Integrating PHEV with Austin Energy’s Smart Grid

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About Austin Energy

- 9th largest public power utility in the USA
- Over $1.2 billion in annual revenues
- Servicing almost 400,000 premises representing ~1 M population
- Leader in conservation and renewable energy
- Leader in the use and management of distributed generation
- Leader in PHEV
Plug-In Partners is a national grass-roots initiative to demonstrate to automakers that a market for flexible-fuel Plug-In Hybrid Electric Vehicles (PHEV) exists today.

• Initiated January 2006

• Objectives successfully completed October 2008
AE PHEV Pilot Project

- 2 Toyota Prius Hybrids – Charge Management Pilot
- 100,000 PHEVs Modeled on Austin Energy Grid

V2Green Charge Management System

A123 Systems Hymotion L5 Conversion
PHEV vs Generating Capacity

How Many PHEVs Can the Power System Accommodate Without Increasing Capacity?

Answer using the “Valley Filling” Method*

*Pacific NW National Laboratory: Impacts Assessment of Plug-In Vehicles on Electric Utilities and Regional US Power Grids
Summer Day Load Profile

Peaking Units
Other Gas-fired
Combined Cycle
Coal
Nuclear

MW

Hour Ending

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PHEV Potential Impact

With Existing Generation Fleet
(assuming utilities have some control over PHEV charging)

- Increased electric system minimum load
- Increased utilization of baseload generation
- Decreased power plant cycling
- Positive impact on earnings and electric rates

Source: DOE PNNL
PHEV facilitates wind energy utilization in regions where wind generation is strongest at night.
Wind Generation – Sweetwater

August 2007
Charging Scenarios

- **Manual** on/off charging

- Charging during a **time window** (on-peak/off-peak)

- **Time-centered** charging (aligns charging with peak wind)

- Charging with **price signals** (time-of-use or real-time)

- **Goal** charging (grid **ancillary services** such as regulation or following a **wind signal**)

- **Location** specific charging
Results Summary
(assuming 1.0 kW per hour charging rate)

- No new generation required to charge 100,000 PHEV on AE grid between 12:00 AM and 8:00 AM

- Value of AE grid ancillary services
  - One Way (Grid-to-Vehicle only): $122 per vehicle
  - Two Way (Grid-to-Vehicle & Vehicle-to-Grid): $225 per vehicle

- ~ 50% of AE premises are multi-family (no PHEV outlet)

- Transformer loading is a potential issue without PHEV charge management
Emissions Comparison

(100,000 Vehicles @ 14,600 miles/year or 40 miles/day in AE Grid)

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<thead>
<tr>
<th></th>
<th>NO&lt;sub&gt;x&lt;/sub&gt; (tons)</th>
<th>CO&lt;sub&gt;2&lt;/sub&gt; (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Tailpipes</td>
<td>1,774</td>
<td>669,680</td>
</tr>
<tr>
<td>All Day Charging*</td>
<td>79</td>
<td>313,300</td>
</tr>
<tr>
<td>12:00 AM to 8:00 AM Charging*</td>
<td>79</td>
<td>304,455</td>
</tr>
<tr>
<td>Reduction</td>
<td>95%</td>
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*1 kW charging for 8kWh per day per vehicle
Thank You!

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