Hydrogen as part of our value chain

Vinod Philip, Chief Technology & Strategy Officer
March 19, 2021
INFORMATION AND FORWARD-LOOKING STATEMENTS This document contains statements related to our future business and financial performance, and future events or developments involving Siemens Energy that may constitute forward-looking statements. These statements may be identified by words such as “expect,” “look forward to,” “anticipate” “intend,” “plan,” “believe,” “seek,” “estimate,” “will,” “project,” or words of similar meaning. We may also make forward-looking statements in other reports, prospectuses, in presentations, in material delivered to shareholders, and in press releases. In addition, our representatives may from time to time make oral forward-looking statements. Such statements are based on the current expectations and certain assumptions of Siemens Energy’s management, of which many are beyond Siemens Energy’s control. These are subject to a number of risks, uncertainties, and other factors, including, but not limited to, those described in disclosures, in particular in the chapter “Report on expected developments and associated material opportunities and risks” in the Annual Report. Should one or more of these risks or uncertainties materialize, should acts of force majeure, such as pandemics, occur, or should underlying expectations including future events occur at a later date or not at all, or should assumptions prove incorrect, Siemens Energy’s actual results, performance, or achievements may (negatively or positively) vary materially from those described explicitly or implicitly in the relevant forward-looking statement. Siemens Energy neither intends, nor assumes any obligation, to update or revise these forward-looking statements in light of developments which differ from those anticipated. This document includes supplemental financial measures – that are not clearly defined in the applicable financial reporting framework – and that are or may be alternative performance measures (non-GAAP measures). These supplemental financial measures should not be viewed in isolation or as alternatives to measures of Siemens Energy’s net assets and financial position or results of operations as presented in accordance with the applicable financial reporting framework in its consolidated financial statements. Other companies that report or describe similarly titled alternative performance measures may calculate them differently. Due to rounding, numbers presented throughout this and other documents may not add up precisely to the totals provided and percentages may not precisely reflect the absolute figures.
Three pillars to support our strategy

- Low- or zero-emission power generation
- Transport of electricity and storage
- Reducing CO₂ footprint and energy consumption in industrial processes
We are serving the entire hydrogen value chain
Vast compression product portfolio for the entire hydrogen value chain with more than 1,500 operating compressors

<table>
<thead>
<tr>
<th>Green Hydrogen</th>
<th>Grey/Blue Hydrogen</th>
<th>Hydrogen pipelines</th>
<th>Hydrogen storage</th>
<th>Hydrogen liquefaction</th>
<th>Hydrogen Synthesis gas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RECIPROCATING Compressors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A¹</td>
</tr>
<tr>
<td><strong>TURBO Compressors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A¹</td>
</tr>
<tr>
<td><strong>GEARED Compressors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A¹</td>
</tr>
</tbody>
</table>

- **N/A¹** Not used today or applicable for current and foreseen volumes and pressure levels
- **Under commercial operations**
- **Existing relevant portfolio currently being introduced into new market applications**
- **Ongoing development to further improve efficiency in low mole weight gas compression (H₂)**

© Siemens Energy, 2021
Our advanced technologies successfully manage the challenging characteristics of hydrogen combustion

**Physics of fuel molecules**
- Lower density
- Higher diffusivity

**Flame kinetics**
- More challenging flame characteristics require more complex combustor design

**Additive Manufacturing for better mixing and cooling**
- Performance enabled by Additive Manufacturing
  - Optimized mixing for flash-back resistance
  - Improved tailored cooling
  - Rapid prototyping and testing

Eight burner fronts on printing plate SGT-600, SGT-700 and SGT-800
Hydrogen capabilities apply across the entire gas turbine range

The pathway to burn 100% hydrogen

<table>
<thead>
<tr>
<th>Gas Turbine</th>
<th>Released hydrogen capability</th>
<th>Ongoing Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGT5-9000HL</td>
<td>0% – 30%</td>
<td>25% – 100%</td>
</tr>
<tr>
<td>SGT-800</td>
<td>0% – 50%</td>
<td>25% – 100%</td>
</tr>
<tr>
<td>SGT-600</td>
<td>0% – 60%</td>
<td>25% – 100%</td>
</tr>
<tr>
<td>SGT-400</td>
<td>0% – 10%</td>
<td>25% – 100%</td>
</tr>
</tbody>
</table>

until 2023 – 100% H₂ in Industrial Gas turbines
until 2030 – 100% H₂ in Heavy Duty Gas turbines

Investments for upgrading the global fleet of gas turbines by making them a key technology for transitioning to a decarbonized world

- **Large GTs:** >45 years of accumulated experience on H₂ (syngas) combustion
- **Medium GTs:** >10 years experience based on H₂ admixture
- **Small GTs:** ≈1 m OH of high hydrogen combustion experience
- **Aero GTs:** >100k hours of recorded operation on high hydrogen fuels (up to 78 vol%)

1 The performance may be reduced based on H₂ concentration, emissions requirement and power rating

© Siemens Energy, 2021
Our technologies and systems are designed for upgradability to support the decarbonization of the installed base

Main systems requiring modification when upgrading to higher H₂ content

- Fire Protection System
- Gas Group I&C electrical equipment
- Additional Flame Control and Combustion Monitoring Systems
- Burner Adjustment/Exchange
- Fuel Gas System material and set-up
- H₂ compatibility of plant auxiliary and peripheral systems

Consequences and solution

- Project specific evaluation and decision on required modifications
- Power output control to ensure compliant NOx emission levels
- Conventional/non-H₂ fuels may be required for start-up and shutdown
- Re-certification with respective authorities might be required
Customer example: providing clean energy to Braskem, Brazil

Scope

- 2 x SGT-600
- 3 x Reciprocating Compressors
- E-houses
- Extension of HV Substation
- Advanced load-shedding System
- Software for plant control

Features

- Co-Generation plant fueled by residual process gas with high hydrogen content
- 6.3% CO$_2$ and 11.4% water consumption reduction
- 100% plant availability through redundant design
- 15 year contract to build, own & operate the cogeneration plant

up to 60% H$_2$

Co-Firing in combined cycle solution, providing 38 MW and 160 tons of steam per hour
Siemens Energy’s global setup enables global engagement in hydrogen projects

STRONG SIEMENS ENERGY FOOTPRINT:

- Present in >90 countries
- ~90 Sales and Execution offices
- ~75 Service centers
Over 53 units and 2.5 million operating hours worldwide across different industries and power ranges since 1979
Conclusions

1. **Unique combination** of global presence, service networks, solutions know-how, partner ecosystems and customer relations to enable the Hydrogen Economy.

2. Unmatched set of technologies, products and systems supports entire hydrogen value chain for both brownfield and greenfield applications.

3. Proven operational experience of green hydrogen solutions across production, compression and application around the world.

4. The partner-of-choice in the transition to a global Hydrogen Economy.