WHERE ARE WE ON UTILITIES REGULATION? BEST PRACTICES ACROSS THE COUNTRY: TOU AND RATE IMPACTS

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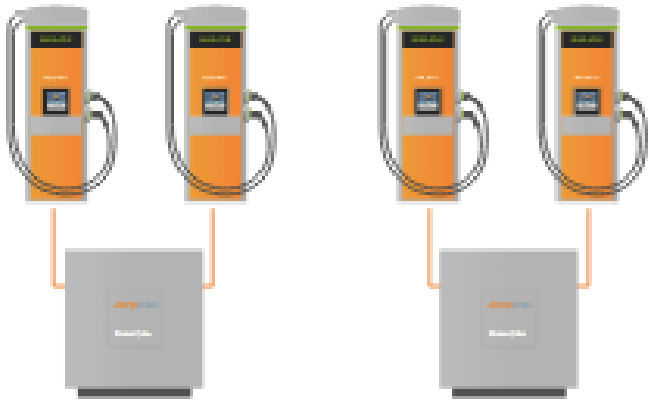
DIFFERENT RATES FOR DIFFERENT USE-CASES

For Level 2 chargers (typically 7-19 kW), which are mainly used for residential and workplace charging over 8 hours or more, a conventional Time of Use (ToU) rate design to encourage **managed charging is appropriate**.



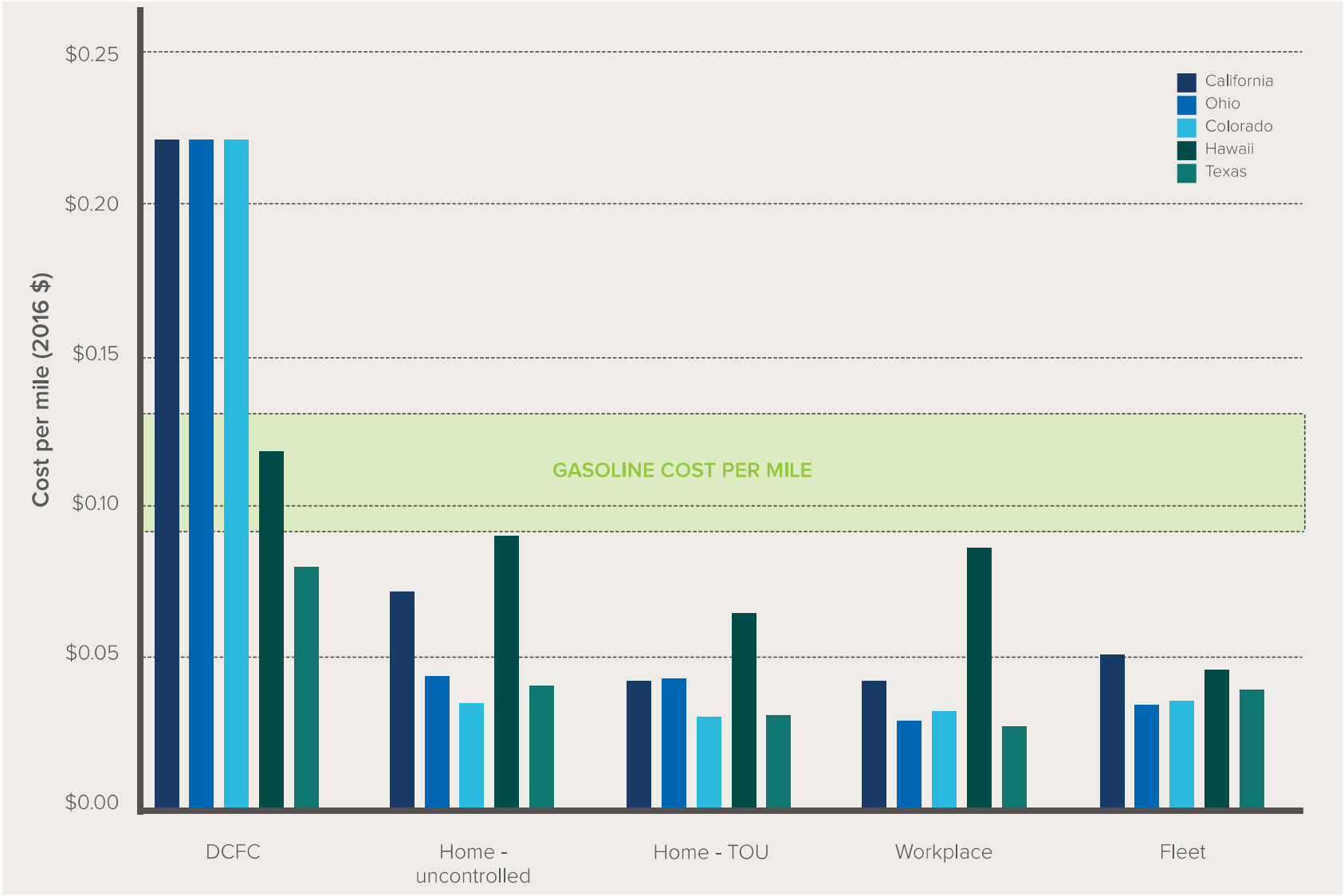
For DCFC (50-350+ kW), which are used briefly (< 1 hour) at random times, a more sophisticated rate design is needed, which minimizes the role of demand charges until the market matures.

- The load is “spiky” and unpredictable.
- The DCFC use-case is **not conducive to managed charging**.

RATE DESIGN OBJECTIVES

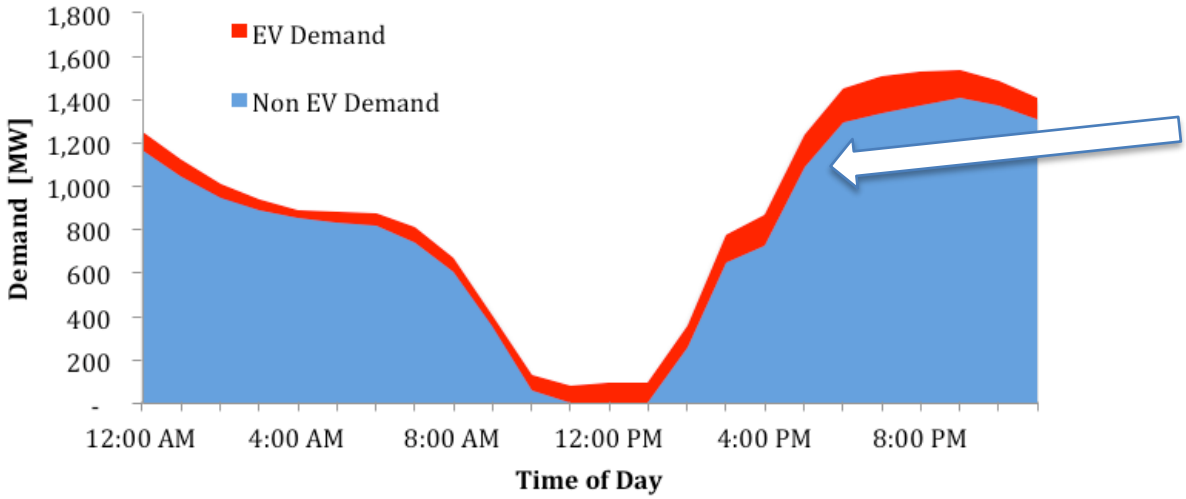
- Charging should be **profitable** so that it is sustainable.
- Charging should always be **cheaper than gasoline** (typically **$0.29/kWh, or ~$0.09/mile, or less**).
- Level 2 charging should be considerably **cheaper than DC fast charging.**
- EV chargers should be on **dedicated tariffs** and on **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.

LEVEL 2 IS COMPETITIVE WITH GASOLINE; DCFC ISN'T



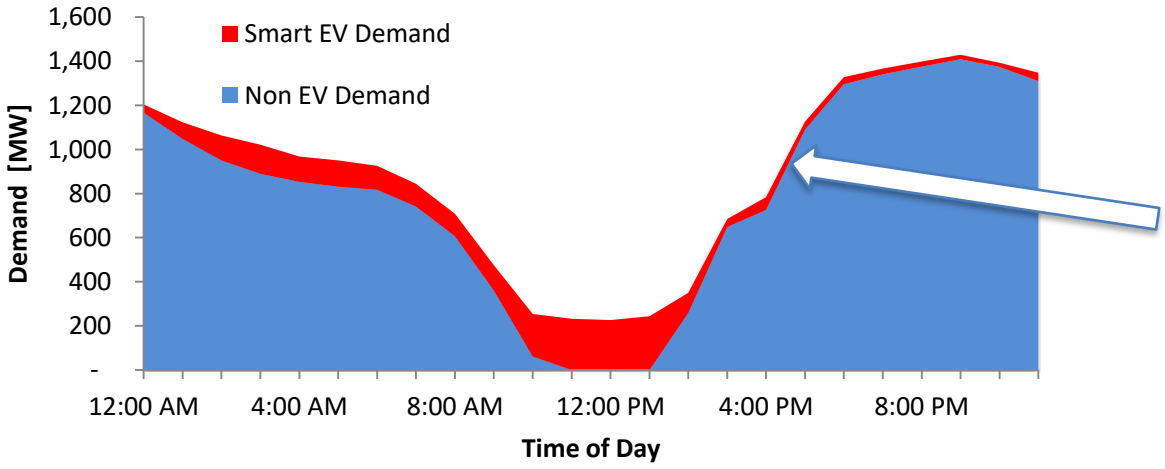
MANAGED CHARGING

- Projected HECO demand with 23% EV penetration with uncontrolled EV charging



Big "duck curve"

- Projected HECO demand with 23% EV penetration with managed EV charging



Smaller "duck curve"

MANAGED CHARGING

Managed charging of electric vehicles (G2V not V2G) can deliver many benefits:

- Optimize existing grid assets and extend their useful life
- Avoid new investment in grid infrastructure
- Supply ancillary services, such as frequency regulation and power factor correction.
- Absorb excess wind and solar generation
- Reduce emissions
- Reduce electricity and transportation costs
- Reduce petroleum consumption

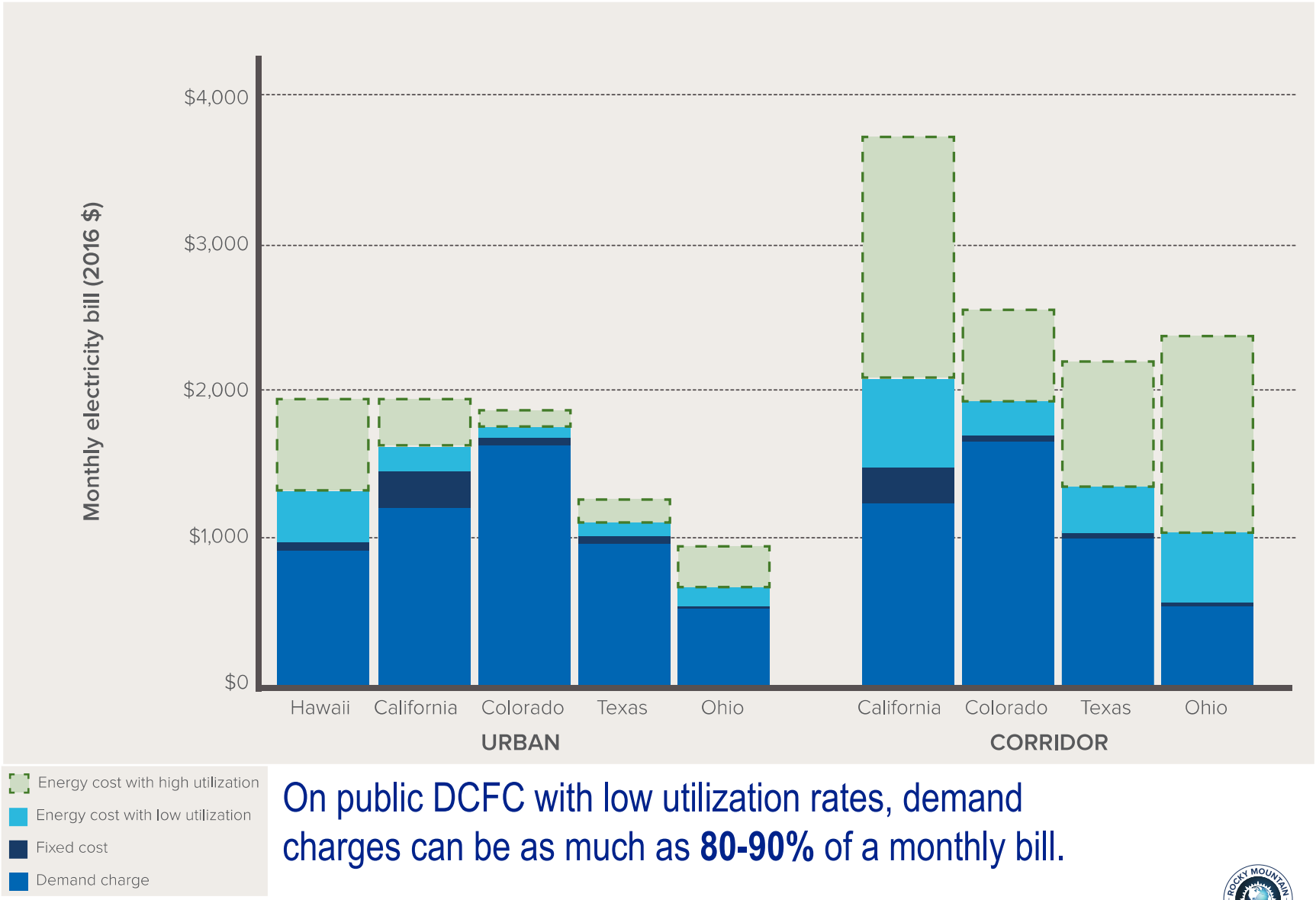
RATE DESIGN IS KEY

But: Managed charging is difficult and costly with DCFC depots

KEY ISSUES WITH DCFC RATE DESIGN

1. **DC fast charging is mostly a market failure.**
2. Public **DCFC are critical** parts of the network. We cannot achieve our transportation electrification aims without widespread public DCFC.
3. Conventional utility rates with **demand charges can kill the business case** and are not suitable:
   - Use punishing, non-coincident demand charges
   - Do not accurately reflect the true cost of service
   - Are not consistent across utilities
4. New, DCFC-specific rates are needed while the market is young and charger utilization rates are low.

DEMAND CHARGES KILL AT LOW UTILIZATION

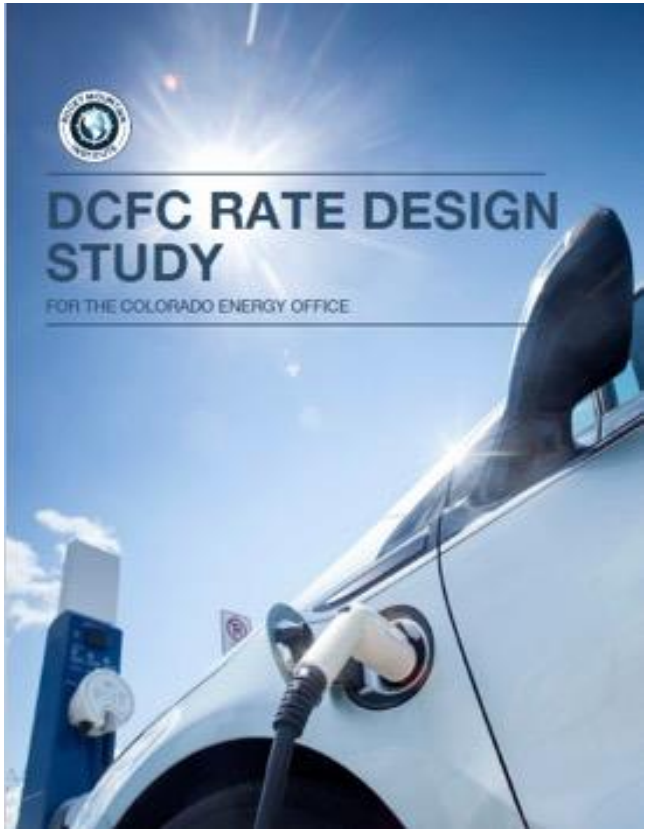


On public DCFC with low utilization rates, demand charges can be as much as **80-90%** of a monthly bill.

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.**

DCFC RATE DESIGNS COMPARED



DCFC Rate Design Study **(Sept 2019)**

We compared:

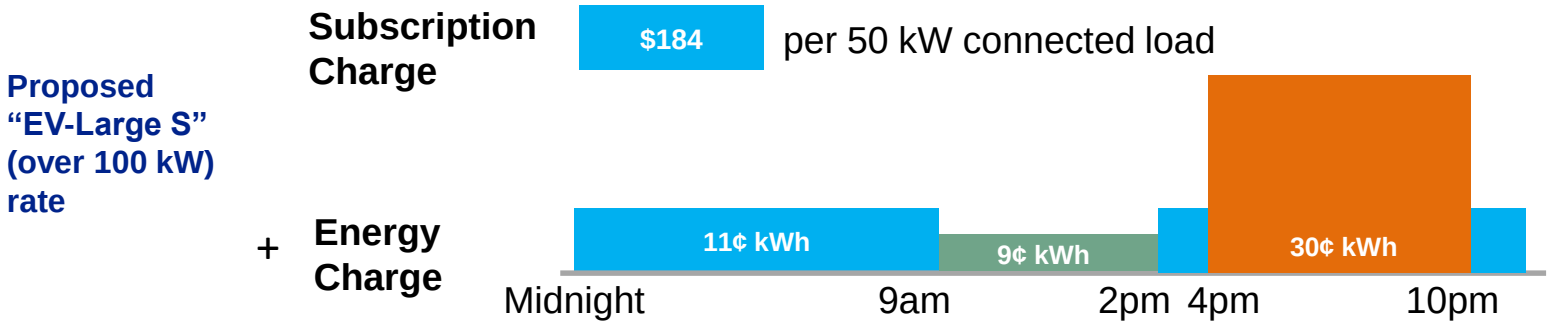
- **Three tariffs:**
  - Xcel Energy's S-EV
  - PG&E's EV-Large S
  - RMI's DCFC
- **Three load profiles:**
  - Public DCFC charging depot with two dual-port 50 kW chargers
  - Public DCFC charging depot with two dual-port 150 kW chargers
  - Transit bus depot with 25, 100-kW chargers
- **Three utilization rates** on public DCFCs: 5%, 10%, and 30%

Goal: Meet or beat gasoline parity at $0.09/mile.

DCFC RATE DESIGNS COMPARED
XCEL COLORADO'S S-EV TARIFF

- Fixed monthly charge: $34.40/mo.
- Two-tier ToU rate:
  - $0.054/kWh on-peak (9 am – 9 pm)
  - $0.027/kWh off-peak (9 pm – 9 am)
- CPP adder: $1.50/kWh
- Low (distribution) demand charge: $5.63/kW

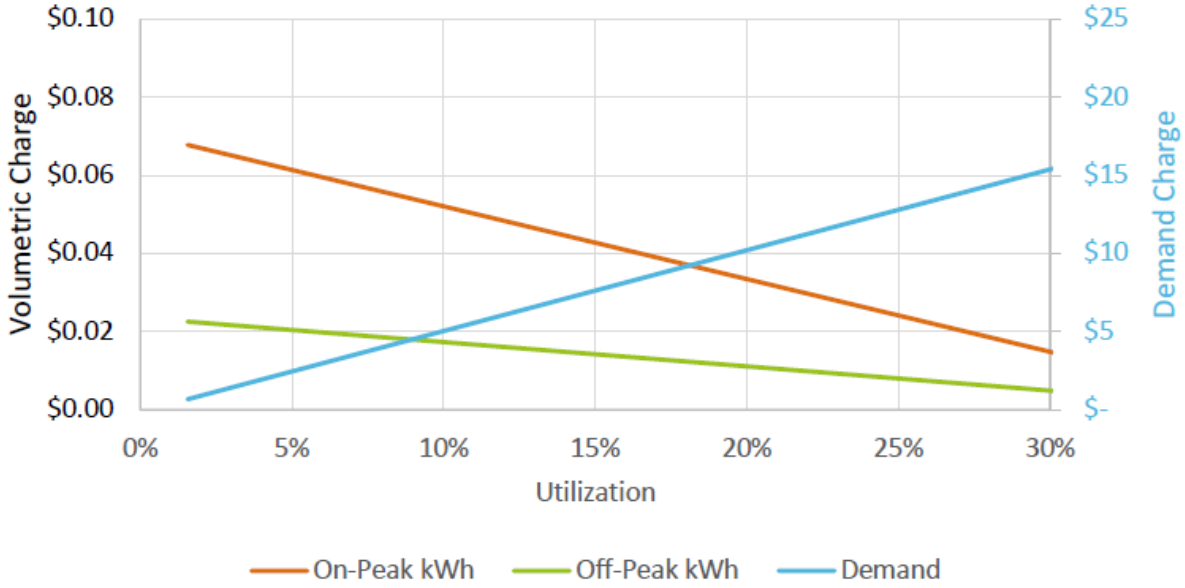
DCFC RATE DESIGNS COMPARED
PG&E'S PROPOSAL



- No demand charges
- Three-part ToU rate 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

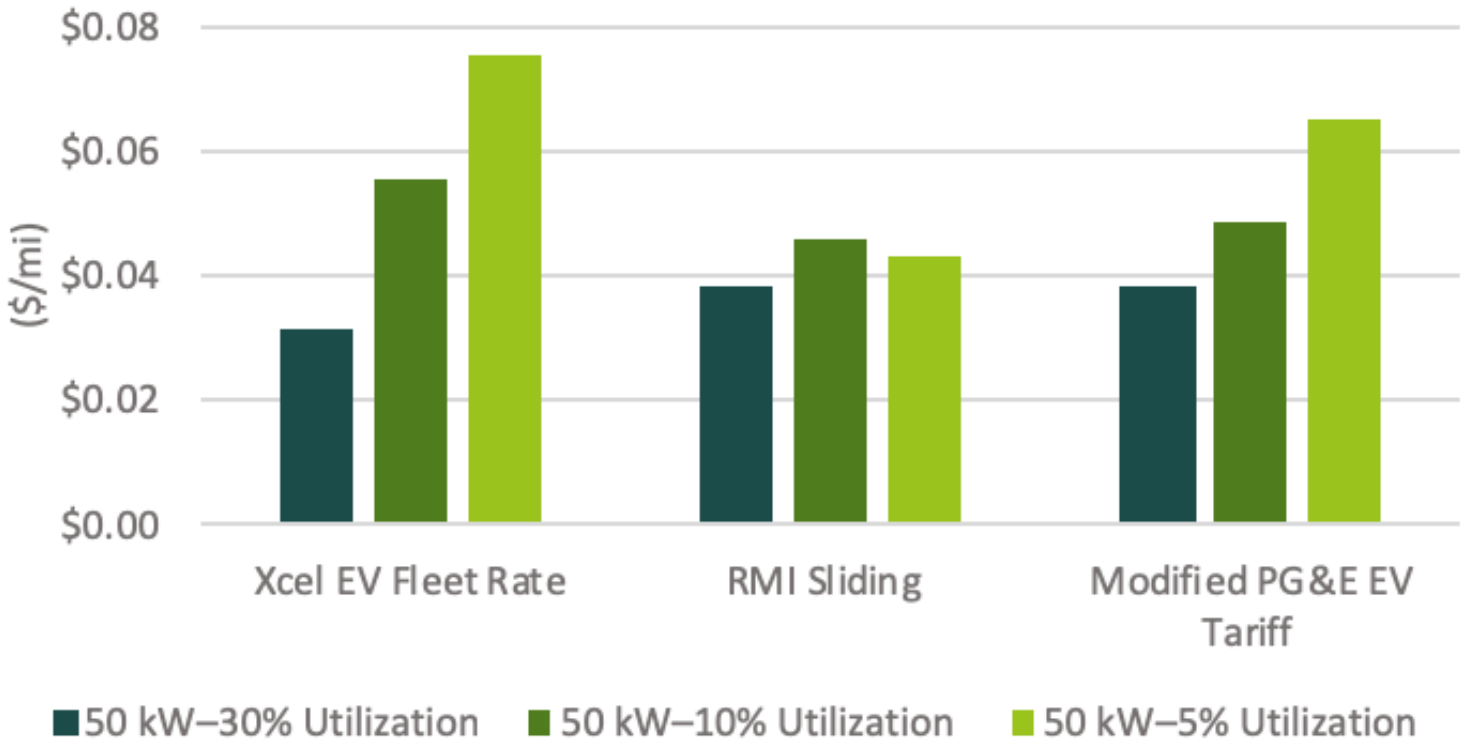
DCFC RATE DESIGNS COMPARED
RMI'S PROPOSAL

- Charges scale *as a function of utilization rates*.
- Recovers the same revenue over 10 years as Xcel's own rate.
- Fixed monthly charge: $34.40/mo.
- Two-tier ToU rate:
  - On-peak (9 am – 9 pm) Decreases from $0.068 to $0.007
  - Off-peak (9 pm – 9 am) Decreases from $0.022 to $0.002
- Demand charge: Increases from $0.677 to $17.622/kW



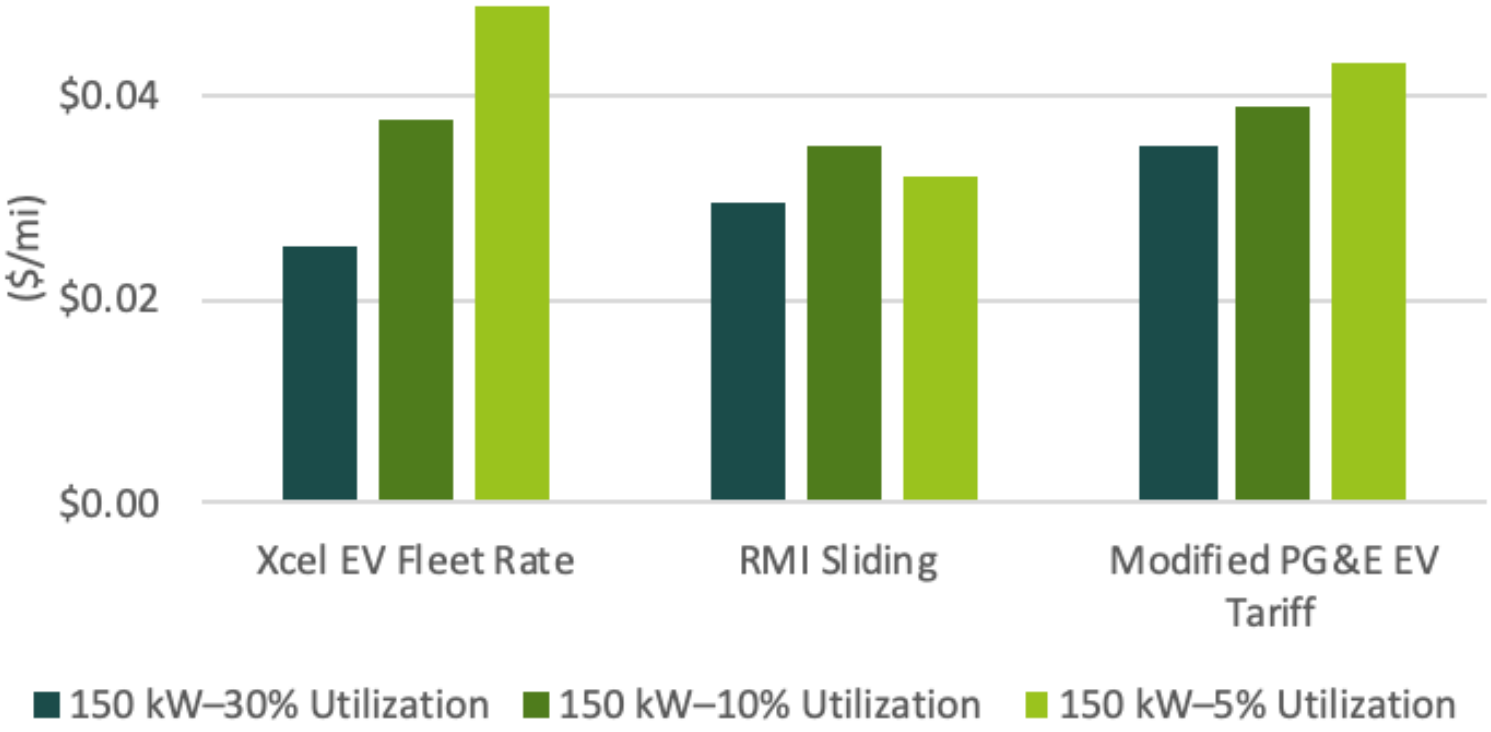
DCFC RATE DESIGNS COMPARED
PUBLIC 50 KW DCFC

RMI tariff produces *the lowest cost at low utilization* and the highest cost at high utilization

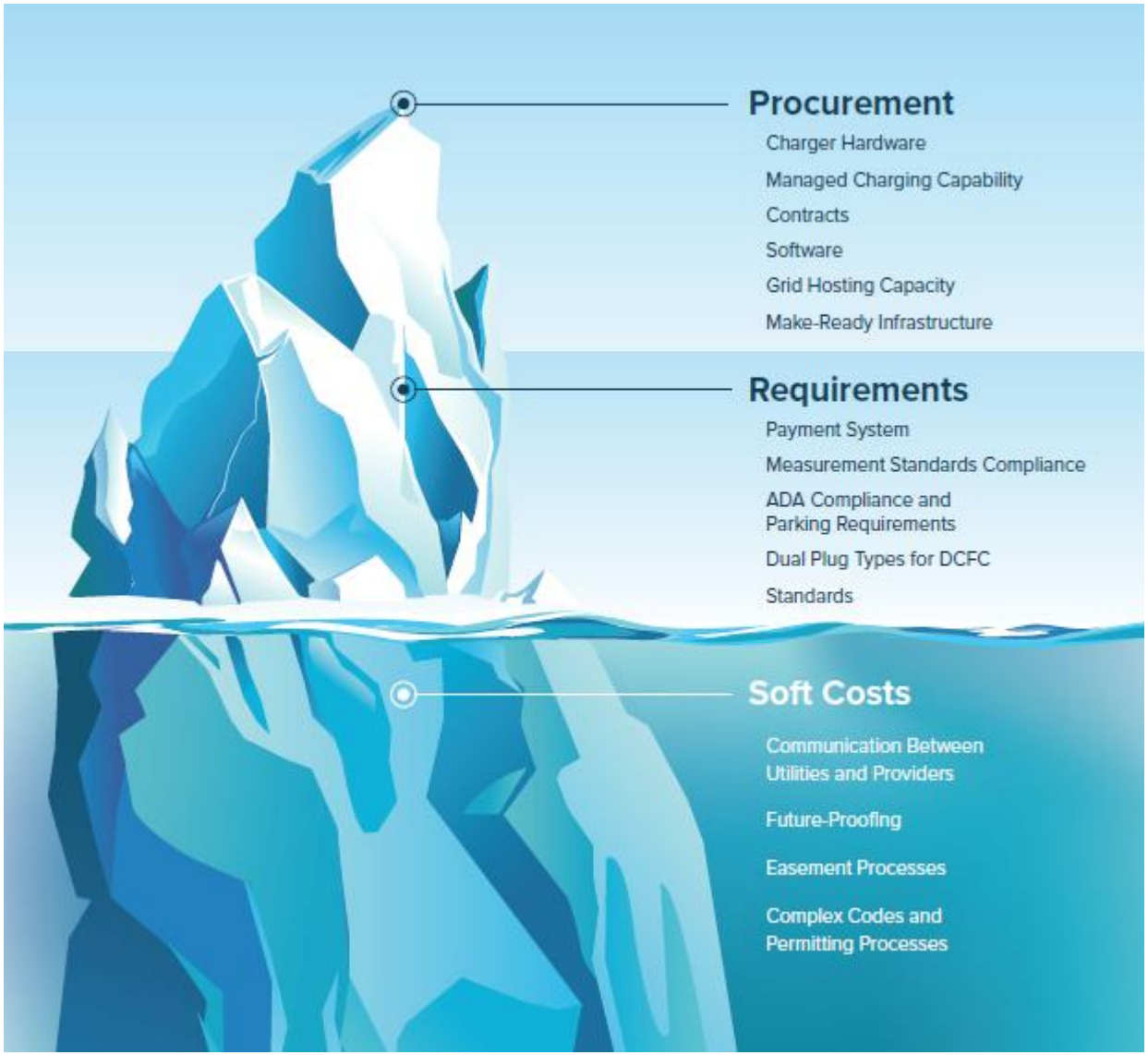


DCFC RATE DESIGNS COMPARED
PUBLIC 150 KW DCFC

RMI tariff produces the *most consistent cost per mile* and the cheapest cost at 5% and 10% utilizations



COST ASSESSMENT



- Procurement should require open standards
- Future-proofing isn't easy
- Utility engagement is critical
- Soft costs and other process issues incur unnecessary expenses

REDUCING SOFT COSTS

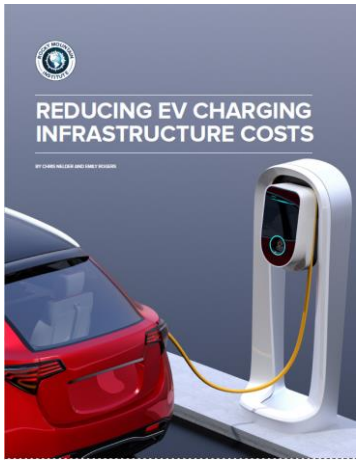
What can government do?

At the **federal** level, requirements for ADA compliance and building permitting can be clarified and standardized.

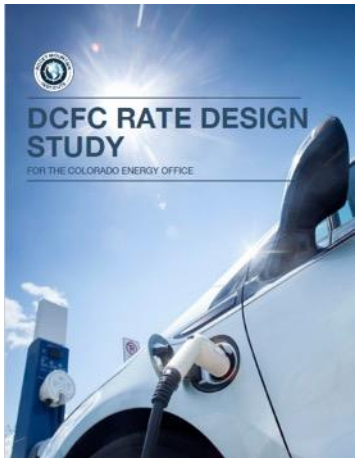
At the **state** level, permitting & utility interconnection can be streamlined (e.g., CA AB 2188) and ADA compliance can be clarified.

At the **municipal** level, building and planning departments can standardize codes and permitting requirements across jurisdictions, offer simple checklists for required documentation, and offer online permits.

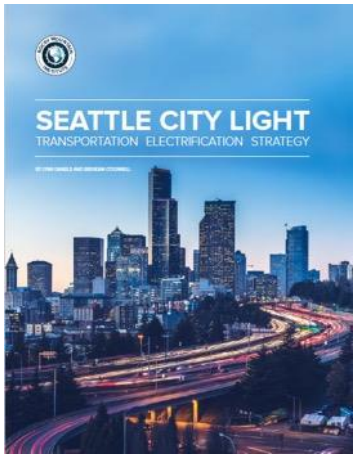
RMI EV-GRID REPORTS



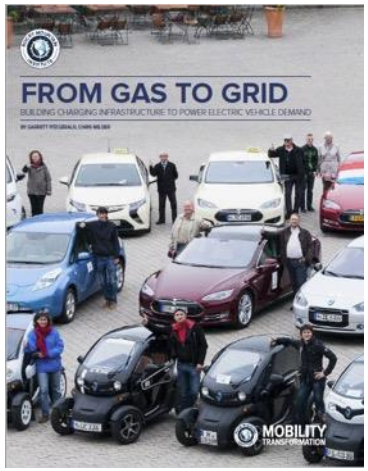
Reducing EV Charging Infrastructure Costs **(January 2020)**



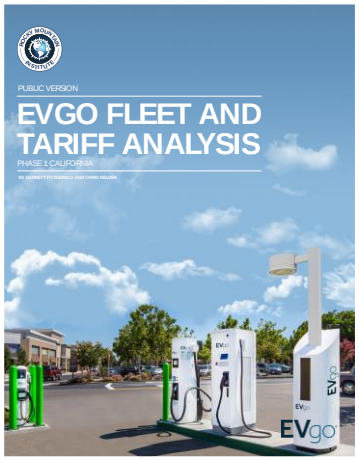
DCFC Rate Design Study **(Sept 2019)**



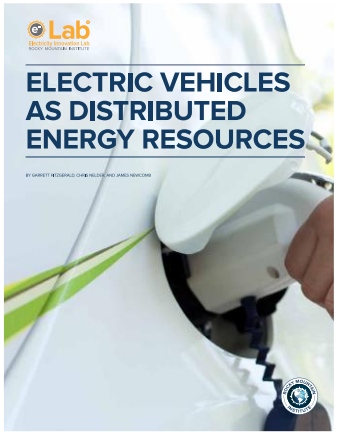
Seattle City Light TE Strategy **(Aug 2019)**



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



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



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

Thank you!

Transforming global energy use to create a clean, prosperous, and secure low-carbon future.