Smart Charging and V2X in the Real World

Valuing VGI
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E3 focuses on energy and its uses

E3’s transportation practice draws on our broad electric sector expertise

**DERs & Rates**
- Analyzes distributed energy resources, emphasizing their costs and benefits now and in the future
- Supports rate design and distribution system planning

**Clean Energy**
- Provides market and policy analysis on clean energy technologies and climate change issues
- Includes comprehensive, long-term GHG analysis

**Asset Valuation**
- Determines grid-scale asset values from multiple perspectives and supports large user procurement
- Valuations incorporate policy, regulation, economic and technology variables.

**Planning**
- Develops and deploys proprietary tools to aid resource planners
- Informs longer-term utility system planning and forecasting

**Market Analysis**
- Models wholesale energy markets both in isolation and as part of broader, more regional markets
- Key insights to inform system operators and market participants

Models wholesale energy markets both in isolation and as part of broader, more regional markets

Key insights to inform system operators and market participants
The evolving value of VGI

+ The value opportunity for VGI is expected to shift over time
+ Some revenue streams will shrink due to market saturation (e.g. ancillary services), while others will grow due to increasing renewable penetration (e.g. energy shift)

**Illustrative Evolution**

Long term driver of value is shifting energy across hours to integrate renewables (e.g. shift daytime solar energy to nighttime)

Near term driver of value is shifting energy on peak days to avoid investments in new power plants and new distribution-level wires infrastructure

Today ancillary services (fast response services) are high in value, but the market size is small
Load shifting is likely to have the highest market size, growth potential, and value for EVs.
+ V2G can provide up to $620 per EV annually versus unmanaged charging

250 Mile BEV in 2025

<table>
<thead>
<tr>
<th>Annual $/EV</th>
<th>Unmanaged Charging</th>
<th>V1G (Managed Charging)</th>
<th>V2G (Vehicle-to-Grid)</th>
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<tbody>
<tr>
<td></td>
<td>(-$362)</td>
<td>($17)</td>
<td>$258</td>
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<td>$275</td>
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<td>$345</td>
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$275 Relative benefit V2G vs V1G
$345 Relative benefit V1G vs unmanaged

+ To realize this potential value several barriers must be overcome:
  - Regulatory hurdles – interconnection, revenue grade metering etc.
  - Dividing revenues across stakeholders (OEMs, aggregators, drivers, site hosts etc.)

+ More dynamic rates for EV charging could be a simple way forward in the near term