ASPIRE

NSF Engineering Research Center

Advancing Sustainability through Powered Infrastructure for Roadway Electrification

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Illinois Asphalt Pavement Association Annual Meeting – March 11 - 12

ASPIRE *by the Numbers*

Funding
$68m to date, additional $56m committed

Peer Reviewed Publications
140+

Outreach
11,500+ attendees reached through events

Patents Awarded
14+

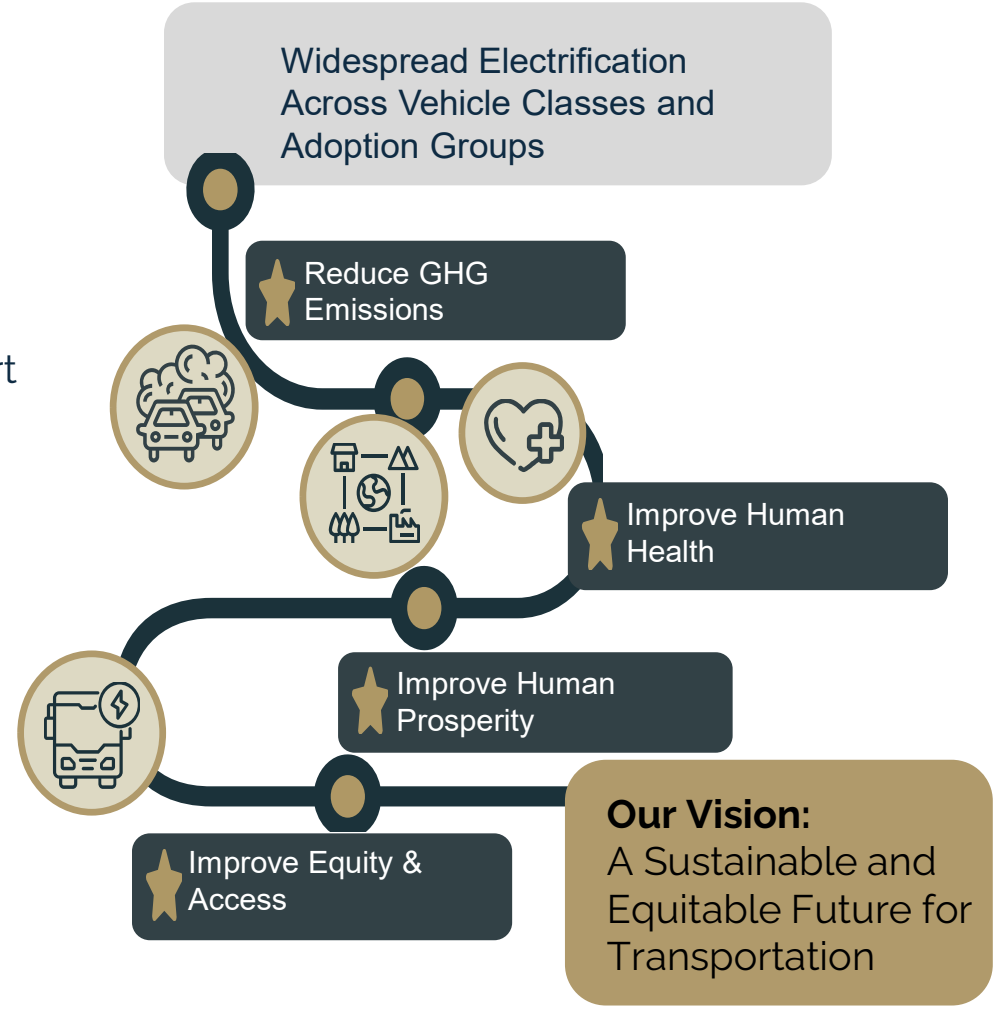
Faculty, Students & Staff
1400+

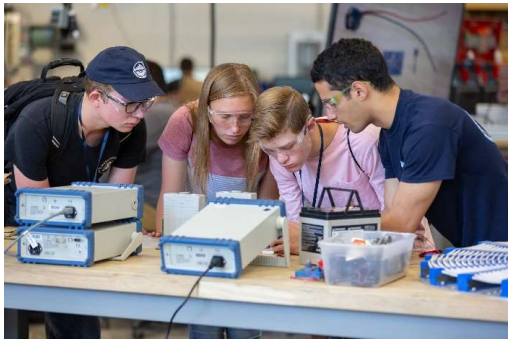
Industry & Innovation (IIB) Members
60+

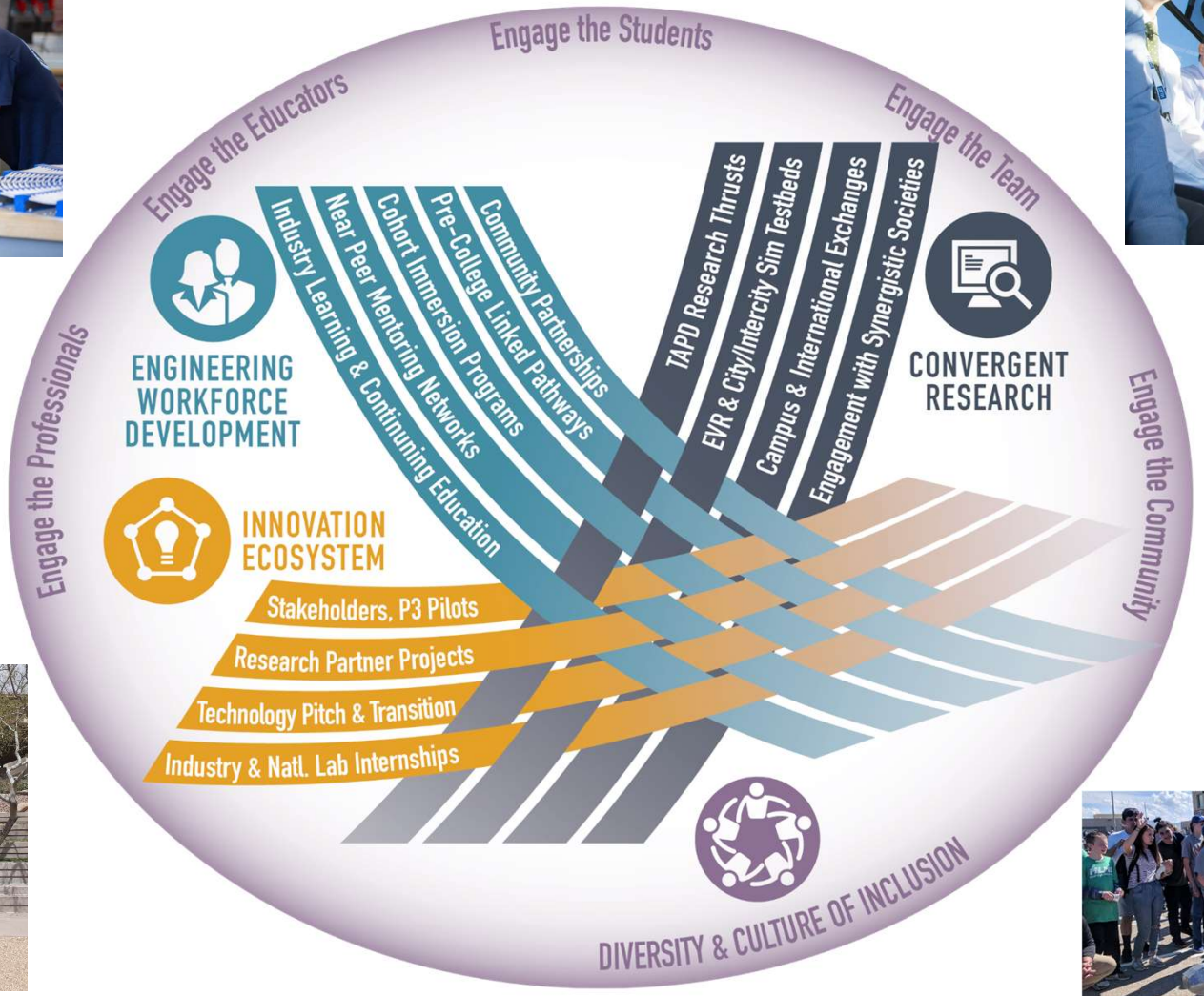

H2
Electric Bus

ASPIRE's Vision

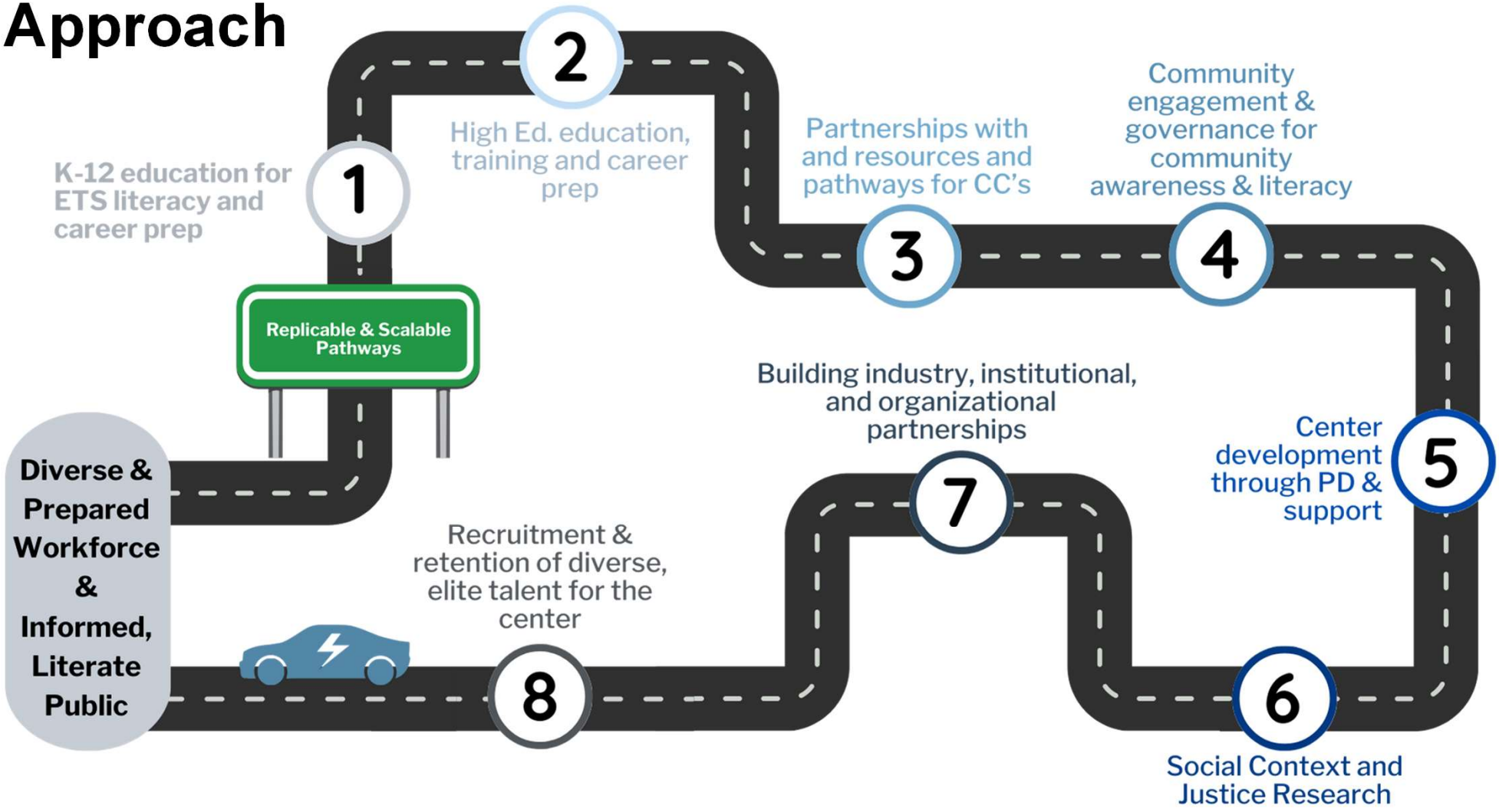
ASPIRE started in 2020 as a multi-disciplinary effort **across 10 affiliated Universities** and over **sixty partners.**






Engage the Students
Engage the Team
Engage the Community
DIVERSITY & CULTURE OF INCLUSION
Engage the Professionals
Engage the Educators
ENGINEERING WORKFORCE DEVELOPMENT
CONVERGENT RESEARCH
INNOVATION ECOSYSTEM
Industry Learning & Continuing Education
Near Peer Mentoring Networks
Cohort Immersion Programs
Pre-College Linked Pathways
Community Partnerships
TAPD Research Thrusts
EVR & City/Intercity Sim Testbeds
Campus & International Exchanges
Engagement with Synergistic Societies
Stakeholders, P3 Pilots
Research Partner Projects
Technology Pitch & Transition
Industry & Natl. Lab Internships

Approach


2
High Ed. education, training and career prep
Partnerships with and resources and pathways for CC's
3
Community engagement & governance for community awareness & literacy
4
K-12 education for ETS literacy and career prep
1
Replicable & Scalable Pathways
Building industry, institutional, and organizational partnerships
7
Center development through PD & support
5
Diverse & Prepared Workforce & Informed, Literate Public
Recruitment & retention of diverse, elite talent for the center
8
6
Social Context and Justice Research

Areas of Research

Equity

- Social Equity
- Environmental Justice
- Technology & K-22 Education

Data

- Data Analysis & Fusion
- AI / Optimization / Co-sim
- Cybersecurity / IoT / Networks

Adoption

- User Acceptance / Society
- Public Policy / Economy
- Techno-economics

Power

- Power Systems
- Grid Integrated Charging Systems
- Battery Systems

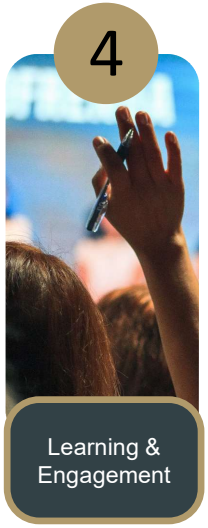
Transportation

- Transportation Systems
- Transportation Infrastructure

Slide 7

KW0 Do we need to change "Equity" to "Inclusion"? or "Access"?
Kat Webb, 2024-02-22T17:35:50.253

ASPIRE NSF Engineering Research Center



VIRGINIA TECH

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

University of Colorado Boulder

THE UNIVERSITY OF UTAH

UtahState University

UTEP

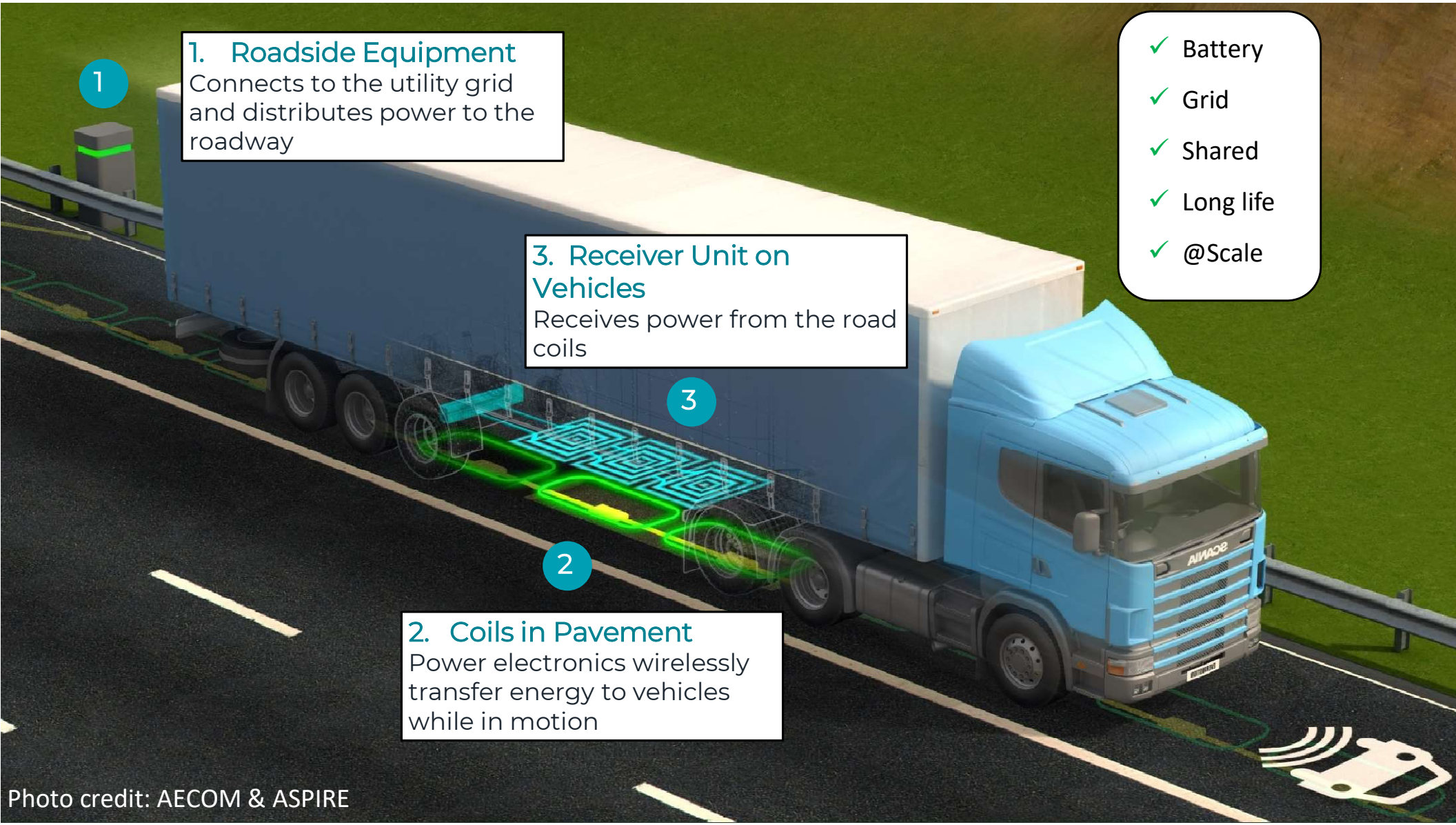
UCCS
University of Colorado Colorado Springs

Colorado State University

PURDUE UNIVERSITY

Cornell University

Industry + Innovation


1
1. Roadside Equipment
Connects to the utility grid and distributes power to the roadway
3. Receiver Unit on Vehicles
Receives power from the road coils
3
2
2. Coils in Pavement
Power electronics wirelessly transfer energy to vehicles while in motion
✓ Battery
✓ Grid
✓ Shared
✓ Long life
✓ @Scale
Photo credit: AECOM & ASPIRE

ASPIRE – EVR Testing

electreon

Electreon 25 kW+ x 3 50m DWPT

Indoor Test rail

MAGMENT

Magment 50 kW DWPT

ENRX

ENRX 200 kW 40m DWPT

THE UNIVERSITY OF AUCKLAND NEW ZEALAND

UoAuckland WPT pad

Energy Management System

STATE U

P

USU/Purdue 200 kW DWPT

Falcon - 1MW Pilot

EVR Facility Expansion

1. EVR Building Addition

- Building (existing) = **4,985 SF**
- Level 1 addition = **16,641 SF**
  - Truck bays / research shop
  - Conference room
  - Offices
- Level 2 addition = **8,321 SF**
  - Open work area
  - Group work areas
  - Roof terrace for track viewing

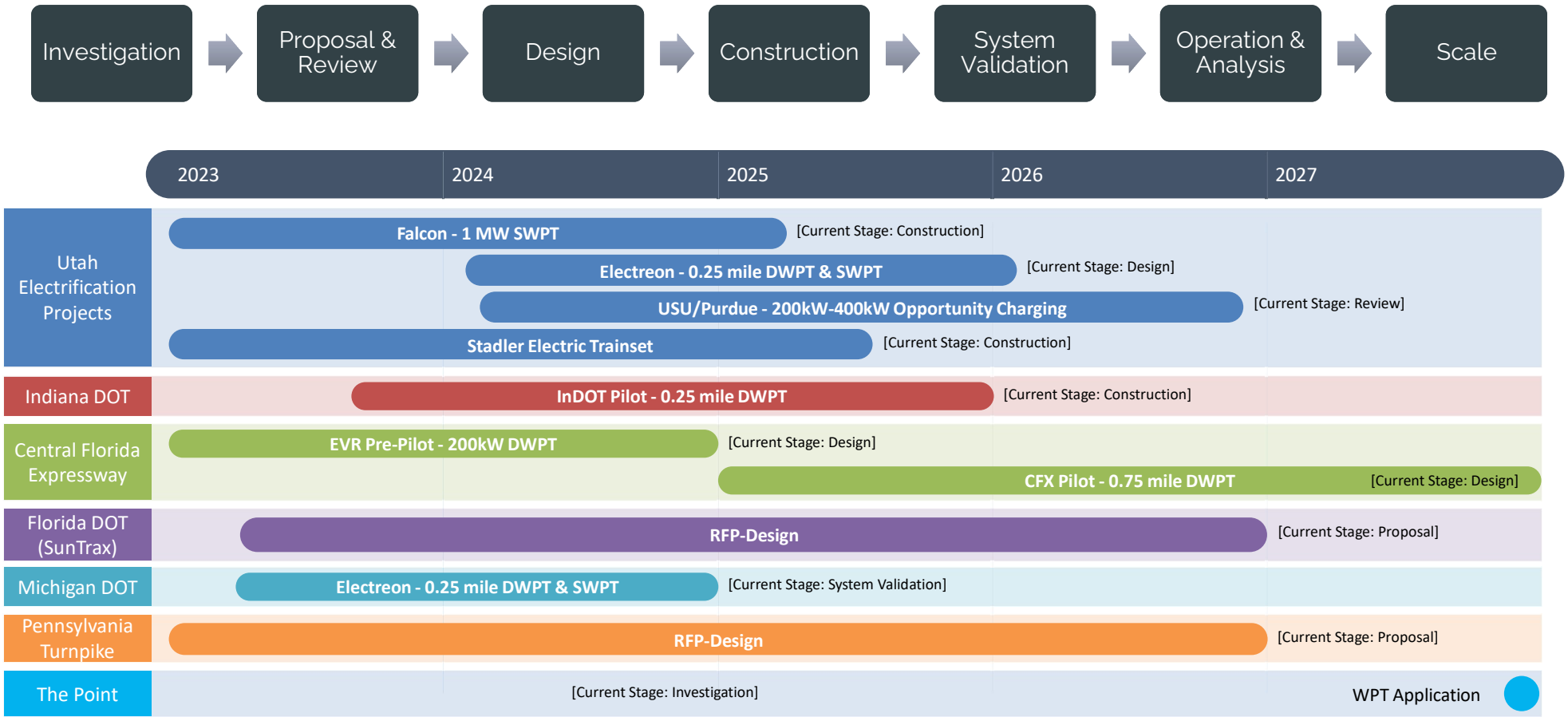
2. EVR Track Addition

- Asphalt (existing) = **27,539 SF**
  - Single lane
- Asphalt addition = **52,151 SF**
  - Triple lane

3. Research Team

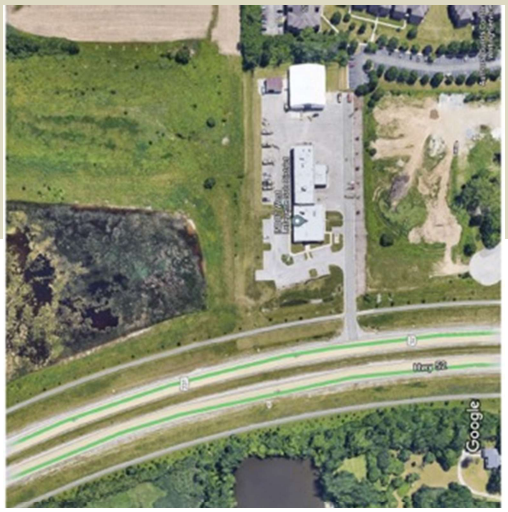
- **11** Full-Time Staff
- **11** Faculty
- **42** Students

ASPIRE - Commercial Projects

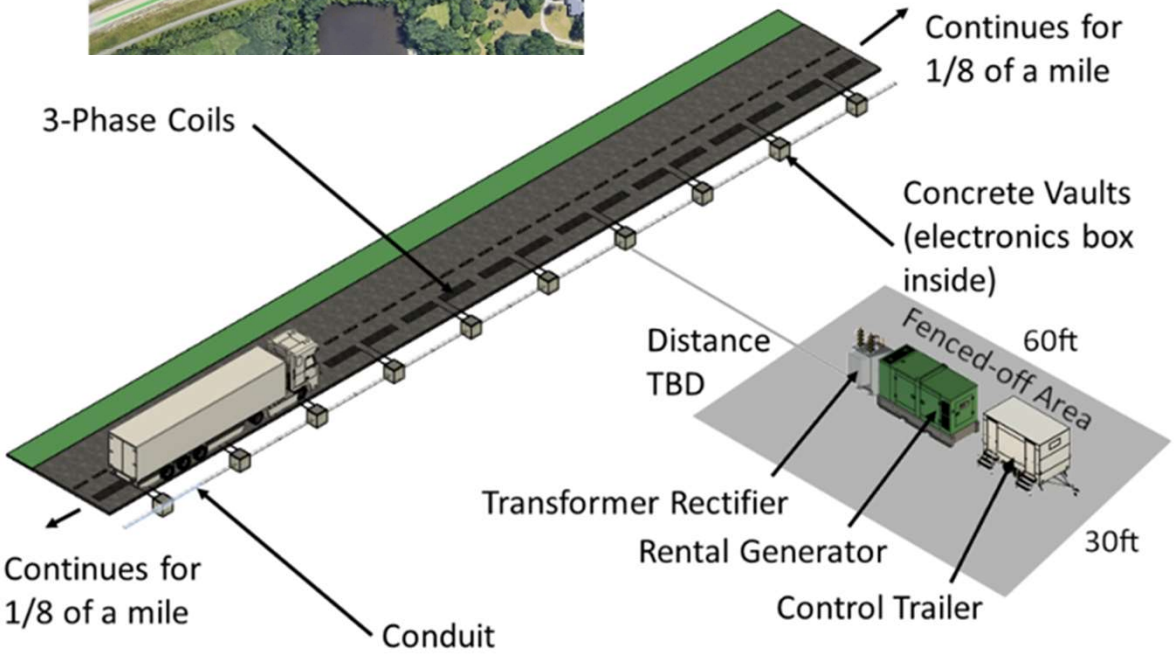


Pilot Developments

Indiana DWPT Pilot



- Loc.: US 231/US 52
- Adjacent to INDOT West Lafayette
- ¼-mi stretch
- Coreless transmitter (simplicity)
- Concrete pavement
- Letting of project 09/23
- Construction to begin Spring 2024



Pilot Developments

Indiana DWPT Pilot

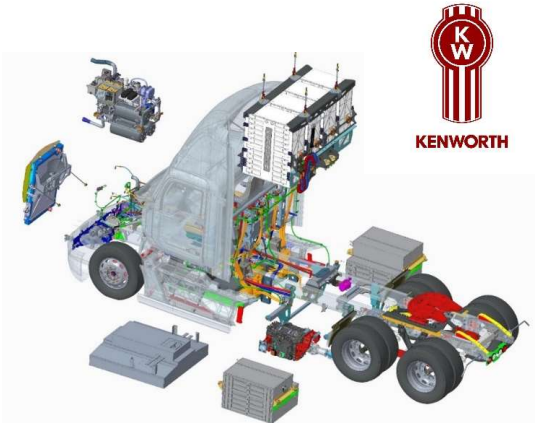
Key objectives

- Validate model predictions
- Establish/demonstrate relatively straightforward construction techniques
- Demonstrate safety of technology
- Supports modeling of grid/transportation coupling
- Demonstrate interoperability across vehicle classes
- Explore health of pavement with embedded coils
- Advance community understanding of technology
- Pilots motivate standards alignment
- Advance IN business, health, environment

Utah Pilot Developments

- **Utah Freight Electrification Pilot**
  - State promoted pilot test area
  - 1 MW deployment
  - 0.25 mile Electreon DWPT & SWPT
  - WPT opportunity charging system co-developed with Purdue
  - Smart charge management
  - Lease agreement finalized with UIPA
  - Engineering design in-progress & Design Review with SLC
  - Electric trainset
  - Demonstration of 1 MWhr battery pack (stand-alone and utility supporting application)
  - Results will assist future Utah I-15 corridor planning for multi-modal hub locations

- **Megawatt Static WPT**
  - DOE project – hardware developed by USU
  - Planned deployments (spring 2024) at EVR and Utah Inland Port (UIPA)
  - Two UPS routes with significant elevation change and cold climates
    - SLC to Logan, UT (193 miles)
    - SLC to Orem, UT (187 miles)



KENWORTH

Pilot Developments

Central Florida Expressway

- ENRX partnership
- USU supported design and EVR testing on indoor test rail
- Planned ¾-mile installation on tollway
- Planned installment (mid-2024) at EVR for testing
  - Pavement
  - Thermal
  - Performance

ENRX®

Slide 17

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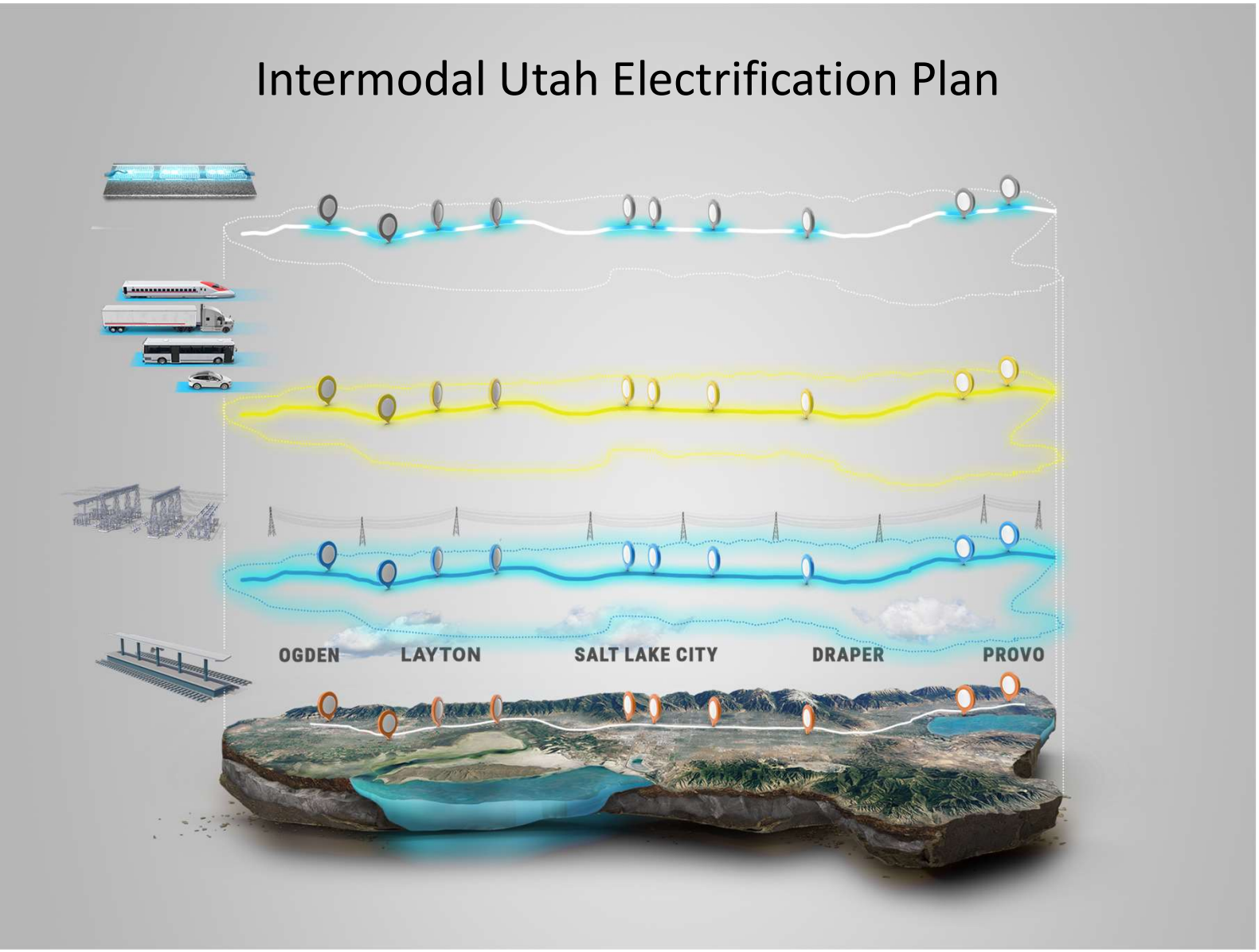
Intermodal Utah Electrification Plan



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

Smart Grid Management

- Charger Management Solutions
  - ABB
    - Develop a scalable, secure, and resilient eMosaic platform
    - Localized and bulk grid services
    - Smart charge management
  - Intermodal Hub
    - Planning
    - Algorithm Development
    - Soft-/Hardware Deployment
    - Pilot & Field Evaluation
  - Connected Communities
    - Grid network support/flexibility across multiple communities (DERs management of 8.26 MW, 13 MWh)

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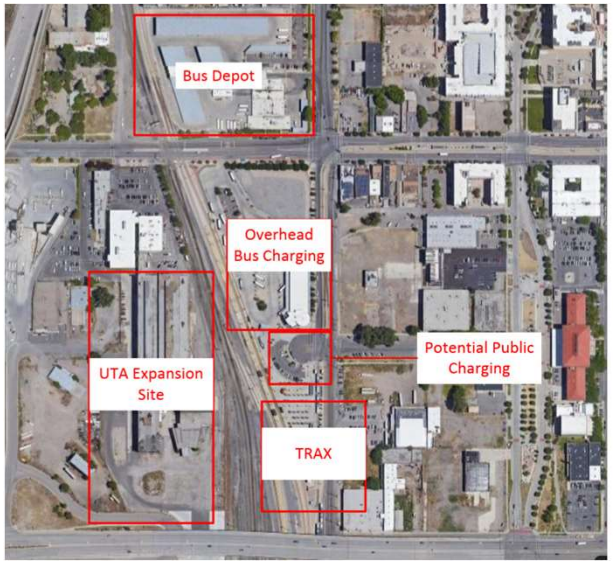


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Thank You

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