Fall 2012 Composite Data Products – Backup Power

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Backup Power Fuel Cell Systems Deployed

Cumulative Systems Deployed

- Sites may have more than one FC system
- Not all FC systems are supplying operation data
Backup Power Deployments

<table>
<thead>
<tr>
<th>State</th>
<th>kW Capacity</th>
<th>Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>84</td>
<td>16</td>
</tr>
<tr>
<td>California</td>
<td>567</td>
<td>122</td>
</tr>
<tr>
<td>Colorado</td>
<td>24</td>
<td>5</td>
</tr>
<tr>
<td>Connecticut</td>
<td>121</td>
<td>26</td>
</tr>
<tr>
<td>Florida</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Georgia</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Illinois</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Indiana</td>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td>Kentucky</td>
<td>22</td>
<td>4</td>
</tr>
<tr>
<td>Massachusetts</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Michigan</td>
<td>164</td>
<td>40</td>
</tr>
<tr>
<td>New Jersey</td>
<td>110</td>
<td>27</td>
</tr>
<tr>
<td>New York</td>
<td>186</td>
<td>44</td>
</tr>
<tr>
<td>South Carolina</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>Utah</td>
<td>36</td>
<td>9</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>1484</strong></td>
<td><strong>315</strong></td>
</tr>
</tbody>
</table>

Site Capacity (line height proportional to installed site kW capacity)
Starts by Month

1526 of 1533 Starts Successful (99.5%)
52% Conditioning Starts

Starts
Conditioning
Successful Start

Calendar Month

1) FC system conditioning is an automated operation for regular system checks; activated after long periods of no operation.
FC system conditioning is an automated operation for regular system checks that are run after long periods of no operation.
Cumulative Hydrogen Consumed by Month

- 76.9 kgs Total Consumed H₂
- 30,222 scf Total Consumed H₂
Fuel Cell System Starts by Day of Week

System Starts by Day of Week

<table>
<thead>
<tr>
<th>Day</th>
<th>Starts [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sun</td>
<td>6</td>
</tr>
<tr>
<td>Mon</td>
<td>5</td>
</tr>
<tr>
<td>Tues</td>
<td>33</td>
</tr>
<tr>
<td>Wed</td>
<td>23</td>
</tr>
<tr>
<td>Thur</td>
<td>13</td>
</tr>
<tr>
<td>Fri</td>
<td>10</td>
</tr>
<tr>
<td>Sat</td>
<td>5</td>
</tr>
</tbody>
</table>
Fuel Cell System Starts by Time of Day

System Starts by Time of Day

1) FC system conditioning is an automated operation for regular system checks; activated after long periods of no operation.
Continuous Fuel Cell System Run Time

Max Continuous Run Time = 29 hours
Unsuccessful Operation Categories

- EStop: 1
- No Fuel: 1
- System Failure: 5
System Start Ambient Temperature

![Ambient Temperature at Start](chart)

- Frequency [%]
- Ambient Temperature [°C]

NREL cdp_bu_12
Created: Sep-13-12 12:06 PM
Max system hours = 51.5
25% of systems have hours > 10.3
CDP-BU-14
Site Capacity

Capacity by Site

Number of Sites

Capacity [kW]

75%

0 2 4 6 8 10 Inf

0 50 100 150 200

NREL cdp_bu_14
Created: Sep-28-12 10:46 AM
Fuel Cell Backup Power Operation and Grid Outages

- Unit Location
- Unit Location with Data
- Conditioning Operation
- Operation
- Grid Outage

Cumulative Number of Starts

2010  2011  2012  2013