Grid for the Future: Harnessing Zero Emission Vehicles to Enhance Grid Reliability

Kurt Johnson, The Climate Center
COP 27 November 10, 2022
Vision

California becomes a global model for utilizing Bidirectional Zero Emission Vehicles as:

1) energy resilience and reliability assets—to keep the lights on at critical community facilities as climate change-fueled extreme weather events threaten the grid

2) an energy management tool, storing energy from solar overgeneration and shifting it to evening peak hours when demand is high
Panelists

Siva Gunda, California Energy Commission
Cliff Rechtschaffen, California Public Utilities Commission
EVs are growing rapidly globally

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**EV Charging Load Capacity by Region, World Markets: 2020-2030**

(Source: Guidehouse Insights)
California is leading the US in EV adoption

2035 year by which all new passenger vehicle sales in CA will be electric

1.3 million+ cumulative sales of EVs

39% share of EVs in the US registered in CA

Sources: California Energy Commission and US Department of Energy
California is leading on solar adoption

1 million+ rooftop solar installations

11.6 GW of photovoltaics

EVs can load shift solar to evening peak periods

Source: California Energy Commission
8 million

Image Source: Clean Technica
What is Bidirectionality?

Vehicle to Grid (V2G) energy flow diagram using a DC bidirectional charger.

Image Source: Clean Energy Reviews
If 5 million EVs in CA in 2030 were bidirectional, their stored energy would be enough energy to power every home in California for a day

Data Sources: California Energy Commission, US Census
California VGI innovation
California is directing nearly $4B toward zero emission infrastructure over the next several years, including bidirectional charging.
Currently available bidirectional vehicles include:

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Model</th>
<th>Connector Type</th>
<th>V2G</th>
<th>V2H</th>
<th>V2L</th>
<th>Available</th>
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<tbody>
<tr>
<td>Nissan Leaf ZE1</td>
<td></td>
<td>ChadeMO</td>
<td>YES</td>
<td>YES</td>
<td>No</td>
<td>Now</td>
</tr>
<tr>
<td>Outlander PHEV</td>
<td></td>
<td>ChadeMO</td>
<td>YES</td>
<td>YES</td>
<td>No</td>
<td>Now</td>
</tr>
<tr>
<td>Hyundai Ioniq 5</td>
<td></td>
<td>CCS</td>
<td>No</td>
<td>No</td>
<td>YES</td>
<td>3.6kW</td>
</tr>
<tr>
<td>KIA EV6</td>
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<td>CCS</td>
<td>No</td>
<td>No</td>
<td>YES</td>
<td>3.6kW</td>
</tr>
<tr>
<td>BYD Atto 3</td>
<td></td>
<td>CCS</td>
<td>No</td>
<td>No</td>
<td>YES</td>
<td>3.2kW</td>
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<tr>
<td>BYD Han EV</td>
<td></td>
<td>CCS</td>
<td>No</td>
<td>No</td>
<td>YES</td>
<td>3.2kW</td>
</tr>
<tr>
<td>Ford F-150</td>
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<td>CCS (TBC)</td>
<td>YES</td>
<td>9.6kW</td>
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<td>Jul 2022</td>
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<tr>
<td>MG ZS EV (2023)</td>
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<td>No</td>
<td>YES</td>
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<tr>
<td>VW ID Models</td>
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<td>CCS</td>
<td>No</td>
<td>No</td>
<td>YES</td>
<td>(TBC)</td>
</tr>
</tbody>
</table>

Image Source: Clean Energy Reviews
The technology exists. It’s time to scale.
“Vehicle to grid capacity...is a game changer.” — California Governor Gavin Newsom