RATE DESIGN CONSIDERATIONS FOR EV CHARGING

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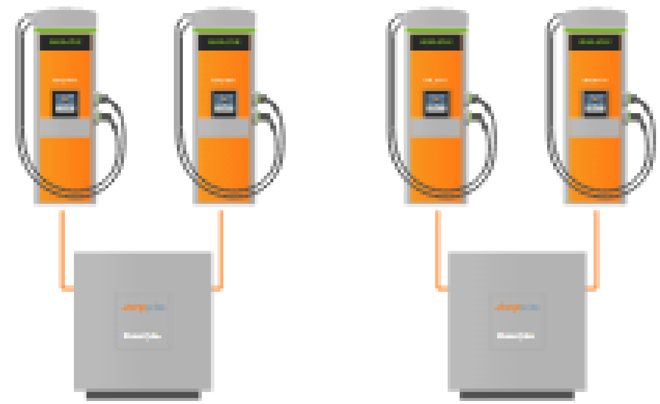
CHARGER TYPES

Level 2 chargers (4-22 kW) are **inexpensive** and **can provide grid services** with managed charging.

Level 2 is appropriate anywhere vehicles can stay a few hours:

- residences
- workplaces
- shopping areas
- charging depots



DCFC (50-350+ kW) are **very expensive** and **can't easily provide grid services** with managed charging.

DCFC is appropriate for:

- high-traffic urban centers
- commuting corridors
- stops on interstate highways
- charging depots for TNC fleets
- mass transit

KEY ISSUES

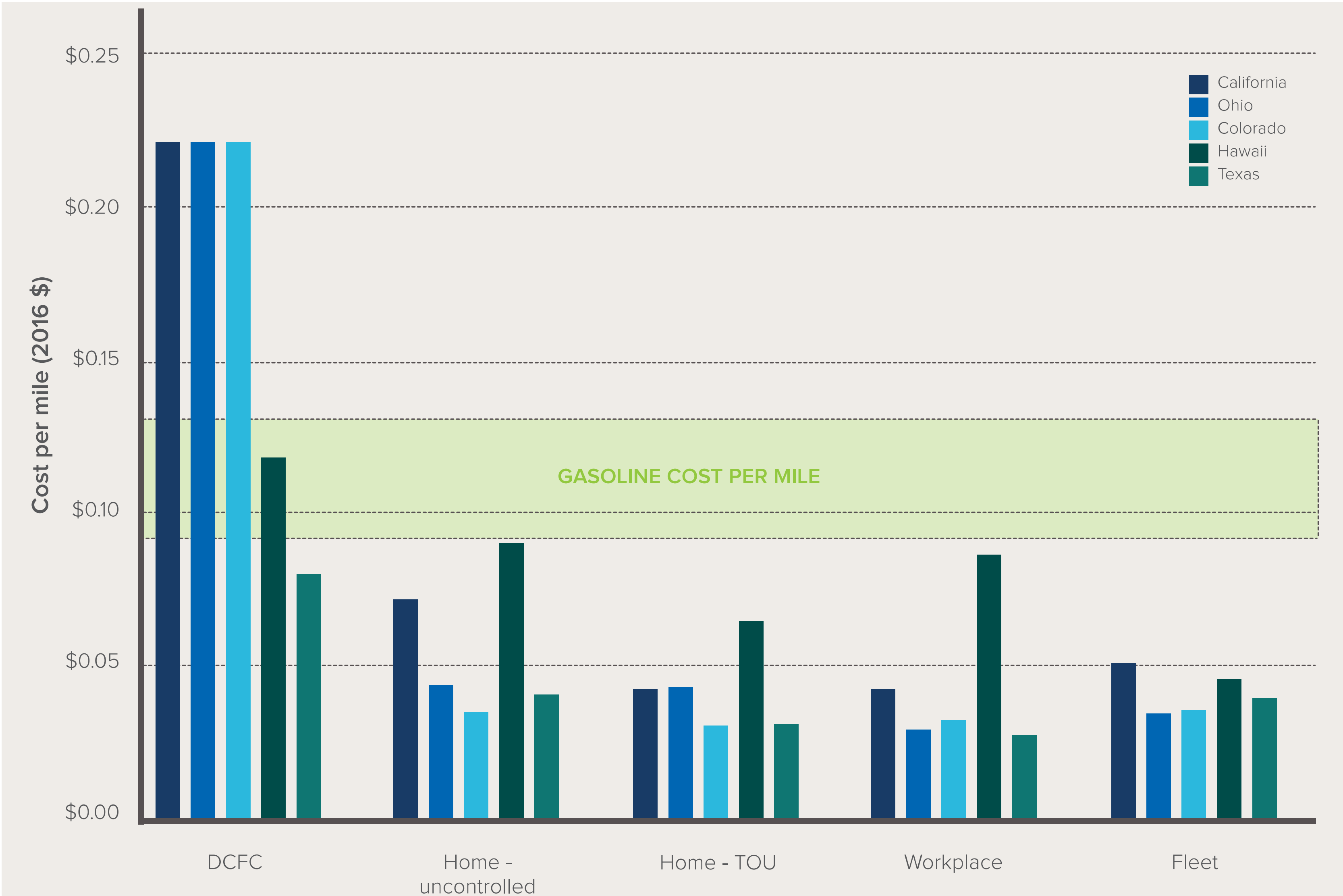
1. **DC fast charging is mostly a market failure** we will have to correct to achieve our transportation electrification aims.
2. This problem almost certainly requires **a rate design cure**.
3. **Charging depot loads will be significant.** In addition to today's 50-150 kW DCFC loads, let's have a view toward funding & recovering costs for 2+ MW loads at public charging depots, 5-10+ MW loads at transit bus barns and 20+ MW loads at truck stops.
4. **Utility investment is necessary.**
5. **Fleet electrification entails a steep and treacherous learning curve.** Most fleet managers are unfamiliar with charging equipment, operational aspects of managing charging, financial impacts of charging and maintaining electric fleets, etc. Horror stories abound.

PUBLIC DCFC RATE DESIGN ISSUES

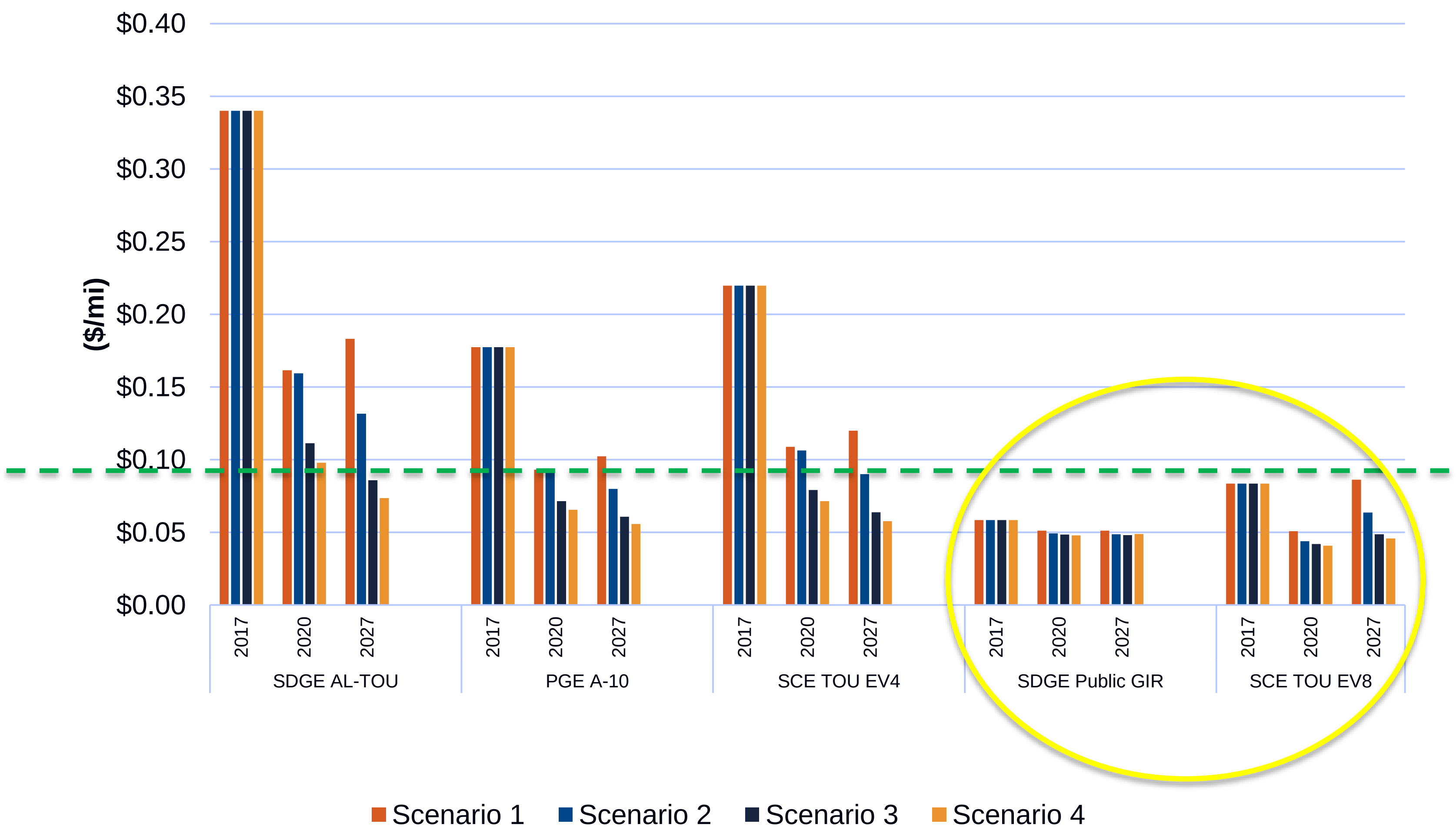
- Public DCFC are critical parts of the network.
- Therefore it is critical that tariffs support public DCFC infrastructure. But **most existing tariffs are not designed for DCFC operators and are not suitable**:
  - Do not accurately reflect the true cost of service
  - Are not consistent across utilities
  - Lack appropriate price signals for effective integration of EVs onto the grid
- DCFC utilization varies by host type, and increasing utilization eases issues with demand charges.

→ We need tariffs that create a better business case for DCFC owners & operators.

LEVEL 2 IS COMPETITIVE WITH GASOLINE; DCFC IS NOT



DEMAND CHARGES: ICE PARITY WITHOUT THEM



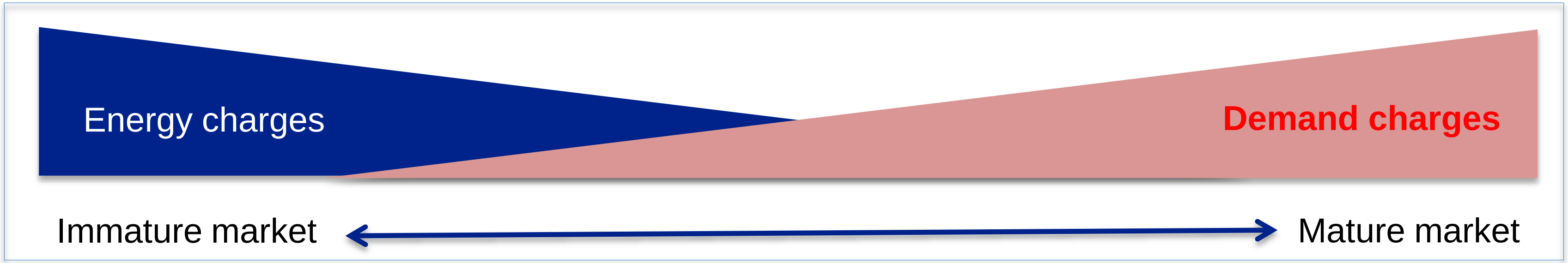
RATE DESIGN GOALS

- Charging should be **profitable** so that it is sustainable.
- Charging should always be **cheaper than gasoline** (typically $0.29/kWh, or ~$0.09/mile, or less).
- Level 2 charging should be considerably **cheaper than DC fast charging.**
- EV chargers should be on **dedicated tariffs** and on **separate meters**, preferably the meter built into the charging station.
- Tariffs should offer an opportunity to **earn credit for providing grid services** through managed charging.
- Ideally, utilities could leverage distributed energy resource management systems (DERMS) to **promote a more efficient use** of existing grid infrastructure by offering varying rates, or interconnection costs, or levels of cost sharing for make-ready by location.

RATE DESIGN PRINCIPLES FOR EV CHARGERS

- Tariffs should be **time-varying**, and preferably dynamic, while recovering most utility costs.
- Tariffs should have **low fixed charges** which primarily reflect routine costs for things like maintenance and billing.
- Tariffs should reflect the actual cost of providing service, and should charge more for **coincident peak demand.**
- If demand charges are necessary, they should be scale with utilization rates, and recover **only location-specific costs of connection to the grid, not upstream costs**, so that customers sharing capacity share costs, and **continuous-capacity customers are not subsidized by short, infrequent loads.**
- **Cost shifts** should be **demonstrated, not assumed**, esp. when utilization is low.
- If a cost shift to low- to moderate-income (LMI) customers is demonstrated, it **should be offset by investments** in mobility services and infrastructure **for LMI residents**, not avoided altogether.

ADDRESSING THE DEMAND CHARGE PROBLEM
RMI'S PROPOSAL

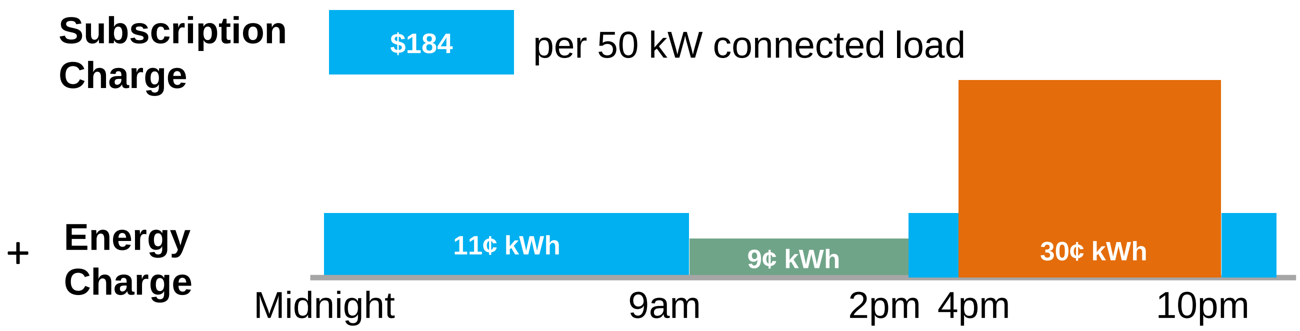


- While the market is young, there are no demand charges. More cost is shifted to volumetric charges until the market matures.
- As the market matures and utilization rates climb, demand charges scale up and volumetric charges scale down.
- Can be done as a function of utilization rates. Example: (indicative pricing)

Utilization rate	Volumetric rate (kWh)	Demand charge (kW)
<=10%	$0.20	$0
15%	$0.18	$1
20%	$0.16	$2
30%	$0.15	$3
40%	$0.14	$4
50%+	$0.11	$5

ADDRESSING THE DEMAND CHARGE PROBLEM
PG&E'S PROPOSAL

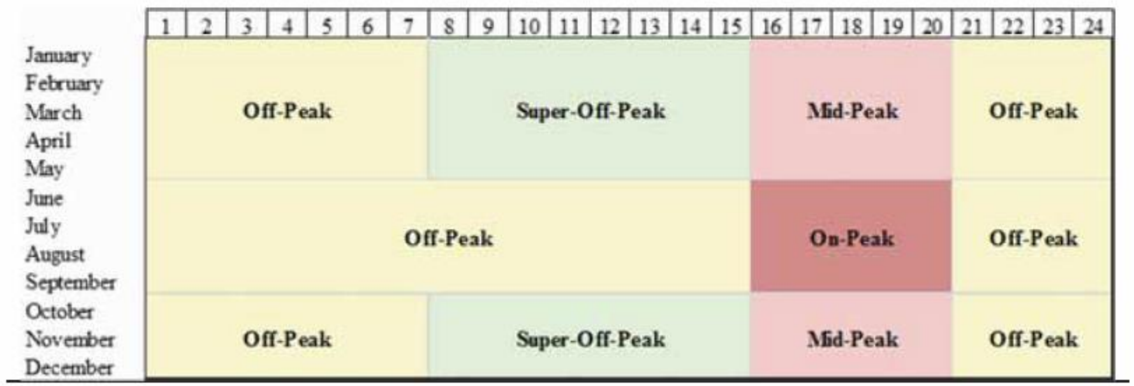
Proposed "EV-Large S" (over 100 kW) rate



- No demand charges
- Time of Use rate is matched to system peaks for appropriate cost recovery
- Rates are stable year-round, sending charging networks and drivers reliable and appropriate price signals
- Allows profitable DCFC operation across a wide variety of load shapes and charging scenarios

ADDRESSING THE DEMAND CHARGE PROBLEM
SCE'S DEMAND CHARGE HOLIDAY PROPOSAL

Figure III-7
Proposed TOU Weekday Periods for New V Rates (Hour Beginning)



- SCE has proposed four new rates for EVs
- No demand charges for first 5 years, then demand charges phase in over next 5 years. By Year 11, back to regular rates.
- Time of Use rate is matched to system peaks for appropriate cost recovery
- Rates vary by winter/summer, reflecting system costs and sending charging networks and drivers reliable and appropriate price signals
- Should allow profitable DCFC operation
- Other utilities are proposing similar "demand charge holiday" approaches

ADDRESSING THE DEMAND CHARGE PROBLEM
XCEL'S "RULE OF 100" APPROACH

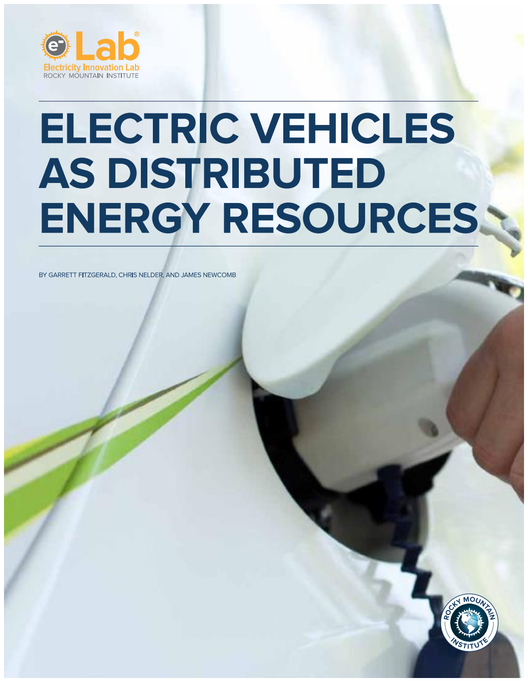
Demand calculation

***y* kW demand * .9 power factor * .9 = adjusted demand**
(= > current demand or 50% of largest adjusted demand over previous 11 months)

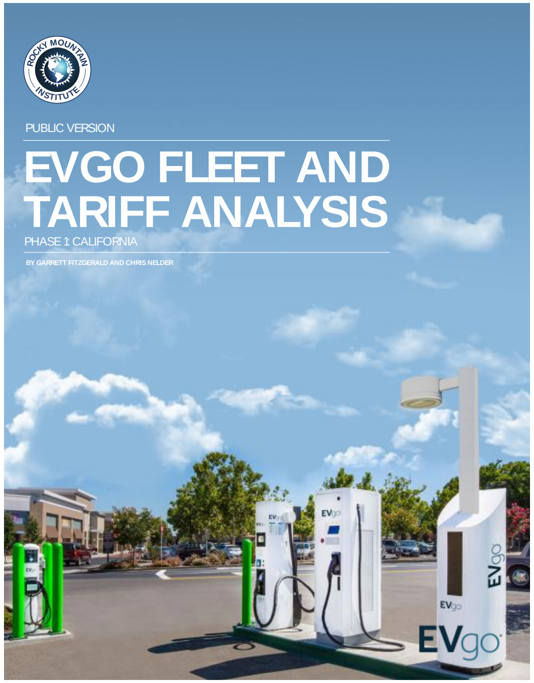
If demand charges are = < ***x* kW h / 100 hours/mo**

- Xcel's "A14" tariff in Minnesota
- Effectively calculates demand charges as a function of utilization.
- For example, a 50 kW DCFC used once per day would result in a bill that is 70% lower.
- By the time the same charger is used five times per day, the provision no longer has any effect upon the bill

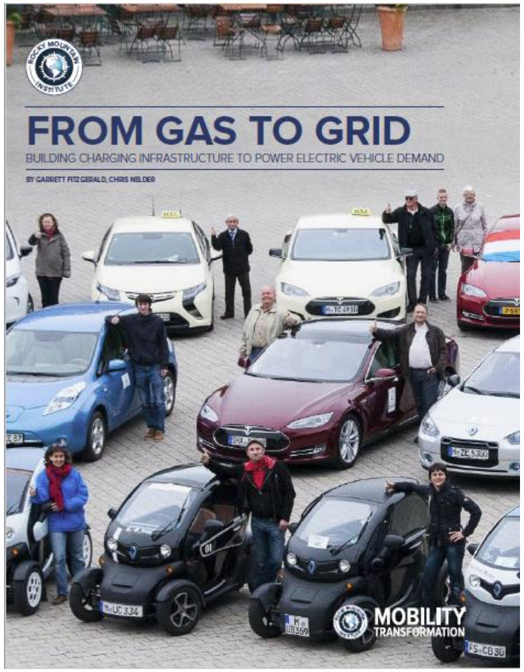
RMI EV-GRID REPORTS



Electric Vehicles as Distributed Energy Resources **(June 2016)**



EVgo Fleet and Tariff Analysis **(March 2017)**



From Gas to Grid **(October 2017)**