SMART POWER GENERATION

Wärtsilä North America, Inc

December, 2012

Wayne M. Elmore
Regional Director, Power Plants Sales
Wärtsilä Corporation – an overview

Solutions for

Energy

Marine/offshore

18,000 professionals in over 70 countries

- USD5.5bn sales in 2011 (USD6.0bn in 2010)
- Solid financial standing, EBIT 11.1% in 2011
- Listed in Helsinki, Finland

Our values

Capture opportunities and make things happen

Foster openness, respect and trust to create excitement

Do things better than anyone else in our industry

Ship Power 24%
Power Plants 32%
Services 43%

Americas 20%
Europe 30%
Asia 38%

Other 12%
Wärtsilä USA since 1979. Currently 450 employees.

- Helsinki, Wärtsilä HQ
- Houston, USA HQ
- Main Factories
- US Service Offices
Installed base – Wärtsilä Powering the world*

Europe:
Output: 11.8 GW
Plants: 1783
Engines: 3336

Asia:
Output: 17.2 GW
Plants: 1619
Engines: 3487

Americas:
Output: 9.5 GW
Plants: 367
Engines: 1220

Africa & Middle East:
Output: 10.4 GW
Plants: 830
Engines: 2116

Total: 48.8 GW
Plants: 4599
Engines: 10159
Countries: 169

* December 2011
TOTAL MARKET: 99.9 GW

NB. Other combustion engines not included – data from IESG for 2011 not available
NB. Includes all gas and liquid-fuelled power plants with prime movers above 5 MW
NB. Includes estimated output of steam turbines for combined cycles (factor 0.5 for industrial turbines, 0.4 for aeros)
## Wärtsilä in The Caribbean

<table>
<thead>
<tr>
<th>Country</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anguilla</td>
<td>19</td>
</tr>
<tr>
<td>Antigua</td>
<td>81</td>
</tr>
<tr>
<td>Aruba</td>
<td>98</td>
</tr>
<tr>
<td>Bahamas</td>
<td>49</td>
</tr>
<tr>
<td>Belize</td>
<td>24</td>
</tr>
<tr>
<td>Bermuda</td>
<td>45</td>
</tr>
<tr>
<td>Bonaire</td>
<td>8</td>
</tr>
<tr>
<td>BVI</td>
<td>33</td>
</tr>
<tr>
<td>Cayman Island</td>
<td>21</td>
</tr>
<tr>
<td>Curacao</td>
<td>49</td>
</tr>
<tr>
<td>Dominica</td>
<td>9</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>1399</td>
</tr>
<tr>
<td>Grenada</td>
<td>21</td>
</tr>
<tr>
<td>Guyana</td>
<td>144</td>
</tr>
<tr>
<td>Haiti</td>
<td>36</td>
</tr>
<tr>
<td>Jamaica</td>
<td>244</td>
</tr>
<tr>
<td>Martinique</td>
<td>95</td>
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<tr>
<td>Nevis</td>
<td>3</td>
</tr>
<tr>
<td>Puerto Rico</td>
<td>10</td>
</tr>
<tr>
<td>St. Kitts</td>
<td>7</td>
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<tr>
<td>St. Lucia</td>
<td>78</td>
</tr>
<tr>
<td>St. Maarten</td>
<td>114</td>
</tr>
<tr>
<td>St. Martin</td>
<td>15</td>
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<tr>
<td>St. Vincent</td>
<td>17</td>
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<tr>
<td>Suriname</td>
<td>56</td>
</tr>
<tr>
<td>Trinidad</td>
<td>11</td>
</tr>
<tr>
<td>Tobago</td>
<td>64</td>
</tr>
<tr>
<td>Turks &amp; Caicos</td>
<td>17</td>
</tr>
</tbody>
</table>

**2767 MW Total Capacity**

**INTERNAL USE ONLY**
<table>
<thead>
<tr>
<th>Country</th>
<th>Total</th>
<th>Project Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guatemala</td>
<td>374 MW</td>
<td>Puerto Quetzal, Genor, Esquintia, Planta Arizona</td>
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<tr>
<td></td>
<td></td>
<td>114 MW, 40 MW, 60 MW, 160 MW</td>
</tr>
<tr>
<td>Honduras</td>
<td>465 MW</td>
<td>Elcosa, Lufussa I, Lufussa II, Enee, Roatan</td>
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<tr>
<td></td>
<td></td>
<td>80 MW, 80 MW, 267 MW, 32 MW, 6 MW</td>
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<tr>
<td>El Salvador</td>
<td>434 MW</td>
<td>Talnique, Nejapa, Acajutla, Soyapango</td>
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<tr>
<td></td>
<td></td>
<td>105 MW, 150 MW, 148 MW, 16 MW</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>62 MW</td>
<td>Tipitapa, Planta Managua</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 MW, 12 MW</td>
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<tr>
<td>Costa Rica</td>
<td>8 MW</td>
<td>Colima</td>
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<tr>
<td></td>
<td></td>
<td>8 MW</td>
</tr>
<tr>
<td>Panama</td>
<td>96 MW</td>
<td>PanAm</td>
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<tr>
<td></td>
<td></td>
<td>96 MW</td>
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</tbody>
</table>

1424 MW Total Capacity
Competitive generation cost and high dispatch

- Highest efficiency (45% in simple cycle and 50% in combined cycle)
- No derating enabling higher dispatch in hot climate and at high altitude
- High plant efficiency over a wide load range due to multiple generating sets
- Low maintenance costs, not influenced of frequent starts and stops, and cyclic operation
- Low/no water consumption

Energy Efficiency

Multi tasking plant prepared for future markets

- Unlimited, super fast, reliable starting and stopping with no impact on maintenance schedule
- Fast reserve, load following, peaking and base load
- All ancillary services
- Grid support, wind enabling

Fuel Flexibility

Continuous choice of most feasible fuel

- Solutions for
  - Liquid and gaseous fuels
  - Renewables
- Hedge for the future
  - Multi fuel plants
  - Fuel conversions

Operational Flexibility
1) **All in One!**
   A unique combination of valuable features!

2) **Enables the transition to a better power system!**

![Smart Power Generation Diagram](image-url)
Flexibility vs. Electrical Efficiency

- **CCGT’s**
- **Industrial GT’s**
- **Aero-GT’s**
- **Wärtsilä Flexicycle™**
- **Wärtsilä SC**

- **Steam Power Plants**
- **Simple Cycle**
- **Combustion Engines – Simple Cycle & Flexicycle™ (Combined Cycle)**
- **Combined Cycle Gas Turbines**

Starting time
Ramp rate
Part load operation

Net Electrical Efficiency

- 50%
- 40%
- 30%

Flexibility

- Low
- Medium
- High
Modularity

Our modular design allows for easy capacity additions and makes it simple for our customers to construct an optimally sized plant.
Multi-engine solution allows for a **good partial load efficiency** with a plant turn down ratio of 30%.

**Net Plant Efficiency (%)**

**Part load efficiency**

- N-3 units
- N-2 units
- N-1 units
- N units

**10 Recip Engines**

**Aeroderivative GT**

**Industrial GT**

*Note: Gas turbine performances by GTPro / 15 °C / 10 bar Natural Gas*
Dispatch flexibility

Efficiency and Spinning Reserve Operating Modes

Net Plant Heat Rate (Btu/kWh) (HHV)

Efficiency Mode

Spinning Reserve Mode

22 x 20V34SG

Plant Net Output
Typical reliability data for Wärtsilä gas engines:

- Excellent unit availability
- Excellent unit reliability
- Excellent unit starting reliability
No start penalties & No start-up costs

Unlimited starts & stops with no impact on cost or maintenance schedule.

This is unique, no other competing technology offers the same.
Older coal & gas boilers will be replaced per new EPA rules…50 GW opportunity!

NGCC has lowest LCOE

1 GW of SPG needed for each 2.7 GW of new wind

Sources: EIA & ICF
Case Colorado, USA – Grid Stability

Total wind generation drops (green curve) from 700 MW to 350 MW during 1 hour

Grid stability Power Plants based on gas fired combustion engine gensets are started, providing fast reaction to the change (red and white curves)
W34SG, fast start up and loading

1. Start up conditions maintained continuously
2. Speed acceleration and synchr. 1 min
3. Loading, 4 min
4. Total start up and loading time, 5 min

Engine conditions:
+ HT-water temperature >70°C
W50SG, fast start up and loading

1. Start up preparations, 1 min
2. Speed acceleration and synchronisation, 1 min
3. Loading, 5 min
4. Total start up and loading time, 7 min

Engine conditions:
- HT-water temperature >70°C
What does quick start mean to a power plant owner?

Start up and loading of a Gas Engine power plant compared to a GTCC

Case Study*

STEC Pearsall 24 x W20V34SG Simple Cycle
STEC Sam Rayburn 3 x 1 GE LM6000 Combined Cycle
ERCOT Market at $3,000/MWh $895,000 per start
ERCOT Market at $100/MWh $30,000 per start
ERCOT Market at $30/MWh $10,000 per start

* John Packard, STEC, PowerGen 2011 Presentation
Wärtsilä Smart Power Generation in Texas

25 MW – GEUS – Greenville, TX

170 MW – GSEC - Abernathy, TX

203 MW – STEC - Pearsall, TX
GEUS – Greenville, Texas

3 x 20V34SG
25 MW
PG&E Humboldt - Eureka, California

10 x 18V50DF
162 MW
Dominican Republic – over 1,300MW of Wärtsilä plants

108 MW Seaboard Floating Plant

- 108 MW Flexicycle floating power plant based on 18V50DF dual fuel
- Purchased by Seaboard Corp to replace existing floating power plants the first delivered by Wärtsilä in 1989
- In commercial operation 2012 Demonstrated heat rates of 7,000Btu/kWh

430MW Quisqueya I&II IPP

- Two side-by-side Flexicycle dual fuel plants each based on 12 x 18V50DF with common control and systems
- Quisqueya I – owned by Barrick Gold
- Quisqueya II – owned by EGE Haina
- Currently under construction

Wärtsilä installed the first IPP in the D.R. in 1989
The above solutions were considered better alternatives to gas turbines
Smart Power Generation

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