FLEXIBLE PACKAGE SOLUTIONS FOR SIEMENS SGT-800

By
Tobias Kiuru, Mikael Öijerholm
Siemens Industrial Turbomachinery AB
Finspong, Sweden
- **Agenda**
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  - SGT-800 Core Engine
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    - Single Lift package
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    - Lube oil systems
    - Fuel systems
  - Installation examples
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Market and Technical Challenges:

- Operate in remote or harsh areas
- Operate gas turbines on non-standard gas
- Provide reliable energy
- Provide low carbon energy at low cost
Heavy duty gas turbines

50 Hz

- SGT5-8000H: 400 MW
- SGT5-4000F: 307 MW
- SGT5-2000E: 172 MW
- SGT6-8000H: 296 MW
- SGT6-5000F: 242 MW
- SGT6-2000E: 114 MW

60 Hz

- Ind. Trent 60: 54 to 66 MW
- SGT-800: 48 to 53 MW
- SGT-750: 37 / 38 MW
- SGT-700: 33 / 34 MW
- Ind. RB211: 27 to 34 MW
- SGT-600: 24 / 25 MW
- SGT-500: 19 / 19 MW
- SGT-400: 13 to 14 MW / 13 to 15 MW
- SGT-300: 8 / 8 MW
- SGT-200: 7 / 8 MW
- SGT-100: 5 / 6 MW
- Industrial 501: 4 to 6 MW

Industrial and aero-derivative gas turbines

50 or 60 Hz

Power Generation / Mechanical Drive

- Industrial
- Aero-derivative
- Heavy duty 60 Hz
- Heavy duty 50 Hz
SGT-800 Core engine

- Single shaft
- Tilting pad bearings
- Cold end drive
- Welded rotor
- Bolted 3-stage turbine
- Annular combustor
SGT-800 Core engine

- Robust DLE system
- Flexible in Fuels, Operations, Ambient Matching and Installations
- Excellent Combined Cycle performance

**Simple Cycle**

<table>
<thead>
<tr>
<th></th>
<th>47.5 MW(e)</th>
<th>50.5 MW(e)</th>
<th>53.0 MW(e)</th>
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</thead>
<tbody>
<tr>
<td><strong>Power output</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Electrical efficiency</strong></td>
<td>37.7%</td>
<td>38.3%</td>
<td>39.0%</td>
</tr>
<tr>
<td><strong>Exhaust gas flow</strong></td>
<td>132.8 kg/s</td>
<td>134.2 kg/s</td>
<td>137.2 kg/s</td>
</tr>
<tr>
<td><strong>Exhaust temperature</strong></td>
<td>541 ºC</td>
<td>553 ºC</td>
<td>551 ºC</td>
</tr>
</tbody>
</table>
Classic package

- Originally developed for IPG market
- Traditional package
- Possible to do in situ maintenance
- Flexible: can operate on a wide range of fuel types
Single lift package

- Smaller footprint
- Improved I&C time
- 48h core exchange (increases availability)
- Enhanced string test possibilities
- No changes to the proven, robust SGT-800
Single Lift Skid
- Welded I-beams
- Lift or slide into position
- Integrated wet skid
- Multi or three point mount
Package systems
Lube oil supply unit

- On top of the wet skid
  - Module
  - Shared components
- Easy access
Gas fuel system

- Common components
- Different installation
Enclosure

- Enclosure fully assembled
- Flexible engine roll out
- Flexible maintenance
Diffuser

- Shorter and lighter
  - Same efficiency
- Lower thermal losses and lower noise
- Impacts in a positive way the overall package length
High degree of completion
- Auxiliary systems pre built and tested
- Package pre tested
- Customer interfaces outside of the sound enclosure
- Core test (option)
Single Lift Package - Increased availability

- Same inherent average fleet availability and reliability as Classic package
- Single Lift features:
  - Quick core engine exchange of 48 hours
  - Turbine slides onto support structure outside the enclosure
- Increases the availability for the customer, less downtime for customer
  - Minimizing downtime to 7 days
Fuel flexibility
3rd Generation Dry Low Emission Dual fuel burner

- Fuel transfer section (A)
- Swirl-generator section (B)
- Mixing tube section (C)
- Pilot gas injection (1)
- Central gas injection (2)
- Main gas injection (3)
- Pilot liquid injection (4)
- Main liquid injection (5)

- 3rd Generation DLE* System
- Well proven
- Uncomplicated system
- Load rejection capability

* Dry Low Emission
Flexible fuel operation

<table>
<thead>
<tr>
<th>Gas Fuel Constituents</th>
<th>Max</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane, CH₄</td>
<td>mole %</td>
<td>100</td>
</tr>
<tr>
<td>Ethane, C₂H₆</td>
<td>mole %</td>
<td>100* *Certain conditions required above 30% Ethane level</td>
</tr>
<tr>
<td>Propane, C₃H₈</td>
<td>mole %</td>
<td>100* *Certain conditions required above 30% Propane level</td>
</tr>
<tr>
<td>Butanes and heavier alkanes, C₄+</td>
<td>mole %</td>
<td>15</td>
</tr>
<tr>
<td>Hydrogen and carbon monoxide, H₂ + CO</td>
<td>mole %</td>
<td>15 *Higher levels may be considered on a project to project basis</td>
</tr>
<tr>
<td>Inerts, N₂/CO₂</td>
<td>mole %</td>
<td>50/40</td>
</tr>
</tbody>
</table>

Single burner high pressure rig burning increasing H₂ content in Natural Gas
Measured NOx and CO (DLE)

Low NOx and CO performance demonstrated also on part load
Installation examples
Arctic offshore

- 2x1 power block of 150MW, >56% efficiency
- 70x30 meter footprint
- 48 hours core engine exchange
- Plug & Play concept; generate power within 26-30 months from order
150MW case study in the Middle East area

- 4 units instead of 5
- Small footprint
- 10 weeks instead of 19 I&C
- 960 more hours available for power production
Summary / Key take away's

- Siemens offer solutions for the SGT-800 to benefit customers requirements:
  - Reduced footprint: Reduced cost for transportation, excavation, site logistics
  - High degree of completion: Less cost and time for I&C
  - Maintained reliability and improved availability: More production days
  - Fuel flexible DLE system: Operate on unconventional fuel with low emissions

- Ready concept to support different requirements
Thank you!