



NSF Engineering Research Center

Advancing Sustainability through Powered
Infrastructure for Roadway Electrification



Georgia Legislative Committee on Electrified Transportation

Allie Kelly
The Ray, Executive Director
ASPIRE, Executive Advisory
Board - Chair

ASPIRE NSF Center Partnerships



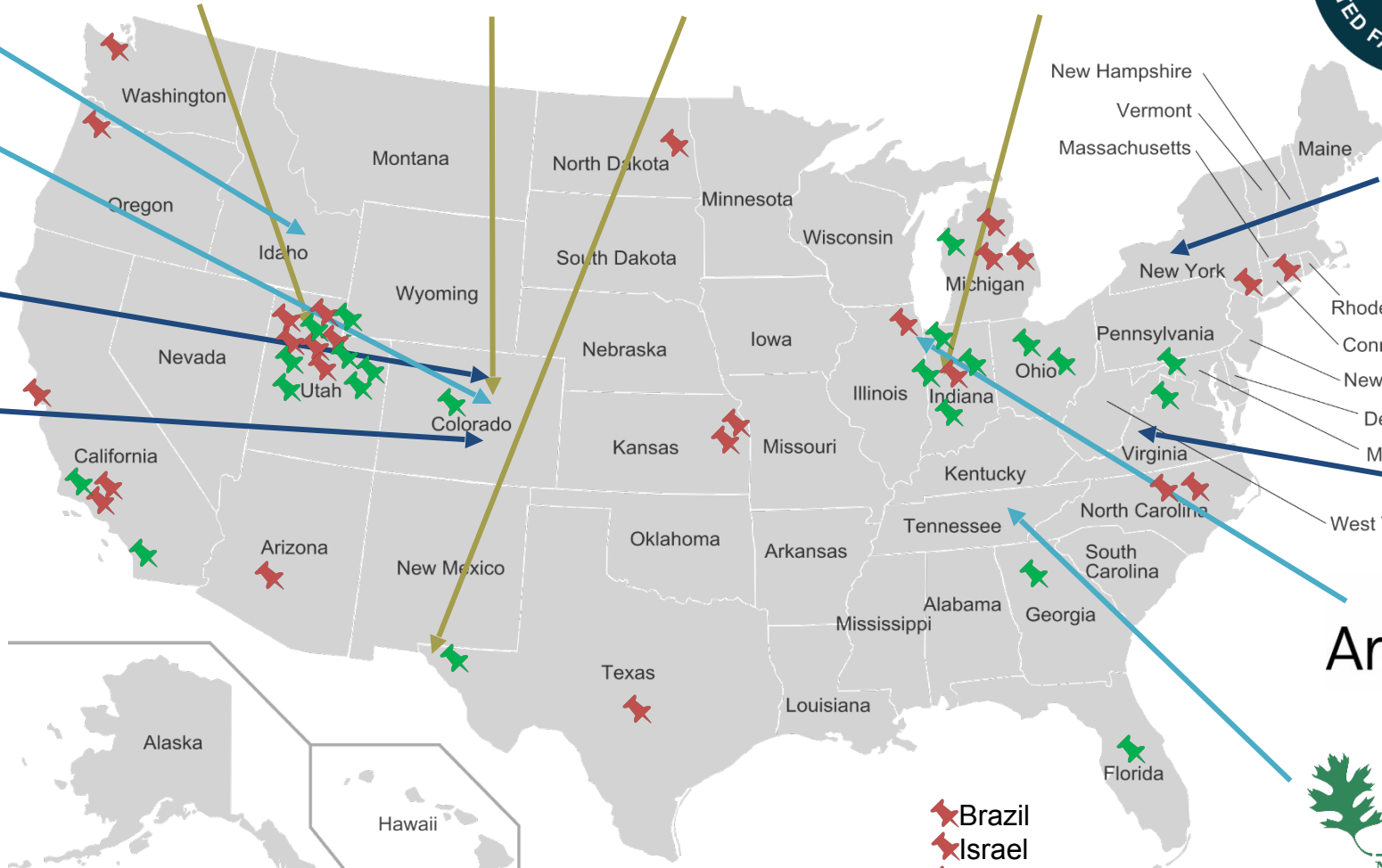
THE UNIVERSITY OF AUCKLAND
NEW ZEALAND



Cornell University



VIRGINIA TECH.



Innovation partners



Industry members

- Red pin icon: Brazil
- Red pin icon: Israel
- Red pin icon: Germany
- Red pin icon: Sweden





Business as Usual?

500 mile range semi-truck

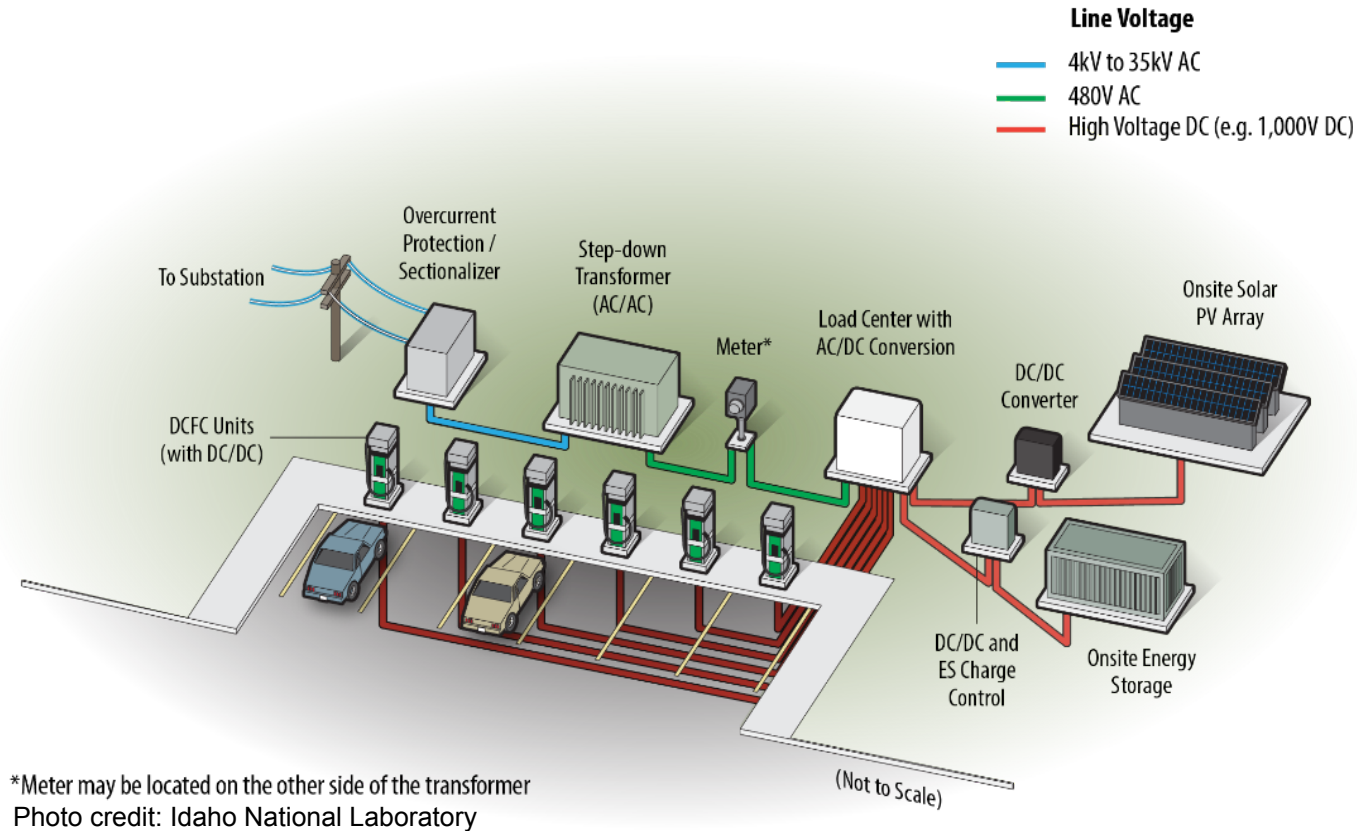
\$150,000 battery

15,000 lb battery

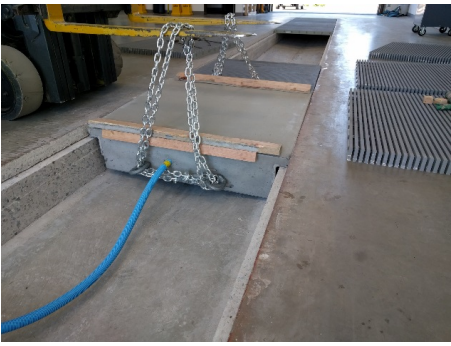
2 MW+ for 30 min charge

>\$1 per mile electricity

(at \$150 per kWh battery, 15 lb per kWh, 2 kWh per mile, \$0.50 per kWh electricity)



Total US Vehicle Battery Cost at 100% adoption, 500 mile range
\$7.8 Trillion



Cost Comparison



Gas or Diesel

\$0.16 / mile

\$0.67 / mile

**Long Range Battery +
Ultra Fast Charging**

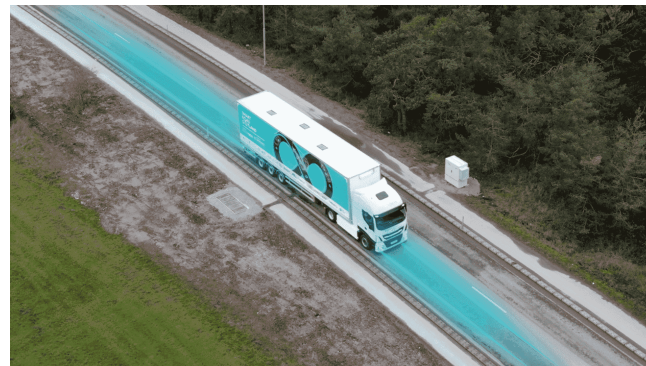
\$0.20 / mile

\$1.25 / mile

Electric Road

\$0.07 / mile

\$0.30 / mile



1

1. Roadside Equipment

Connects to the utility grid and distributes power to the roadway

3. Receiver Unit on Vehicles

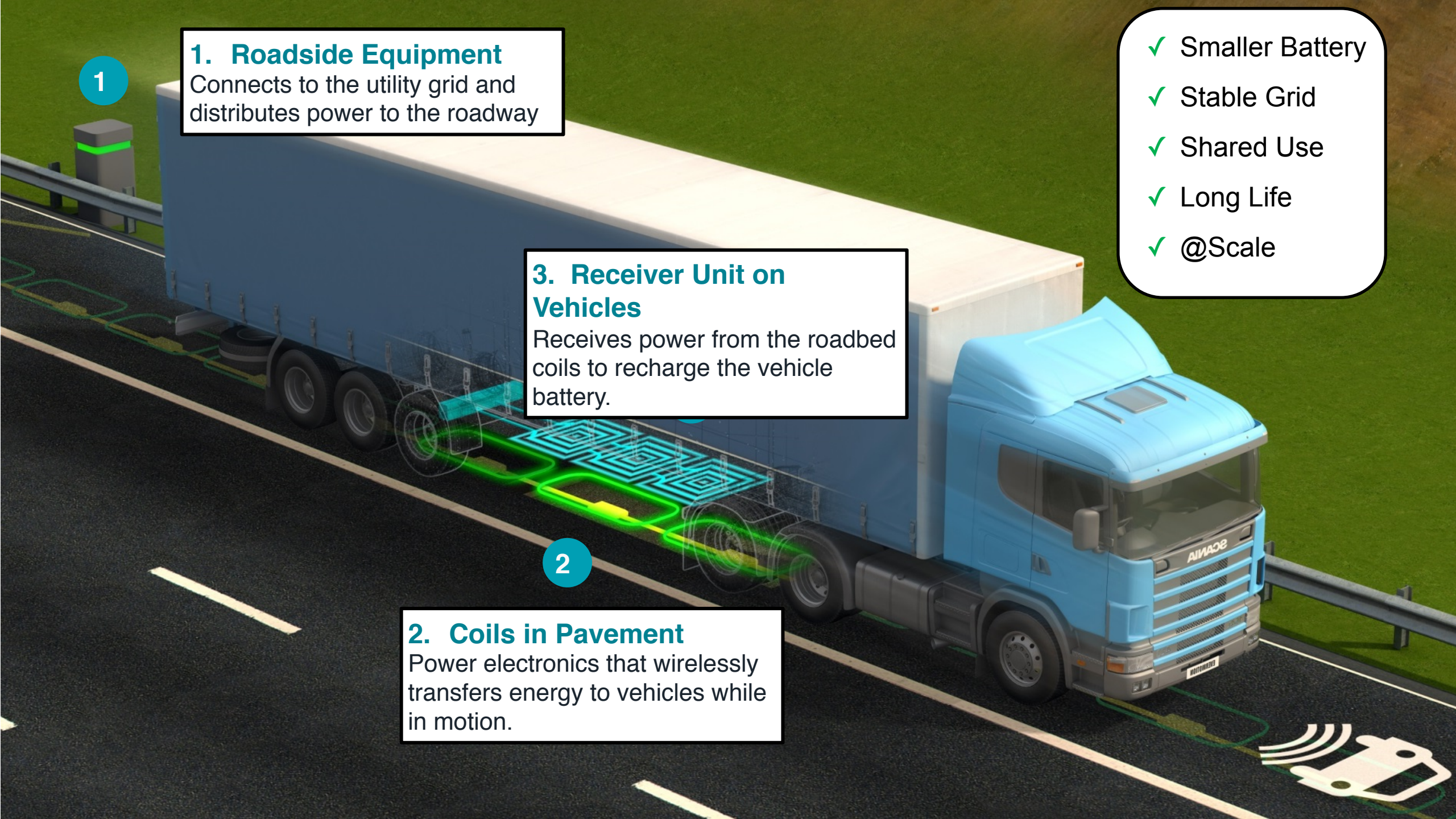
Receives power from the roadbed coils to recharge the vehicle battery.

2

2. Coils in Pavement

Power electronics that wirelessly transfers energy to vehicles while in motion.

- ✓ Smaller Battery
- ✓ Stable Grid
- ✓ Shared Use
- ✓ Long Life
- ✓ @Scale



Wireless Extreme Fast Charging Demonstrations

500 kW Wireless Extreme Fast Charging at Port of Los Angeles



Megawatt Wireless Charging in Seattle & Portland

Long Range Battery Electric Vehicle by:
Kenworth Truck Company
KENWORTH

Freight Operator:
United Parcel Service
UPS

Wireless Chargers by:
WAVE
Utah State University
WAVE **UtahState University**

Seattle Public Utility Partner:
Seattle City Light
Seattle City Light

Portland Utility Partner:
Portland General Electric
Portland General Electric

Data Analytics:
eIQ Mobility
eIQ MOBILITY

Legend:
● One Megawatt Wireless Extreme Fast Charger
■ Intercity Hauling Routes 60 to 120 miles
■ Regional Hauling Route 340 mile round trip Seattle ↔ Portland





Wireless EV charging via highway pavement to be tested in Indiana

STEPHEN EDELSTEIN JULY 26, 2021 17 COMMENTS View Gallery



Full-scale Dynamic Wireless Power Transfer and Pilot Project Implementation



Research Team:
Prof. John Haddock
Nadia Gkritza,
Dionysios Aliprantis,
Steve Pekarek

The 1st Wireless Electric Road System in the U.S.

The world's most advanced electrified road

STREETS: 1 mile wireless dynamic charging + static charging on city and state roads

VEHICLES: Charging shuttles, passenger vehicles, class 6 trucks, AV, and transit buses

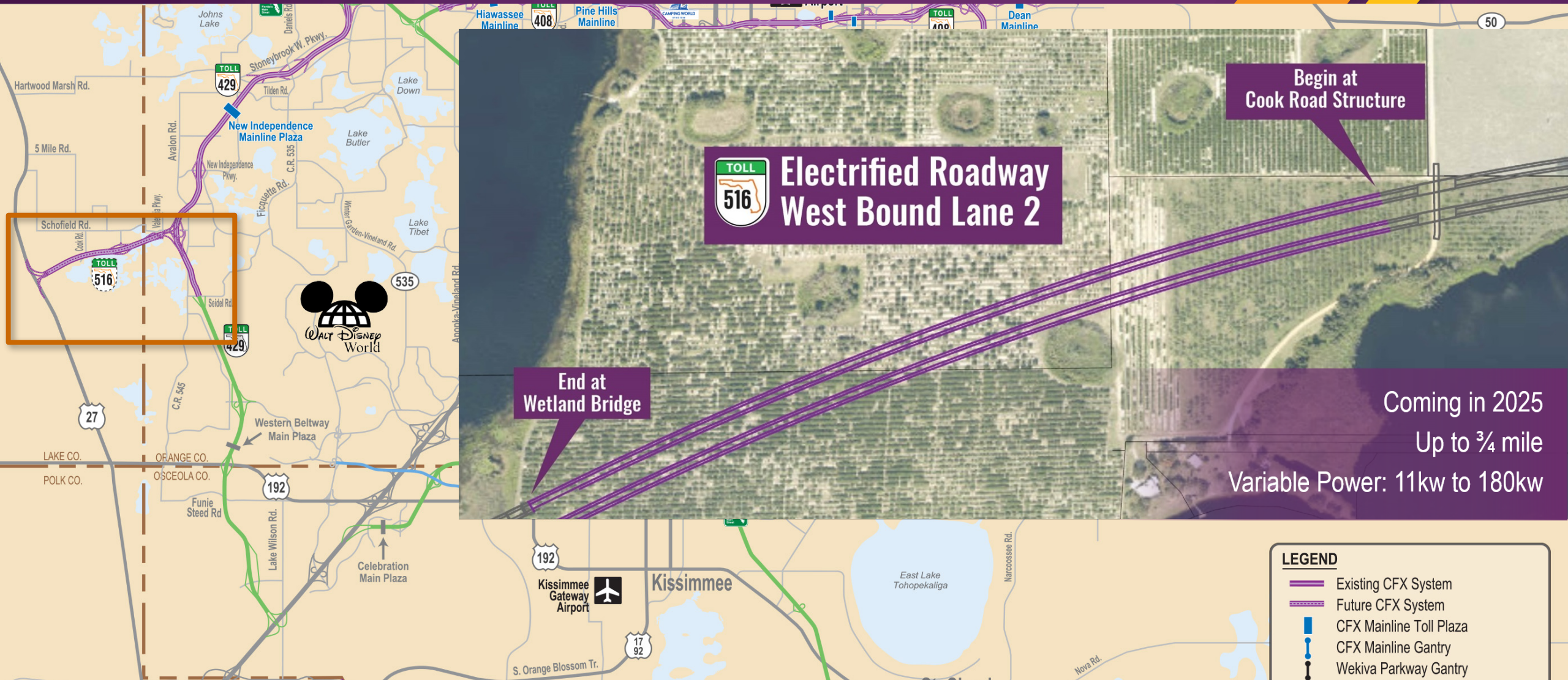
INNOVATION: Urban living lab supporting mobility & electrification innovation

STATUS: Planning, design and use case development. Start of operation in 2023

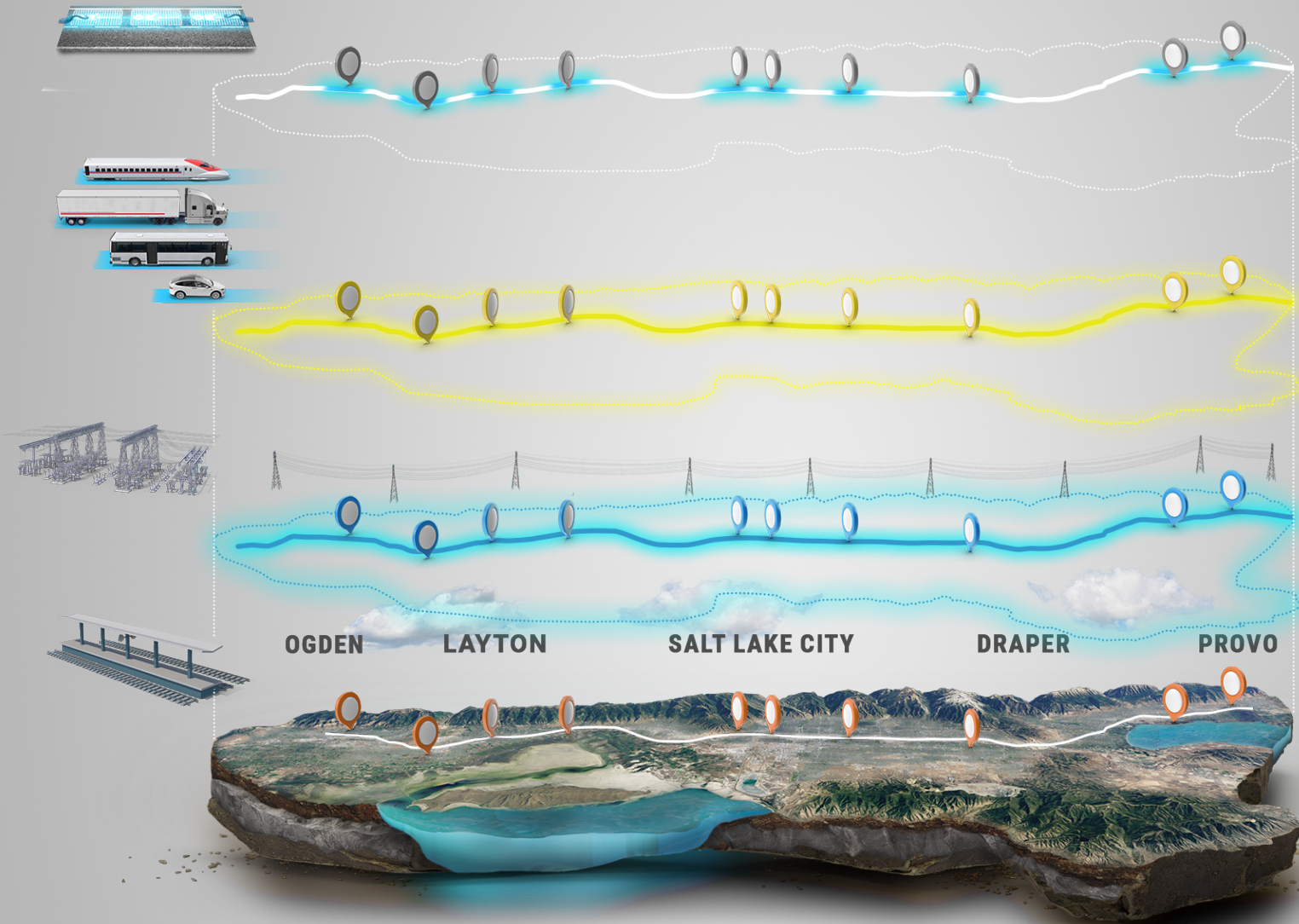
electre^on In Partnership with



CFX Lake/Orange Expressway Pilot Project



Intermodal Utah Electrification Plan



Commuter and light rail serve as roadmap for intermodal charging hubs

Multi-megawatt substations at hubs with coordinated grid loading

Fast charging networks leverage rail infrastructure for trucks, buses, and passenger vehicles

Future electric roads leverage shared rail & road infrastructure along corridor

Shared public infrastructure with load management reduces cost and emissions for all transportation

20-Year Roadway-Electrification Roadmap

2023

Phase 1 Pilots
(1/4 - 1/2 mile)



2023: Electric Roadway pilots installed in Utah, Indiana, and Florida.

2026

Extended Pilots
(1 - 2 miles)



2026: Initial learnings extended as supply chain is built out.

2030

Road Segments
(5 - 10 miles)



2030: Installing roadway segments in key locations across the US.

2035

Corridors
(50 - 100 miles)



2035: Electric Roadway corridors established.

2040

Interstate Highways

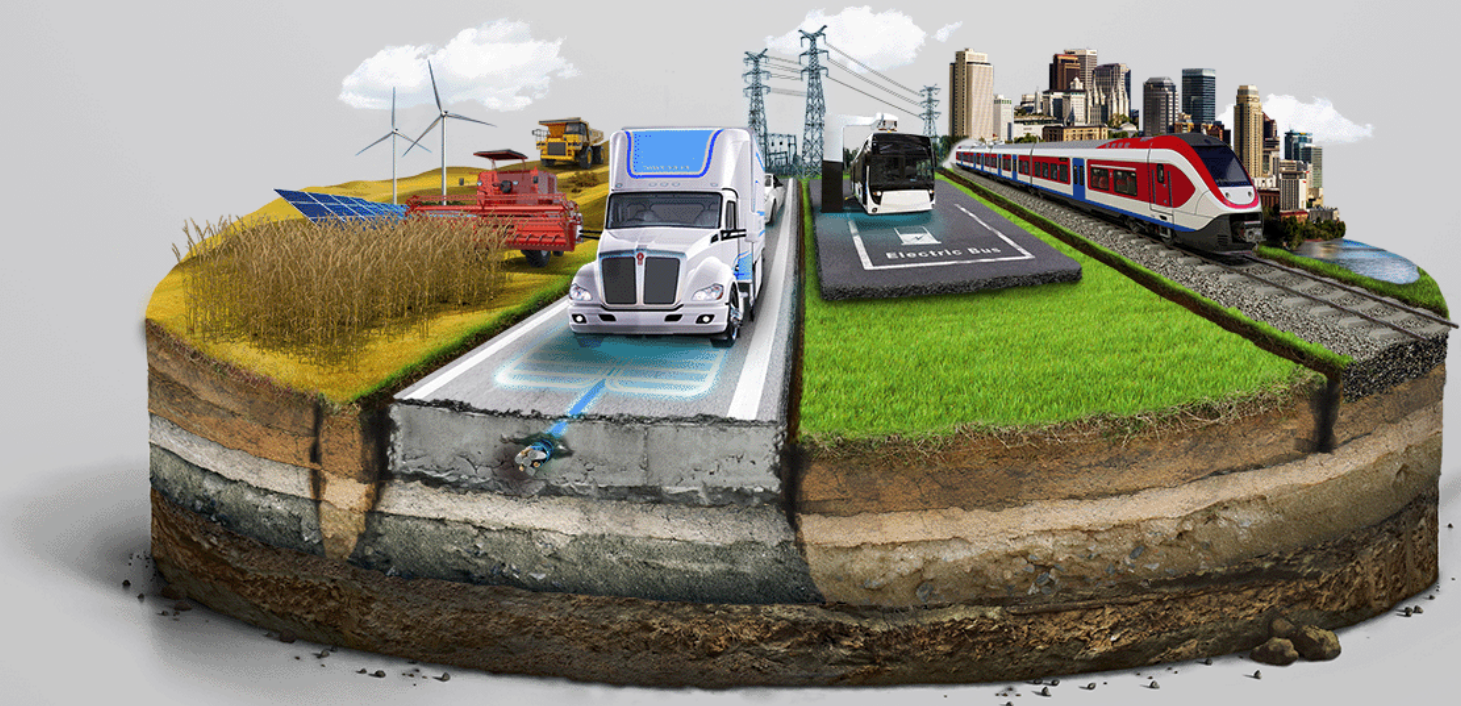


2040: Electric Roadways expand from metro areas.



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Electrified Roadway Overview

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