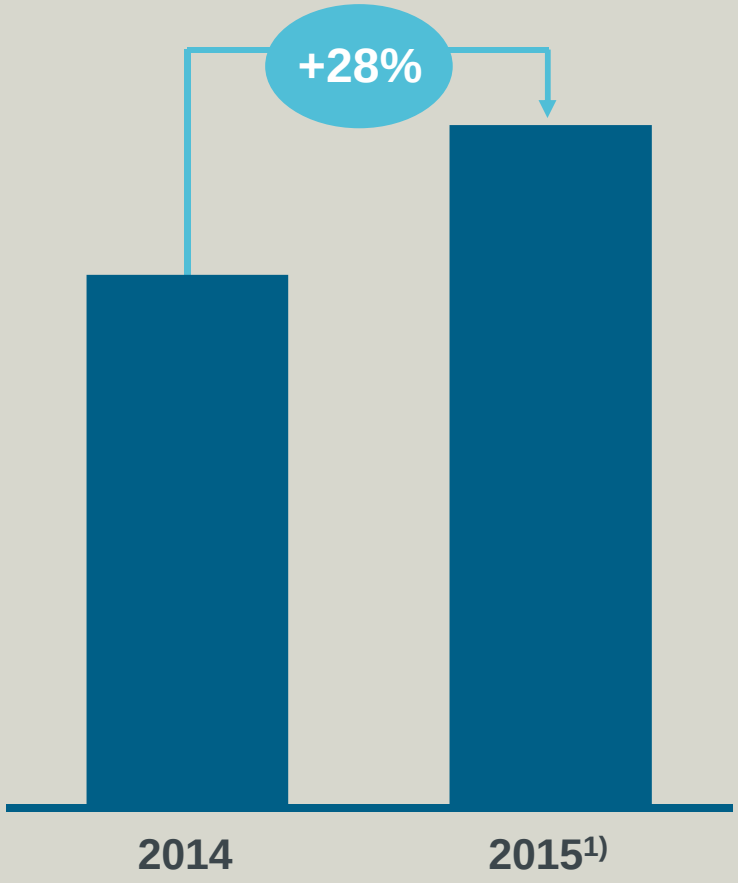
R&D spending



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

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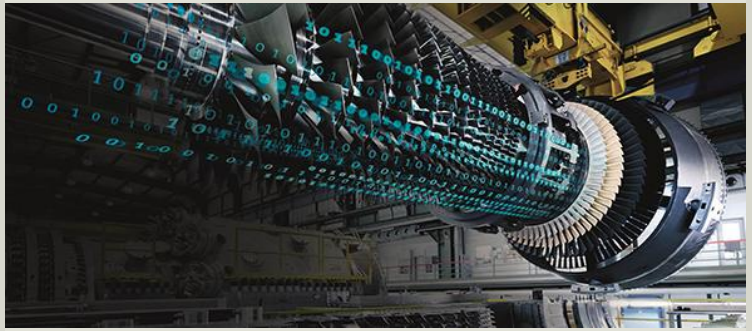
Utilize global fleet experience

Data Analytics Platform Architecture Sinalytics

Example: Gas turbine data transfer



Turning plant data and OEM knowledge into business assets

50GB gas turbine data per day

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'** fuel cost savings potential per year per plant

Power and Gas – Powerhouse in power generation

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Power and Gas Division

Oil & Gas

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

Power Generation

Decentral

Central

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

Power Generation Services Division

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

Decentral power generation (50 Hz and 60 Hz)

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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_x (mostly < 15ppm NO_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_2 footprint

Industrial power plant Diamantina in Australia – reliable power for North West Queensland

SIEMENS

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)

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Portfolio

Heavy-duty gas turbines
(100 MW to 400 MW)

Generators
(25 MVA to 2,235 MVA)

Utility steam turbines
(90 MW to 1,900 MW)

Power plant solutions
- Gas turbine power plant solutions
- Combined cycle power plants (CCPP)
  - Single-shaft and multi-shaft configuration
  - Integrated solar combined cycle power plants
- Integrated gasification combined cycle
- Combined heat and power (CHP)

Instrumentation and electrical solutions

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

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

SIEMENS

Customer
Stadtwerke Düsseldorf
Location
Düsseldorf, Germany
Date
2016

~ 61.5% net efficiency

603,8 MW_{el} electrical output

300 MW_{th} maximum district heating capacity

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

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

SIEMENS

Customer
POSCO
Location
South Korea
Date
2014 – 2015

1,262 MW_{el} installed electrical capacity

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

Designed for 250 starts per year

Challenges

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

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

Egypt Megaproject – 14.4 GW H-Class power further national grid

SIEMENS

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

> 60% net efficiency

24 H-Class gas turbines

14.4 GW total combined capacity

Challenges

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

Solution

- Three natural gas-fired combined cycle power plants including 24 H-Class gas turbines and 12 steam turbines
- Adds 14.4 GW to Egypt's national grid
- Provide training to future power plant workers and service personnel

Customer benefits

- Increased power generation capacity and reliability of power supply
- Reduced CO_2 emissions and diversification of the energy mix
- Supports economic growth
- Increases the number of jobs and benefits for education and training

Oil & Gas

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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

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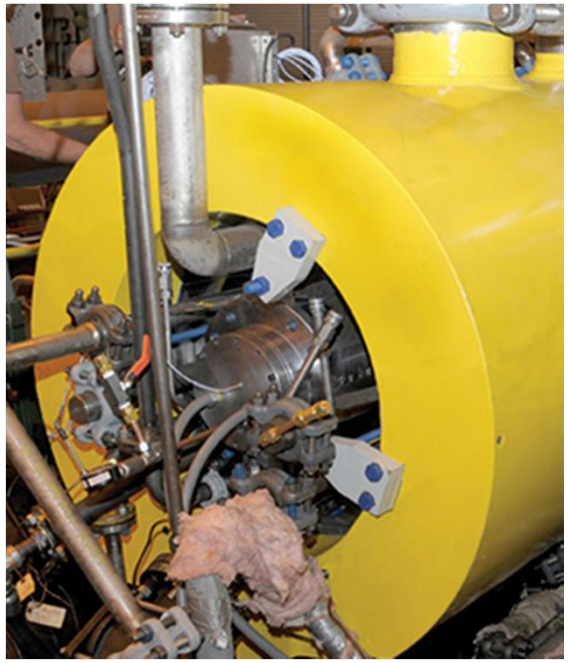
Customer
Petrobras
Location
Offshore Brazil
Date
In operation since 2009



Reduced CAPEX

Reduced OPEX

Reduced footprint and weight

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

Customer benefits

- Machine can use either the hydro-carbon-rich or CO_2-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

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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.

Game-changing service technologies

Data-driven services

Customer proximity

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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