High Efficiency Fuel Cell/Advanced Turbine Power Cycles

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Conference Sponsor:

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Contracting Officer Representative (COR):

Wm. C. Smith

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Westinghouse SOFC Pilot Manufacturing Facility
Cell Scale-Up Plan: 89\% H_2, 11\% H_2O, 85\% Fuel Utilization

Westinghouse 25 KW SOFC Unit at the Utility's Facility on Rokko Island
Pressure Effect on SOFC Power

Pressure Effect on SOFC Efficiency
SureCELL™ Versus Conventional Gas Turbine Plants

SureCELL™ Product Line for Distributed Power Applications

Table 1.

<table>
<thead>
<tr>
<th>Product</th>
<th>Number of CT's</th>
<th>Number of SOFC Modules</th>
<th>Cycle Efficiency (LHV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 MW</td>
<td>1</td>
<td>1-2</td>
<td>60%</td>
</tr>
<tr>
<td>10 MW</td>
<td>1</td>
<td>6-8</td>
<td>60%</td>
</tr>
<tr>
<td>20 MW</td>
<td>2</td>
<td>12-16</td>
<td>62%</td>
</tr>
</tbody>
</table>
20 MW Pressurized-SOFC/Gas Turbine Power Plant
10 MW SOFT/CT Power Plant

SureCELL™ Plant Concept Design Requirements

- Application
  - Natural Gas AC Power to Grid
  - No Heat Supply to Customer

- Duty Cycle
  - 4:1 Turndown Capability

- Design Basis
  - Minimum COE/Mature Components

- Plant Operation and Staffing
  - Automatic, Remotely Monitored
  - On-site Operators Not Required

- Installation
  - Indoors, 0.25 acre max footprint

- Equipment Design Lifetimes
  - SOFC: 10 Years
  - Other Plant Equipment: 30 Years

- NO\textsubscript{X}
  - 5 ppmvV Max

- Plant Component Transportation
  - Basis - Unrestricted US Trucks
  - 8.5' W, 13.5' H, 25' L, 40,000 lbs
Westinghouse SOFC Market Entry

<table>
<thead>
<tr>
<th>Year</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>Verify pressurized SOFC reforming</td>
</tr>
<tr>
<td>1996-98</td>
<td>Design and verify pressurized SOFC generator</td>
</tr>
<tr>
<td>1996-99</td>
<td>Develop improved SOFC manufacturing process</td>
</tr>
<tr>
<td>1999</td>
<td>Integrated SOFC/CT plant on-line</td>
</tr>
<tr>
<td>1998-99</td>
<td>Westinghouse production factory investment</td>
</tr>
<tr>
<td>2000-05</td>
<td>Integrated plant sales growing to 500MW/yr</td>
</tr>
<tr>
<td>2003-05</td>
<td>Westinghouse production capacity expansions</td>
</tr>
<tr>
<td>1005+</td>
<td>Entry to larger plant segments/production growth</td>
</tr>
</tbody>
</table>