GE Energy Infrastructure

Renewable Energy

Seth Dunn

April 3, 2009
GE Energy Infrastructure

Employees: 65,000  •  ‘08 revenue: ~$40B  •  Operating in 140 countries

Power & Water
$23B
- Power generation
- Renewable Energy
- Gas Engines
- Nuclear
- Gasification
- Wastewater treatment
- Process chemicals

Energy Services
$10B
- Contractual agreements
- Smart Grid
- Field services
- Parts & repairs
- Optimization technologies
- Plant management

Oil & Gas
$7B
- Onshore & offshore natural gas
- Transportation
- Processing
- Pipeline inspection
- Subsea
- Extraction
GE Power & Water ... Broadest product portfolio

Wind  Solar  Water Technologies  Biomass

Gas  Nuclear  Cleaner Coal  Smart Grid

100+ years of technology leadership
A world leader in renewable energy solutions

$5B investment ...

Wind
- Leading N. American wind turbine supplier
- 6x unit growth since '02
- 12,000+ 1.5MW installed globally

Solar
- Residential, commercial and utility applications
- PrimeStar Solar thin film technology investment
- Large utility projects in Europe

Biogas
- Power range: 0.25MW - 4MW
- Fuel flexibility: Natural gas or a variety of renewable or alternative gases

Energy Financial Services
- Developing creative financial solutions
- 25+ years in Energy Finance
- $19B assets

- 10 manufacturing/assembly sites
- 4,700 global employees
- Installed base: 25GW
- Projects in 65+ countries
- $200M invested in supply chain
- 10,000 sub-supplier jobs created
Global renewable annual installations (GW)

Financial crisis causing 1st slowdown in a decade

Solar
Wind

<table>
<thead>
<tr>
<th>Year</th>
<th>Solar</th>
<th>Wind</th>
</tr>
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<tbody>
<tr>
<td>'00</td>
<td>4.0</td>
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<tr>
<td>'01</td>
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<tr>
<td>'02</td>
<td>7.1</td>
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<td>'03</td>
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<td>'04</td>
<td>9.0</td>
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<td>'05</td>
<td>12.6</td>
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<td>16.4</td>
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<td>22.8</td>
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<tr>
<td>'08</td>
<td>31.0</td>
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<tr>
<td>'09 Est.</td>
<td>38.6</td>
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<tr>
<td>'09 Corr.</td>
<td>25.6</td>
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</table>
Wind ... most economic large scale renewable

Wind

Cost of Electricity (¢/kWh)

Cost of Electricity nearing mainstream

20 year levelized
US ¢ per kWhr

- Fixed cost of electricity
- Energy security
- Zero air emissions

Basis: $8.00/MMBtu NG
Global wind installs ... 7X growth since 2000

Wind has become a mainstream power generation technology

An amazing decade ...
- US installs #1 ...
  ~45% wind ('08)
- US largest wind generator
- 1 out of 2 US wind turbines are GE

A bright future
- Today ~4% renewable kW
- For each additional point ...
  ~40,000 wind turbines
  ~500,000,000 solar panels

Asia
EU
N. America
GE 1.5MW ... The Industry Workhorse

Increasing Customer Value ('02-'08)

**Capacity Factor**

$450MM/GW*

+9pts

- Increased rotor size ... XLE
- Increasing output ... WindBOOST

**Reliability**

$200MM/GW*

+12pts

- GE Design for key components
- Improved diagnostics ... Mark Vle, CBM

*20yr NPV estimate

Proven Experience

- 12,000+ turbines in operation
- 150+ million operating hrs
- 90,000+ GWh produced

39% increase in swept area
The European Workhorse ... GE 2.5xl

Product Evolution

1st  2.5s installed  May ‘04
1st  2.5xl tech demo installed  July ‘06
1st  Unit COD  Sept ‘08
     8 countries ... 1GW of commitments
     60hz Certification  Mid ‘09

Advancing Technology

DEWI  Germany
Cerros de Radona  Spain
Froidchapelle  Belgium
Compact Drive-train

55m AT Blade
Solar ... a bright future

120,000 TW (600 TW “feasible”)

1 hour of sunlight = 1 year of energy demand

Map of Global Solar Energy Resources

Solar ... fastest growing renewable

Industry installation forecast (GWs)

- '06: 1.9
- '08: ~4.0
- '10: ~5.5

~40% CAGR

Source: GE Estimates

2008 regional installs

- Spain: 38%
- Germany: 37%
- U.S.: 10%
- ROW: 8%
- Japan: 7%

>90% of demand subsidy-driven

Growing segment ... incentive driven

Source: EPIA & GE Estimates
## Investing across growth platforms

<table>
<thead>
<tr>
<th>Modules</th>
<th>Inverters</th>
<th>Solar Systems</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Module" /></td>
<td><img src="image2.png" alt="Inverter" /></td>
<td><img src="image3.png" alt="Solar Systems" /></td>
</tr>
</tbody>
</table>

### ThinFilm Leadership
- Develop line in place
- PrimeStar ramp
- Deliver best-in-class TF module

### Power conversion
- GE 250-500 kW Inverter
- Utilizing Wind Controls Tech & Volume
- Grid Friendly Differentiation

### Utility Scale Power Plant
- Standardized & scalable
- Integrated grid controls
- Modular design ... cost ↓

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**Differentiating through best in class module & grid capabilities**
PrimeStar – making solar cost competitive

GE a majority owner of PrimeStar Solar, Inc.

- Focused on large scale, cleaner, renewable, cost competitive solar electric power a reality
- Developing high performance thin film photovoltaic (PV) modules for large scale applications
- Scaling up patented thin film PV technology that was developed at the U.S. Department of Energy’s National Renewable Energy Laboratory (NREL)
- Advantaged in high humidity diffused light installations

1st product – targeted for 2009

Installed system cost
Commercial roof mounted

($/W)

<table>
<thead>
<tr>
<th>Year</th>
<th>C-silicon</th>
<th>Thin Film</th>
</tr>
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<tbody>
<tr>
<td>Current</td>
<td>$8</td>
<td>$6</td>
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<tr>
<td>2015</td>
<td>$7</td>
<td>$4</td>
</tr>
</tbody>
</table>
Delivering a utility-scale thin film solution

Complete Solar System Package

**System Specs**

- **1.2MW**
- **Area** 8 Acres
- **Efficiency** 9 ->12+ %CE
- **Steel Posts** 1,500
- **Modules** 10,000
- **Production** 2,500 MWh/yr

**“Plug & Play” Advantages**

- GE Reliability & Execution
- Grid Friendly & GE Controls
- Simplified & Scalable
- Cost Competitive

Building on GE Power Generation expertise
GE biogas applications

Landfill Gas
Best in class emissions

Waste Water Treatment Plants
Dual-Fuel switching capability

Animal / Industrial Bio
World’s largest biogas installation

Type 3
Type 4
Type 6
Landfill gas solutions

- More than 25 years of experience in the combustion of landfill gas
- 1,200+ landfill gas systems with a total electrical output of over 1,200 MW
- Best in class emissions with TSA & CLAIRE systems
Biomass solutions for North America

Drivers

- RPS expanding ... biomass being defined distinctly
- Climate change ... regional greenhouse gas policies
- Increasing power prices ... increasing biogas project viability
- Legislation around organic waste disposal
- Baseload renewable generation source
- Increasing energy efficiency ... cogeneration

Potential

- Landfill Gas: 1,300 MW
- Waste Water Treatment Plants: 300+ MW
- Animal / Industrial Bio waste: 2,700 MW

GE Proprietary and Confidential
Successful policy has driven U.S. growth

**Federal production tax credit**

<table>
<thead>
<tr>
<th>Year</th>
<th>Partial PTC Year</th>
<th>Full PTC Year</th>
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<tbody>
<tr>
<td>'98</td>
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<tr>
<td>'99</td>
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**US Annual Wind Installed Additions**

- **Partial PTC Year**
- **Full PTC Year**

**Growth drivers**

- **National:** PTC ... 2.1c/kWh, 10y
- **State:** RPS
  - Jan 07: 22 states ... ~44 GW wind
  - Jan 09: 33 states ... ~55 GW wind

**Renewable portfolio standards**

- RPS + penalty (20+DC)
- RPS + discretionary (8)
- Voluntary RPS (5)
- Proposed RPS (2)

**But PTC ineffective in current crisis**
State RPS momentum continuing

Revisions

Enactments

Source: LBL, GE

1st requirements 2008-12
Potential new/revised
Financial crisis ... impact on renewables

<table>
<thead>
<tr>
<th>Customers’ business model impacted overnight</th>
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<tbody>
<tr>
<td>• ~40% of value from tax benefits: PTCs &amp; MACRS</td>
</tr>
<tr>
<td>• Tax credits monetized through “financial services”</td>
</tr>
<tr>
<td>• Tight debt markets for turbine/construction loans</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>US Wind installs pre 9/’08</th>
<th>Investment required ‘09</th>
<th>Tax equity needed</th>
<th>Tax equity available</th>
</tr>
</thead>
<tbody>
<tr>
<td>~50% CAGR</td>
<td>~8</td>
<td>$26B</td>
<td>$16B</td>
</tr>
<tr>
<td>2.5</td>
<td>5.2</td>
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- Other financing
- GAP in tax equity
- Tax equity supply
- Customer balance sheet

$16B

$26B

$1-3B

$4B

$9B

$4B
GE Advocacy to “re-start” US renewable energy

Steps to drive demand

1. Refundable PTC
   Extend 3 years
   30% ITC Option
   ITC refund (Treasury grant)

2. Gov’t loan guarantee

3. Sustainable policy
   RES 25% by ‘25

Stimulus

- ✓
- ✓
- ✓

Energy bill

- ✓
- X

PTC “fix” included in stimulus
# US Federal RES – ’09 proposals

<table>
<thead>
<tr>
<th>Key Provisions</th>
<th>Bingaman</th>
<th>Markey</th>
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<tbody>
<tr>
<td>Near-term target</td>
<td>4% by 2012</td>
<td>6% by 2012</td>
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<tr>
<td>Long-term target</td>
<td>20% by 2021</td>
<td>25% by 2025</td>
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<tr>
<td>Compliance payment</td>
<td>$.03/kWh</td>
<td>$.05/kWh</td>
</tr>
<tr>
<td>Distributed generation REC multipliers</td>
<td>3x (&lt;1 MW)</td>
<td>3x (&lt;2 MW)</td>
</tr>
<tr>
<td>Energy efficiency provisions</td>
<td>Up to 25% of RES</td>
<td>Energy Efficiency Resource Standard (25%*/’20)</td>
</tr>
</tbody>
</table>

*15% electricity, 10% natural gas
Scenarios for Federal RES compliance

2007 Energy Information Administration analysis of 25% by 2025

- Biomass is leading contributor to RES, esp. cofiring in coal plants
- EIA revisiting solar assumptions in analysis of current proposals
Significant wind transmission potential to SE

“Joint Coordinated System Plan” (JCSP) ... conceptual plan to achieve 20% wind in Eastern Interconnect

All major operators ... MISO, SPP, PJM, TVA, MAPP, SERC

15,000 miles of new EHV (75% 765+ kV) lines

230 GW wind + 37 GW baseload steam + 75 GW gas

$85B investment but net $20B cost savings due to low-cost wind + avoided nat gas costs

Source: JCSP
Technology for the next decade

**Wind**
- **Blades**
  - Sweep area
  - Logistics
  - Carbon fiber
- **Controls**
  - Mark VI
  - Load management
  - Model driven
- **Drives**
  - Compact
  - High reliability
  - Light-weight
- **Reliability**
  - Remote monitoring
  - Return to service
  - Upgrades

**Solar**
- **Breakthrough technology**
  - Thin film
  - Nano scale materials
  - Concentrators

Technology that drives lower COE & higher reliability

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*GE* Imagination at work