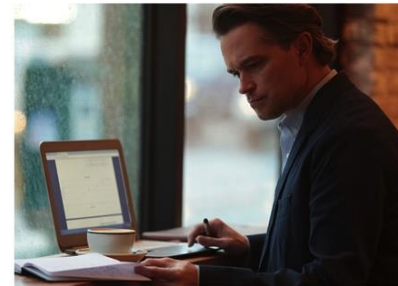


# DOE EV Future Managing Load

November 5, 2020  
James Campbell  
Director of Innovation and Sustainability Policy

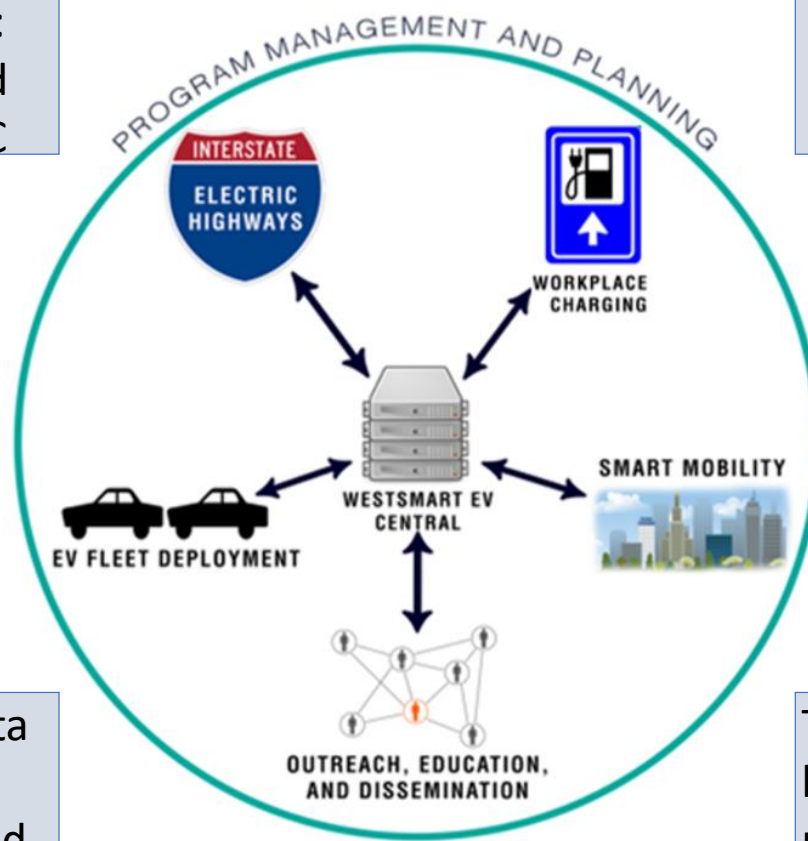


# WSEV Project Approach

Task 1 Electric Highways: 1,500 miles of electrified interstate with 65+ DCFC

Task 3 EV Adoption Pilots: Incentives for 200+ EV purchases

Task 5 WSEV Central: Data collection, analysis, modeling, lessons learned



Task 2 Workplace Charging: Workshops and 600+ L2 at work locations

Task 4 Smart Mobility: All electric solutions in urban areas

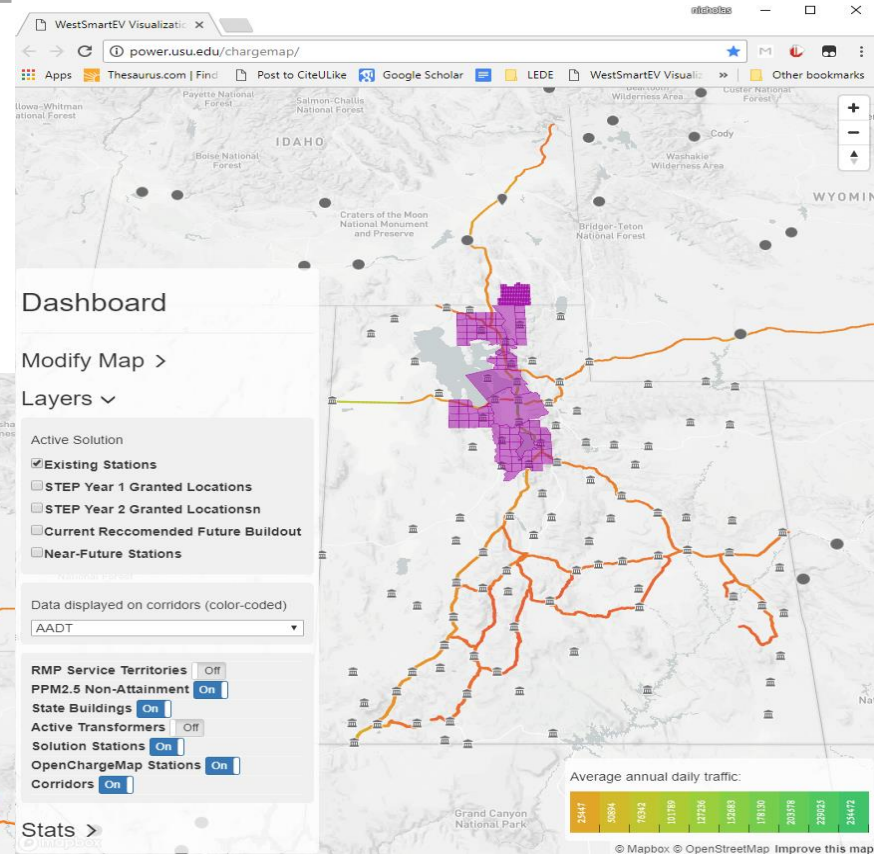
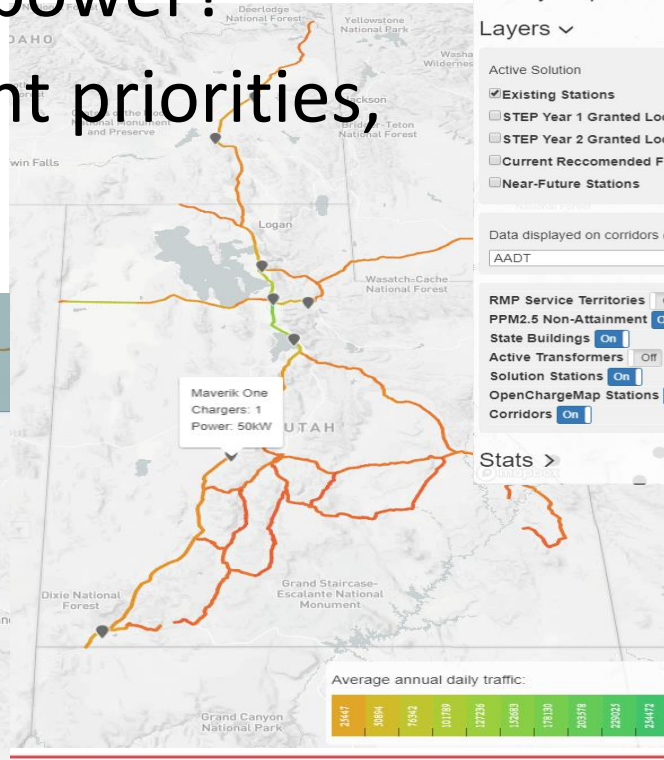
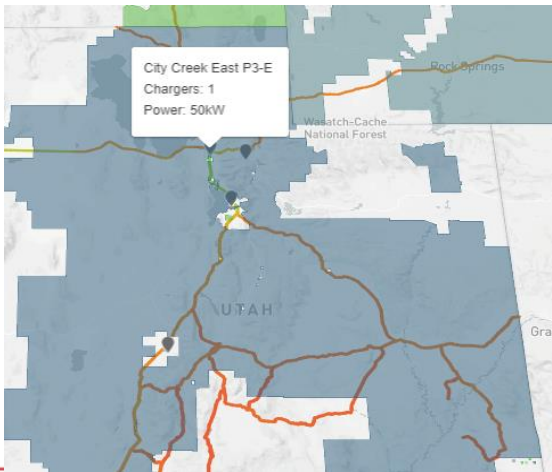
Task 6 Outreach: Lessons learned, dissemination, materials, workshops

## Partners



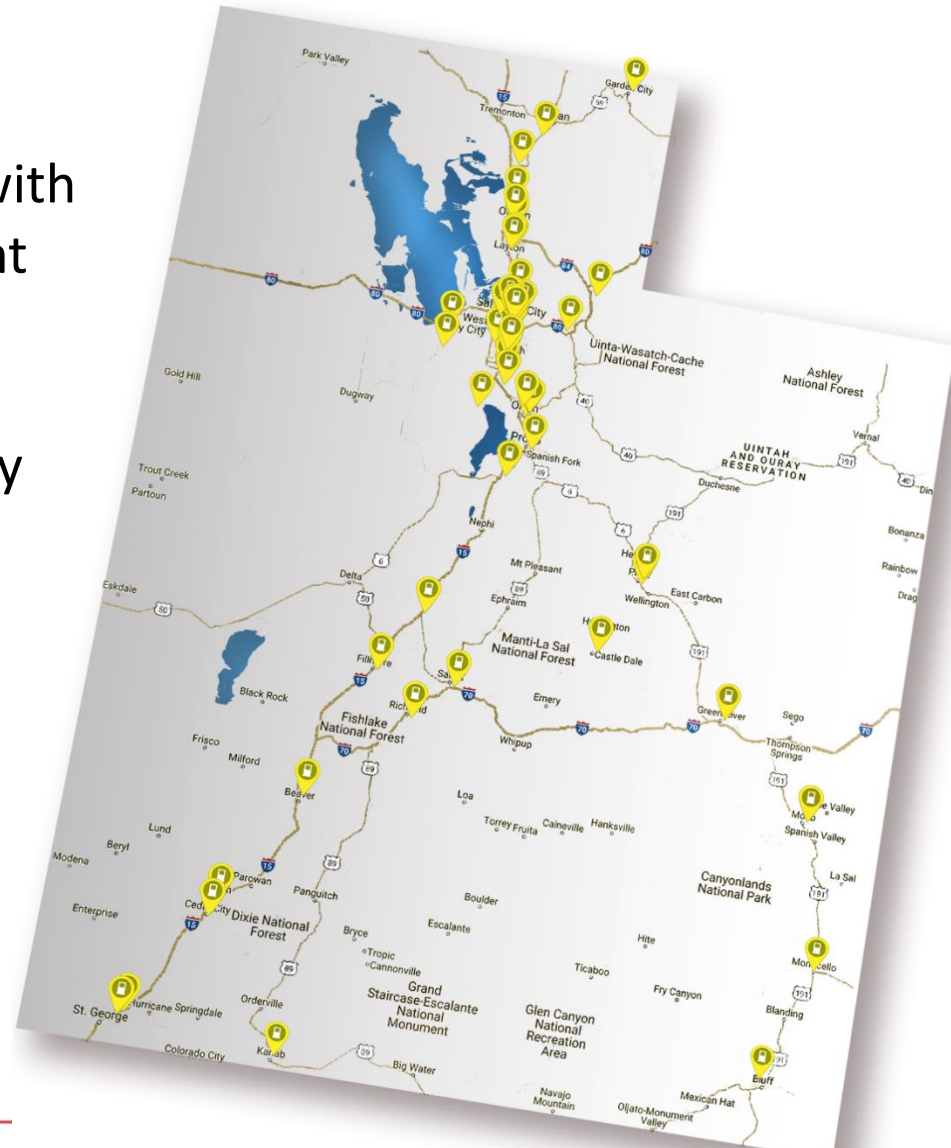
# Decision support for charger buildout

- **Where:** Which specific locations along corridors?
- **How:** Grid connections, how many, how much power?
- **When:** Deployment priorities, timing?



# Chargers throughout the state

- RMP funding coupled with DOE and VW Settlement
- Partnered with UDEQ, UDOT, Maverik, Electrify America



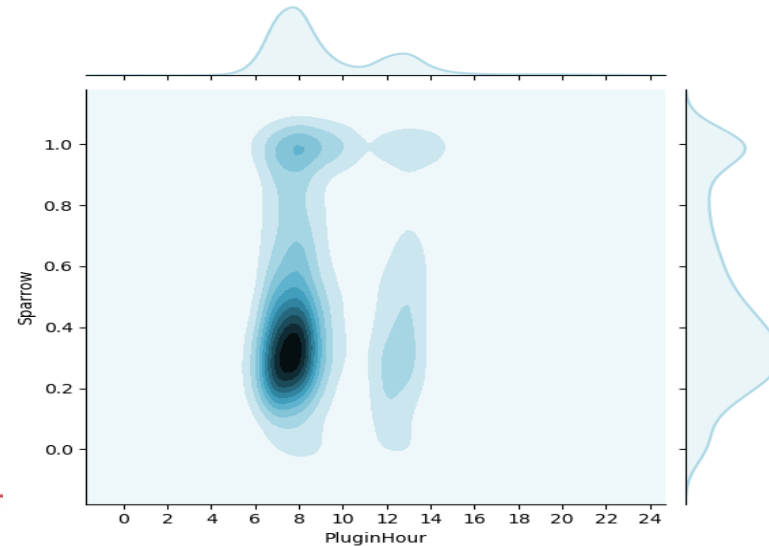
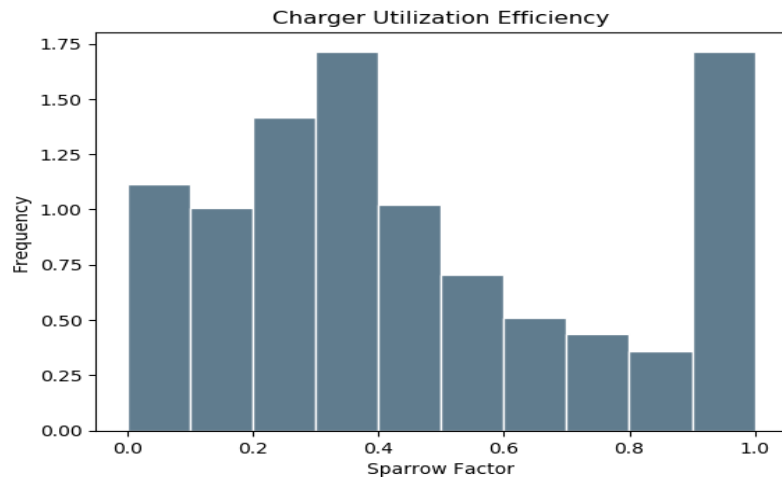
- Installed over 65 DC Fast Chargers
- Installed over 1,600 Level 2 Chargers primarily at workplaces

# Workplace Charging Case Study: Packsize

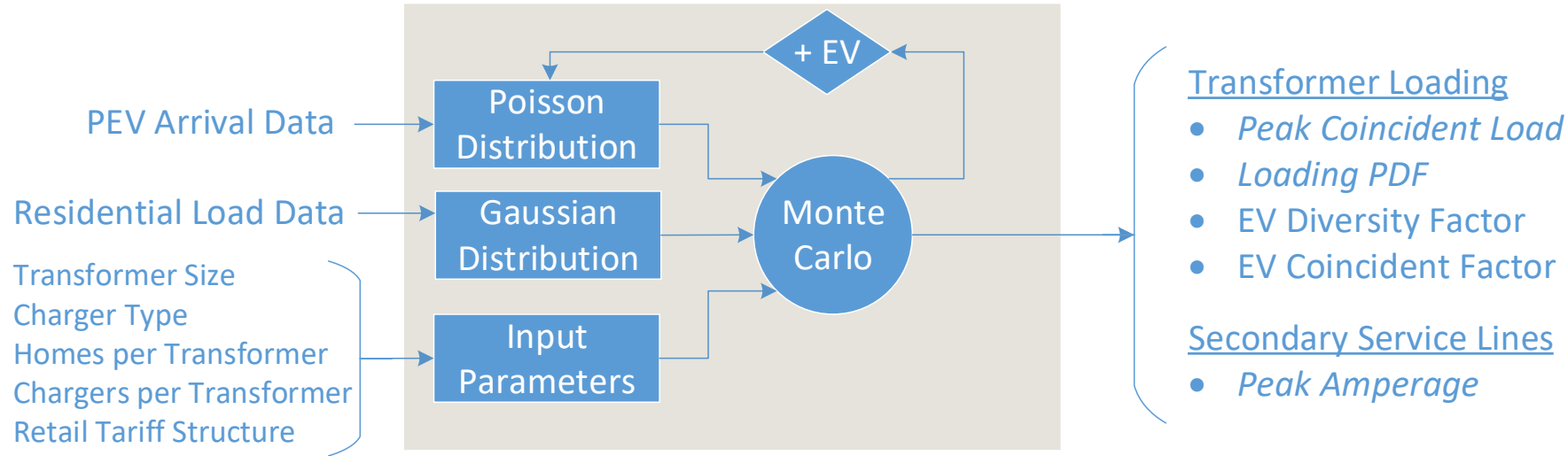


- Over 50 chargers
- 1/3 of all employees have EVs
- Transformer monitors installed
- On site solar reduces some peak load w/ east exposure

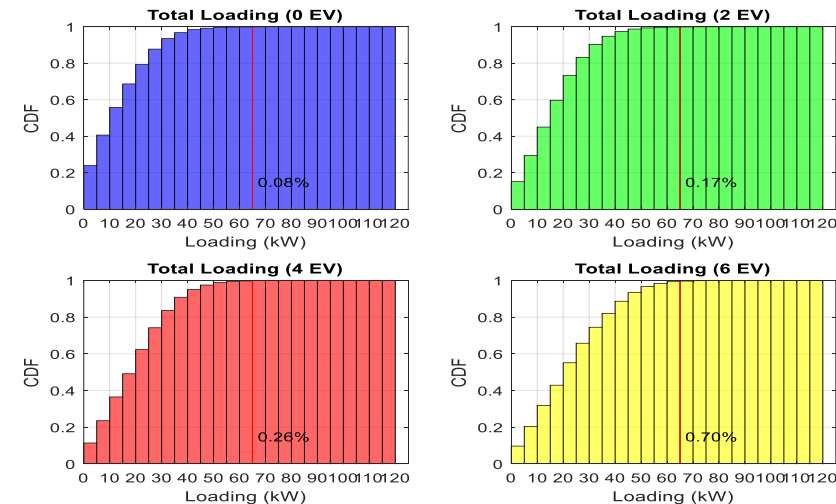
In order to measure the EV charger utilization efficiency, we define sparrow factor as the ratio of time spent charging ( $t_{on}$ ) to time spent connected ( $t_{total}$ ).



## Probabilistic PEV Grid Impact Analysis Tool



- Results show that even at high residential EV charger integration, the utility transformer overload probability is trivial (0.7% for 6 chargers in 11 homes)
- TOU tariffs would reduce transformer overload probability
- Results achieved using INL EV Data



## Depot charging

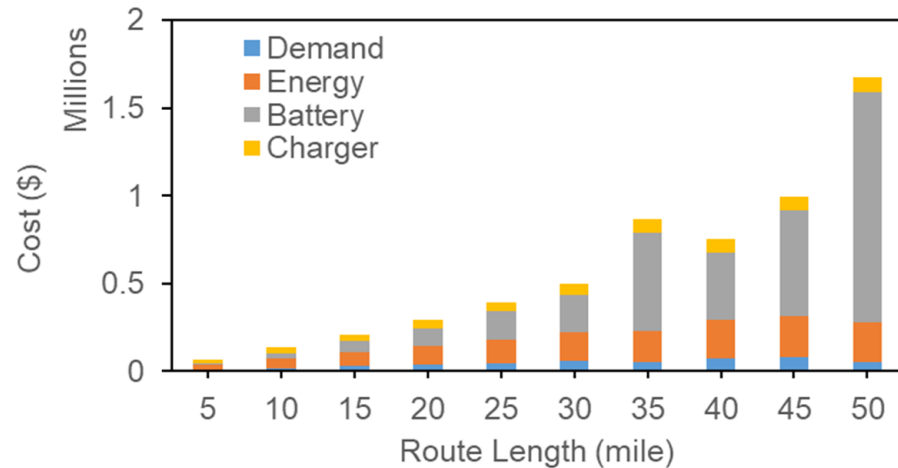


OR

## On-route charging



Total cost with frequency 4/h



- Numerical studies demonstrate the benefit of on-route charging
- Depot charging becomes economical when battery price is greatly reduced

# Smart Mobility: Electric Buses



UTA took Goldilocks approach for charging

Combination of on-route and depot charging

UTA has RFP for 100 ebuses (with other agencies)



NEW FLYER CONNECT\*

5 ebuses in SLC

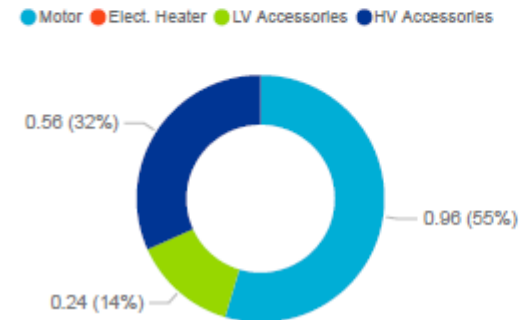


DATE	BUS	MODEL	TRIP	ESS CAPACITY	EV MAX SOC	EV MIN SOC
Wed, Sep 02, 2020	18152	XE40	6	388 kWh	90.4%	5%

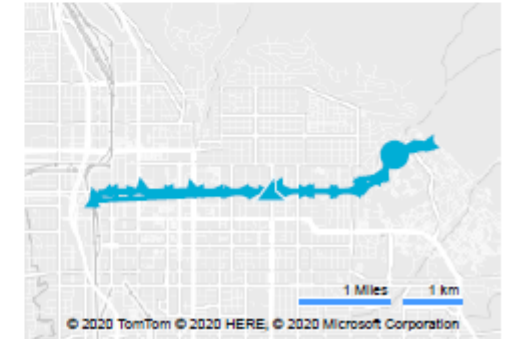
## TRIP DETAILS

02:57 pm Start Time	22.06 Mileage (miles)	76.40 SOC MAX (%)	1.76 Energy Consumption (kWh/mile)
05:48 pm End Time	88.33 Average Temperature (°F)	66.00 SOC MIN (%)	13.63 Energy Consumption (kWh/hour)
02:50:48 Duration	7.75 Average Speed (mph)	38.80 Energy Used (kWh)	

## ENERGY CONSUMPTION BY SUB-SYSTEM (kWh/mile)



## ROUTE



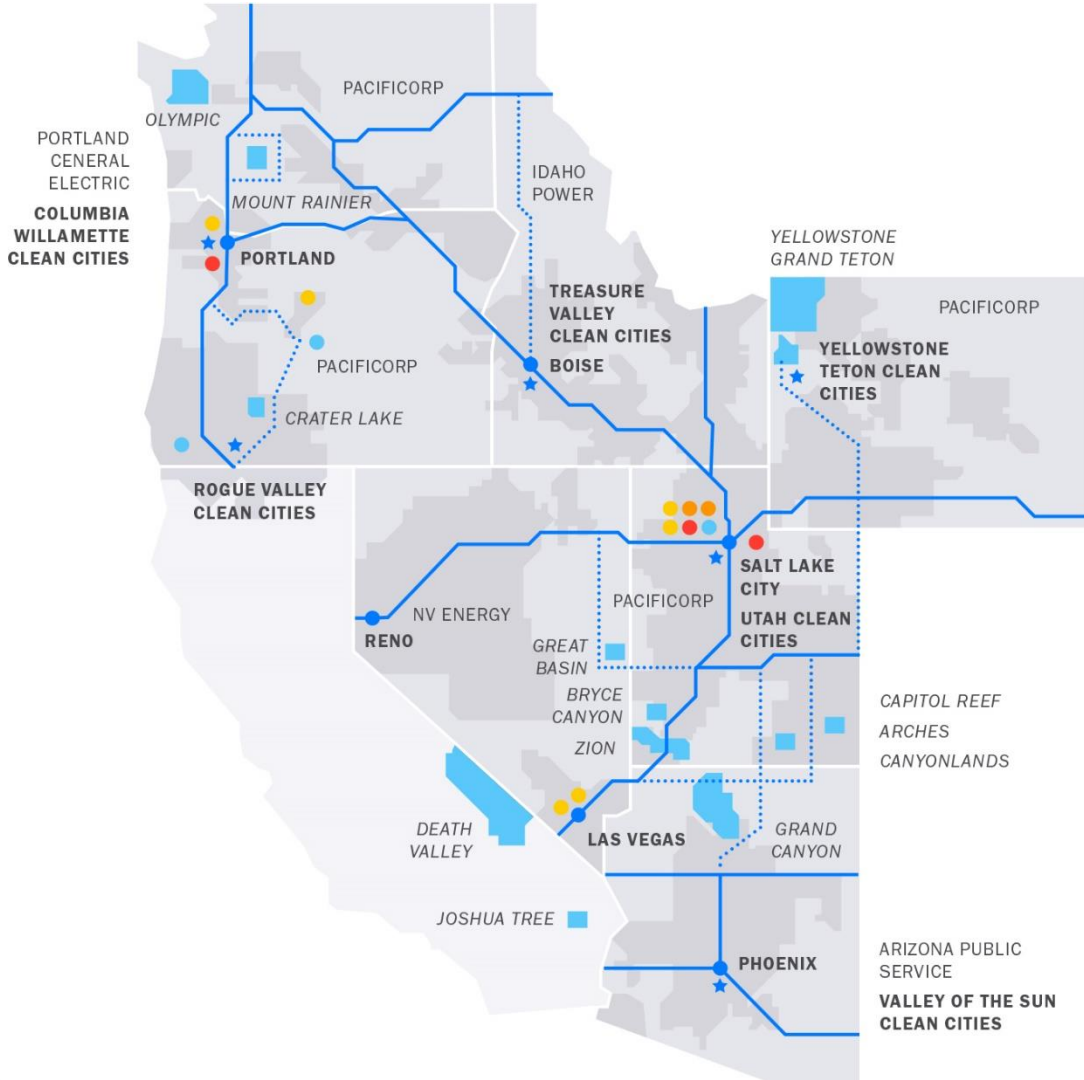
Potential for Intermodal Hub Concept

## Conclusions

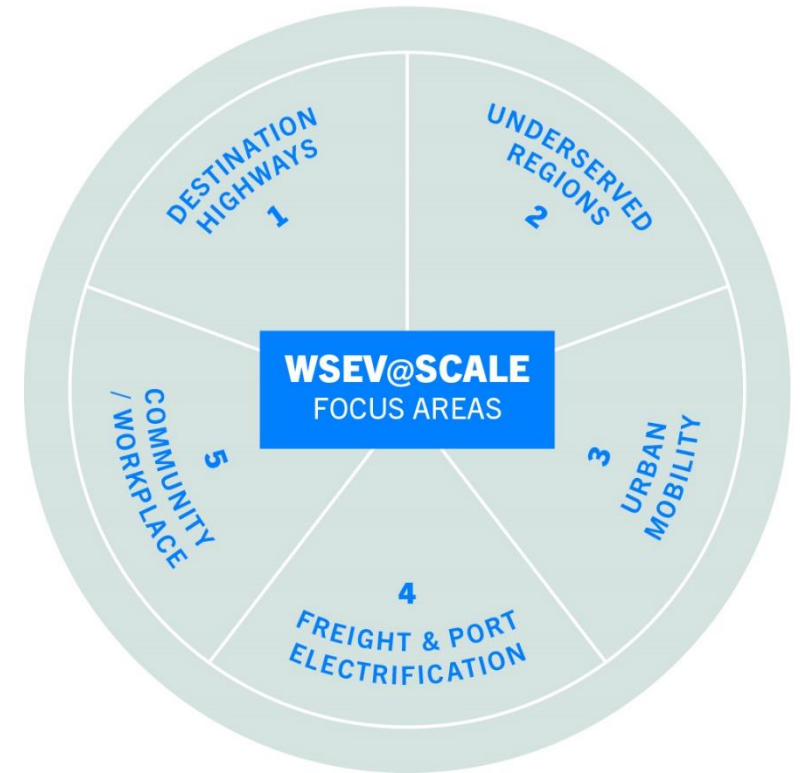
- Data driven approach is essential for infrastructure development
- Workplace Charging good solution for daily commuters
- Electric buses use both on-route and depot-co locate infrastructure
- Current data from EV users and initial TNC data indicate limited public charging
  - Early adopters
  - Need to address social equity
- Needs for broad adoption
  - Expanded public charging
  - Delivery trucks
  - Reduced cost for DCFC



# Next Phase

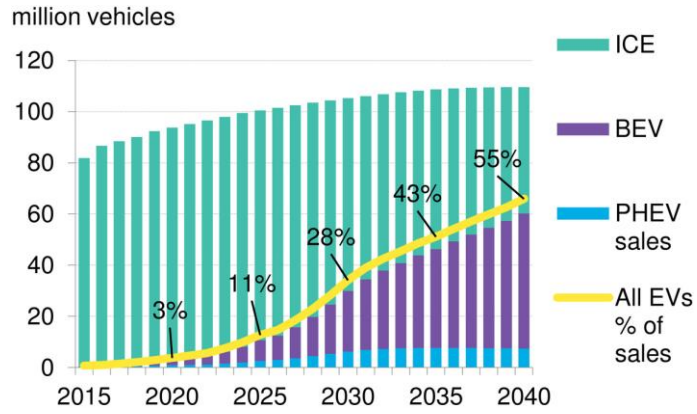


*\$6.6 Million DOE Award*



# Intermodal Hub Project

# Why Intermodal Hub



Source: Bloomberg New Energy Finance

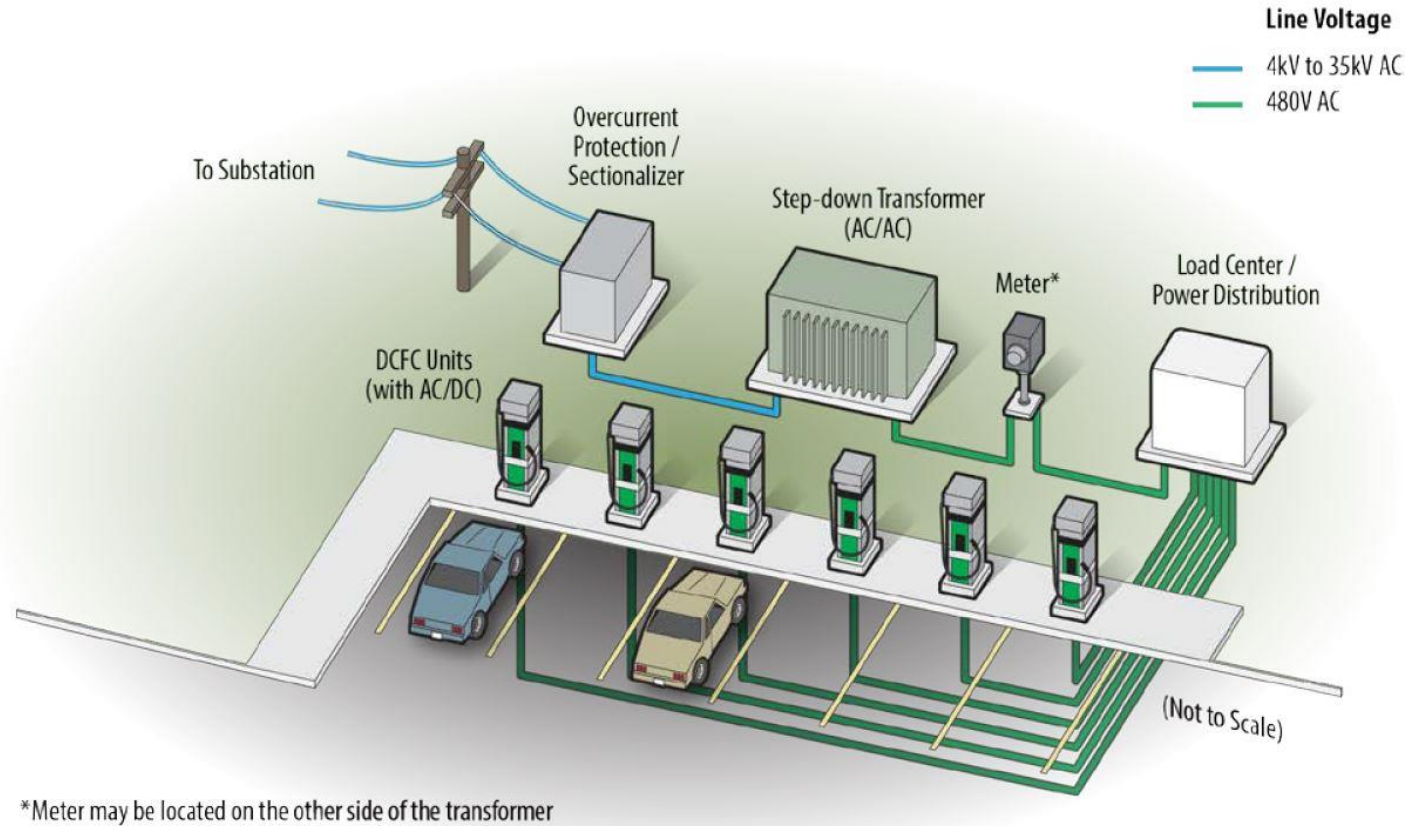
Growth for e-buses will be faster by 2030 86% of global sales will be electric

*“If consumers purchase EVs at the expected rates in the next five to ten years, a lack of charging infrastructure could become an obstacle to [EV adoption](#)”.* Engel et al 2018

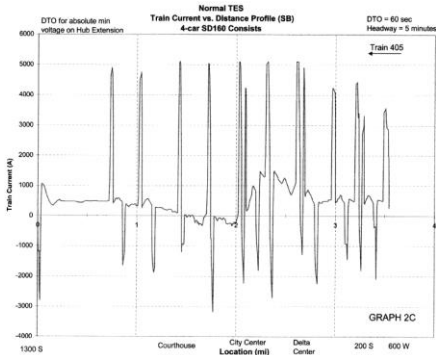
1-450 KW charger requires 450 KW of Infrastructure

6-450 KW chargers require 2700 KW of Infrastructure

**Stacking of loads “worst case” particularly for low utilization**



# Intermodal Hub Pilot Project



TRAX line, predictable MW-level pulsed load



Intermodal Hub facility variable demand

## Intermodal Hub Site-level Energy Management System



Project does not impact substations or feeder circuits

- **Develop control system tools**
  - **Increase utilization**
- **Evaluate potential for utility demand response program or other solutions**
- **Conduct cost benefit evaluation**

2x actively controlled 450 kW overhead bus chargers



3x actively controlled 100 kW bus depot chargers

(TBD) actively controlled public DC fast and L2 EV chargers



- Currently 3 e-buses (Hub to U of U)
- Add 2 e-buses (Hub to PC)
- Potential to add 27 more e-buses

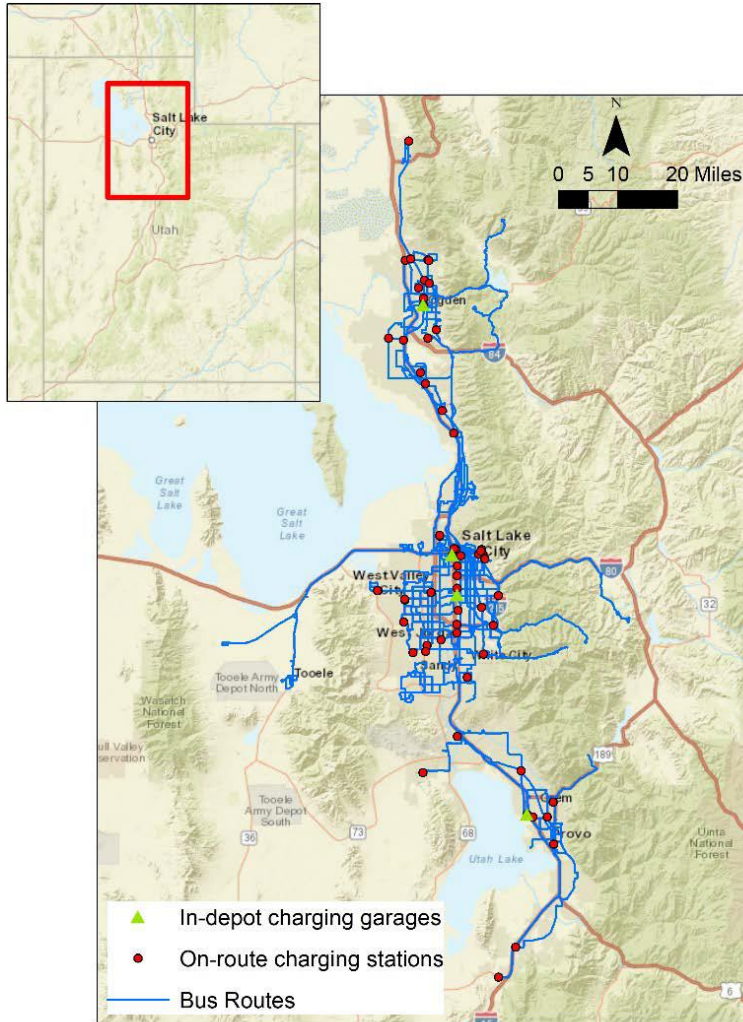
- Expand Hub to include trucking and ride hailing
- Take advantage of infrastructure
- Increase utilization

# Roadmap for Future

Olympic Exploratory Committee report calls for “zero emission transportation system”

If technology is proven then opportunity to deploy:

- UTA study identified 70 potential charging locations
- In addition 50 light rail substation upgrades needed
- Other transit possibilities
  - Park City
  - Zions National Park
  - Airport
  - Truck and distribution centers
- Other industries?
- ASPRIE Center- \$50 million NSF Engineering Research Center at USU



Source: 2018 U of U UTA study on e-buses

