WestSmartEV: Western Smart Plug-In Electric Vehicle Community Partnership for Electric Vehicles and Infrastructure

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June 19, 2018

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Project ID: ti081

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Overview

Overall Goal

- Increase EV adoption in the Intermountain West

Timeline

- Start: January 19, 2017
- End: January 18, 2020
- 33% Complete

Budget

Total project funding	$11,168,873
DOE share	$3,532,330 (PacifiCorp)
	$450,000 (INL)
Cost share	$7,186,543
Budget period 1	$559,250
Budget period 2	$1,598,975
Budget period 3	$1,374,105

Any proposed future work is subject to change based on funding levels.

Barriers Addressed

- Limited availability of charging infrastructure along travel corridors and places of work
- Limited options for multi-modal electric transportation at the community level
- Limited understanding of electric transportation solutions and benefits

Partners

- PacifiCorp
- Utah State University
- Utah Clean Cities Coalition
- University of Utah
- Idaho National Laboratory
- Forth Mobility
- Park City
- Salt Lake City
- Breathe Utah

Project Objectives

Objectives

Increase EV adoption to consequently reduce emissions and petroleum use

Support of VTO Tech Goals

- National Security: reduce foreign oil; bolster interstate tech
- Economic Growth: spur EV sales and charging/grid development
- Affordability: influence billing rates and charger placement
- Reliability/Resiliency: plan for grid impacts and opportunities

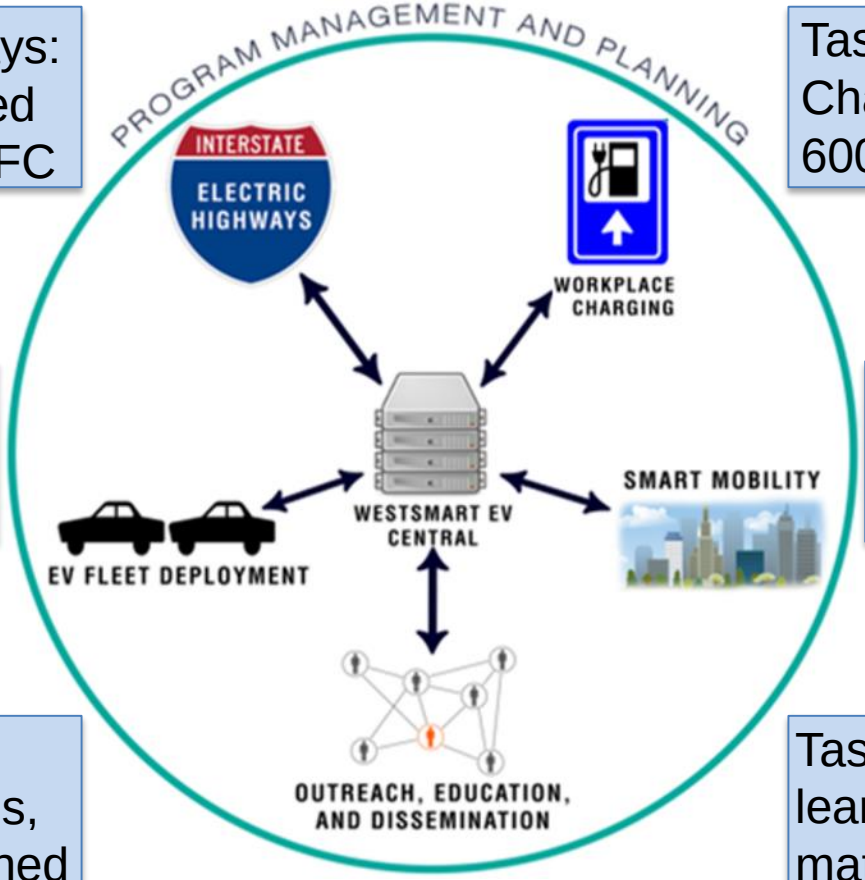
Impact

- Increase EV charging/range capacity on electrified highways
- Expand EV owner opportunity to charge at places of work
- Provide and supplement PEV purchase incentives
- Develop electric mobility solutions to connect technologies and communities
- Facilitate data-based investment and policy decisions
- Create awareness and buy-in through outreach materials and workshops

Project Approach

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

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



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

Task 4 Smart Mobility: All electric solutions in urban areas

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

Task 6 Outreach: Lessons learned dissemination, materials, workshops

Go/No Go Considerations: EV adoption forecasts validated and on track; success in pilots indicate positive plan for expansion

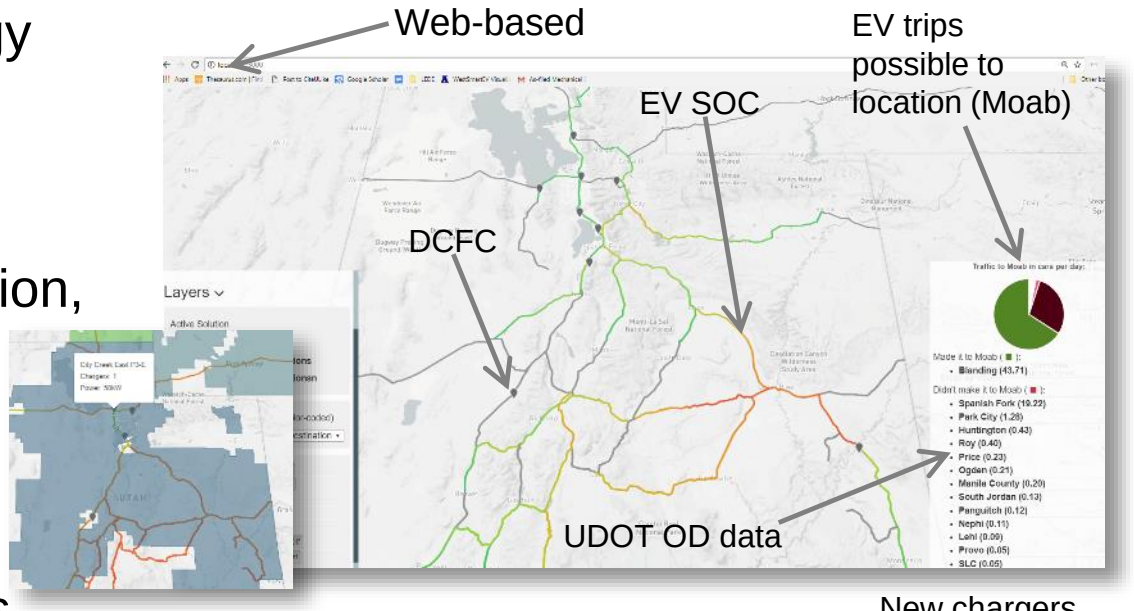
Milestones

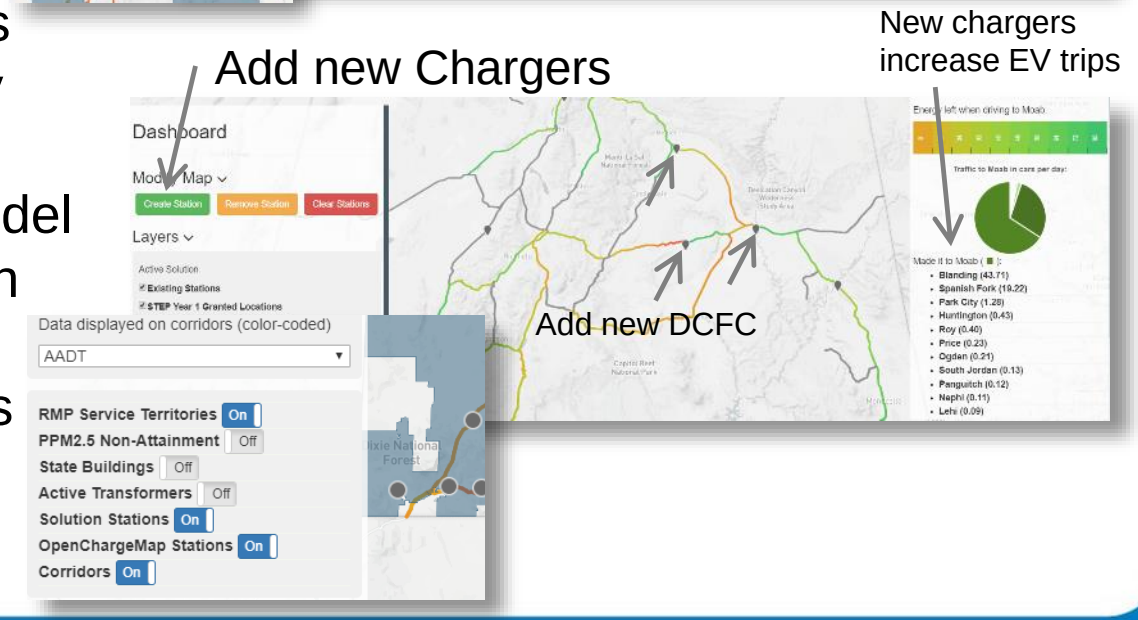
Pilot Phase Milestones	Type	Progress
Pilot partner proposals received from desired locations	Technical	**Achieved**
Pilot corridor chargers operating, lessons learned/best practices (LL/BP) positive for expansion	Technical	**Achieved**
Workplace charging at team sites, data collection proceeding	Technical	**Achieved**
Pilot workplace charging operating, LL/BP positive for expansion	Technical	**Achieved**
Pilot EV deployment operating, LL/BP positive for expansion	Technical	**Achieved**
Pilots in SLC/Park City demonstrate smart mobility approach viability	Technical	**Achieved**
Adoption models validated, pilot data indicates meeting impact goals	**Go/No Go**	**Achieved**

Expansion Phase Milestones	Type	Progress
Corridor chargers expanding, LL/BP positive for full rollout	Technical	In Progress
Workplace charging expanding, LL/BP positive for full rollout	Technical	In Progress
EV adoption numbers expanding, LL/BP positive for full rollout	Technical	In Progress
Mobility services expanding, LL/BP positive for full rollout	Technical	In Progress
Smart mobility expansions based on pilot LL/BP validate models and indicate positive plan for rollout	**Go/No Go**	In Progress

Accomplishments: DCFC location analysis

- Developed power and energy demand models along the corridors
  - Dynamic vehicle models
  - All corridors, each direction, including elevation
  - State DOT volume and origin-destination traffic data
- Developed dynamic analysis tool of EV trips supported by DCFC
  - Energy consumption model
  - EV trips possible through the network
  - Online visualization tools





Accomplishments: Charger integration

Chargers installed or in progress to date

- 20 DC Fast Chargers (DCFC)
- 343 Level 2 (L2) AC charger ports

Highway corridor coverage

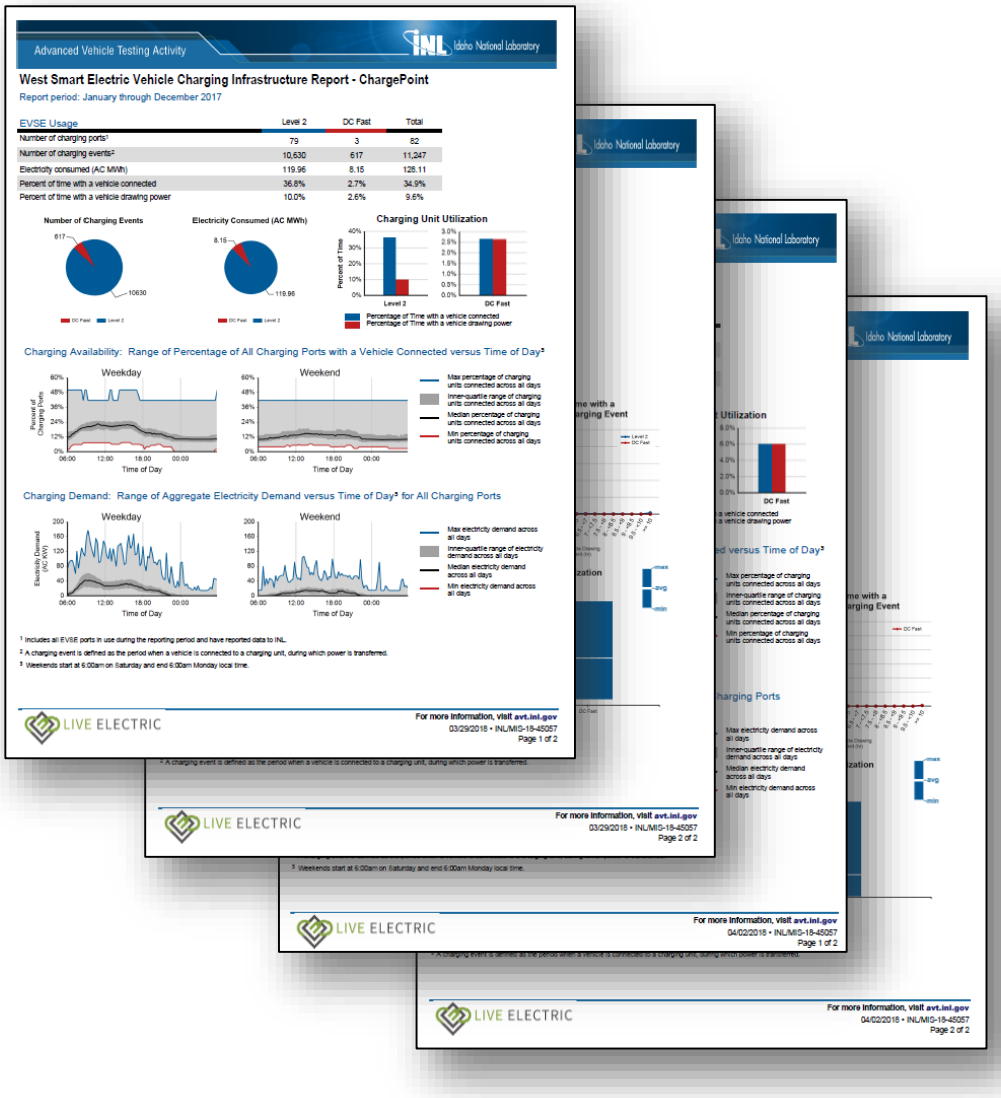
- Utah Interstates I-15, I-80: chargers at least every 100 miles, targeting every 50 miles
- National parks: EV access to Zion and Bryce Canyon, plans for Arches and Yellowstone

Photos: PlugShare.com

Accomplishments: Data Analysis Overview

Quarterly Analysis and Reporting

- Level 2 EVSE & DC Fast Chargers
  - ChargePoint
  - GreenLots
  - EVgo
- Analysis and reporting includes
  - Cumulative metrics
  - Weekday vs. Weekend
  - 15-minute utilization
    - PEVs connected
    - Electrical load demand
  - Time of day distribution
    - % of EVSE connected
    - % of EVSE transferring power
    - Energy transfer
- Wide range of locations
  - Workplace charging
  - Urban public
  - Corridor travel



Accomplishments: Further In-Depth Analysis

- Variation in driver choice
  - Battery SOC
    - Start of charge
    - End of charge
  - Impact of price per
    - Connection
    - kWh
    - Duration
  - Time of day and duration of charge event
- Variation in fleet composition
  - BEV vs. PHEV
  - CHAdeMO vs. J1772 CCS
  - PEV charge requirements
    - Level 2 charge power
    - DCFC charge power
  - PEV energy requirements

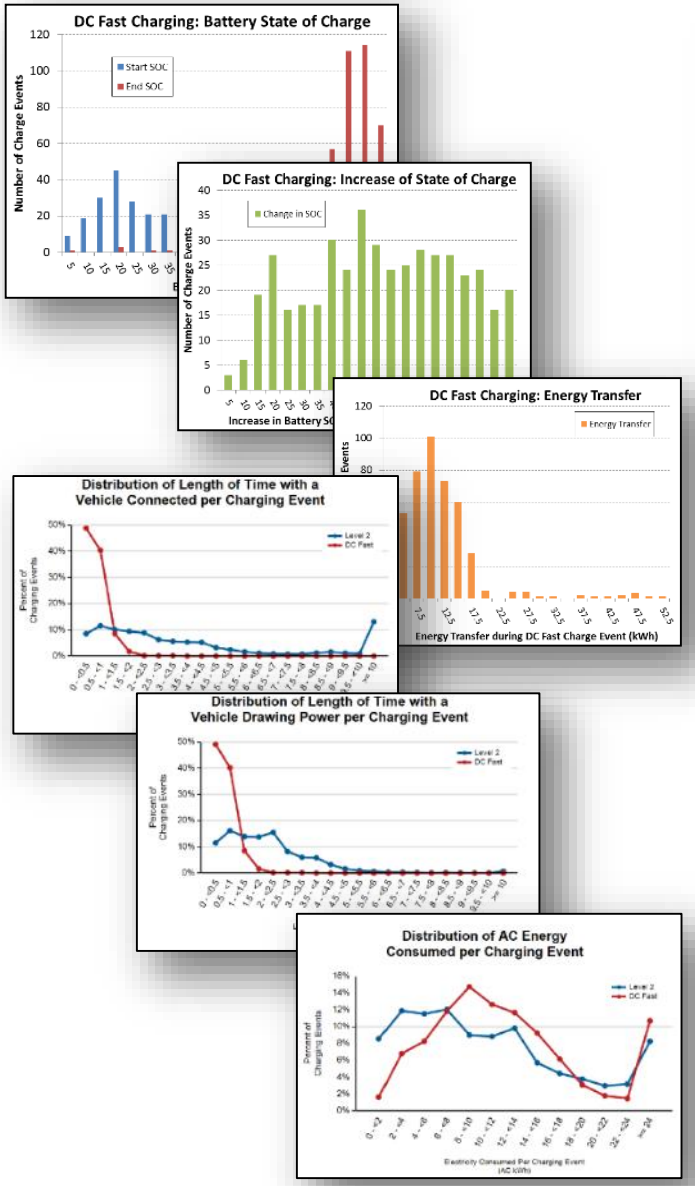


Photo: PlugShare.com

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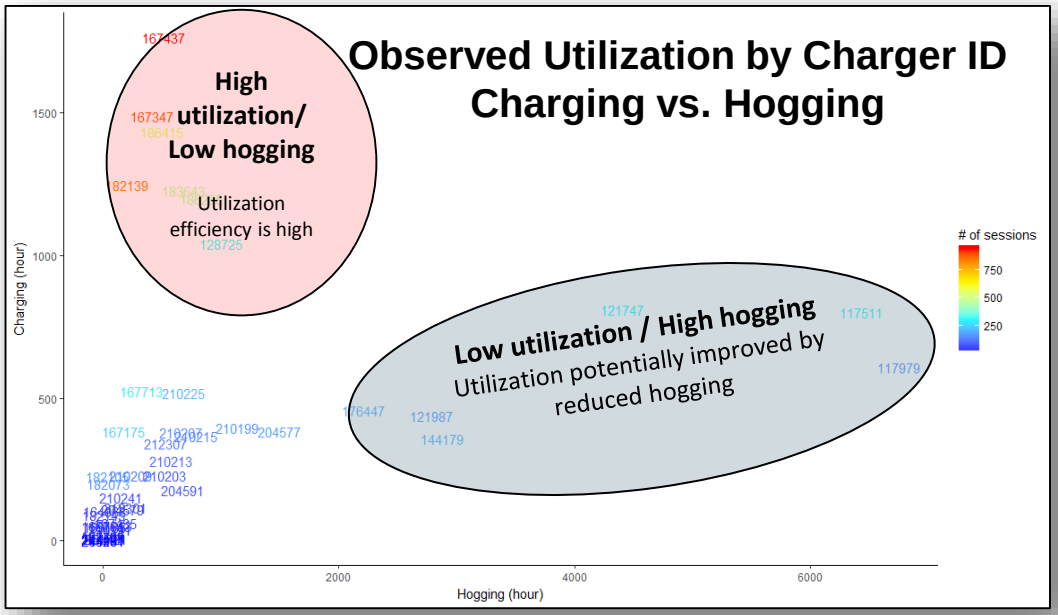
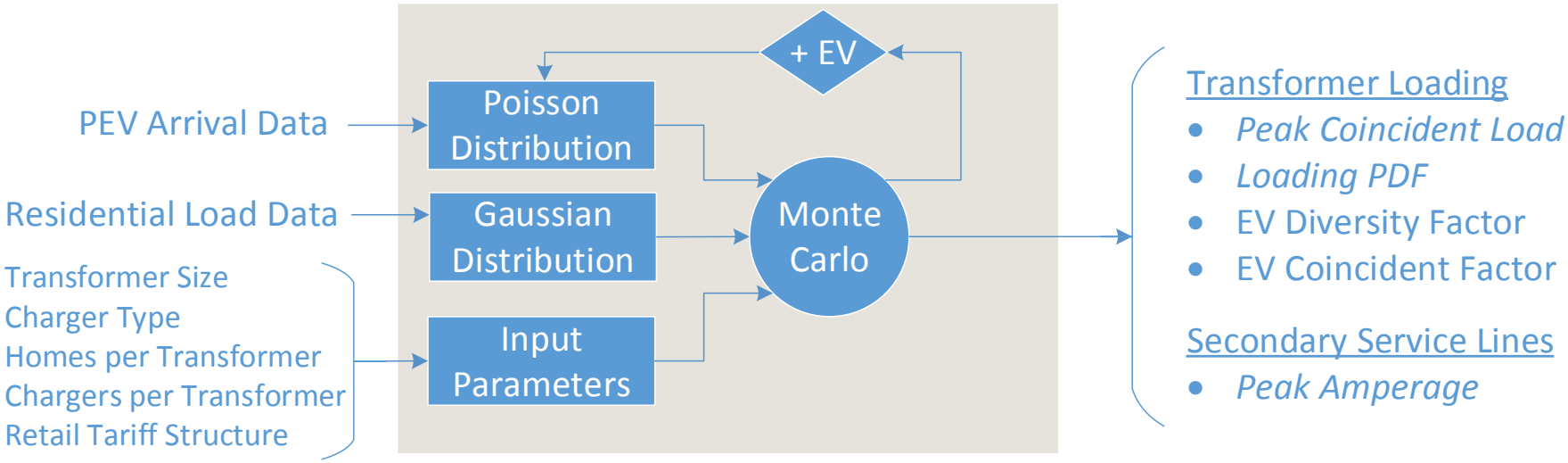
Accomplishments: EVSE Utilization Analysis

- EVSE hogging
  - PEV occupies the EVSE after charging completion
  - Results in lost charging opportunity for others
  - Dependency linked to EVSE rate structure fee:
    - ⇧ no cost for charging
    - ⇧ $ per connection
    - ⇧ $ per kWh
    - ⇩ $ per time connected
- Less hogging
  - Leads to more charging opportunities
  - Better for both EV drivers and EVSE operators
  - Potentially improves utilization

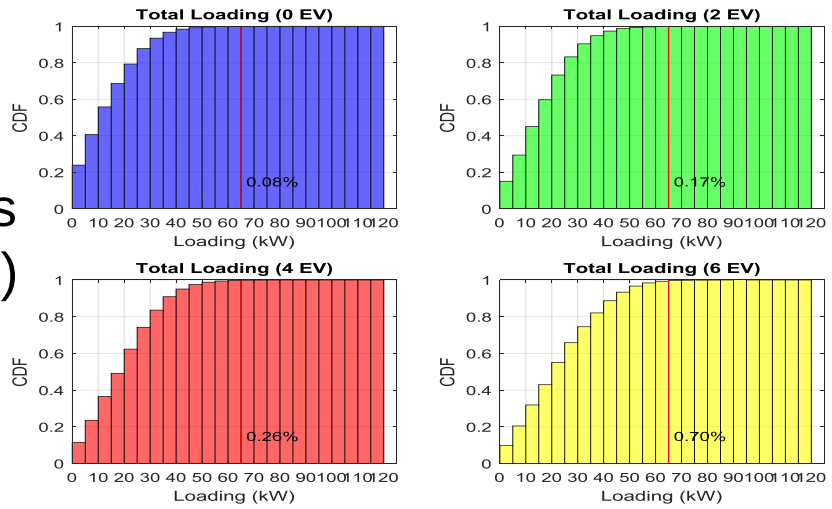


Accomplishments: Residential Grid Impact

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



Accomplishments: Smart mobility e-bus

Six electric buses

- 253,098 miles travelled
- Cost per mile: $0.208
- 23 MPGe (vs. diesel at 4 MPG)

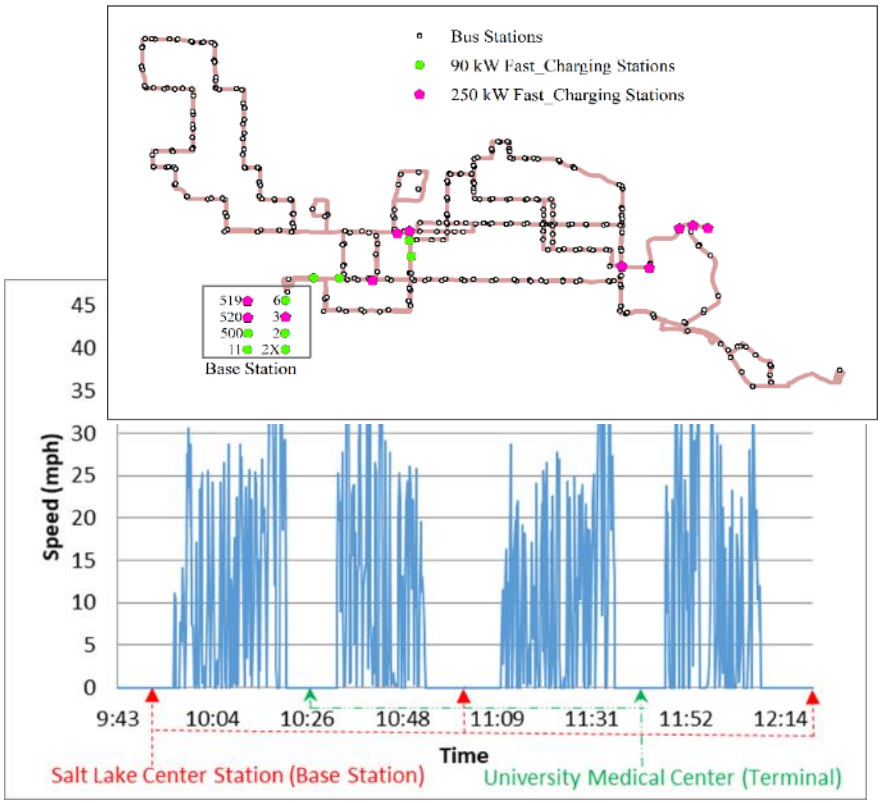
Photo: Park City Transit

88 electric bikes

- First and last mile solution
- 32,634 miles, 9,623 trips

Y2 rollout planning: Salt Lake City

- Collected real world drive cycles
- Developed electric bus system planning tool



Accomplishments: Smart mobility services

Launched UBER electric program

- First pilot program in the nation
- Incentivize drivers to participate
- Train drivers to be EV ambassadors
- Provide access to multiple strategically located fast charging stations

Photo: Forth Mobility

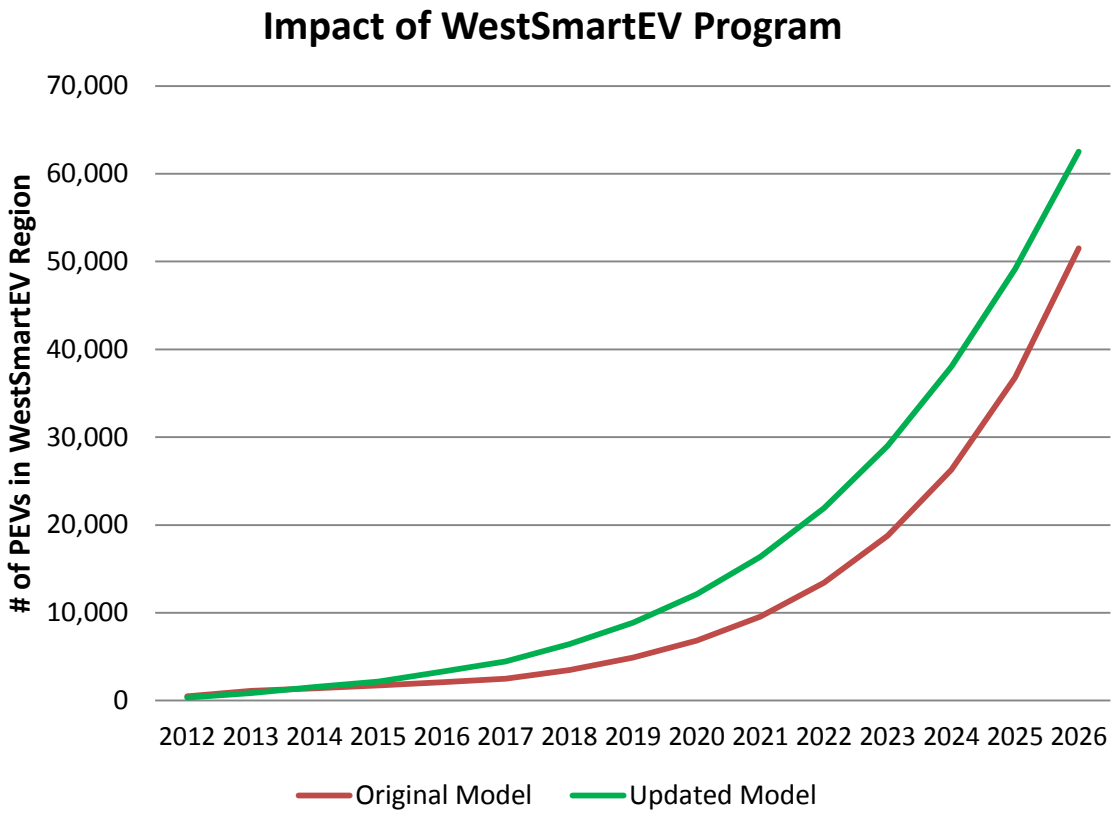
Launched electric car share program with Giv Development group

- New low-income housing project powered by 100% renewable energy
- Car share for residents includes short and long range EVs

Photo: Giv Develoment

Accomplishments: PEV adoption model

- Incorporates latest PEV sales data
- Calibrated updated EV adoption model
- Planned model improvements will incorporate impacts of
  - Charging infrastructure along corridors and at the workplace
  - Smart mobility solutions and services
  - EV incentive programs
  - Outreach activities



Collaboration/Coordination Among Project Team

Program Planning, Management, Communication, DOE Reporting

Utah State University
- Program coordination
- Electric transportation tech advisor

PacifiCorp

Prime/Project Lead
- Regional Utility (UT, ID, WY, WA, CA, OR)
- PMP execution, task/milestone tracking

- RMP/USU Bi-weekly program management calls
- RMP/USU Bi-weekly calls with each task area team
- RMP/USU Bi-monthly face to face entire team meetings

Utah State University
- Modeling
- Data collection and analysis
- Charging infrastructure
- Smart Mobility, Electric Hwy task lead

INL Idaho National Laboratory
- Real-time data collection, analysis and processing
- Federal Laboratory resources and perspective

The University of Utah
- Distributed energy and grid integration
- Grid impacts research perspective on RMP/EVSE interface

Utah Clean Cities
- Workplace charging/Fleet task lead
- Leverage Clean Cities networks for outreach, education workshops

Salt Lake City / Park City
- Local government initiatives
- Sustainability and Smart Mobility deployment

Additional Partnerships
EVIA, Forth, Regional Clean Cities, Breathe Utah, ChargePoint, Maverik, UDOT, Utah DEQ, UTA

Overall Impact

Contribution highlights to date

- The number of EVs in Utah has doubled
- I-15 Utah highway corridor has been electrified
- Cost effective electric bus system has been deployed

Sustaining project goals beyond period of performance

- PacifiCorp cost share investment $2M per year committed for two years past period of performance
- Project engagement with communities on mobility solutions
- Development and dissemination of lessons learned and best practices for extension to other geographical areas and markets

Projected overall impacts by 2026

- Double EV growth rate, resulting in more than 60,000 EVs
- Reduce annual CO2 emissions by more than 300M pounds
- Reduce annual imported oil use by more than 29.9M gallons

Summary

Three key takeaways

- The project's overall goal to **increase EV adoption** in the Intermountain West is **being achieved**.
- The **primary methods** of achieving this goal include
  - DC fast charging on corridors and L2 charging in the workplace
  - New and expanding electric mobility services
  - Effective and consistent outreach and education efforts
  - Data-driven decision making; lessons learned plugged in as best practices
- In one year, the number of EVs in Utah has doubled; with critical infrastructure in place and expanding, the region presents fertile ground to see similar growth; and **communities are realizing the benefits of reduced environmental impact and stimulated economic impact**.