Electric Vehicle Market Overview – What's Here, What's Coming, and What are Utilities Doing about It

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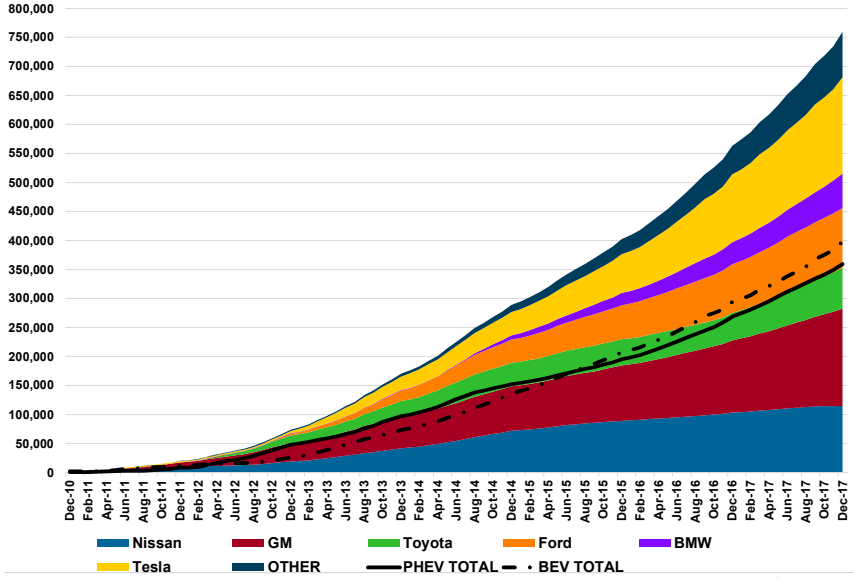
- What's here
- What's coming
- Can the grid handle it?
- Can we be smarter?

What's here

US EV sales exceed 758k at end-of-2017



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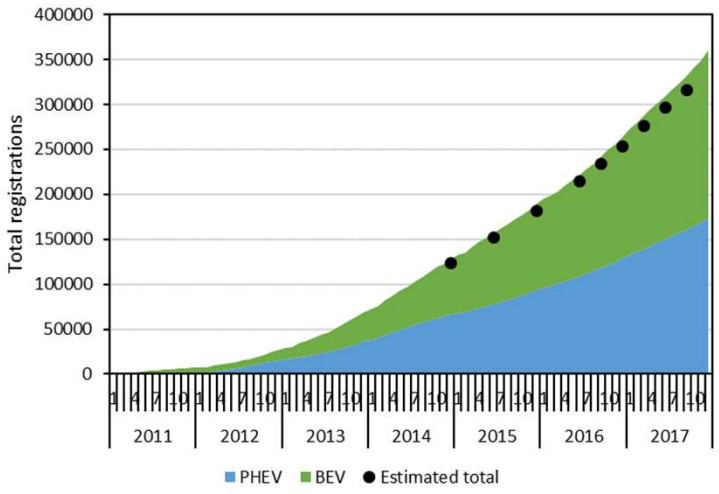
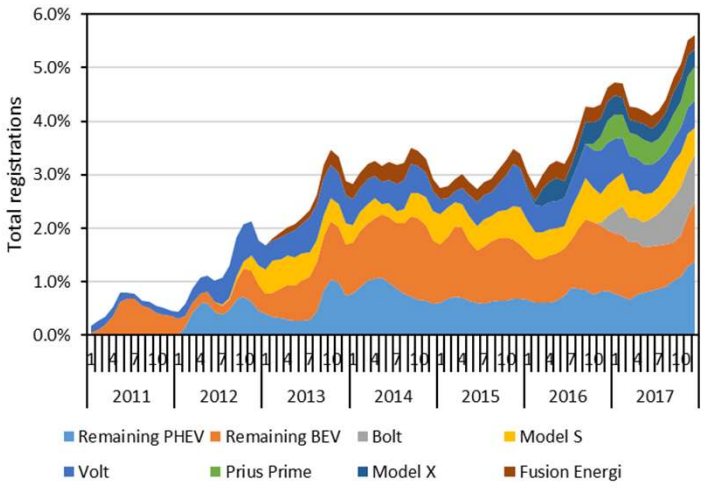
California registrations



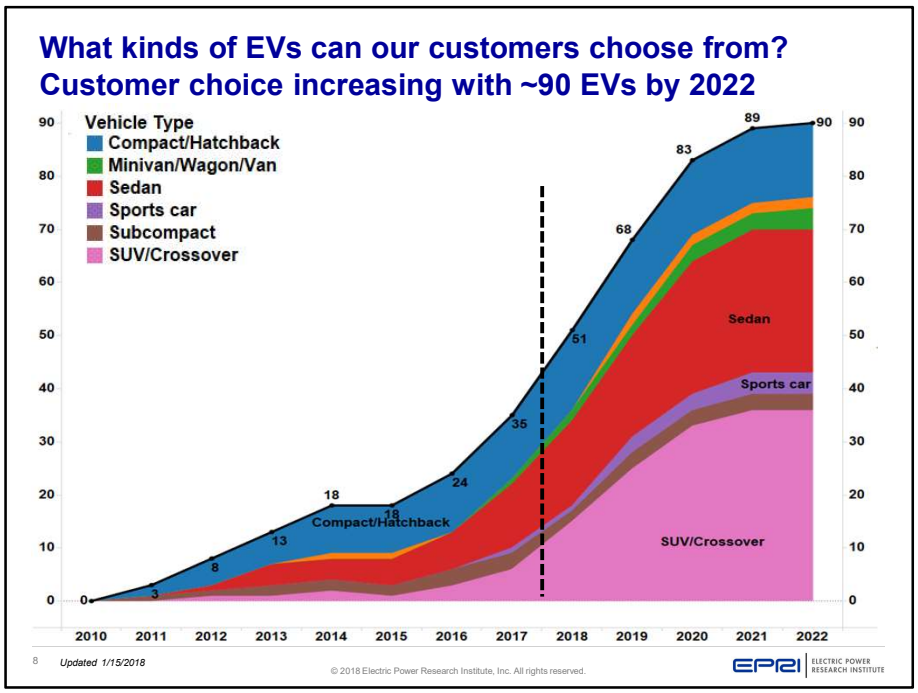
Through end-of-2017; EPRI analysis

California share

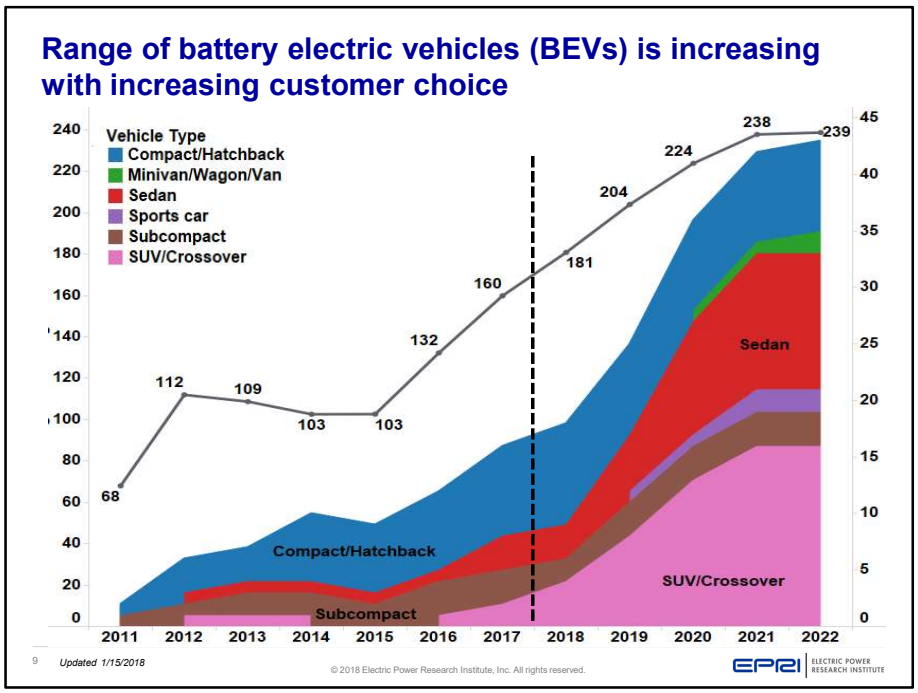


Through end-of-2017; EPRI analysis

What's coming



EPRI analysis



EPRI analysis

2017 Los Angeles Auto Show featured many EVs

Here come the big ones

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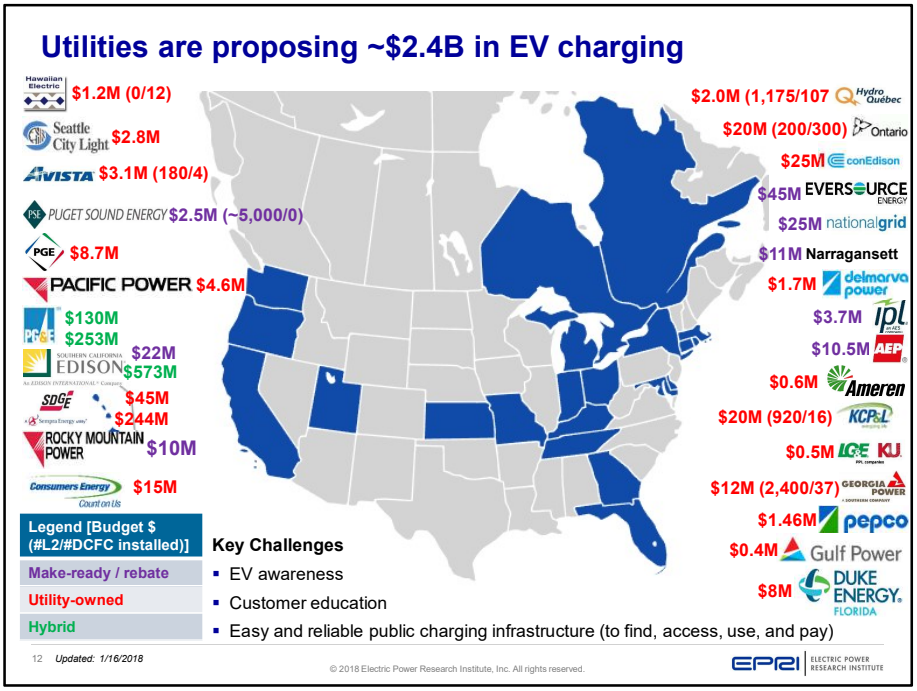
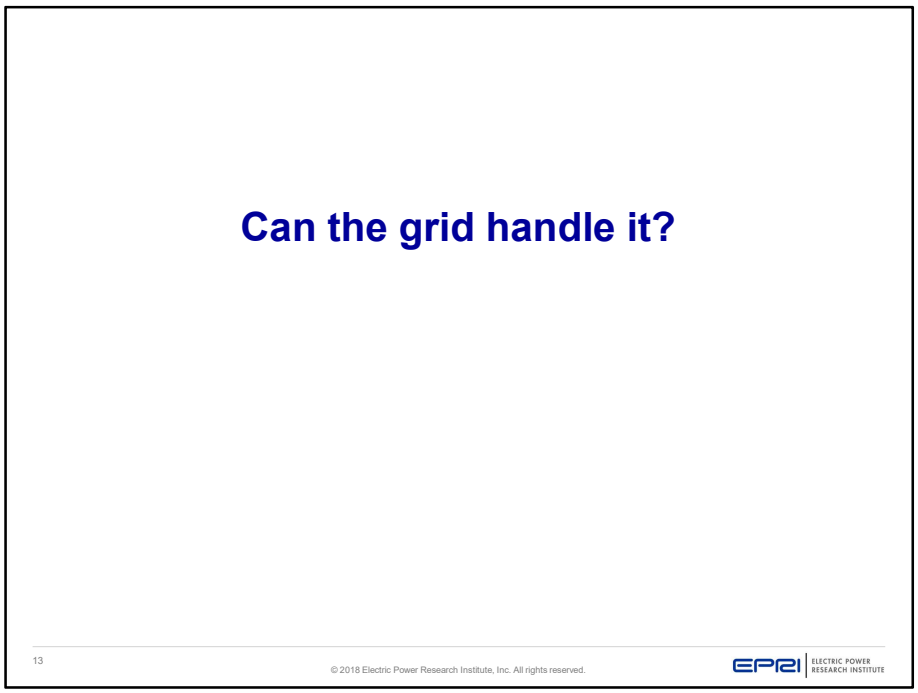
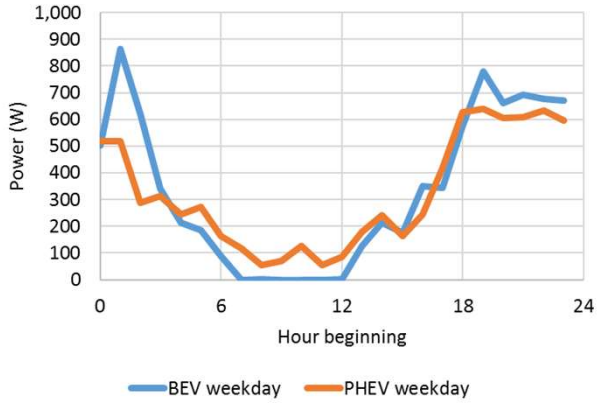


EPRI analysis



Note that in this discussion “generation” refers to energy, for example in GWh, and “capacity” refers to the ability of generators to supply power, for example in GW. Both are scaled to the number of vehicles, based on the numbers in slide 14. Note that there are many reasons that these national figures for generation and capacity would not be available to every customer in every location; they are meant to convey the order-of-magnitude.

Impacts per vehicle



- An average PEV has a power impact of about 1 kW and an energy impact of about 3000 kWh/year

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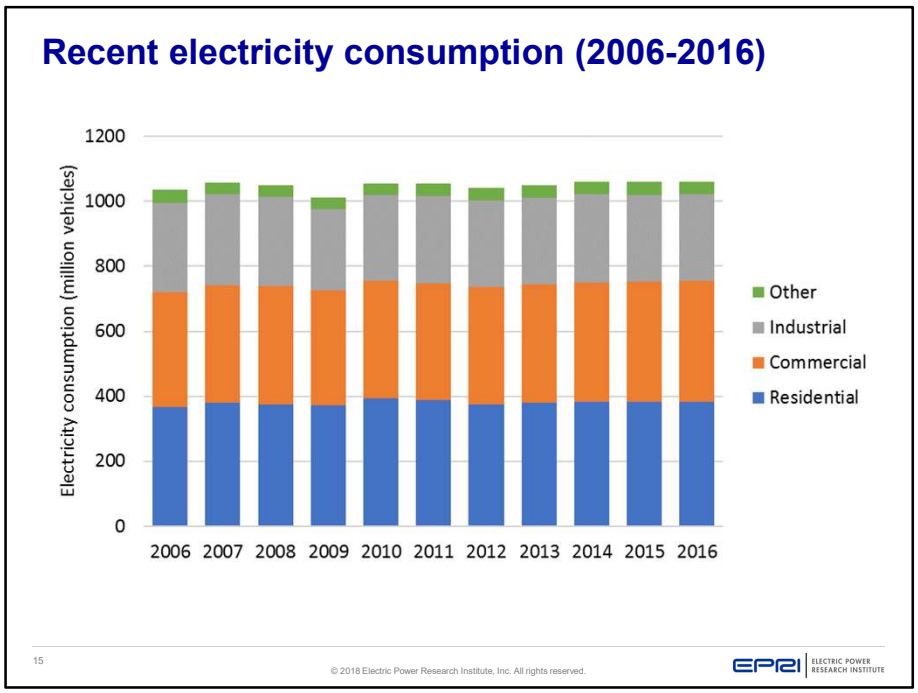
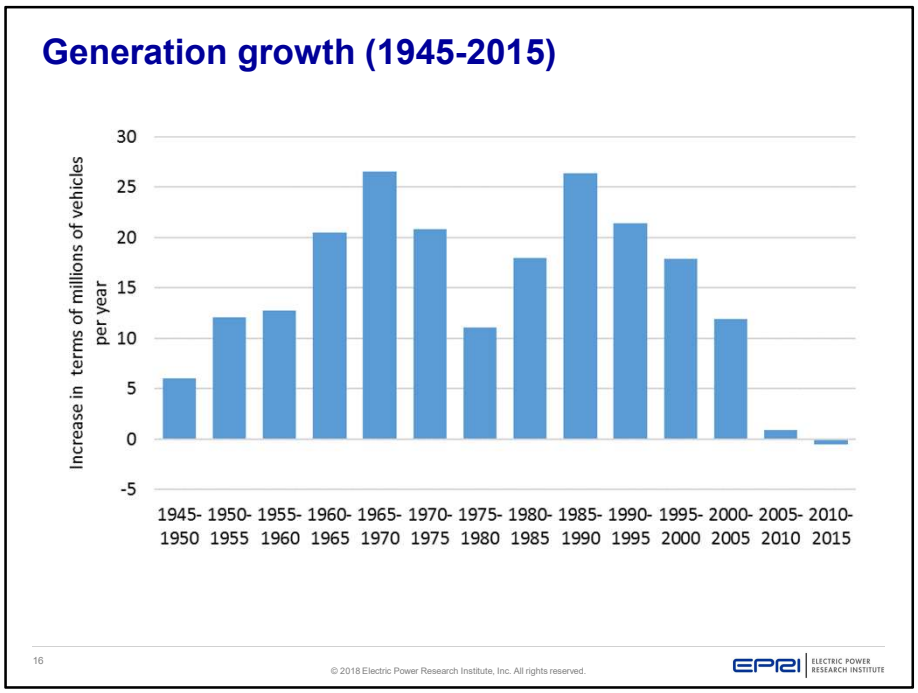
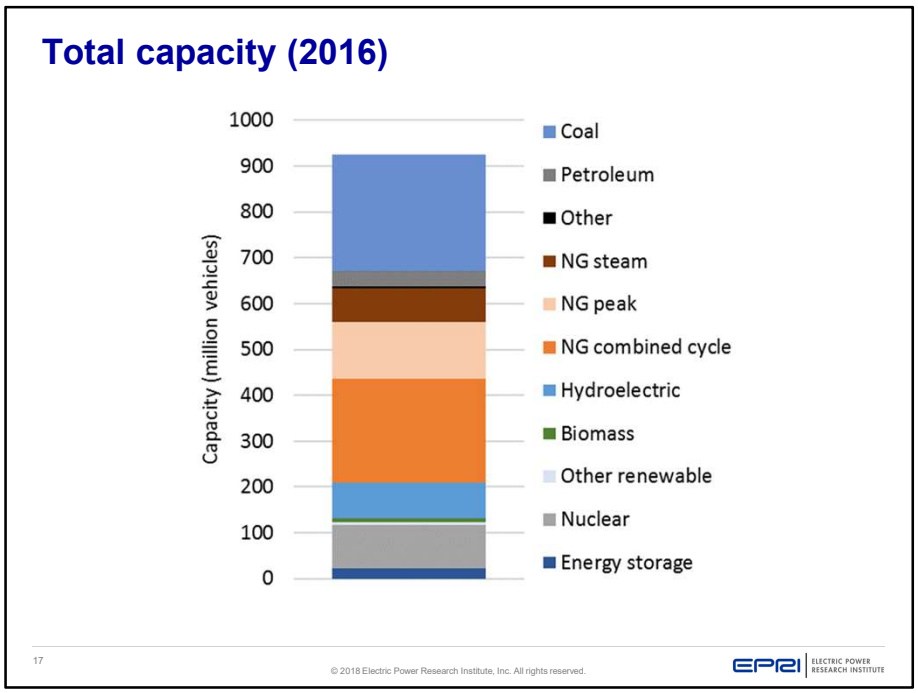
EPRI analysis of western utility; although no time-of-use variation was in place for this rate, many people still waited until after midnight to charge.



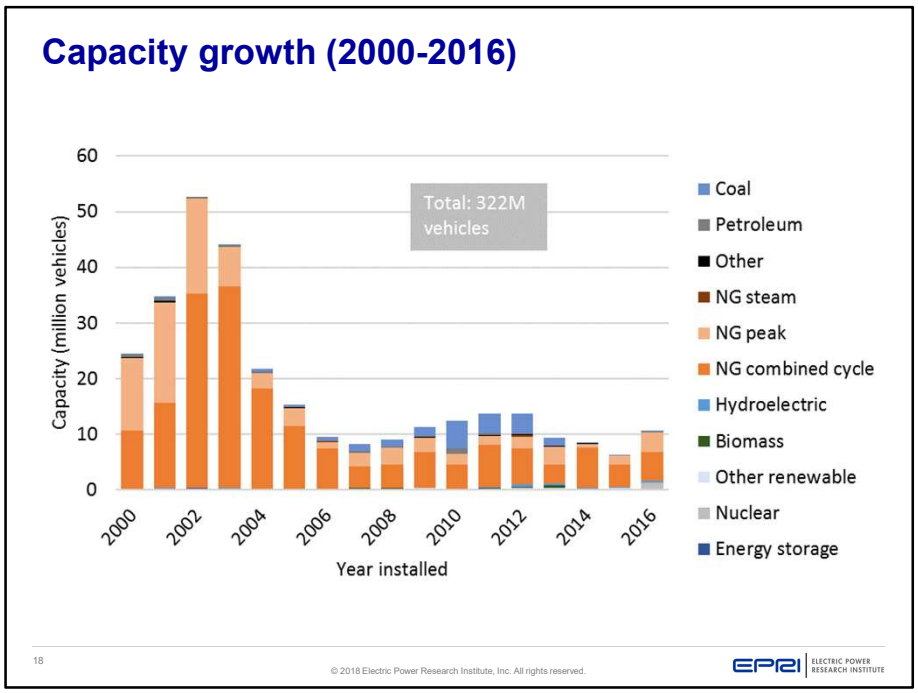
The US generates enough electricity to fuel 1 billion cars at current vehicle efficiency levels.
EIA data (with scaling)



In the past 10 years there has been little growth in generation, but historically there have been sustained periods of time when the grid added 25 million vehicles worth of generation ***per year.*** EIA data (with scaling)

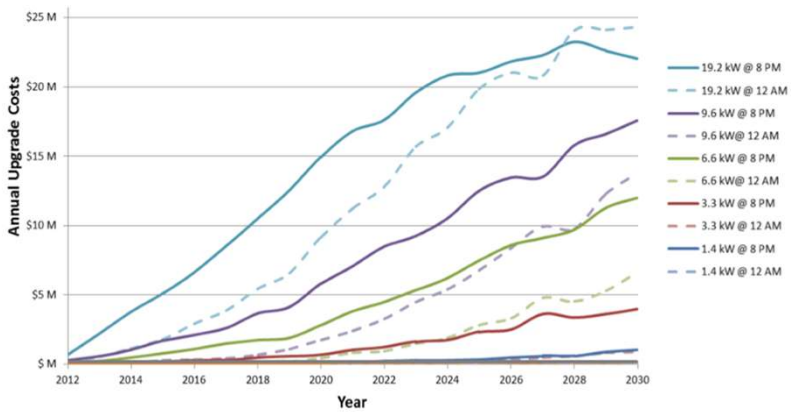


The US also has capacity equivalent to about 900 million vehicles (note that intermittent renewables are excluded from this). EIA data (with scaling)



In the past 16 years, the US has added about 10M-50M vehicles worth of capacity per year (note that intermittent renewables are excluded from this). EIA data (with scaling)

Residential distribution impacts



- Sacramento Municipal Utility District analysis of distribution impacts

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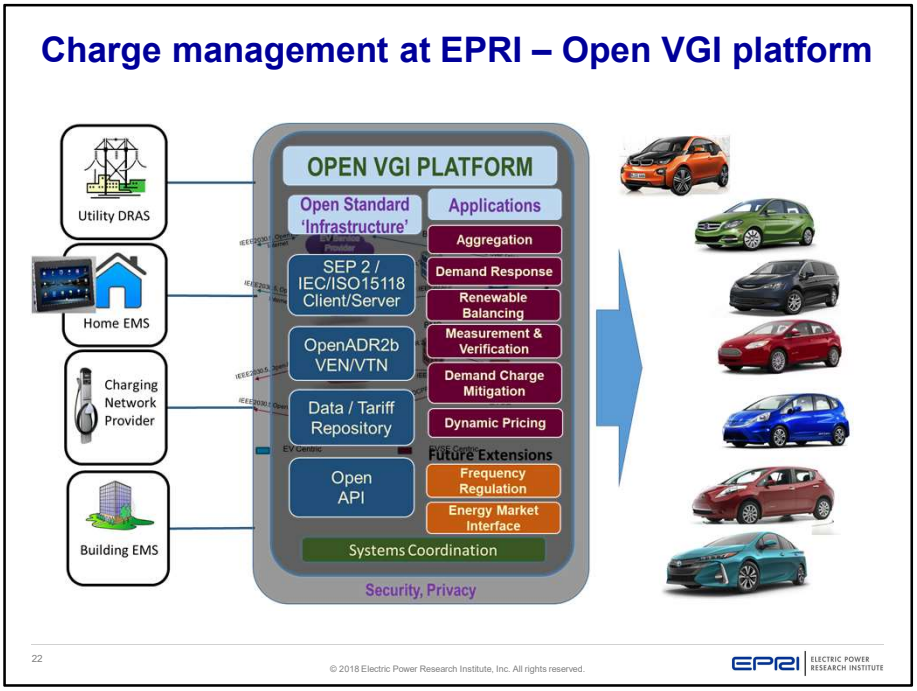
For the same number of vehicles, scenarios with high power incurred much higher costs than those with less power. Delaying charging till midnight helped in most situations. Note that what is good for the distribution system may not be good for generation capacity and vice-versa. For more information see “SMUD’s EV Innovators Pilot - Load Impact Evaluation”: https://www.smud.org/-/media/About-Us/Research-and-Development/Energy-Research-and-Development/research-EV-innovators.ashx?la=en&hash=AC5E4B8ED85279926EBF59B54E41426FFE79F29A

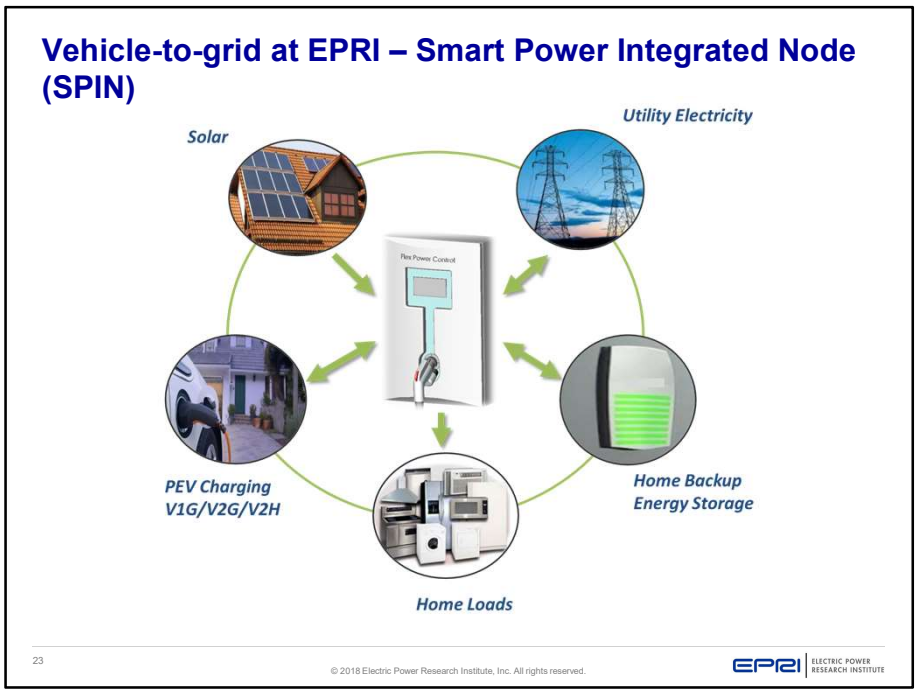
That was the “big iron” solution; how about using intelligence to mitigate problems?

Options to improve

- Charge management
  - Time of use rate
  - Direct signaling
- Demand response
- Vehicle-to-grid

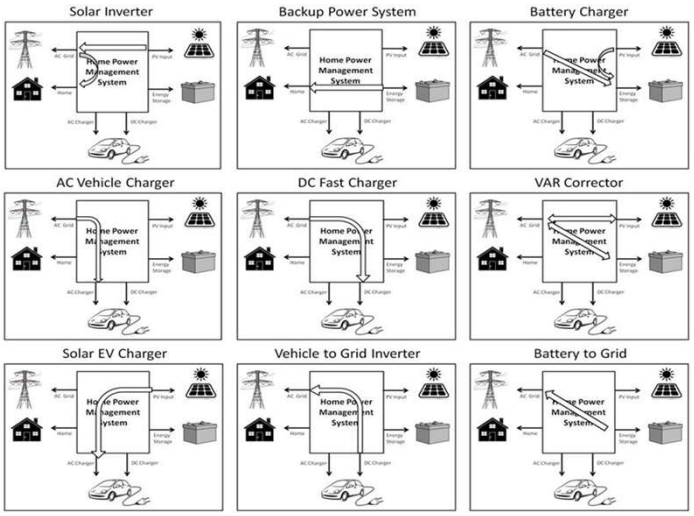


Open VGI is meant to be a “Rosetta Stone” to allow different upstream communication protocols and methodologies to interface with different vehicle ones, while ensuring end-to-end security.



SPIN is a specific devices being developed to act as a smart inverter to route power betwee advanced energy products, particularly those using DC power. The project includes funding and involvement from DOE and CEC.

SPIN Operating Modes / Scenarios



This is an overview of the proposed use cases.

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