

ENABLING VEHICLE CHARGING INFRASTRUCTURE

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STATES SHOULD GET READY TO...


- Deploy public charging stations
- Enable utility investment to accommodate EV chargers
- Enable private sector investment in charging infrastructure
- Streamline interconnections, permitting and compliance for EV chargers
- Manage EV charging to benefit all utility customers


CHARGING INFRASTRUCTURE: TODAY AND TOMORROW


Everything is changing...

- Today: 7 kW home charging, 50 kW fast chargers
- Tomorrow: Commitments for 150 kW fast chargers, up to 350 kW
- Retail built up around chargers like gas station? “Mega”-chargers at truck stops?
- Electrify America installing 150 DCFC network. Charging power levels up to 350kW will be available at every station
- Home charging is dominant now, but will not be as EV range grows and adoption moves to apartment dwellers



 ABB Terra HP high power EV charger can operate at powers of **up to 350 kW**

 It can recharge the largest EV batteries in **less than 15 minutes**

 **Future-proof** architecture serves current and future BEVs though scalability and interoperability.






ENABLING UTILITY INVESTMENT IN CHARGING INFRASTRUCTURE

Jurisdictions vary in their views on utility ownership of charging infrastructure.

- Utility investment in “**make-ready**” infrastructure is advisable everywhere, BUT...
- Utility incentives to invest in make-ready should be **performance-based**
- Utility investment in charging stations (not just make-ready) should focus on installations that are **unlikely to interest private sector** companies, like low-income multi-unit dwellings



NEEDED UTILITY INVESTMENT

Large new loads		Can require
	Residential Level 2 chargers (2.9 – 7.7 kW) • Each EV is like adding the load of a house	<ul style="list-style-type: none"> • Distribution transformer upgrades
	Workplace Level 2 chargers (7.7 – 16.9 kW) • Up to ~1 MW	<ul style="list-style-type: none"> • Distribution transformer upgrades • Feeders • Service panel upgrades
	Public high-speed (DCFC) charging depots • 50 kW – 2 MW	<ul style="list-style-type: none"> • Distribution transformer upgrades • Feeders • Service panel upgrades • Make-ready
	Transit bus barns, fleet vehicles • 5 – 30+ MW	<ul style="list-style-type: none"> • Distribution transformer upgrades • Feeders • Service panel upgrades • Make-ready
	Interstate truck stops • 20 – 40 MW	<ul style="list-style-type: none"> • Distribution transformer upgrades • Feeders • Service panel upgrades • Make-ready

ENABLING PRIVATE SECTOR INVESTMENT

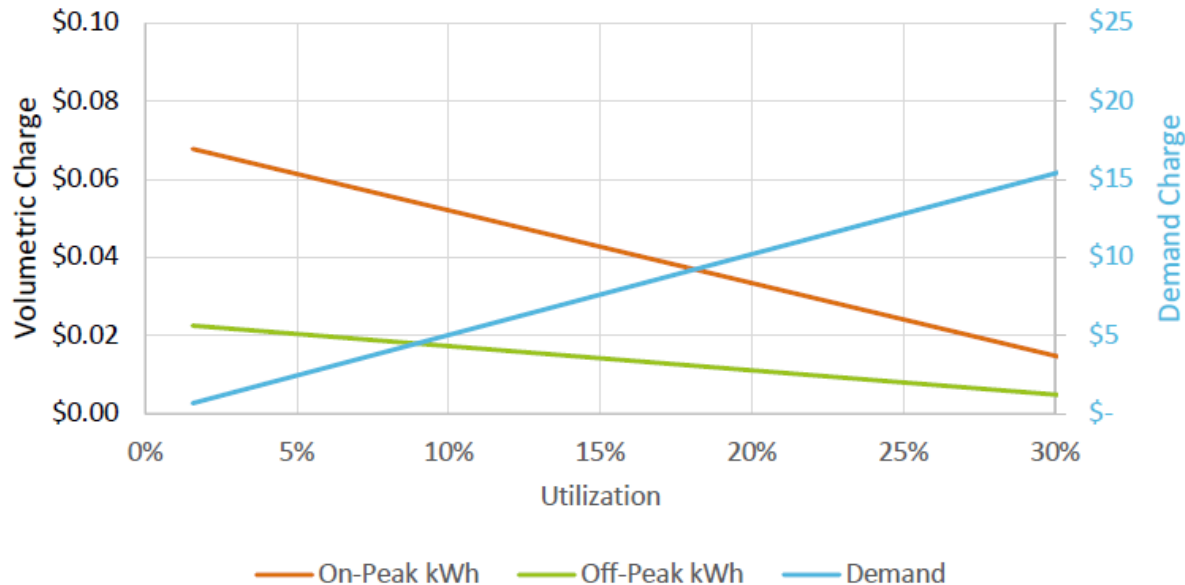
- **Public DCFC** are critical parts of the network and should be mostly built, owned & operated by the private sector.
 - Therefore it is critical that tariffs support public DCFC infrastructure.
 - But **most existing tariffs destroy the business case for investing in them:**
 - Use punishing, non-coincident demand charges
 - 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.**

PRIVATE-SECTOR FRIENDLY RATE DESIGN

- Charging should be **profitable** so that it is sustainable. But **demand charges make this impossible** when utilization rates are low.
- 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.

DCFC RATE DESIGNS COMPARED RMI'S PROPOSAL

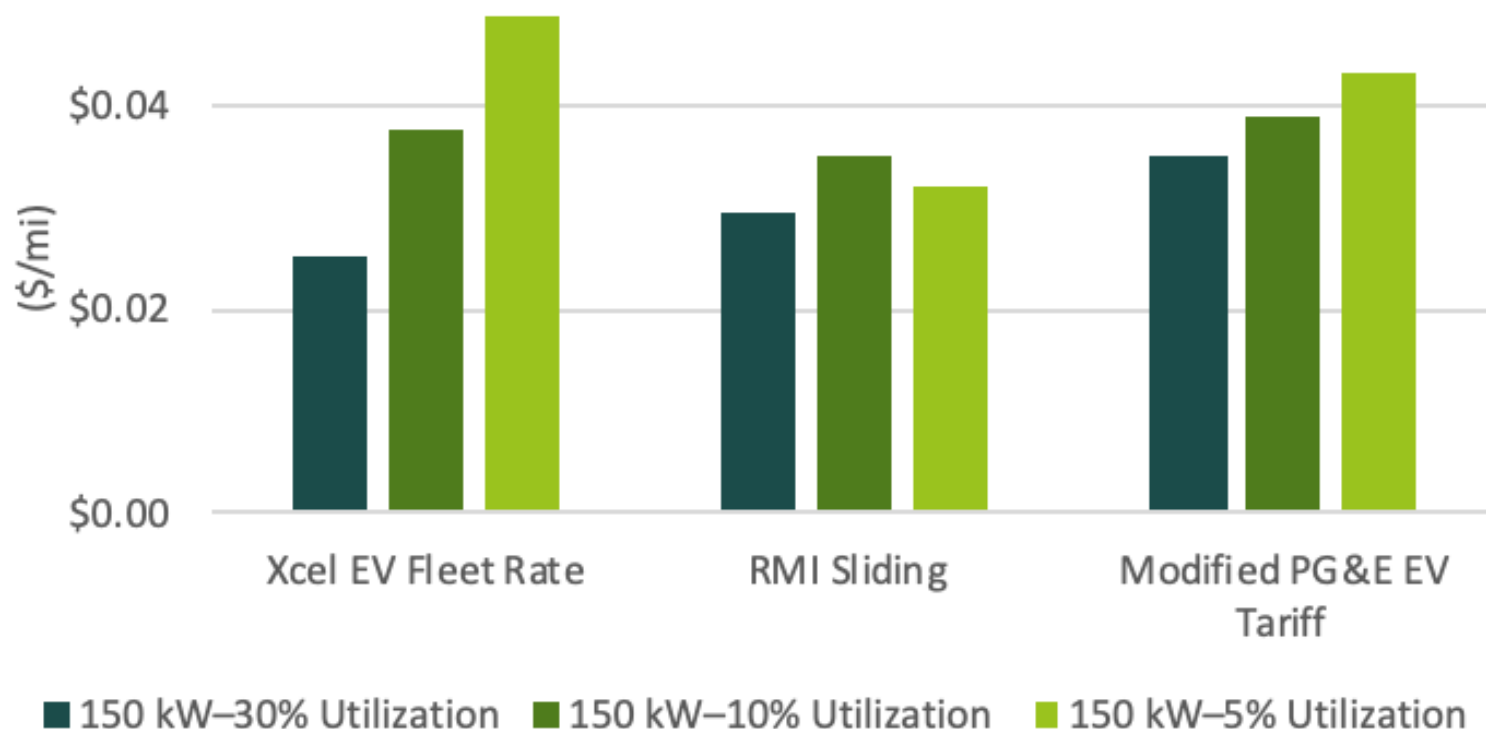
- Charges scale *as a function of utilization rates*.
- Fixed monthly charge: \$34.40/mo.
- Two-tier ToU rate:
 - On-peak (9 am – 9 pm) Decreases from \$0.068 to \$0.007
 - Off-peak (9 pm – 9 am) Decreases from \$0.022 to \$0.002
- Demand charge: Increases from \$0.677 to \$17.622/kW



DCFC RATE DESIGNS COMPARED

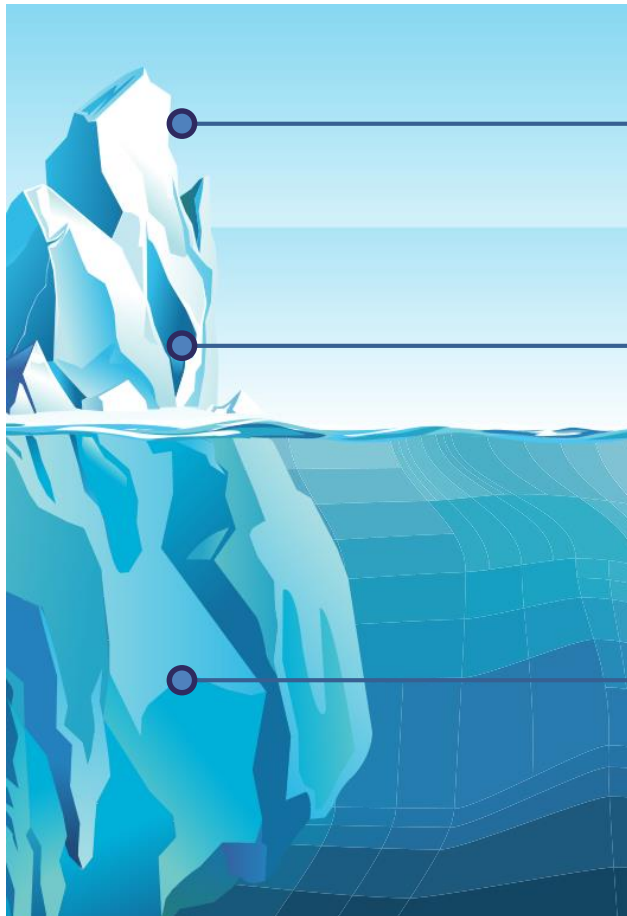
PUBLIC 150 KW DCFC

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



REDUCE SOFT COSTS OF DEPLOYING CHARGERS

Streamline interconnections, permitting and compliance



Procurement

- Charger Hardware
- Managed Charging Capability
- Contracts
- Software
- Grid Hosting Capacity
- Make-Ready Infrastructure

Requirements

- Payment System
- Measurement Standards Compliance
- ADA Compliance and Parking Requirements
- Dual Plug Types for DCFC
- Open Standards

Soft Costs

- Communication Between Utilities and EVSPs
- Future-Proofing
- Easement Processes
- Complex Codes
- Complex and Inconsistent Permitting Processes

REDUCING SOFT COSTS

What can government do?



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



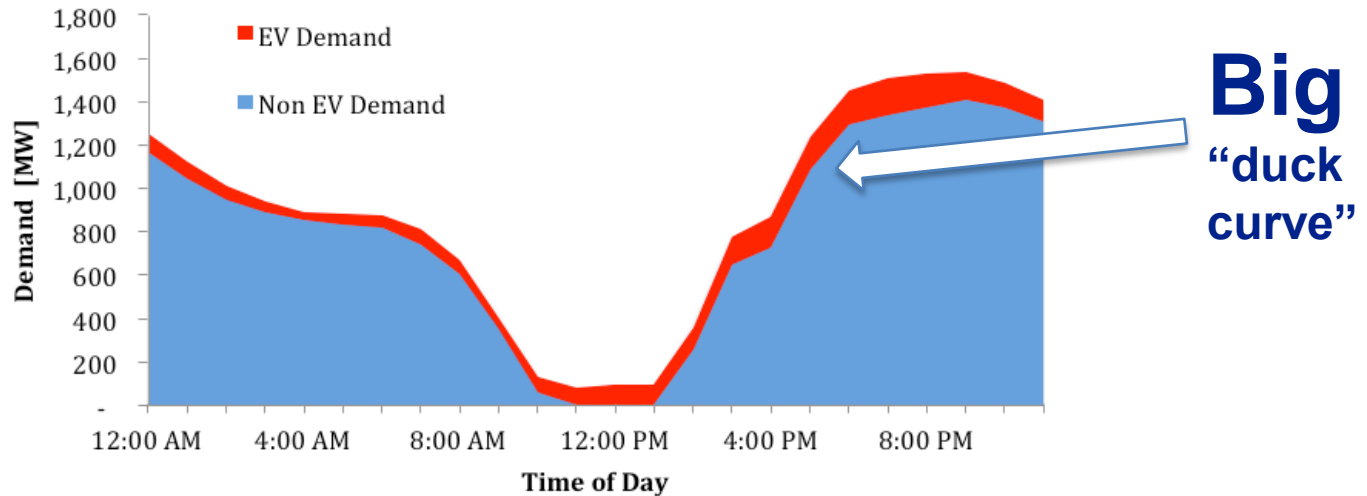
At the **state** level, permitting & utility interconnection can be streamlined (e.g., CA AB 2188) and ADA compliance can be clarified.



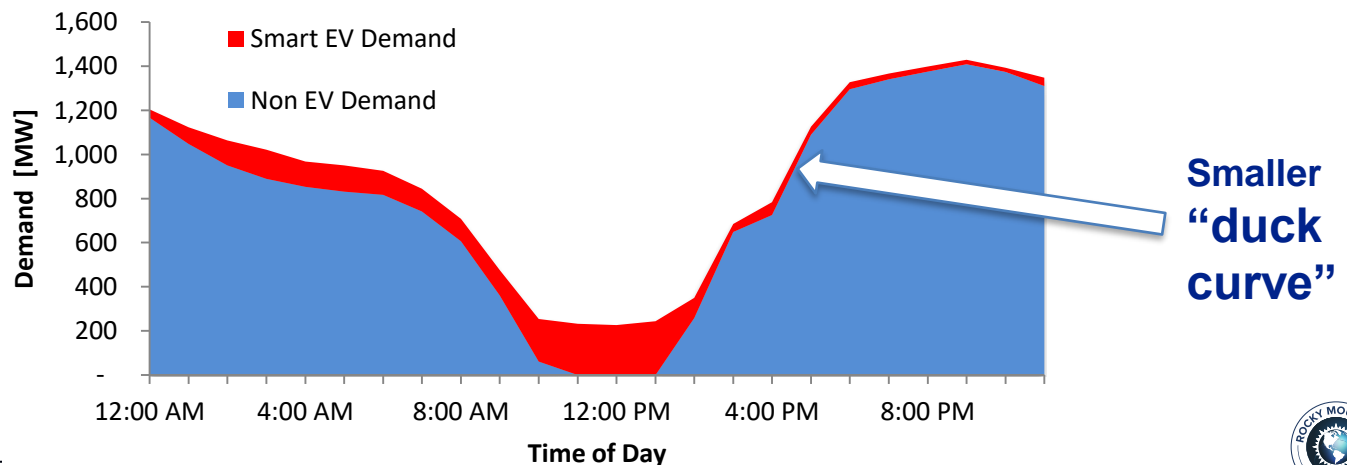
At the **municipal** level, building and planning departments can standardize codes and permitting requirements across jurisdictions, offer simple checklists for required documentation, and offer online permits.

MANAGED CHARGING

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



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



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

PLAN FOR THE FUTURE



- Potentially large loads on the way, **plan ahead** and “future proof” installations to minimize capital expenditures
- **Develop programs & rates** for charging stations today to enable private sector investment and support managed charging
- **Streamline and debottleneck** utility interconnections, permitting, & compliance
- **Get ready** for accelerated adoption tomorrow

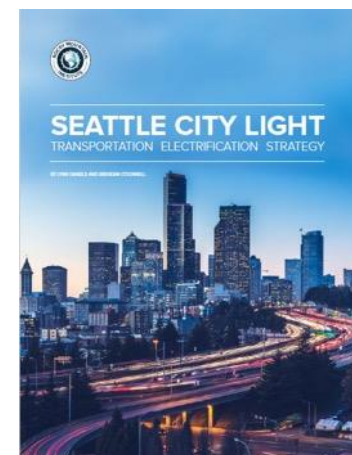
RMI EV-GRID REPORTS



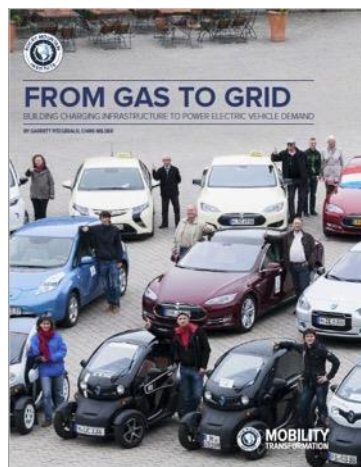
Reducing EV Charging Infrastructure Costs
(January 2020)



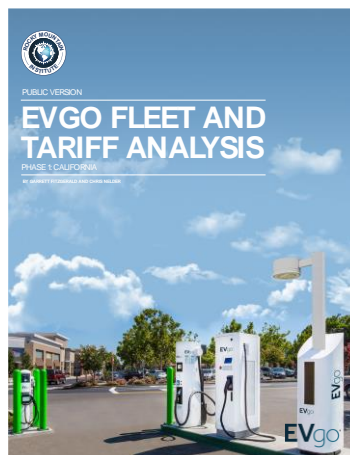
DCFC Rate Design Study
(Sept 2019)



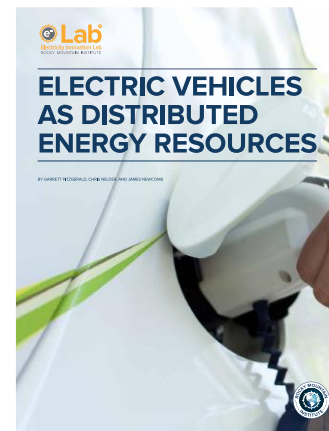
Seattle City Light TE Strategy
(Aug 2019)



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.