WESTERN GOVERNORS' ASSOCIATION

Examining Transmission and Distribution Infrastructure Across the West

Pacific Northwest
NATIONAL LABORATORY

Grid Capacity for EVs at Scale: Phase I+II

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USDRIVE
DRIVING RESEARCH AND INNOVATION FOR VEHICLE EFFICIENCY AND ENERGY SUSTAINABILITY

WGA Webinar

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U.S. DEPARTMENT OF ENERGY BATTELLE

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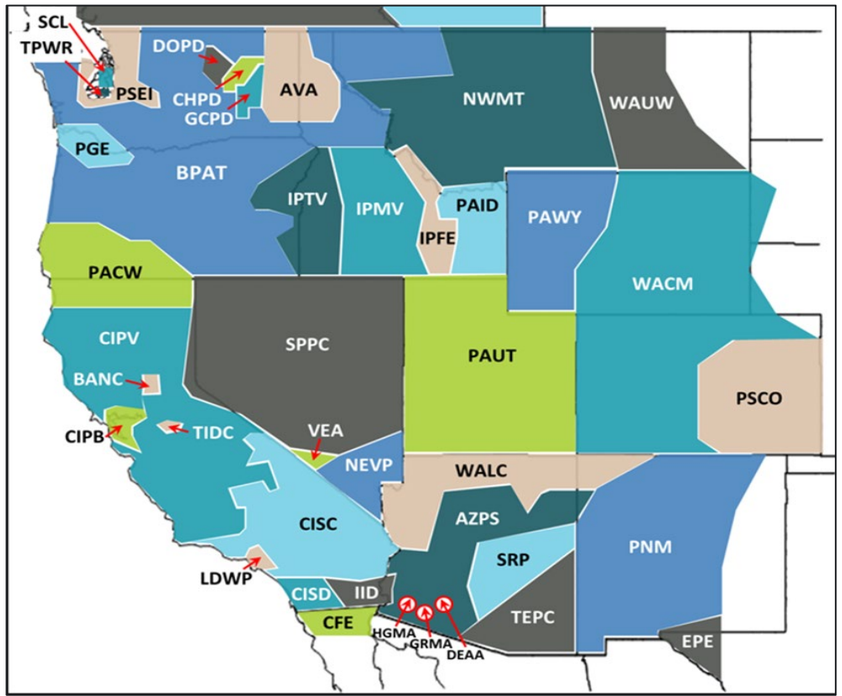
Purpose of the WECC Study, Phase I

As adoption of EVs is accelerating, provide insights into the limitations of the US bulk power grid to serve the new EV load

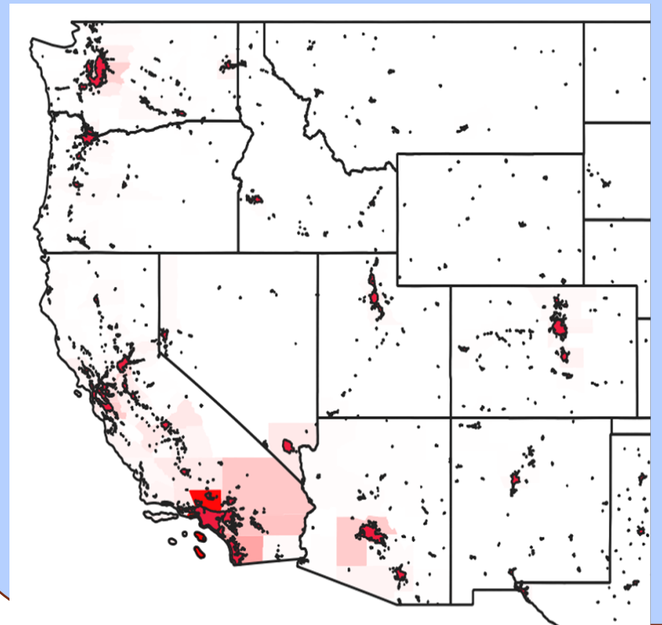
Question 1: Are there sufficient resources in the US bulk power grid to provide electricity to the projected EV fleet?

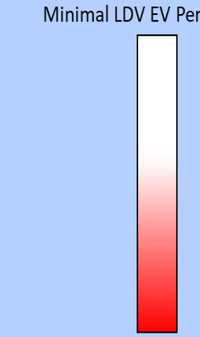
Question 2: How will the generation mix dispatch be impacted by the additional EV load?
- what are the expected production cost impacts?
- what are the challenges and benefits to grid operations

WECC



2028 EV adoption : 9 mill. (LDV)
70 K (MDV)
94 fast chargers

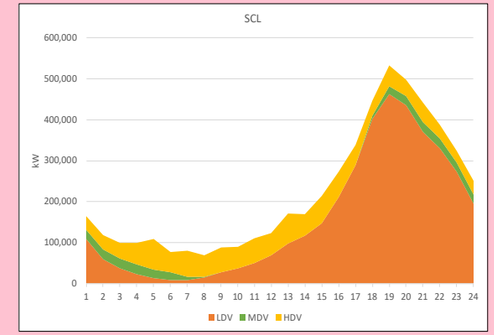




Load Profile
Seattle

SCL

	LDV	MDV	HDV
No of vehicles (LDV, MDV) and charging events (HDV)	259,532	1,569	
% of WECC vehicles	3%	2%	



Conclusions of Study, Phase I

Question 1: Are the sufficient resources in WECC to provide electricity to the projected EV fleet?

Answer: YES. high scenario with national fleets of ~24M LDV, 200k MDV, 150k HDV are not expected to cause resource adequacy issues in the WECC

EV carrying capabilities of the WECC: For 2028, we estimated that at:

- for unmanaged charging (HHND): 30-37 M LDVs (plus 200k MDV, 150k HDV)
- for managed charging: 65+ M LDV (plus 200k MDV, 150K HDV)

we are likely to encounter limiting resources to further accommodate more EVs, unless more generation and transmission is built

Conclusions of Study, Phase I

Question 2: How will WECC's generation mix be impacted by additional EV load?

Answer:

1. **Production cost:** at high EV penetration (24M) increases on average 13%, in CA highest: 22%, Arizona lowest: 3%
2. **Generators contributing to EV charging:**
    1. primarily natural gas units (CC, CT) with CC carrying the bulk, CT are used during peak periods.
3. **Unmanaged "evening charging" stresses the system**
    1. **by setting new system peaks**
    2. **exacerbates Duck Curve:**
4. **EV loads reduces Renewables curtailments 70% or more (WECC)**
5. **Managed charging increases the EV hosting capability, avoids curtailment and reduced Duck Curve**

Scope for EV@Scale: DISTRIBUTION, Phase II

- Questions Addressed:
  - **when** and **where**, **which EVs(LDV, MDV, HDV)**, and **how** Evs impact Distribution ?
  - Understanding on what the EV hosting capabilities are under various assumptions given
    - ✓ Utilities' infrastructure upgrade assumptions for reasons other than electrification of transportation?
    - ✓ Value of managed charging strategies
    - ✓ Other non-wires solutions (DER)
  - Incorporate EV hosting capability methods into Distribution System Planning
- Outcomes and products
  - Routines/procedures for utilities to perform Distribution System Planning with EV considerations
  - EV (LDV) adoption model by neighborhoods relevant for distribution planning, incentive analysis, equity studies
  - Some insights from case-studies with SCE, + ???

Example of how to determine EV hosting capability: Phase II

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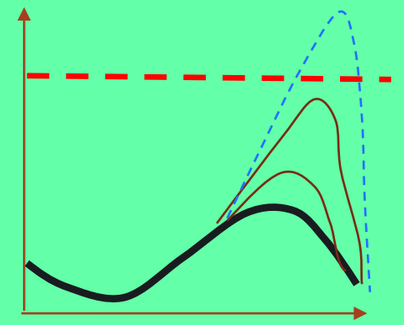
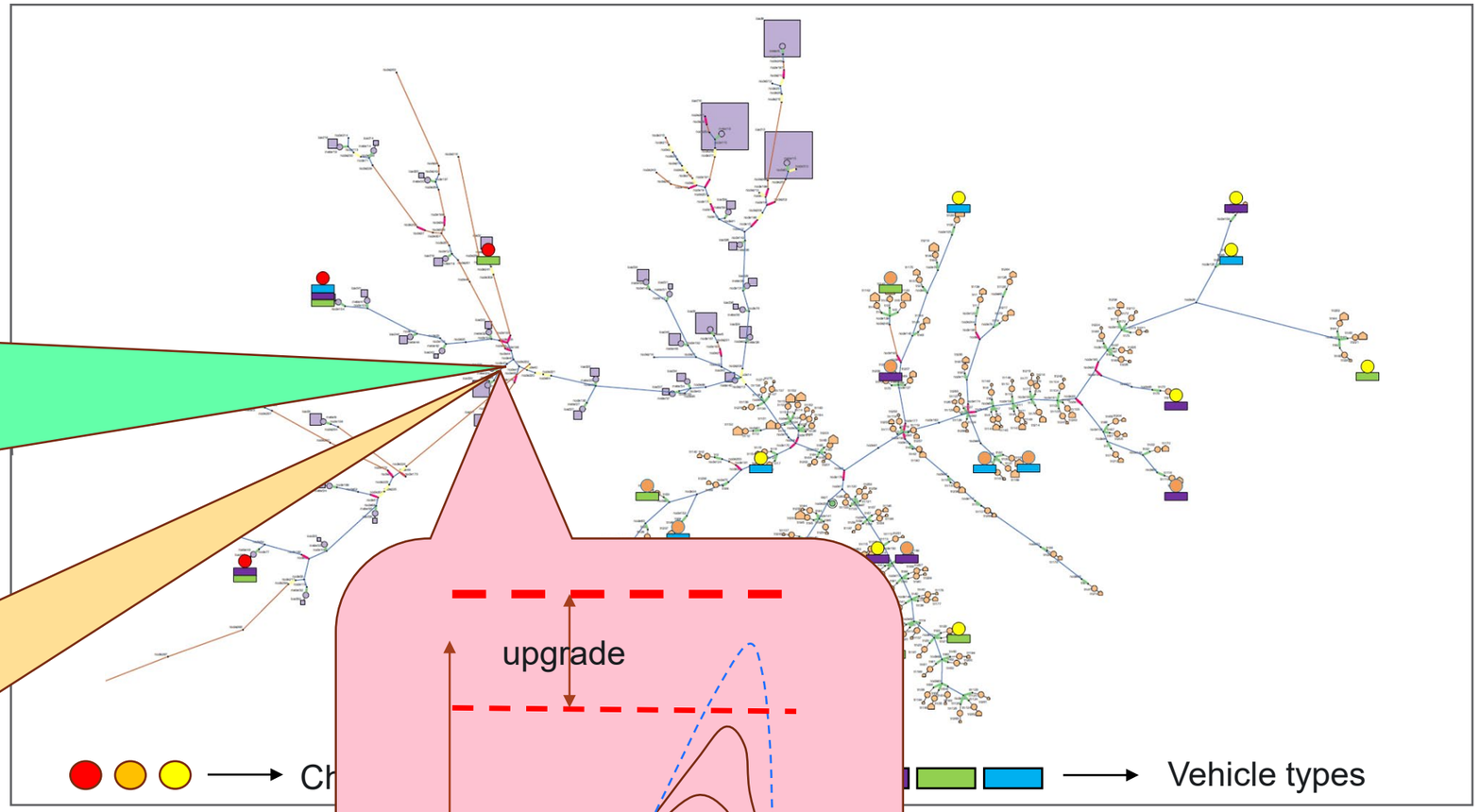
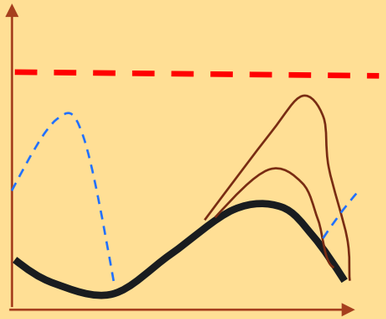
Problem



Thermal limits violation



Solution 1



Charge management

Solution 2

Some policy questions for considerations

- Bulkpower:
  - Do IRP study look far enough out into the future? Or are they too myopic to exclude EV penetration targets?
  - What are the right wholesale market rules to create incentives for Smart Charge Management?
- Distribution System
  - What are the retail price signals for inducing smart charge management. Would TOU schedules be sufficient?
  - what are the minimum technology requirements on Evs and charging stations to assure future-proofing technologies?
  - What is the value of Smart Charging?
- Market adoption of EVs
  - What are the right incentives for EV adoption and Charging Infrastructure development from a state as well as utility perspectives?

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ENERGY DEVELOPMENT

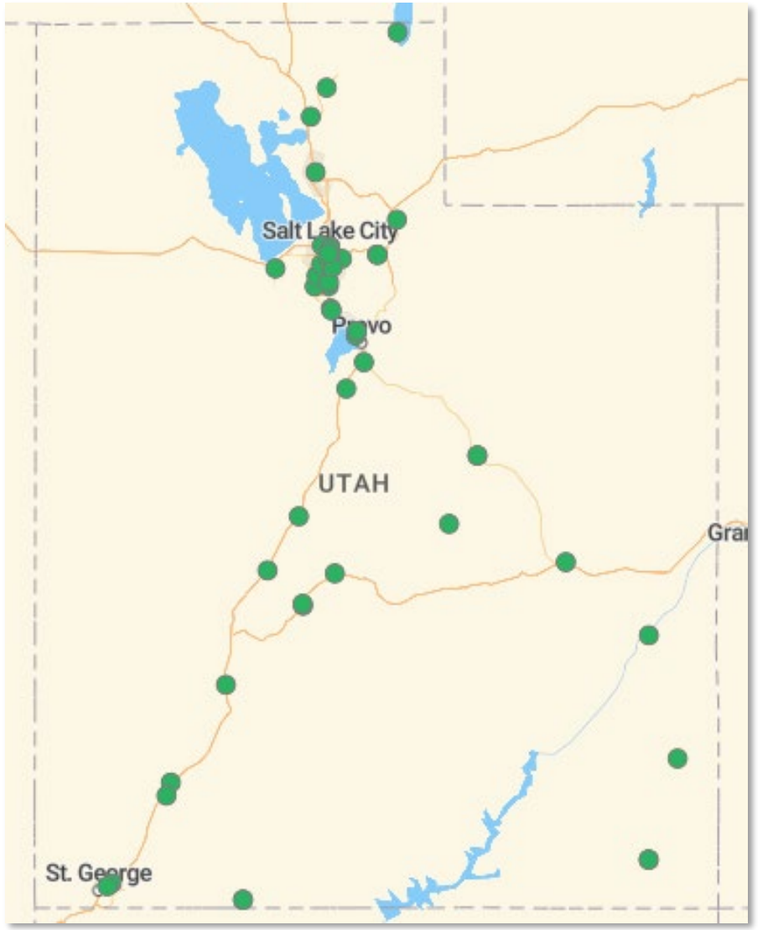
EV Infrastructure Planning

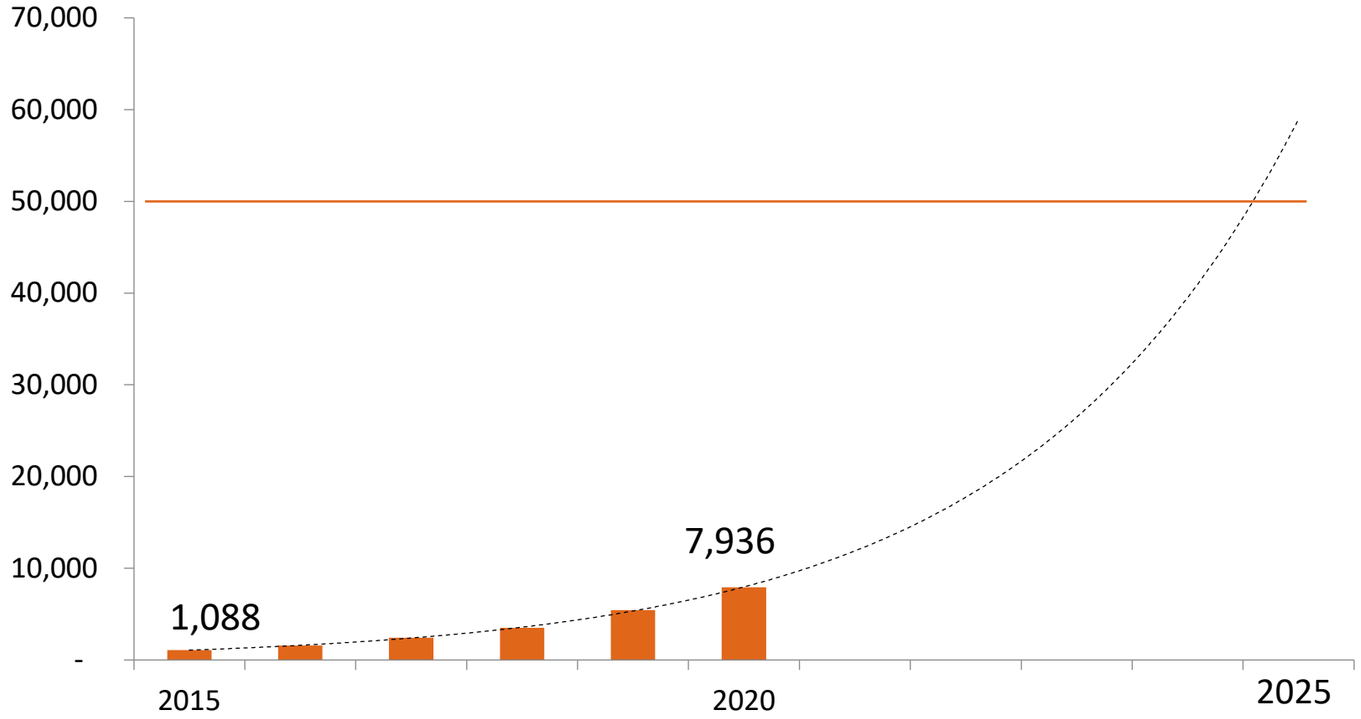
Western Governors' Association

February 11, 2021

Annie Schneider, Senior Program Specialist, Transportation

EV Market





DCFC — 142 outlets
L2 — 1,177 outlets

Image source: afdc.energy.gov, vehicle data from the Utah Tax Commission

Funding Sources

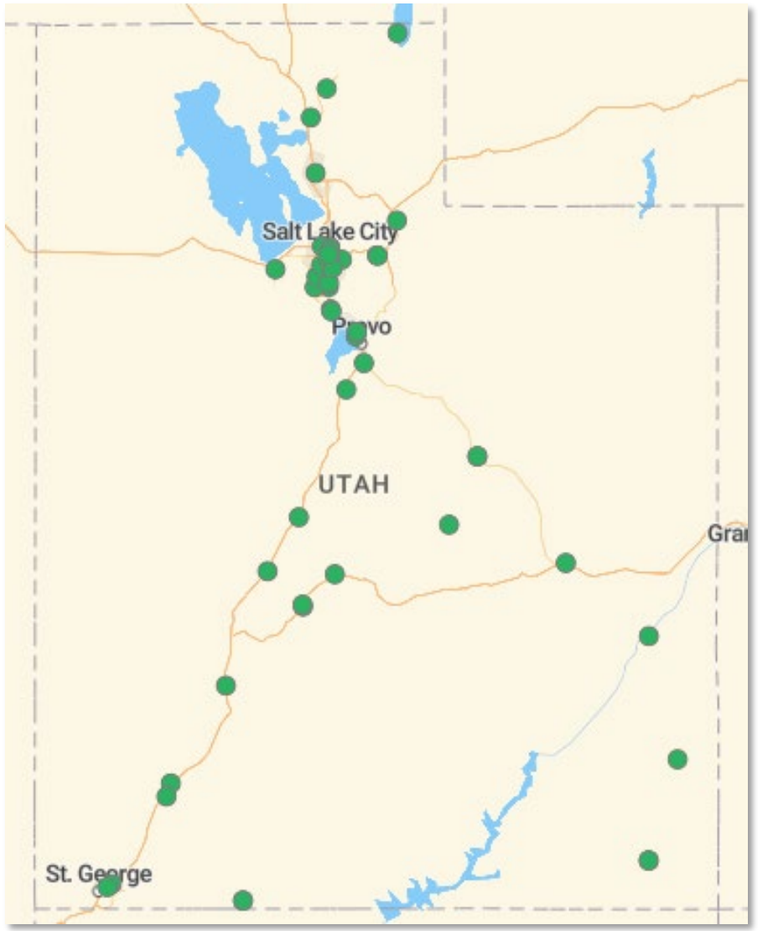


Image source: afdc.energy.gov

- **State-funded programs**
  - Workplaces and State facilities
- **VW settlement funds**
  - DCFC
- **Utility programs**
  - Grants and incentives

Partnerships

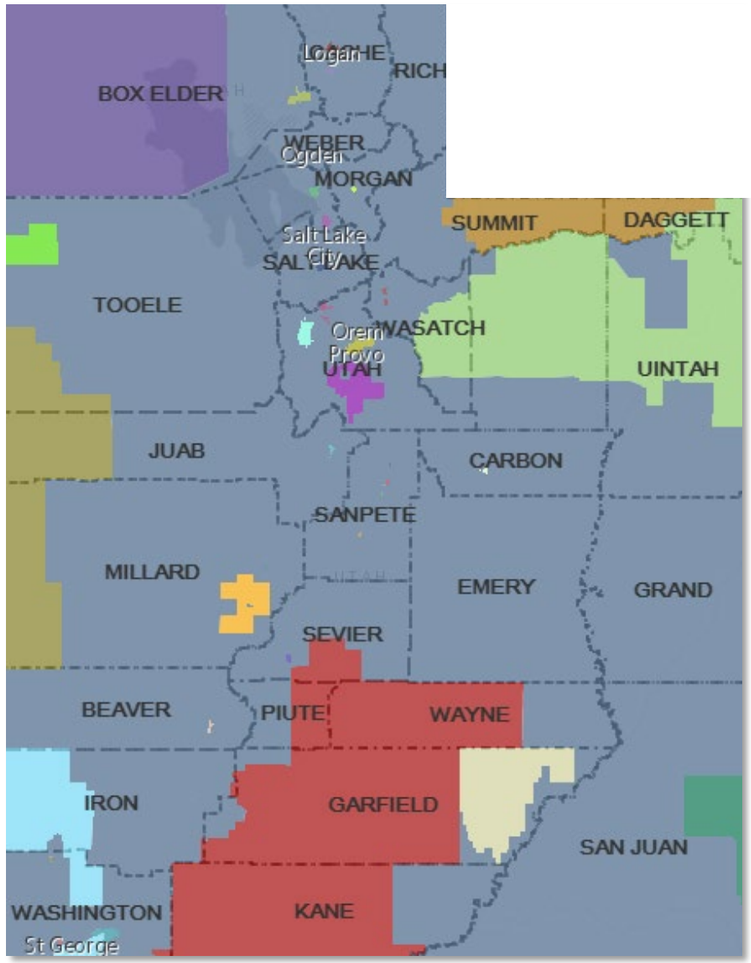


Image sources: Utah EV Master plan, 2019 8 state MOU

Utah's Approach

Image source: Utah Clean Cities

- Be proactive
- Encourage more charging infrastructure
- Build partnerships

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Thank you!

Questions?

Learn more at **energy.utah.gov**

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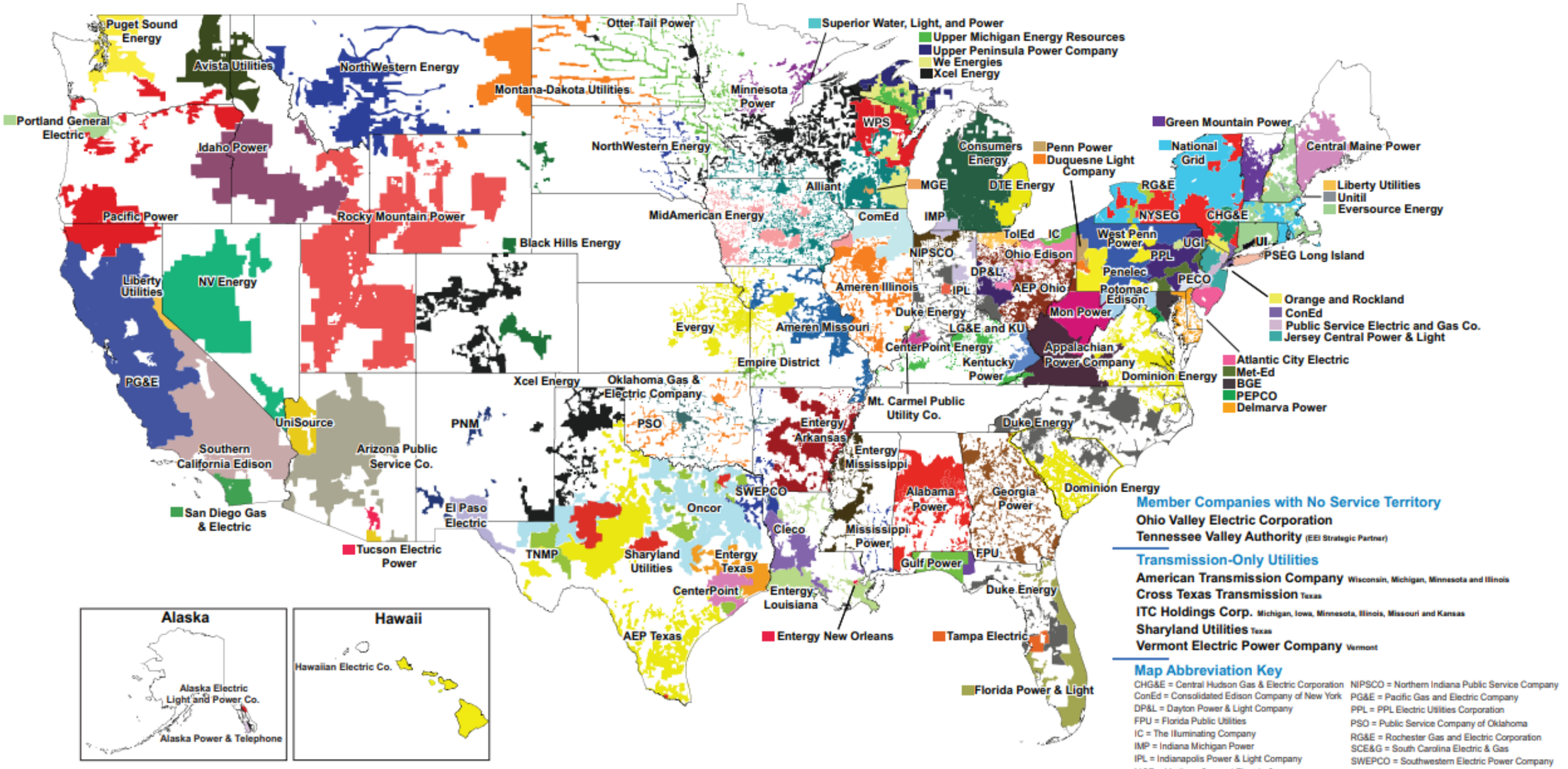
EEI U.S. Member Company Service Territories



Member Companies with No Service Territory

- Ohio Valley Electric Corporation
- Tennessee Valley Authority (EEI Strategic Partner)

Transmission-Only Utilities

- American Transmission Company — Wisconsin, Michigan, Minnesota and Illinois
- Cross Texas Transmission — Texas
- ITC Holdings Corp. — Michigan, Iowa, Minnesota, Illinois, Missouri and Kansas
- Sharyland Utilities — Texas
- Vermont Electric Power Company — Vermont

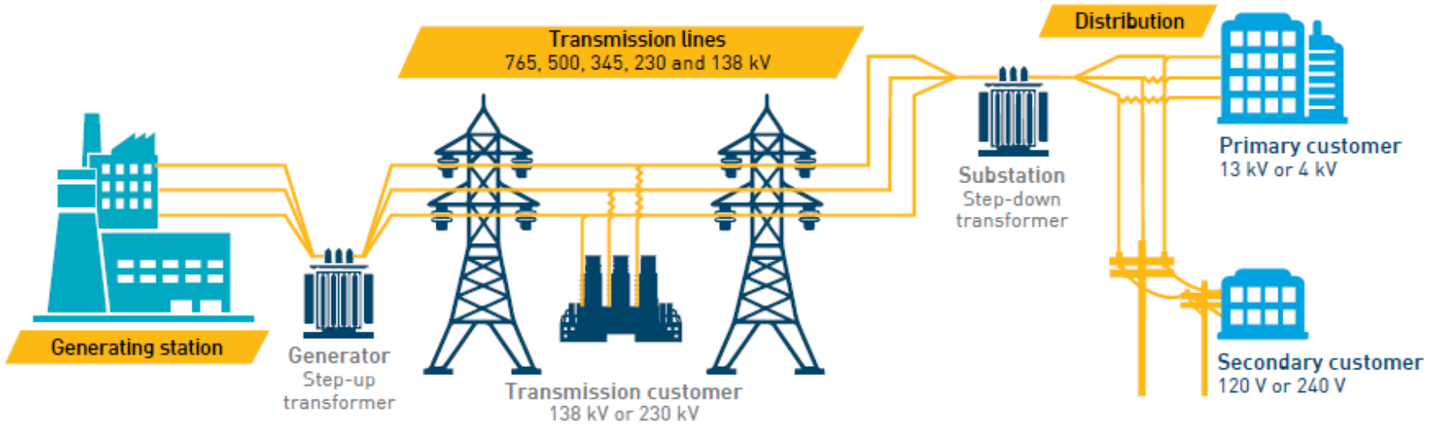
Map Abbreviation Key

CHG&E = Central Hudson Gas & Electric Corporation
ConEd = Consolidated Edison Company of New York
DP&L = Dayton Power & Light Company
FPU = Florida Public Utilities
IC = The Illuminating Company
IMP = Indiana Michigan Power
IPL = Indianapolis Power & Light Company
MGE = Madison Gas and Electric Company
NYSEG = New York State Electric & Gas Corporation
NIPSCO = Northern Indiana Public Service Company
PG&E = Pacific Gas and Electric Company
PPL = PPL Electric Utilities Corporation
PSO = Public Service Company of Oklahoma
RG&E = Rochester Gas and Electric Corporation
SCE&G = South Carolina Electric & Gas
SWEPCO = Southwestern Electric Power Company
TolEd = Toledo Edison
UI = The United Illuminating Company
WPS = Wisconsin Public Service Corporation

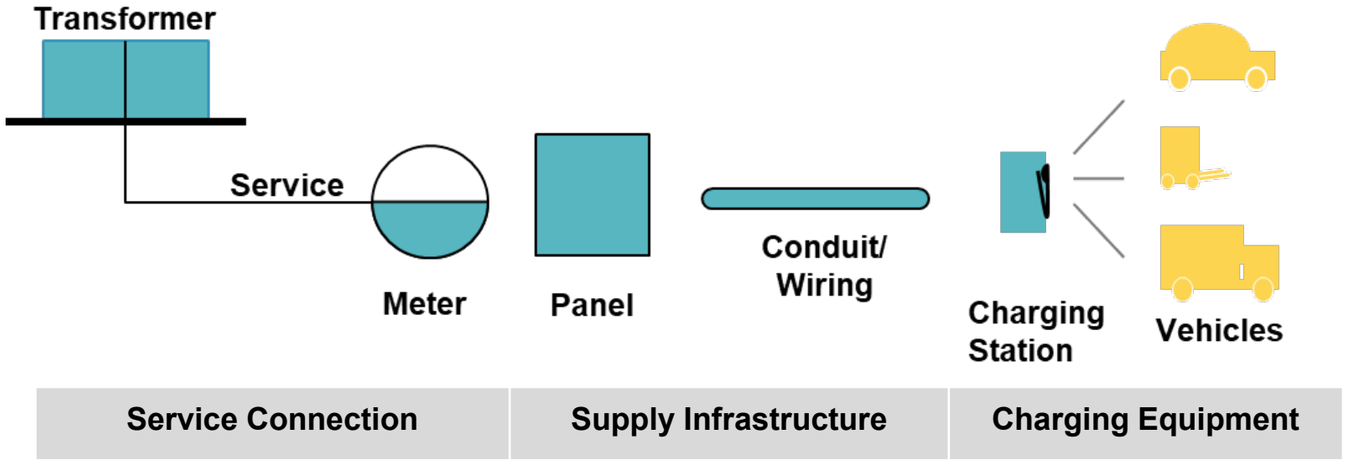
Produced by Edison Electric Institute. Data Source: ABB, Velocity Suite. October 2020

Energy Grid and EV Charging Infrastructure

Energy Grid



Charging Infrastructure



Source: PG&E, *Take Charge: A Guidebook to Fleet Electrification and Infrastructure*

Key Messages

- **Clean energy:** electric transportation (ET) is key to reducing emissions from transportation
- **Electric company roles:** deploying infrastructure, expanding access, grid integration
- **Collaboration needed:** energy grid is dynamic and evolving; stakeholders key to planning for ET at scale