GE Energy is a leading supplier of aeroderivative gas turbines and packaged generator sets for industrial and marine applications. We provide power-generating equipment to utilities, industries and marine fleets throughout the world and are the world’s largest, most experienced gas turbine service provider.
Defining a new era of flexible power generation, GE’s revolutionary LMS100 provides a single, economical solution for the dispatch needs of nearly every market condition. With unparalleled efficiency, 10-minute start times, unmatched hot day performance, load following and cycling capabilities, and reliability derived from proven architecture and technology, the LMS100 is the ideal solution for power generation planners and developers.

A combination of frame and aeroderivative gas turbine technologies, this powerful machine represents the most extensive collaboration of design and manufacturing expertise in the history of GE—delivering over 100 MW with thermal efficiency in excess of 44%.

Offering superior value unavailable in other 80–160 MW gas turbines through high part-power efficiency, cycling capability without maintenance impact, dispatch reliability, turndown capability, and low emissions, the LMS100 gives dispatchers confidence they can meet customer and business needs at any time, day or night.

A Single Solution for Your Needs

Efficiency
+ Fast starts
+ Hot day performance
+ Load following and cycling capabilities
+ Reliability
+ No maintenance penalties
= LMS100® Flexible Power
Our Foundation for Flexibility

The LMS100 provides unsurpassed simple-cycle efficiency and increased power output thanks to an innovative intercooling system.

The intercooling system takes compressed air from the low-pressure compressor, cools it to optimal temperatures and then redelivers it to the high-pressure compressor. In providing a near constant stream of low temperature air to the high pressure compressor, the work of compression is reduced. The result is a higher pressure ratio (42:1) and increased mass flow (460 lb/sec).

In simple-cycle applications, the LMS100 can achieve thermal efficiency in excess of 44%. That’s nearly a 10 point improvement over every turbine in its size range. The impressive level of efficiency—when combined with the ability to cycle without maintenance interval impact—may translate into $4-7 MM in Net Present Value Savings over 15 years.*

LMS100 ISO Performance Data

<table>
<thead>
<tr>
<th>Model</th>
<th>ISO Base Rating (kW)</th>
<th>Heat Rate (Btu/kWh)</th>
<th>Efficiency%</th>
<th>Mass Flow (lb/sec)</th>
<th>Turbine Speed (RPM)</th>
<th>Exhaust Temp (F)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMS100PB</td>
<td>97,718</td>
<td>7,592</td>
<td>45.0%</td>
<td>453</td>
<td>3,600</td>
<td>783</td>
<td>DLE, 25 ppm NOx</td>
</tr>
<tr>
<td>LMS100PB</td>
<td>97,878</td>
<td>7,579</td>
<td>45.0%</td>
<td>453</td>
<td>3,000</td>
<td>784</td>
<td>DLE, 25 ppm NOx</td>
</tr>
<tr>
<td>LMS100PA</td>
<td>103,112</td>
<td>7773</td>
<td>43.9%</td>
<td>469</td>
<td>3,600</td>
<td>770</td>
<td>water injected to 25 ppm NOx</td>
</tr>
<tr>
<td>LMS100PA</td>
<td>103,162</td>
<td>7769</td>
<td>43.9%</td>
<td>469</td>
<td>3,000</td>
<td>767</td>
<td>water injected to 25 ppm NOx</td>
</tr>
</tbody>
</table>

* 5¢/mmBtu gas

Conditions: Performance at the generator terminals; NOx = 25 ppm or 50 mg/Nm3, 59F or 15C, 60% Relative Humidity, No Losses; Fuel Spec. Gas (LHV= 19,000 BTU/lb)
Features of Flexibility

As the only company with the necessary technology base and product experience to bring this innovative product to the power generation industry, GE has incorporated extensive customer feedback into the LMS100 development program—ensuring it has the flexibility to meet current and future needs. The resulting breakthrough system delivers 100 MW of power with:

10-minute fast starts with cycling capability

The flexibility of aircraft engine technology—with 10-minute starts from cold iron to full power—and the ability to start and stop in short 15 minute cycles (several times per day, if needed) without impacting maintenance intervals.

Incredible hot day performance

The flexibility to sustain power levels on hot days when demand is greatest. The LMS100 will increase in power as the temperature rises—up to 75°F (~24°C)—and then fall off in power at a much slower rate than conventional gas turbines. When the temperature again increases demand on the grid, the LMS100 will be at the top of the list to dispatch.

Improved load following and part load efficiency

The flexibility to provide 50 MW of power in less than one minute. When operating at 50% power, the LMS100 can ramp to full power in less than 60 seconds, providing fast response to load demand variations.

The flexibility to provide power at part load as efficiently as most gas turbines at full load—enabling efficient operation anywhere between 50 and 100 MW, as demand requires. At 50% load, the LMS100 can deliver power at 40% simple-cycle efficiency.

The flexibility to provide grid support without load reduction. Even with up to 5% grid frequency variation, the LMS100 can operate with very little power loss—making it uniquely capable of supporting the grid in times of high demand and load fluctuations.
Efficient Performance

Better efficiency also means less fuel burned per megawatt generated and less CO₂ emissions. The efficiency advantage of the LMS100 offers potential savings in terms of CO₂ taxes through reduced greenhouse gas emissions of as much as $0.6 MM each year when compared to a typical simple-cycle gas turbine plant.

Based on an average peaking season of 2,184 hours, the LMS100 reduces CO₂ emissions by more than 30,000 tons when compared to a typical simple-cycle 100 MW gas turbine plant. This CO₂ reduction is equal to the amount of carbon dioxide absorbed by approximately 7,400 acres of forest.

ecomagination:
a GE commitment

Ecomagination is GE’s commitment to aggressively bring to market new technologies that will help customers meet pressing environmental challenges. Ecomagination technologies offer improved efficiency, lower emissions and/or improved operating performance compared to other similar power generation technologies in the same power class. The LMS100, as one of the newest products in the ecomagination portfolio offers our customers 100 MW at 46% thermal efficiency with a wide range of operating flexibility for peaking, mid-range and base-load operation with lower start up emissions and 10-minute starts.
Proven, Reliable Technology

Sound heritage
The LMS100 core engine is derived from the CF6 family of aircraft engines, the same baseline architecture as the LM6000®. The current LM6000 fleet includes 588 operating engines with over 10.5 million accumulated fired hours of operation. Reliability for the LM6000 fleet is currently 99.14% and availability is currently 97.76%. The low-pressure compressor (LPC) is derived from GE’s MS6001FA gas turbine which has 65 units in operation with more than 1,000,000 hours of operation.

*Based on ORAP® reliability data, using current sample, which includes 151 operating units. ORAP®, All rights reserved: SPS®

Customer-designed controls
The LMS100 control system employs the Mark VIe and fiber optics for signal transmission between the package and control system. This system reduces the number of signal interconnects by 90% and the number of mechanical interconnects by 25%—which yields a simpler and more reliable design with a faster, more efficient installation and startup.

Designed for reliability
In addition, the integrated control system includes redundant sensors with smart selection logic to reduce single sensor failure trips. The fiberoptic distributed I/O (input/output) system is located outside the module to prevent electromagnetic or radio frequency interference and minimize false trips. Reliability of the LMS100 is further enhanced by redundant fans, fuel pumps, resistance temperature detectors (RTDs) and remote monitoring and diagnostics.

Comprehensive full scale validation tests
Consistent with GE’s practice for design validation, extensive design assurance and validation tests were established and executed for both the engine and balance of plant equipment.

The core engine, a gas generator consisting of the LMS100 high-pressure compressor, single annular combustor and high-pressure turbine, completed testing in December 2004 at the high altitude test cell in GE’s aircraft engine facility in Ohio. More than 1500 pieces of instrumentation were used to measure key design parameters. The testing confirmed aeromechanics, mechanical design and variable geometry optimization for performance, paving the way for full scale power plant validation testing.

Extensive, full scale testing of an LMS100 simple-cycle power plant was conducted at GE’s packaging facility in Houston, Texas. More than 2,500 pieces of instrumentation were used to validate performance, emissions, intercooler operation and sub-system capability at the most extreme operating conditions expected in commercial service.

The LMS100 full load power plant test, completed in November 2005, confirmed performance, operability, emissions, mechanical and electrical operations all successfully met or exceeded the requirements. Testing demonstrated 10-minute starts, fast load following, transient capability and efficiency—all hallmark characteristics of the LMS100.
Designed for Availability and Main

Maintainability features

● Modular construction permits replacement of the aero components without total disassembly
● Multiple borescope ports allow on-condition monitoring without turbine disassembly
● Condition-based maintenance and remote diagnostics
● Split casing construction of the booster (LPC) and aeroderivative compressor allows detailed on-site inspection and blade replacement
● Package accessory systems are externally mounted for ease of on-site replacement
● Package mounted maintenance cranes in auxiliary module

Modular “supercore“ enhances power plant availability

GE has established a target availability of 97.5% and 98.5% target reliability for a mature LMS100 power plant. The “supercore“ consists of the HPC, Combustor, HPT and IPT rotative modules, which can be exchanged in less than four days during on-site maintenance to optimize plant availability.

24 HOUR BREAKER-TO-BREAKER CHANGEOUT OF THE SUPERCORE
## LMS100 service intervals

<table>
<thead>
<tr>
<th>Interval</th>
<th>Scheduled Maintenance Action</th>
<th>Outage Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,000 hours (every 4K h)</td>
<td>Borescope inspection (includes cool-down time)</td>
<td>12 hours</td>
</tr>
<tr>
<td>25,000 hours</td>
<td>Hot section interval*&lt;br&gt;1) On-site hot section replacement (combustor, HPT, IPT)</td>
<td>4 days&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>50,000 hours</td>
<td>Depot maintenance&lt;sup&gt;b&lt;/sup&gt;&lt;br&gt;1) Major hot section overhaul (combustor, HPT, IPT)&lt;br&gt;2) Inspect booster, intercooler, scroll frames, HPC, aft shaft and bearings&lt;sup&gt;c&lt;/sup&gt;&lt;br&gt;3) Power turbine overhaul</td>
<td>4 days&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>75,000 hours</td>
<td>Hot section interval&lt;sup&gt;b&lt;/sup&gt;&lt;br&gt;1) On-site hot section replacement (combustor, HPT, IPT)</td>
<td>4 days&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>100,000 hours</td>
<td>Depot maintenance&lt;sup&gt;b&lt;/sup&gt;&lt;br&gt;1) Major hot section overhaul (combustor, HPT, IPT)&lt;br&gt;2) Inspect booster, intercooler, scroll frames, HPC, aft shaft and bearings&lt;sup&gt;c&lt;/sup&gt;&lt;br&gt;3) Power turbine overhaul</td>
<td>4 days&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Ratable module installed during maintenance period.
<sup>b</sup> Lease/spare “supercore” and Power Turbine modules are installed during maintenance period. For depot maintenance, outage duration is 60 days if no spare/lease module(s) are used.
<sup>c</sup> Roller and ball bearings are replaced at 50,000 hours; hydrodynamic bearings are inspected.

### Maintenance services

All warranty and follow-on services for the LMS100 will be provided by GE Energy either on site or at one of several service center locations around the world. These services can include Contractual Service Agreements (CSAs), lease engines, spare parts, rotatable modules, training resources and user conferences.

GE Energy’s Contractual Services Agreements provide the field service, labor, parts and repairs necessary for equipment maintenance while protecting your investment and minimizing your costs. CSA programs can be structured to include unplanned maintenance events with guarantee incentives on reliability and availability.

GE’s lease engine program provides a spare “supercore” that can be installed in 24 hours when service center maintenance is required. The power turbine module can also be replaced within an additional 24 hours.
Flexible Growth Platform

The LMS100 is a flexible growth platform designed to meet your changing energy needs. While actual plant layout depends on specific customer needs and site requirements, there are four basic LMS100 configurations available when combined with intercooler selection and combustion technology.

- **LMS100 Single Annular Combustor with Water** – Water or steam can be injected into the combustor to provide emission reduction and achieve 25 ppm NOₓ levels while operating on natural gas fuels between 50% and 100% power.

- **LMS100 DLE** – An advanced dry low emission (DLE) combustor will be available for sites that have a restriction on water usage. Using the DLE combustor, customers will be able to achieve 25 ppm for both NOₓ and CO emissions while operating on natural gas fuels.

- **Intercooler Options** – Water is the primary cooling agent in the shell and tube heat exchanger available with the LMS100. In areas with an abundant water supply, a standard evaporative cooling tower can be integrated. An optional closed-loop wet intercooler can be provided with a secondary dry, fin-fan cooler if water usage is restricted.

### LMS100 System Configurations

<table>
<thead>
<tr>
<th>Product Offerings</th>
<th>Fuel</th>
<th>Combustor</th>
<th>Diluent</th>
<th>Power Augmentation</th>
<th>NOₓ Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMS100 SAC, 50/60 Hz</td>
<td>Gas, Liquid or Dual Fuel</td>
<td>Single Annular (SAC)</td>
<td>Water</td>
<td>None</td>
<td>25 ppm</td>
</tr>
<tr>
<td>LMS100 DLE, 50/60 Hz</td>
<td>Gas</td>
<td>DLE2</td>
<td>None</td>
<td>None</td>
<td>25 ppm</td>
</tr>
</tbody>
</table>

Four basic LMS100 configurations are available as the product is introduced. When combined with intercooler selection and duty applications, the LMS100 offers 20 different configuration choices.

### Applications

- **Feed Water Applications**—Increased efficiency, improved flexibility and better economics are among the potential benefits of integrating the LMS100 gas turbine for feed water heating in a coal fired steam plant. The improved efficiency and increased output are achieved through minor modifications of the steam cycle to reduce or eliminate steam extractions in lieu of the gas turbine exhaust and intercooler to heat the feed water.

- **Wind Farm Integration** – The operating characteristics of the LMS100 make it an ideal solution for firming variable wind power. Alternative power sources require high maneuverability, high efficiency (even at partial load), fast starting, low initial capital costs (consistent with moderate to low capacity factors) and good environmental characteristics. The LMS100 simple-cycle gas turbine has all of these characteristics, making a high performance hybrid wind-GT system now economically possible.
For more information on the LMS100 gas turbine system, contact your GE Energy representative or email us at energy.aeromarketing@ge.com.