Waukesha Tech Update

February 2017
GE’s Distributed Power business

<table>
<thead>
<tr>
<th>Technology</th>
<th>Jenbacher Gas Engines</th>
<th>Waukesha Gas Engines</th>
<th>Stationary Diesel Engines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas engines</td>
<td>(0.3-10 MW)</td>
<td>Gas engines</td>
<td>616 Diesel engine</td>
</tr>
<tr>
<td>Target Segments</td>
<td>✓ Power Gen</td>
<td>✓ Oil &amp; Gas</td>
<td>✓ Power Gen</td>
</tr>
</tbody>
</table>
| Benefits | • Electrical efficiency  
• High total efficiency  
• Application diversity  
• Fuel flexibility  
• Advanced monitoring and diagnostics | • Hot/high BTU fuels capability  
• High altitude and ambient capability  
• Fast load acceptance  
• Durability/reliability | • Maintenance friendly engine design  
• High fuel efficiency  
• Solution flexibility  
• High degree of availability (up to 99%) |

The broadest gas-fired portfolio ... 220 kW to 10.4 MW
Waukesha Product Portfolio

Waukesha gas engines’ comprehensive product portfolio offers multiple configurations available in both lean-burn and rich-burn combustion systems to meet specific application requirements.

<table>
<thead>
<tr>
<th>BHP</th>
<th>1000 BHP</th>
<th>2000 BHP</th>
<th>3000 BHP</th>
<th>4000 BHP</th>
<th>5000 BHP</th>
</tr>
</thead>
<tbody>
<tr>
<td>VHP*</td>
<td>366 - 2250 bhp (273 - 1678 kWb)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VGF*</td>
<td></td>
<td>160 - 1175 bhp (119 - 880 kWb)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>275GL*</td>
<td></td>
<td></td>
<td>2720 - 5000 bhp (2028 - 3728 kWb)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Trademark of General Electric Company
# 275GL+ Product Improvements

## Performance improvement

<table>
<thead>
<tr>
<th></th>
<th>12V</th>
<th>16V</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power (bhp)</strong></td>
<td>3,750</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>BSFC (BTU/bhp-hr)</strong></td>
<td>6,494</td>
<td>6,499 – 6,550</td>
</tr>
<tr>
<td><strong>Start of derate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Altitude (ft. @ 100F)</strong></td>
<td>3,500</td>
<td>3,000</td>
</tr>
<tr>
<td><strong>Fuel quality (WKI - BTU/ft³)</strong></td>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td><strong>Fuel flexibility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BTU range (BTU/ft³)</strong></td>
<td>600 – 2,300</td>
<td>600 – 2,300</td>
</tr>
<tr>
<td><strong>Emissions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOx (g/hp-hr)</strong></td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>CO (g/hp-hr)</strong></td>
<td>1.7</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>HC (g/hp-hr)</strong></td>
<td>6.0</td>
<td>5.60</td>
</tr>
</tbody>
</table>

## Fuel flexibility improvement

![Fuel flexibility improvement graph](image)

- 16V275GL+ curve shown

## New power vs. altitude/temp. map

<table>
<thead>
<tr>
<th>Inlet Air Temp (°F)</th>
<th>2,000</th>
<th>3,000</th>
<th>4,000</th>
<th>5,000</th>
<th>6,000</th>
<th>7,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>100</td>
<td>100</td>
<td>98.5</td>
<td>93.9</td>
<td>90.2</td>
<td>87.2</td>
</tr>
<tr>
<td>80</td>
<td>100</td>
<td>100</td>
<td>96.6</td>
<td>92.8</td>
<td>89.7</td>
<td>86.8</td>
</tr>
<tr>
<td>100</td>
<td>100</td>
<td>100</td>
<td>96.5</td>
<td>93</td>
<td>89.2</td>
<td>85.3</td>
</tr>
<tr>
<td>110</td>
<td>100</td>
<td>99.7</td>
<td>95.4</td>
<td>91.2</td>
<td>87.4</td>
<td>83.7</td>
</tr>
<tr>
<td>120</td>
<td>100</td>
<td>98.7</td>
<td>95</td>
<td>90.9</td>
<td>85.9</td>
<td>81</td>
</tr>
<tr>
<td>130</td>
<td>100</td>
<td>97.4</td>
<td>93.3</td>
<td>88.8</td>
<td>84</td>
<td>79.2</td>
</tr>
</tbody>
</table>

- 16V275GL+ table shown
The new VGF F18SE and H24SE

New controls suite for VGF
• Application of proven ESM controls
• Use of emPact AFR w/ GE-branded TWC availability for 0.15 & 0.5 gr/BHP-hr NOx capability from the OEM – lowest on the market

Product Enhancements
• Dual-fuel autoswitching capability for both field gas and propane operation
• OFPG genset with new ECP, TWC, silencer, tail-boarding skid, & radiator
• Controls, AFR2, cylinder heads, oil cooler, oil filtration, crankcase breather –shared technology from other engines

Mobile capability & emissions cert.
• EPA mobile & stationary certification
• Fuels from 850-2350 Btu/scft and from 1400-1800RPM for mobile compression

Most technically advanced controls & robust design in its class...competing against truck engines...poised for growth in new markets!
**ESM2 System**

Available on VHP F3514GSI, F3524GSI, L5794GSI, L7042GSI S4 and L7044GSI

**Engine Control Unit**
- New ECU, additional functionality
- Incorporates AFR2 functionality in single ECU
- Smaller packaging, new location

**Hardware Updates**
- New Power Distribution Box (PDB)
  - Improved diagnostics communication
- Smart Thermocouple Unit (STU)
  - CAN thermocouple interface to ESM2
- APM Analytics w/MyPlant integration

**Additional Performance Monitoring**
- Additional engine protection incorporated:
  - Crankcase pressure
  - Exhaust port temperatures
  - Main bearing temperatures
  - Oil filter differential pressure (pre filter added)
  - Boost pressure sensors
    - throttle reserve monitored

**Customer Interface**
- Standard HMI
  - 12” Touchscreen (15” & 19” Options)
  - Multiple screens for operators
  - Integrated Diagnostics
    - Data logging
    - Fault history
    - Troubleshooting (E-Help)
    - O&M Manual
- ECU Calibration & Code updates
  - remote download capability through laptop interface
Asset Performance Management suite

Standard with 275GL+ and VHP - Optional with VGF-SE

Machine & Equipment Health system

- **Asset status dashboards**
  - Reliability, availability, uptime, utilization & gas through-put metrics
  - 200+ tags/asset in near-real time
  - Fleet map, alarms and alerts summary

- **Diagnostic workbench/charts**
  - Advanced data trending
  - Troubleshooting/diagnostics

- **Mobile App**
  - Key insights at fingertips anytime, anywhere

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Add-on advanced analytics

- **Rule-based analytics**
  - Based on user-defined threshold

- **Custom KPIs**
  - Based on user-defined equations

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Physics based analytics

**For asset condition & component life prediction**

<table>
<thead>
<tr>
<th>Cluster</th>
<th>Analytics</th>
<th>Efficiency/Opex</th>
<th>Throughput (mmscfd)</th>
<th>Emissions</th>
<th>Availability/Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remaining Useful Life</td>
<td>Oil Remaining Useful Life</td>
<td>🟢</td>
<td>🟢</td>
<td></td>
<td>🟢</td>
</tr>
<tr>
<td>Engine Condition</td>
<td>IMAP Differential</td>
<td>🟢</td>
<td></td>
<td>🟢</td>
<td>🟢</td>
</tr>
<tr>
<td></td>
<td>Oil Pressure Monitoring</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compressor Condition</td>
<td>Gas Compressor $P_a$ vs $P_b$</td>
<td>🟢</td>
<td>🟢</td>
<td></td>
<td>🟢</td>
</tr>
<tr>
<td>Package Info</td>
<td>Operating Hours (OPH) per Start</td>
<td></td>
<td></td>
<td></td>
<td>🟢</td>
</tr>
<tr>
<td></td>
<td>Starts per Week</td>
<td></td>
<td></td>
<td></td>
<td>🟢</td>
</tr>
</tbody>
</table>

- **Limited availability**

Impact on Value Driver

- High 🟢
- Medium 🟢
- Low 🟢
GE conversion, modification and upgrade (CM&U) programs

1. **CM&U Programs**
   - Introduced ~2 years
   - Improvements in
     - Reliability
     - Performance
     - Emissions
     - Efficiency

2. **reUp* ... reman components**
   - Reduce lifecycle cost and improve reliability with genuine GE reUp parts solutions

3. **Multiyear agreements on service and replacement parts**

4. **Asset Performance Management**
   - Digital product connectivity
   - Pivotal development point
   - Reduce costs and improve availability with analytics

A full lifecycle approach to improve product performance and extend useful life

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