7HA Gas Turbine
World's Largest, Most Efficient Gas Turbine in its Class
Smart Innovation

Natural gas is becoming the fuel of choice globally and for customers who operate larger blocks of power, the desire for increased operating efficiency and flexibility has never been greater. This dynamic, combined with increasingly stringent environmental regulations, is increasing the demand for highly efficient, H-class gas turbines in order to recognize a more cost effective conversion of natural gas to electricity.

GE introduced its high efficiency H-class technology to the power generation industry ten years ago; today, with 200,000 hours of operation and counting, the technology continues to evolve with the 7HA air-cooled gas turbine.

The 7HA Gas Turbine provides GE’s most cost effective conversion of fuel to power in the 60 Hz H-class industry. It offers the reliability, flexibility, and availability of the F-class fleet and utilizes advanced materials (thermal barrier coatings (TBCs) and single-crystal super alloys) from GE’s H-class gas turbines and aviation business. And, with more than 100 million hours of single-crystal experience and 15 years developing and testing TBCs, GE continues to use these materials to enhance its turbines’ high efficiency architecture.

Combined cycle plants with 7HA Gas Turbines achieve more than 61% net/62% gross combined cycle efficiency based on Gas Turbine World basis.

Two Sizes to Serve Wide Output Needs

The 7HA.01 Gas Turbine model has a simple cycle output of 275 MW, the 7HA.02 Gas Turbine model offers 330 MW for larger block size needs. All HA gas turbines share:
- 14-stage compressor validated in 2011
- 12-chamber DLN 2.6+ combustion with more than 1 million hours and 18,000 starts
- 4-stage, air-cooled hot gas path using proven alloys

The 7HA.02 Gas Turbine model is flow-scaled (similar to speed scaling) from the 7HA.01 Gas Turbine model preserving system architecture, including blade counts, with updates to accommodate higher mass flow at the same efficiency. The 7HA.02 Gas Turbine model represents the largest 60 Hz gas turbine currently available in the industry.

Life Cycle Benefits with the Customer in Mind

Gas turbine and accessory systems employ several features to deliver lower operation and maintenance costs over its life cycle. These include proven single crystal alloys and super blade finishing, along with controls and maintenance schemes for reduced heat rate and output degradation over the life of the turbine. All compressor and turbine blades in the turbine are removable in the field as well.

Outage durations are reduced by over 20% with the use of quick disconnect pipes and quick release roof panels. Maintenance procedures and tools are also developed to reduce combustion inspection, hot gas path and major inspection durations.

Extended warranty and a full suite of service offerings are available, including long term service agreements with availability and reliability guarantee. Fleet spares are also maintained prior to first fire in the field.

Improving Operational Flexibility
- Fast start in as low as 10 minutes from the start command
- Over 40 MW/minute ramping capability in emissions compliance
- Low turndown ... as low as 30% of the baseload output
- Fuel flexibility ... gas and liquid fuels, with wide gas variability including high ethane (shale) gas and LNG
Up to 10,000 Labor-Hours Less to Install
The 7HA Gas Turbine can be installed 25% faster than previous 7F gas turbines through the use of modularized and pre-assembled accessories. Field welds are reduced by 40% and field installed valves are reduced by 98%. Benefits include faster installation schedule, lower installed costs and reduced site labor requirements.

Features and Benefits
• Modern 4-stage air-cooled hot gas path with advanced cooling and sealing technologies improves efficiency and allows more starts per inspection interval. Advanced materials and coatings, including single-crystal super alloys in the turbine section promote durability and extended parts life.
• Proven Dry Low NOx (DLN) 2.6+ dual fuel combustion system maintains low emissions, provides wide fuel capability, and superior turndown as low as 30% of baseload. The system has more than 1 million hours and 18,000 starts.
• Advanced 14-stage compressor leverages GE’s proven aviation and power generation technology, increases reliability and maintenance. All blades are field replaceable and multiple variable vanes provide for high part load efficiency and operability.
• GE’s patented Mark VIe* Distributed Control System (DCS) connects plant components with a single, high-performance, control architecture, enabling comprehensive plant automation schemes.
• Ease of installation and modularity combined with a shorter commissioning cycle provides improved life cycle value and 1 percent more reliability than previous technologies.
• Part of GE’s FlexEfficiency* Portfolio, a collection of modular, efficient, and flexible products that can be configured as needed for specific applications, situations, and priorities.

Technology Validation and Insurability
Technology validation is performed in GE’s unique full speed, full load facility with extensive instrumentation. This approach is recognized as providing product validation, superior to 8,000 hours of operation, and is a key aspect of the commitments of insurability GE has secured from major insurers.

Applicability
The 7HA Gas Turbine serves 60 Hz baseload and cyclic operation in combined cycle and simple cycle applications.

Simple Cycle Performance

<table>
<thead>
<tr>
<th>Feature</th>
<th>275 MW 7HA.01</th>
<th>330 MW 7HA.02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output (net)</td>
<td>275 MW</td>
<td>330 MW</td>
</tr>
<tr>
<td>Heat Rate (net)</td>
<td>&lt;8,240 Btu/kWh</td>
<td>&lt;8,694 kJ/kWh</td>
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<tr>
<td>Efficiency (net)</td>
<td>&gt;41%</td>
<td></td>
</tr>
<tr>
<td>Pressure Ratio</td>
<td>21.5</td>
<td></td>
</tr>
<tr>
<td>Turbine Speed</td>
<td>3,600 rpm</td>
<td></td>
</tr>
<tr>
<td>Exhaust Temperature</td>
<td>1,150°F</td>
<td></td>
</tr>
</tbody>
</table>

Combined Cycle Performance

<table>
<thead>
<tr>
<th>Feature</th>
<th>7HA.01</th>
<th>7HA.02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant Output (net)</td>
<td>405 MW 1x1</td>
<td>813 MW 2x1</td>
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<tr>
<td>Heat Rate (net)</td>
<td>&lt;5,580 Btu/kWh</td>
<td>&lt;5,570 Btu/kWh</td>
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<tr>
<td>Efficiency</td>
<td>&gt;61%</td>
<td>&gt;61%</td>
</tr>
<tr>
<td>Pressure Ratio</td>
<td>21.5</td>
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To find out more about this offering, contact your GE Power & Water sales representative or visit www.ge-energy.com