TM2500+ Power for Hydraulic Fracturing

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Evolution Well Services
Fracking 101

HYDRAULIC FRACTURING

- Water
- Pumper truck

GAS SHALE OR TIGHT GAS RESERVOIR

- Cement casing
- Steel tubing

GROUNDWATER

- Water + sand + additives
- Sand keeps cracks open

Fracturing

Horizontal well
Current Technology Hydraulic Fracturing Site

- Freshwater Tanks
- Slurry Blender
- Chemical Storage
- 16 Pump Trucks
- Frac Trailer
- Company Man Trailers
- Proppant (sand)
- Freshwater Pit
- Freshwater Tanks
- Wellhead
- Wireline Rig

Michigan Department of Environmental Quality website
Current Technology Equipment

Evolutionary Well Services Equipment
EWS Demonstration Hydraulic Fracturing Site

Lethbridge, Alberta

A) Frac Pump Modules
B) Blender
C) Mobile Data Van
D) Chem Addition Mod
E) Blender Mtr Contrl
F) Sand Conv Belt Mod
G) Sand Storage Mod
H) GE TM2500+ GTG
I) Pump Mtr Contrl
Mobile Modular Design

Electric Motor
Fracturing Pump
Blender
TM2500+ Gas Turbine
Compressed Natural Gas (CNG) Fuel

Natural gas from the first well then fuels subsequent wells

Six hours endurance at 50% power for the first well
Primary Components

GE LM2500+ Gas Turbine

- Zero staged version of the LM2500
- 2000+ LM2500 turbines worldwide
- More than 67M operating hours

Brush Electrical Generator

- Air-cooled generator, brushless excitation
- Suitable for Class 1, Group D, Div. 2 areas
- 60Hz (13.8kV) and 50Hz (11.5kV) operation
- Rated at 32,550 kVA @ 0.90pf in ISO conditions
LMI2500 vs. LM2500+ GT Centerlines

LM2500+
- Beefed up LPT disks & rear shaft
- Re-designed LPT airfoils
- Re-designed HPT, TMF & LPT Case
- New Compressor Front Frame & Forward case
- Stage Zero Blisk

LM2500
- CDP Seal

~13 inches
~33 cm

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## TM2500+

- Up to 38% efficiency @ 100% load
- 10 min fast start
- Small Footprint 78’x21’

<table>
<thead>
<tr>
<th>Attributes</th>
<th>TM2500+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Output ISO (MW)(^1)</td>
<td>31</td>
</tr>
<tr>
<td>SC Efficiency(%)(^1)</td>
<td>36.0</td>
</tr>
<tr>
<td>Nox Emissions (ppm)(^1)</td>
<td>25</td>
</tr>
<tr>
<td>Emissions Control</td>
<td>Water</td>
</tr>
<tr>
<td>Footprint</td>
<td>78’x21’</td>
</tr>
<tr>
<td>Noise Level</td>
<td>90</td>
</tr>
<tr>
<td>Fuel</td>
<td>Dual</td>
</tr>
<tr>
<td>Weight (lbs)</td>
<td>200k</td>
</tr>
</tbody>
</table>

- Fleet availability
- Capable of SC application
- Offering turnkey solutions
- Blackstart capability

References:
1) All Power, heat rate, and efficiency @ ISO conditions with water injection at 60 Hz, natural gas fuel

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Customer Interface Requirements*

**Fuel**
- Gas supply pressure is 520 (+/- 20) PSIG at a rate of 320 MMbtu/hr
- Liquid Fuel (diesel) supply pressure is 30 (+/- 10) PSIG, up to 40 GPM (max)

**Water (for NOx suppression)**
- Minimum supply pressure is 15 PSIG up to 28 GPM (max)

**Foundation**
- Site levelness less than 6” per 100 feet
- Adequate access/space for maneuvering the trailers

*These requirements represent general needs of a standard TM2500+ installation. Actual requirements could vary based on site location, site conditions, local ambient conditions, unit configuration, and many other factors.

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Small details make a big difference!
Conventional arrangement for a 15 MW site
40% less area required for power train and pumps using the EWS/GE System
# System Comparison

<table>
<thead>
<tr>
<th></th>
<th>Diesel Truck Pumps</th>
<th>EWS System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prime Movers (15 MW)</td>
<td>14 Diesel Trucks</td>
<td>1 TM2500+</td>
</tr>
<tr>
<td>Pump Units</td>
<td>16</td>
<td>8</td>
</tr>
<tr>
<td>Fuel</td>
<td>Diesel</td>
<td>#2 Diesel/NG/CNG/LNG</td>
</tr>
<tr>
<td>Power Efficiency</td>
<td>38.9%</td>
<td>36.8% (incl -1% elec mtr)</td>
</tr>
<tr>
<td>Noise (max pwr)</td>
<td>105 dB*</td>
<td>90 dB</td>
</tr>
<tr>
<td>Nox Emissions</td>
<td>52.5 Kg/hr Diesel (dry)**</td>
<td>70.4 Kg/hr #2 Diesel (dry)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>43.3 Kg/hr NG (dry)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13.0 Kg/hr #2 Diesel***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7.6 Kg/hr NG***</td>
</tr>
<tr>
<td>Personnel</td>
<td>1 Controller</td>
<td>2 Controllers</td>
</tr>
<tr>
<td></td>
<td>16 Pump Operators</td>
<td>1 Gas Turbine Operator</td>
</tr>
<tr>
<td>Power/Pump Footprint</td>
<td>8,375 sq’</td>
<td>5000 sq’</td>
</tr>
<tr>
<td></td>
<td>778 sq m</td>
<td>464 sq m</td>
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<tr>
<td>People Infrastructure</td>
<td>5x</td>
<td>1x</td>
</tr>
</tbody>
</table>

* Engine surface noise with attenuated intake noise (filter) - BL (free-field sound pressure level Lp, 1m distance, ISO 6798)
** Tier 4 limits attained
*** 42 ppm #2 Diesel, 25 ppm Natural Gas, both with water injection
Questions