Siemens Energy

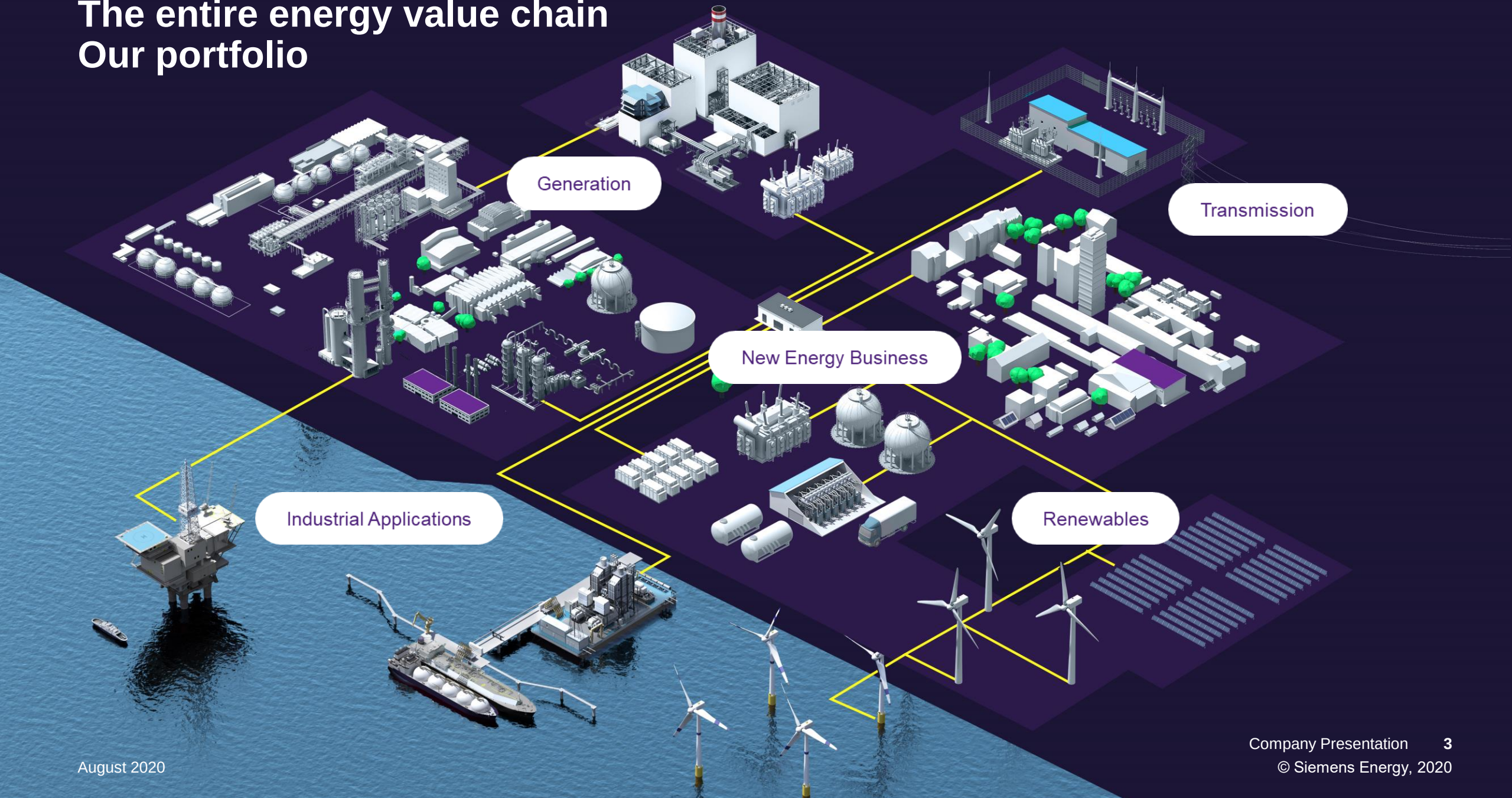
Yalçın Eskiyapan

October 2020

Siemens Energy has a strong position and global footprint

1 Figures as per Combined Financial Statements as of and for the fiscal year ended September 30, 2019
2 Figures as of March 31, 2020

The entire energy value chain
Our portfolio



Industrial Applications

Our promise

For customers from the Industrial Applications business, e.g. Oil & Gas, Industries such as Fiber, Marine or Chemicals, the main priorities in the upcoming years will be to reduce emissions, to extend the lifecycle of assets and to reduce total costs of ownership.

The Industrial Applications Division will help them achieve these objectives by providing safe, reliable and high-efficient, mission-critical Rotating, Electrical, Automation and Digital products, solutions and services that deliver sustainable value across customers' operations.

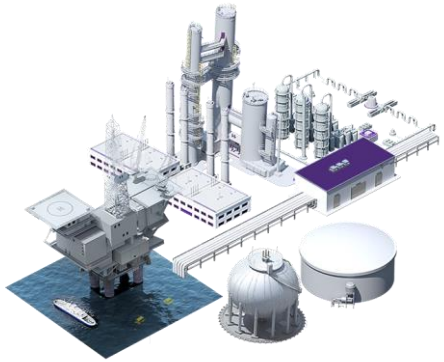
HIGHLIGHT

Hydrogen operation

Emission reduction through energy efficiency, fuel change, hybridization.

Braskem Petrochemical, Hydrogen (H_2), Brazil

Building, operating and maintaining Combined Cycle Power Plant using Hydrogen in the fuel mix (up to 60%) for the gas turbines



Products

- Industrial and Aero-derivative Gas Turbines
- Industrial Steam Turbines
- Turbo Compressors and Reciprocating Compressors
- Generators

Solutions

- Integrated Electrification, Automation and Digital solutions for
  - Onshore and Offshore Oil & Gas, incl. Subsea
  - Marine and Fiber industries
- Water solutions

Service

- Spare parts, repairs, field services
- Modernizations & Upgrades
- Long term programs
- Operations & Maintenance programs
- Digital services

Generation

Our promise

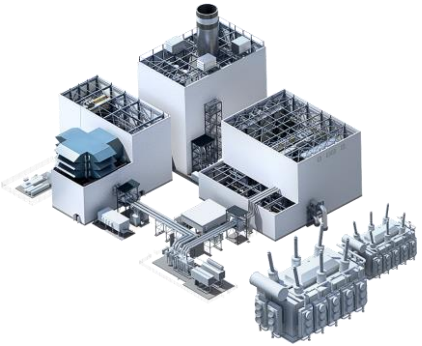
Generation focuses on supporting our customers' individual paths to a decarbonized operation. Today we already offer a broad portfolio of products, technologies, solutions and services that help our customers significantly reduce the carbon emissions of their existing assets. At the same time, we are investing to develop technologies that will be critical in the future for deeper decarbonization solutions targeting the zero-carbon emission goal in power generation applications.

HIGHLIGHT

Using energy more efficiently

Clean and affordable energy
deployed quickly.

Estrella del Mar III, SeaFloat
mobile power, Dominican Republic.



Distributed

- Industrial Gas Turbines
- Industrial Steam Turbines
- Engines

Central

- Large Gas Turbines
- Large Steam Turbines
- Large Generators

Solutions

- Large power plants[1]
- Industrial power plants
- Heat transfer technology
- Re-powering solutions
- Generation transition solutions[2]

Instrumentation & Controls

Turbine and Power Plant Controls

Service

- Modernizations & Upgrades
- Long Term Programs, Operation & Maintenance
- Field service
- Spare parts
- Digital Services

1 Different scopes of supply from package to complete turnkey solution
2 Includes heat pump, heat recycle solutions and decentral hybrid solutions

Transmission

Our promise

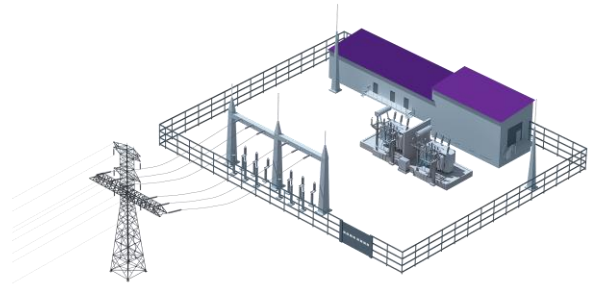
Our transmission, distribution and industrial customers choose us for our innovative, digitized and reliable products, solutions and services that allow them to operate efficient grids for the growing demand of sustainable electrification.

Highlight

Blue Portfolio

Our Blue Portfolio with SF_6-free products plays an essential role in the shift toward environmental friendliness and reduced greenhouse gas emissions.

Daxlanden, 400kV substation
with Clean Air GIB™, Germany



Switching products and systems

- Transmission systems
- Gas-insulated switchgear
- Circuit breakers, surge arresters, disconnectors
- Bundles and Systems

Non-switching products and systems

- Power and distribution transformers
- Bushings, instrument transformers and coils
- Bundles and systems

Solutions

- Substations
- Grid access
- FACTS
- HVDC
- MVDC
- E-packages
- Mobile solutions

Service

- Product related services
- Modernization, upgrades
- Long term programs incl. operations

New Energy Business

Our promise

By enabling the green hydrogen economy, New Energy Business will lead the transition towards a decarbonized world together with our customers and partners. This business will focus on driving forward future-oriented technologies such as Power-to-X and on advancing the development of our H_2 electrolysis systems.

HIGHLIGHT

Enable Hydrogen Economy

Decarbonization of steel production based on hydrogen.

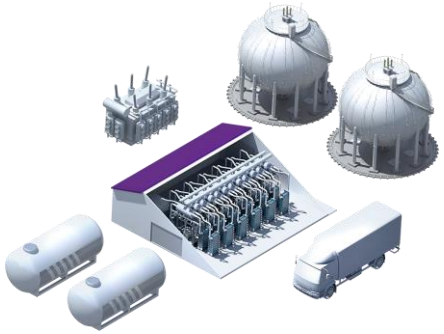
H2FUTURE[1] – A European Flagship project for the generation and use of hydrogen with the **world's largest and highly advanced hydrogen pilot facility in Linz, Austria.**

Partner H2FUTURE[1]

Siemens | VERBUND | Voestalpine | Austrian Power Grid | K1 MET | TNO Project funded by EU

1 This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 735503. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovative program and Hydrogen Europe and NERGHY.

August 2020



Hydrogen Systems

- Industry grade and highest quality green electrolyzer-based Power-to-hydrogen systems and services

Power-to-X-Solutions

- Electrolyzer-based Power-to-Hydrogen and Power-to-Liquids solutions and services
- Electrolyzer-based turnkey solution package

Energy Consulting & Digital Services

- Electrolyzer-integrating Energy system design
- Specific Power-to-X related digital services and optimization solutions

Renewable Energy

Our promise

Siemens Gamesa Renewable Energy offers one of the industry's broadest wind power product portfolios, with both offshore and onshore technology as well as industry-leading service solutions. The installed products and technology have a total capacity base of more than 100 GW.

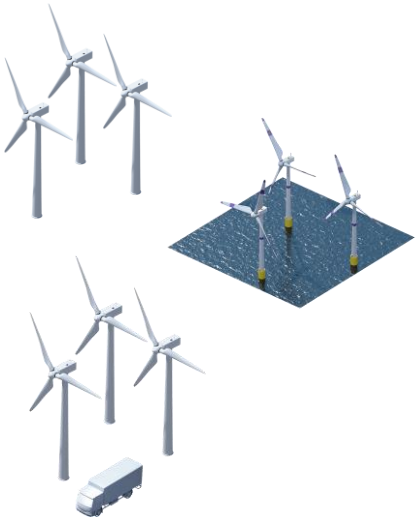
HIGHLIGHT

Hornsea One offshore project in UK

With a capacity of 1,218 MW, Hornsea One is one of the world's largest offshore wind power plants.

The 174 Siemens Gamesa 7 MW turbines will power more than one million of homes in Britain.

Location: UK,120 km off the Yorkshire coast.



Onshore Wind Power

- 87.5 GW installed worldwide
- 40 years' experience in the onshore wind power business
- Onshore portfolio covering all market requirements

Offshore Wind Power

- 15.7 GW installed worldwide
- Proven track record
- Almost 30 years' experience in the offshore wind power industry

Service

- 71 GW under service
- Nearly 32,000 turbines serviced worldwide
- Service operations in 60 countries
- More than 30 years' experience in the wind power industry

Siemens HL-class

Pushing Performance to the Next Level

Joined DNA based on proven H-class design

SGT-9000HL series

Compressor

Enhanced 3D airfoils (3rd gen)
12 stages
1 Inlet Guide Vane/2 Variable Guide Vanes
Simplified casing (combined Vane Carrier)
Individual cantilevered stator vanes
Pressure ratio 24

Combined Journal
Thrust bearing

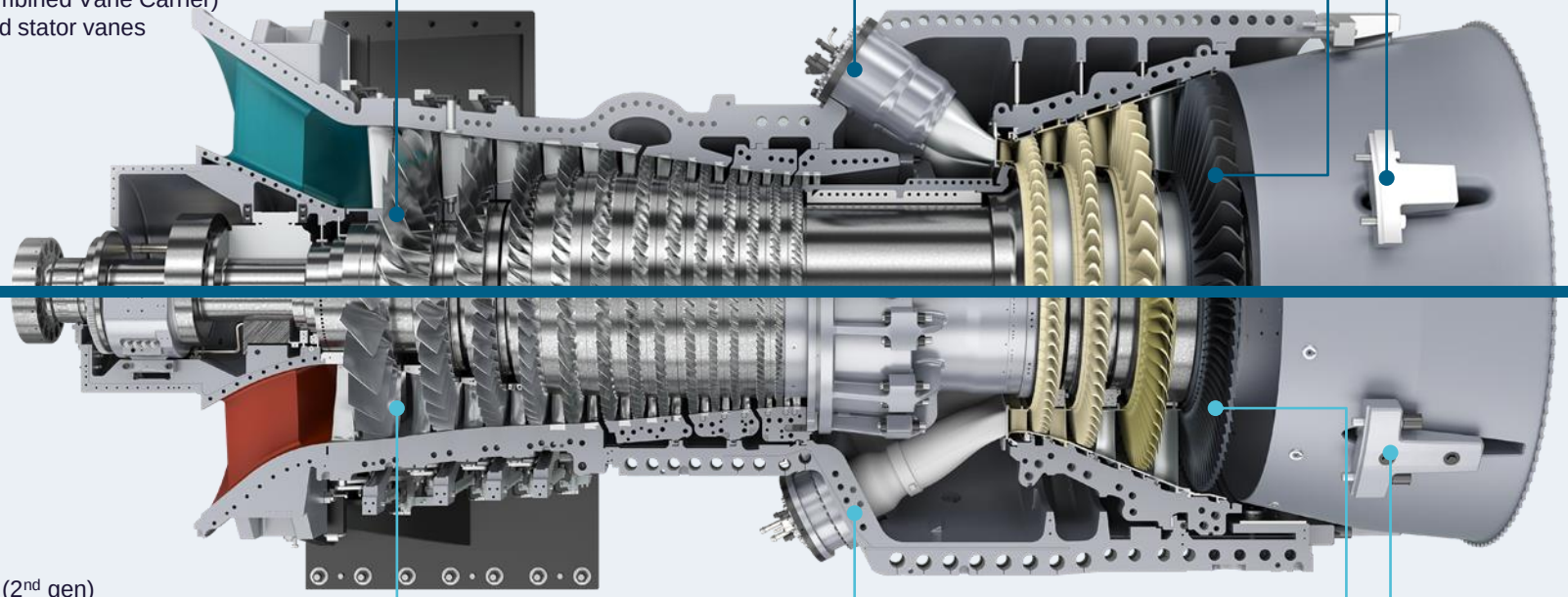
Mid frame

Rotor Air Cooler
12/16 combustors

Turbine

Cooled stage 4, free-standing
Rotating heat shields

Turbine exit cylinder



topview

SGT-8000H series

Enhanced 3D airfoils (2nd gen)
13 stages
1 Inlet Guide Vane/3 Variable Guide Vanes
Pressure ratio 21

12/16 combustors
No Rotor Air Cooler

Uncooled Turbine Blade 4, shrouded
Metallic rings
Interstage seal housing/Pre-swirler

Compressor bleed-cooled Turbine
Exhaust Casing struts

Engine testing & validation under site conditions

Duke Energy Lincoln County		SSE Keadby II
		
Fuel gas and fuel oil, part load, (fast) WetC, fuel gas heating	performance	Fuel gas, part load, (fast) WetC, ST Co-Start, combined cycle optimization
Fast ramping, start/stop, hot ambient simulation (APH), high load and fast fuel transfer, grid code	flexibility	Fast ramping, start/stop, UK grid code
Full rotor dynamics, endurance runs, flutter, leakage, compressor surge, thermal paint	durability	Full rotor dynamics, endurance runs, flutter, leakage, compressor surge, thermal paint
NO_x, CO, CO_2	emissions	NO_x, CO, CO_2

The HL-class:
Experience and technology unite to build the future

Single tie-bolt rotor

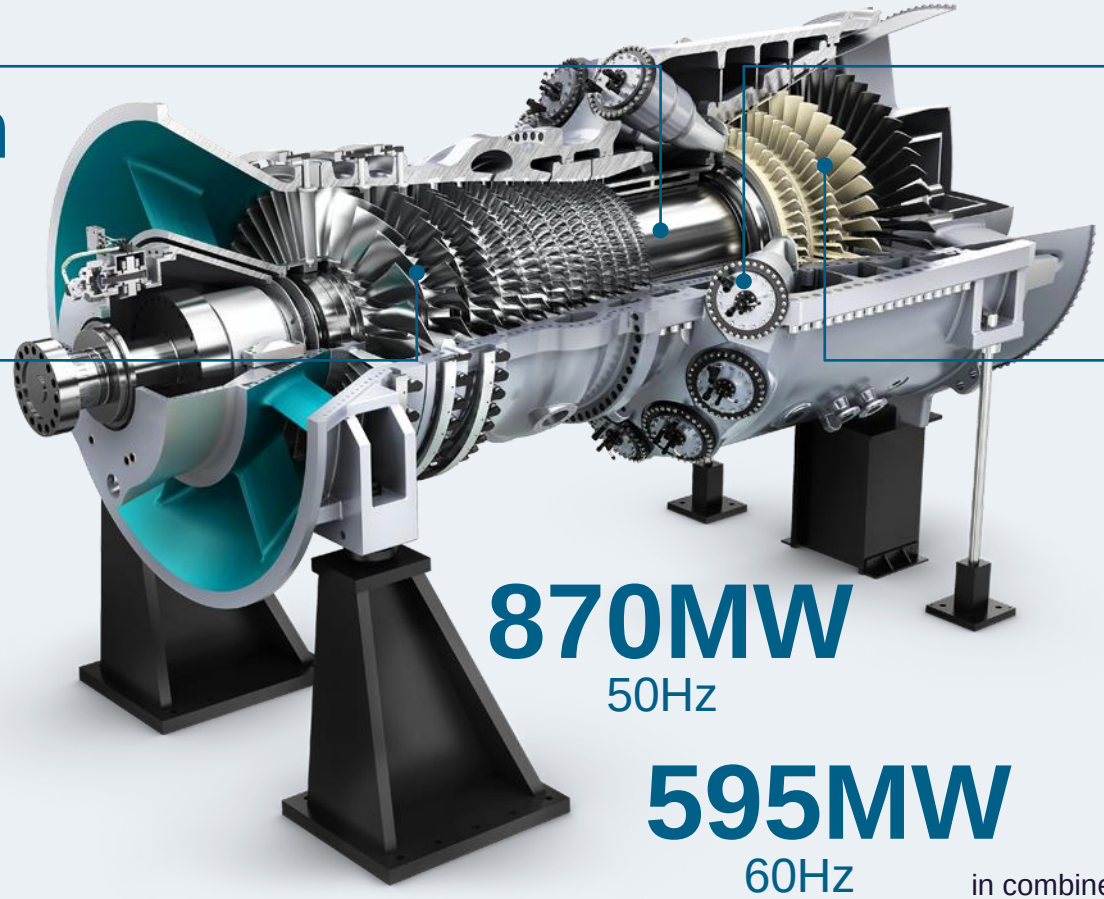
85MW/min

12-stage compressor

33,000 EBH or
1,250 ES*

Combustion

4-stage turbine



870MW
50Hz

595MW
60Hz

>63% efficiency

in combined cycle 1x1 / 1S

Flexibility Performance Serviceability

*EBH: Equivalent Base Hours, ES: Equivalent Starts

Siemens HL-class: Based on H-class design and experience
1,300,000 fired hours on 4 continents

AMERICA	SGT6-8000H
Mexico	7 (5)
USA	19 (17)
Brazil	3 (0)

AMERICA	SGT6-9000HL
USA	2 (0)
Additional selected	✓

EUROPE	SGT5-8000H
Germany	3 (2)
Poland	1 (1)
Turkey	4 (4)

EUROPE	SGT5-9000HL
UK	1 (0)
Additional selected	✓

AFRICA / ME	SGT5-8000H
Egypt	24 (24)
UAE	1 (0)

ASIA	SGT6-8000H
Philippines	1 (1)
South Korea	15 (15)

ASIA	SGT6-9000HL
Korea	4 (0)
Additional selected	✓

ASIA	SGT5-8000H
China	2 (0)
Hong Kong	1 (0)
Japan	2 (2)
Malaysia	6 (6)
Pakistan	2 (0)
Thailand	2 (0)

93 Siemens H-class
are under contract

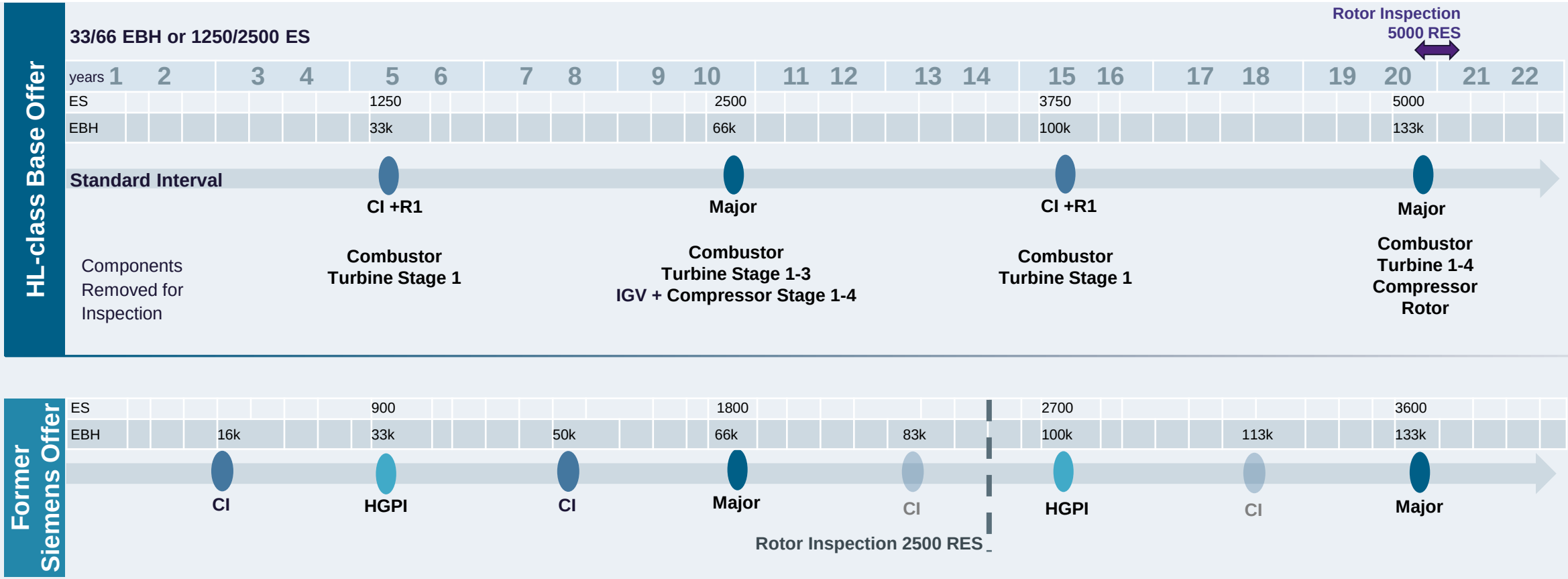
77 units
are in commercial operation

7 Siemens HL-class
are under contract

Several units
are technical selected

Numbers of sold units (thereof in commercial operation)

Standard service concept for 9000HL offers best in class availability



~25% less outage days compared to advanced gas turbine industry standard

EBH: Equivalent Base Hours, ES: Equivalent Starts, RES: Rotor Equivalent Starts, CI+R1: Combustor inspection w/ Turbine row 1 exchange, Major: Major Overhaul, IGV: Inlet Guide Vane

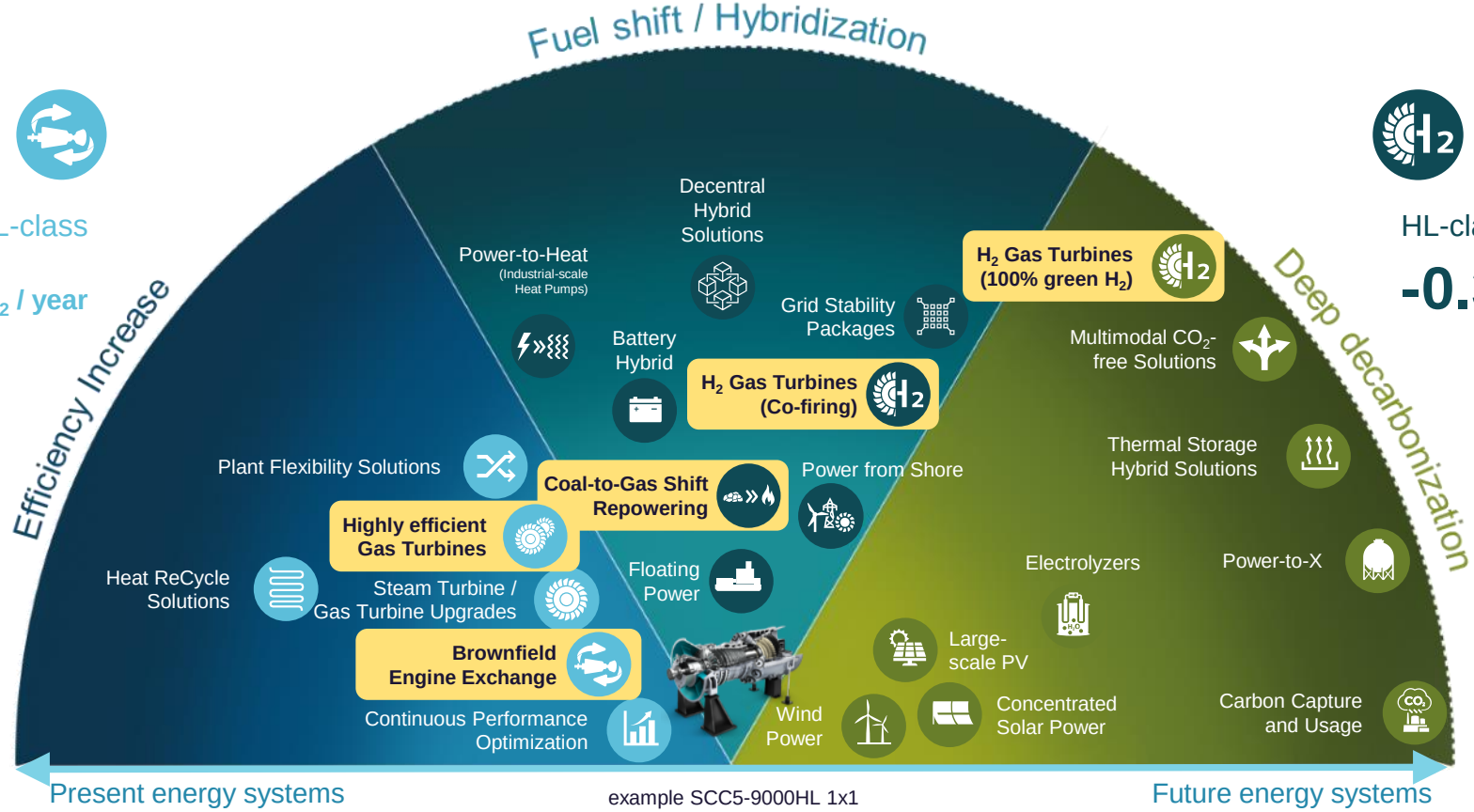
HL-class helps to decarbonize power generation

F-class to HL-class

-0.2M t_{CO2} / year

Coal to HL-class

-3.7M t_{CO2} / year

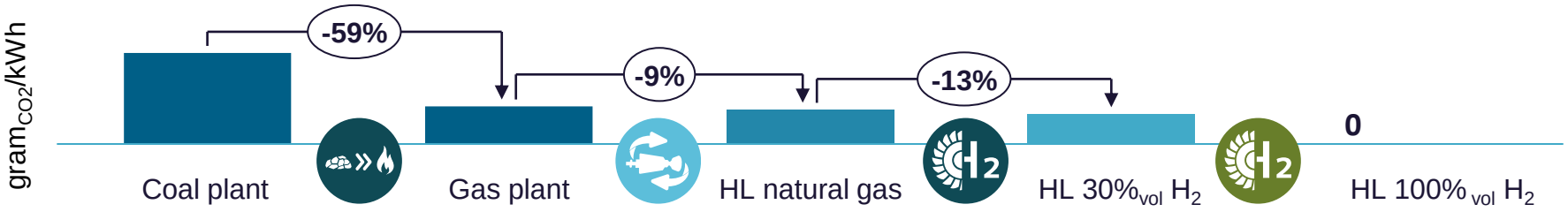


HL-class to 30%$_{vol}$ H_2

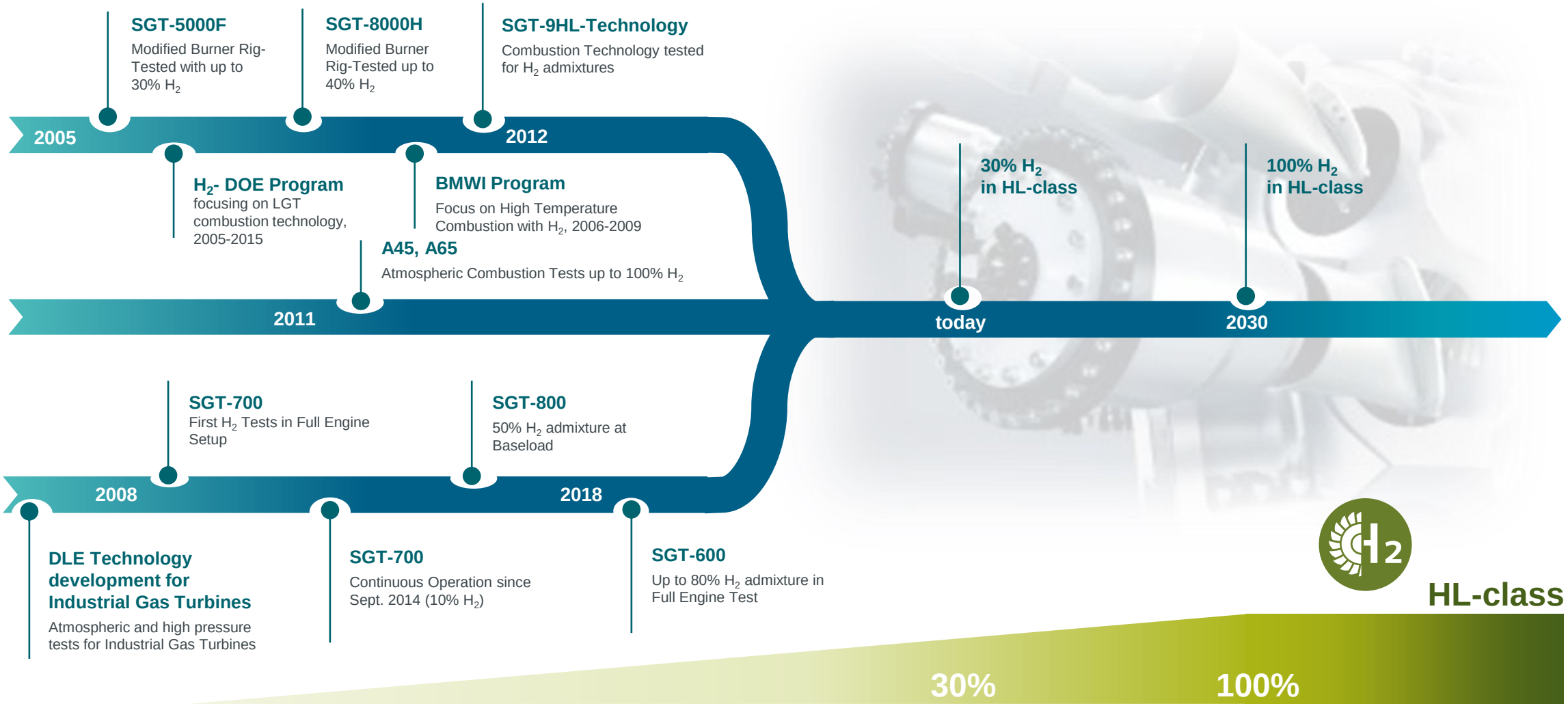
-0.3M t_{CO2} / year

HL-class to 100%$_{vol}$ H_2

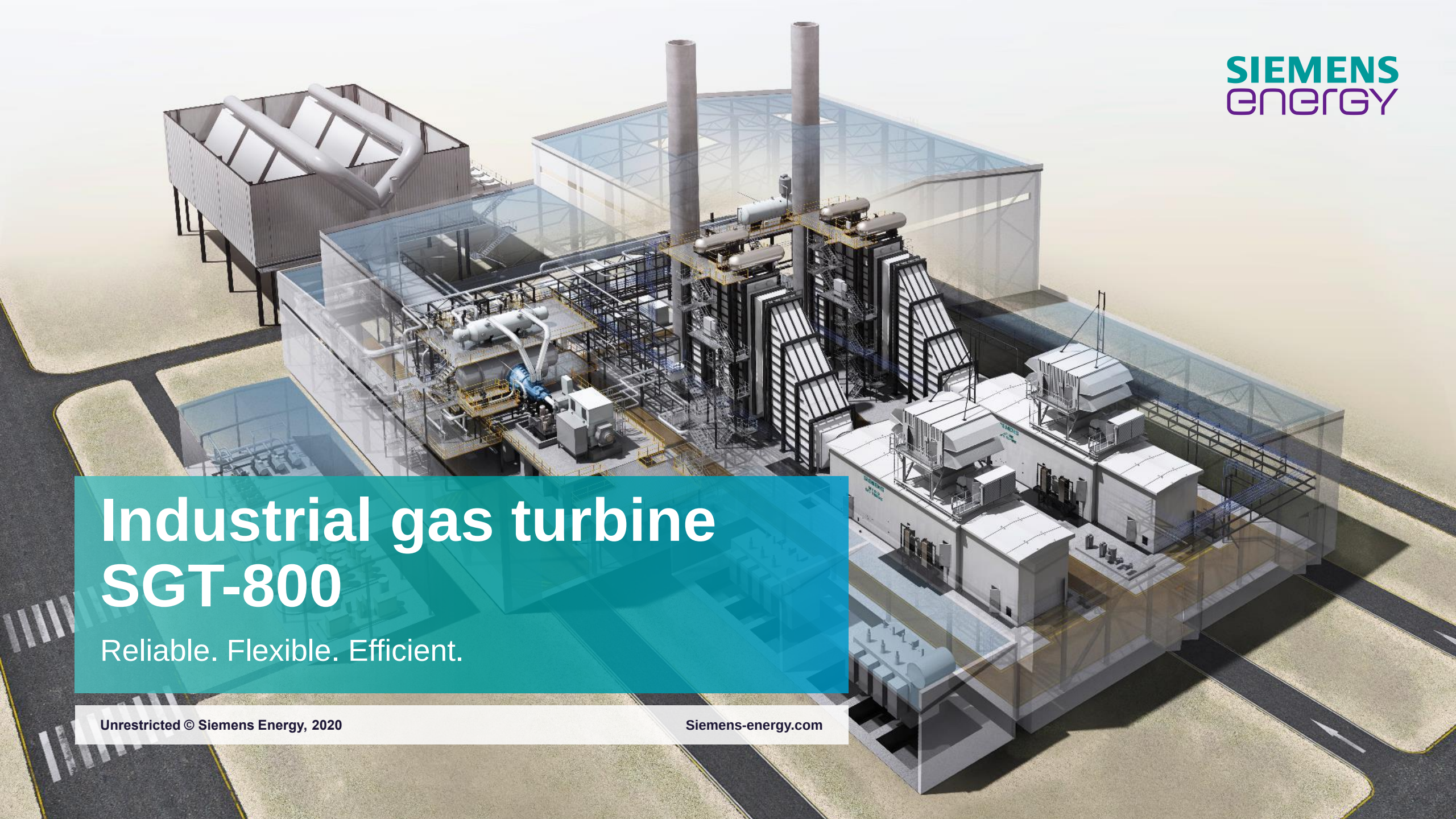
-2.2M t_{CO2} / year



Clear roadmap to 100% hydrogen based on Siemens extensive combustion technology experience



all percentages by volume



Industrial gas turbine SGT-800

Reliable. Flexible. Efficient.

SGT-800 Industrial gas turbine – core engine
Simple and robust design

1 Compressor

- All-welded 15 stage compressor rotor
- 3 stages of variable guide vanes
- Vertically split compressor casing

2 Rotor

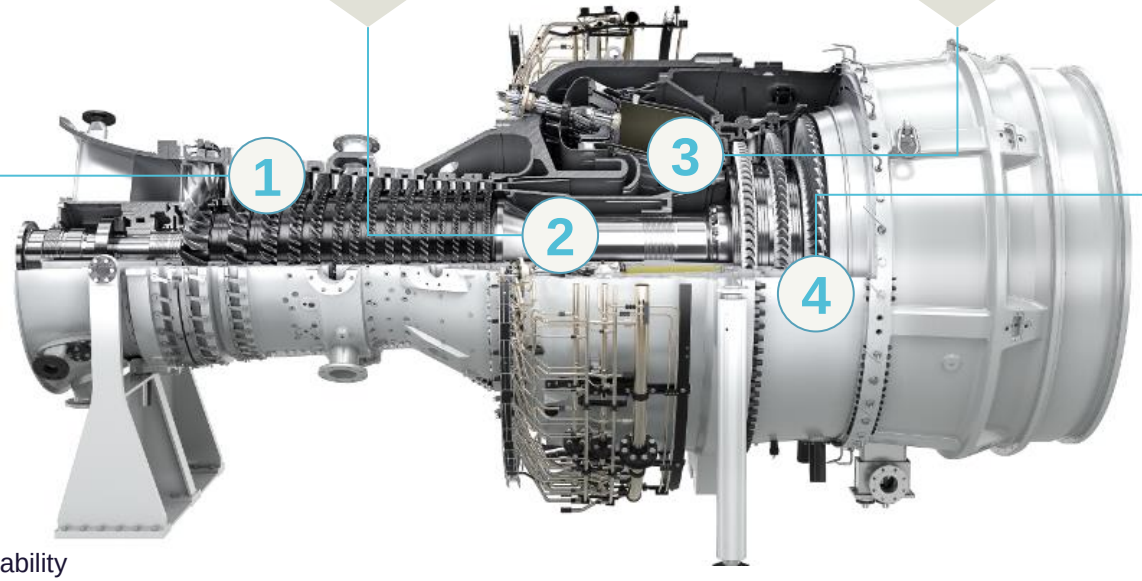
- Single shaft gas turbine
  - Cold end drive
  - Rotor speed 6,600 rpm
- Same core design for 50/60 Hz applications
- Tilting pad type bearings

3 Combustor

- Annular combustor with passive damping
- Robust and fuel flexible dry low emission (DLE) system
- 30 dual fuel DLE burners
- On-load fuel changeover capability

4 Turbine

- Bolted 3-stage turbine
- High exhaust energy giving excellent Cogen / CC characteristics



Flexibility Performance Serviceability

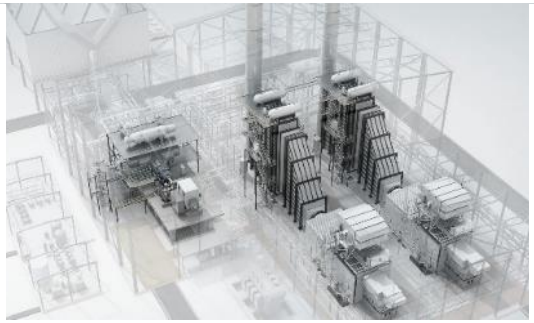
Excellent maintainability

- Simple, robust design with a two-bearing rotor
- Compact and modular design for easy on-site maintenance
- 48-hour core engine exchange, option for off-site maintenance

SGT-800 technical data overview

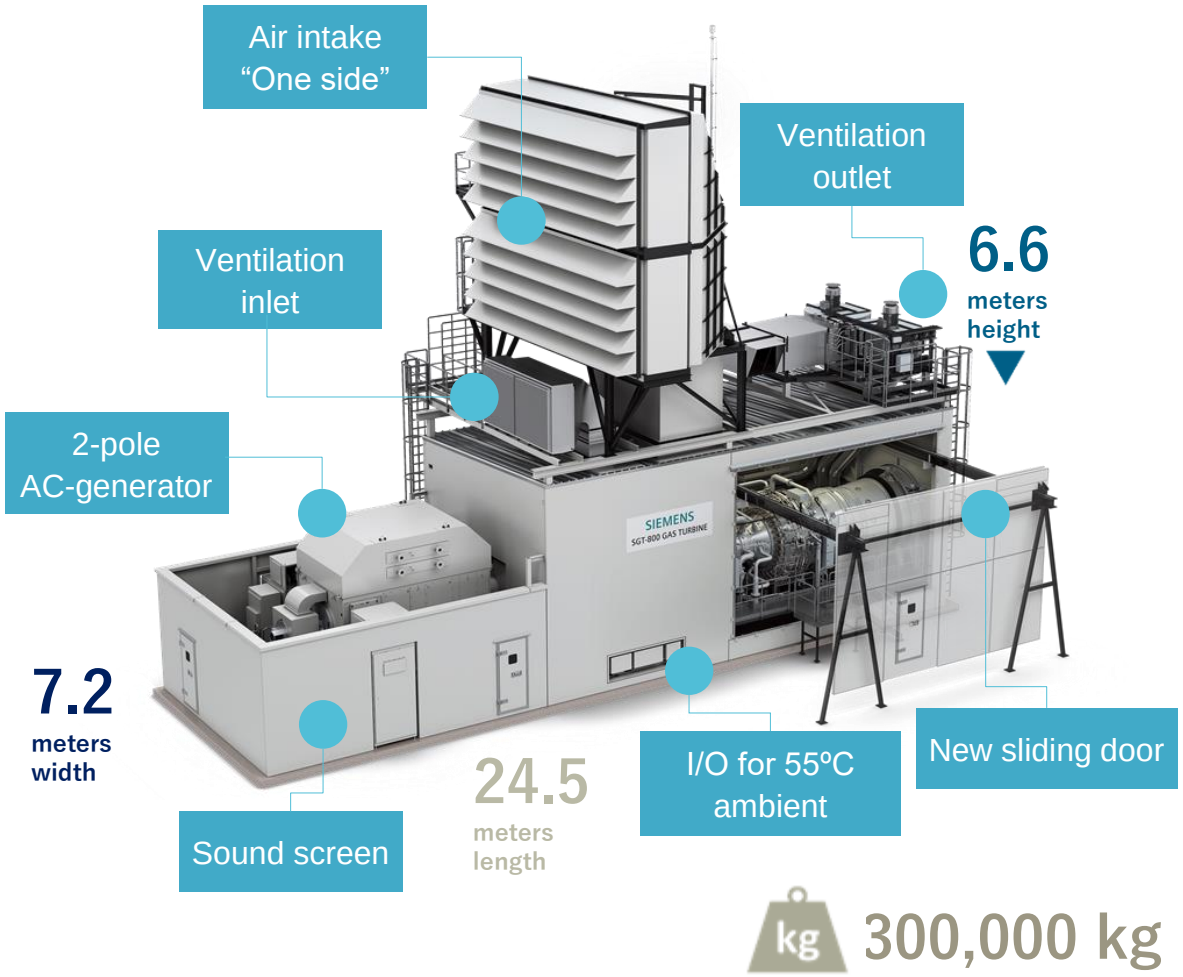
Combined cycle power generation

	50 MW rating	54 MW rating	56 MW rating	57 MW rating	62 MW rating
SCC-800 in 1x1 configuration					
Net plant output	71.2 MW(e)	77.3 MW(e)	79.2 MW(e)	80.7 MW(e)	88 MW(e)
Net plant efficiency	57.2%	56.9%	57.3%	57.9%	59%
Net plant heat rate	6,298 kJ/kWh	6,323 kJ/kWh	6,283 kJ/kWh	6,221 kJ/kWh	6,100 kJ/kWh
SCC-800 in 2x1 configuration					
Net plant output	143.9 MW(e)	156.3 MW(e)	160.5 MW(e)	163.1 MW(e)	180 MW(e)
Net plant efficiency	57.8%	57.5%	58.0%	58.5%	60%
Net plant heat rate	6,233 kJ/kWh	6,257 kJ/kWh	6,207kJ/kWh	6,158 kJ/kWh	6,000 kJ/kWh
SCC-800 in 3x1 configuration					
Net plant output	215.7 MW(e)	234.3 MW(e)	240.6 MW(e)	245.0 MW(e)	270 MW(e)
Net plant efficiency	57.8%	57.5%	58.0%	58.5%	60%
Net plant heat rate	6,228 kJ/kWh	6,261 kJ/kWh	6,207kJ/kWh	6,154 kJ/kWh	6,000 kJ/kWh



Note: The combined cycle plant SCC-800 is available based on one or multiple SGT-800 gas turbines. Combined cycle performance is based on three pressure non-reheat (3PNRH) bottoming cycle.

SGT-800 classic package
with the 62 MW core



Similarities with the package for the 57 MW core

- Ventilation outlet system located on the roof
- Same short diffuser for short GT enclosure length
- Same principle arrangement: Diffuser on the same base frame as the gas turbine and gearbox
- Low loss gear box

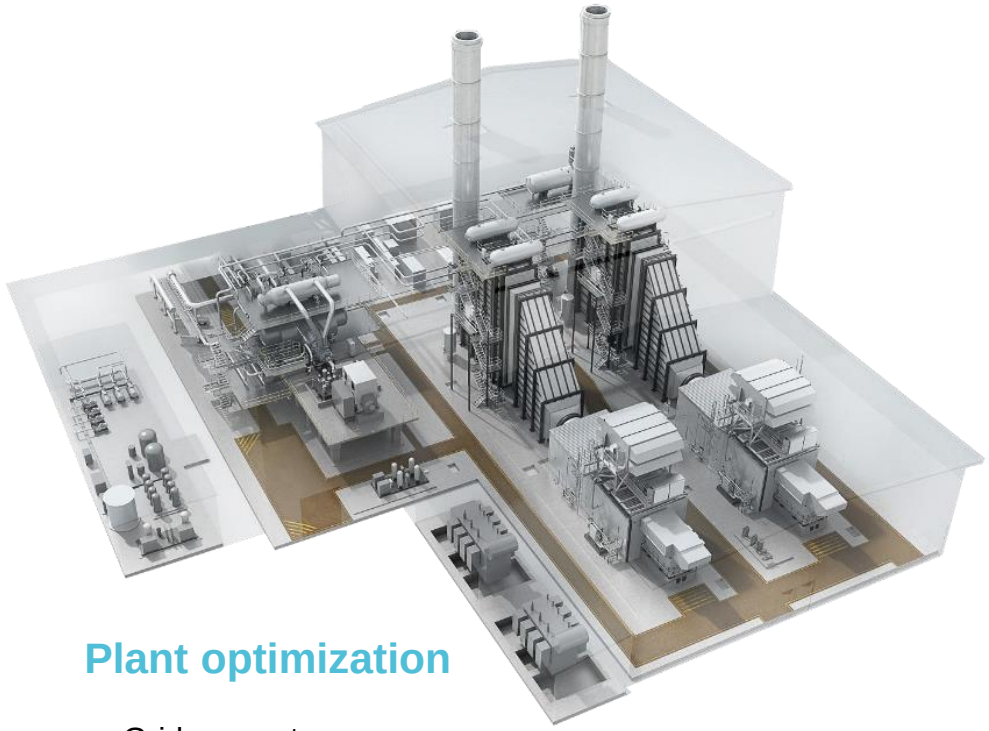
Modifications for the package with the 62 MW core

- 2-pole generator with sound screens
  Acoustic generator enclosure optional
- Single-sided air intake system as standard
- New sliding door arrangement

Dimensions and configuration depending on rating (picture shown for 62 MW rating).
Package dimensions include the AC generator but exclude inlet filter housing and exhaust stack.

SGT-800-based power plant

Industrial power plant for combined cycle and combined heat and power



Plant optimization

- Grid support
- Island mode operation
- Multiple power blocks
- Phased construction

Plant scope flexibility:
From gas turbine and steam turbine only,
to full turnkey power plant.

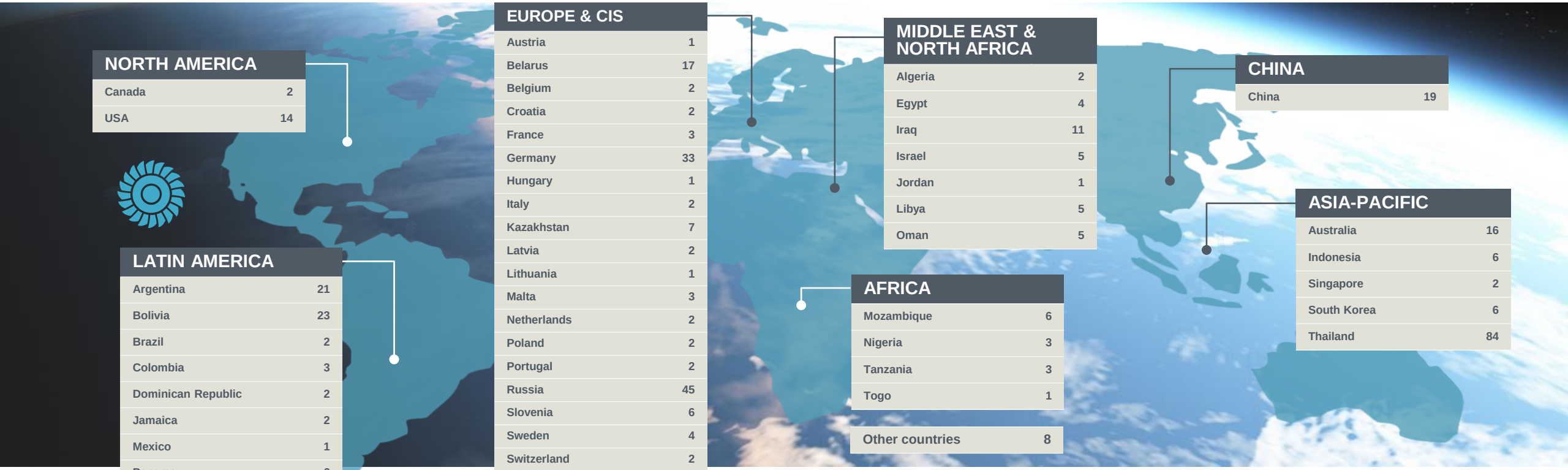
One or multiple SGT-800 gas turbines provide the core of a powerful combined-cycle plant.
> 60% CC net plant efficiency in 2x1 configuration.

High exhaust gas temperature of SGT-800 for excellent steam-raising capability.
> 92% CHP efficiency (with supplementary firing).

EconoFlex™: Flexible plant operation

- 10-minute start, frequent starts and stops, fast load-following, flexible load range
- Multiple units, up to 6x1 configuration, with excellent plant part load performance and emission turn down
- Perfectly suited for grid support to renewable power sources by adding grid stability through single shaft high inertia

SGT-800 – more than 8 million operating hours
Fleet experience in all regions



NORTH AMERICA	
Canada	2
USA	14

LATIN AMERICA	
Argentina	21
Bolivia	23
Brazil	2
Colombia	3
Dominican Republic	2
Jamaica	2
Mexico	1
Panama	6
Peru	1
Venezuela	3

EUROPE & CIS	
Austria	1
Belarus	17
Belgium	2
Croatia	2
France	3
Germany	33
Hungary	1
Italy	2
Kazakhstan	7
Latvia	2
Lithuania	1
Malta	3
Netherlands	2
Poland	2
Portugal	2
Russia	45
Slovenia	6
Sweden	4
Switzerland	2
Turkey	4
United Kingdom	3

MIDDLE EAST & NORTH AFRICA	
Algeria	2
Egypt	4
Iraq	11
Israel	5
Jordan	1
Libya	5
Oman	5

AFRICA	
Mozambique	6
Nigeria	3
Tanzania	3
Togo	1
Other countries	8

CHINA	
China	19

ASIA-PACIFIC	
Australia	16
Indonesia	6
Singapore	2
South Korea	6
Thailand	84

411 **Siemens SGT-800**
units are under contract

thereof **359** units
for Industrial Power Generation

52 units
in Oil & Gas applications

Numbers of sold units | Sep 2020

Thank you for your time
Our contacts for further information

Yalçın Eskiyapan

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