NATIONAL LABORATORY OF THE ROCKIES

De-Risking Megawatt-Scale Charging

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Photo from Getty-181828180

EV Charging and Grid Integration Activities

Analysis

Charging behavior for financial, site control, and demand forecasts

Equipment

Characterization of EV & EVSE grid interactions for control integration

Vehicle to X

Smart charging (V1G), vehicle to grid (V2G), and vehicle to building (V2B)

Storage

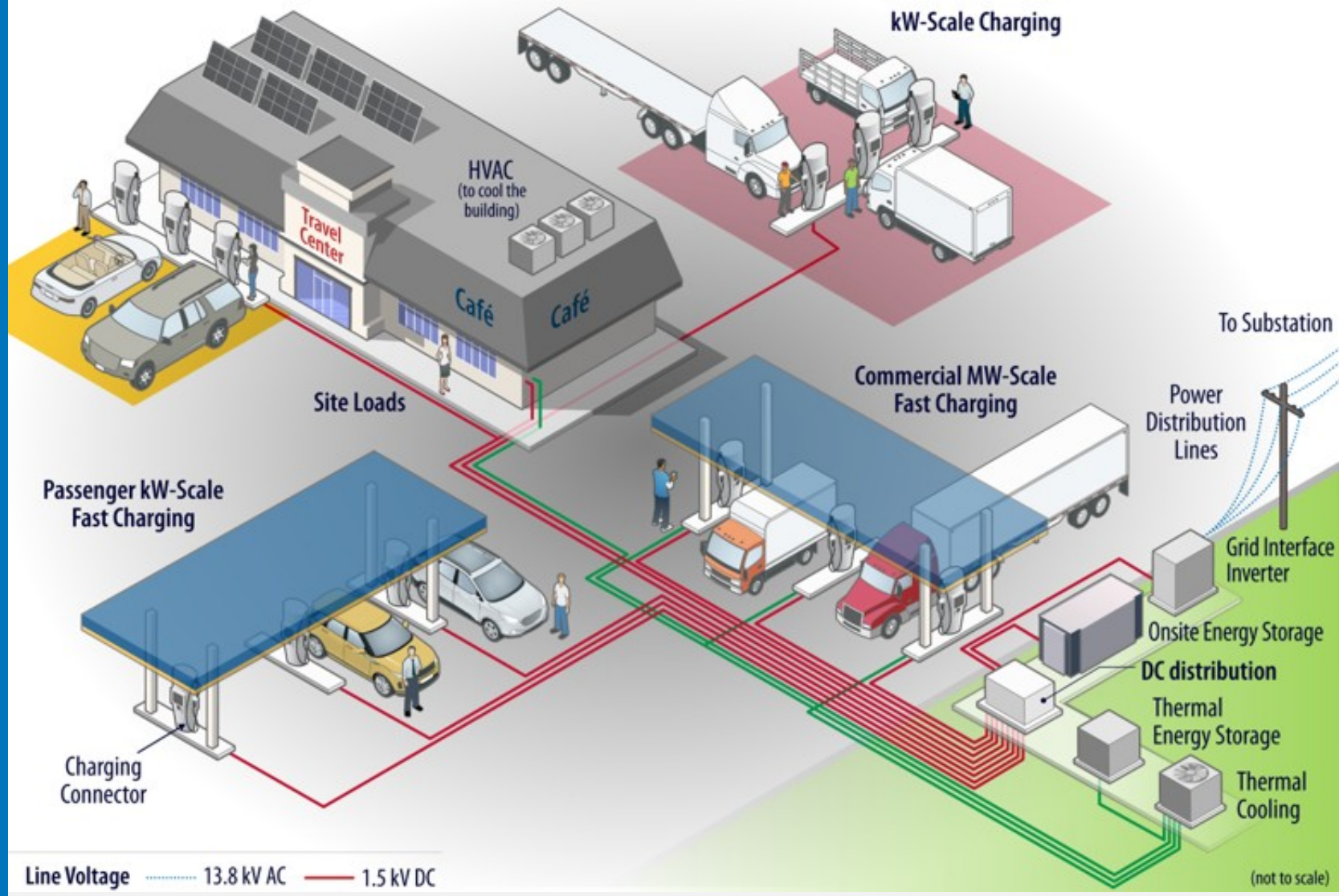
Storage implications for DCFC and charging site integration technologies

Charging Site

Charging site design and operational innovations for LD, MD, and HD

“Closing the Loop”

Evaluation, Modelling, and Emulation to Advance Energy



Identifying **grid integration**, advanced controls, and power conversion hardware solutions for the **Charging Stations of the Future** that achieve a **secure, affordable, reliable,** and **resilient** transportation system.

NLR-Developed Tools

Simulation tools built for vehicle charging modeling, optimization, and simulation

EVI-X Suite

EVI-EnSite - Site Analysis for a Charging Installation

1. Vehicle Arrivals
2. Charging Energy Need
3. Other Vehicle Characteristics

1. Electricity Cost
2. Required Number of Charging Ports and Wait Times
3. Charger Power Draw
4. Site Utilization

EVI-Rental - Developing Load Profiles for EV Rental Fleets

1. Rental Demand
2. Vehicle Fleet Info & User Behavior
3. Charging Infrastructure
4. Weather & Utility Data

1. Required Number of Charging Ports
2. Charger Utilization
3. Customer Wait Times
4. Charging infrastructure and utility Costs

EVI-Edges - Behind-the-Meter Resources Optimization and Analysis

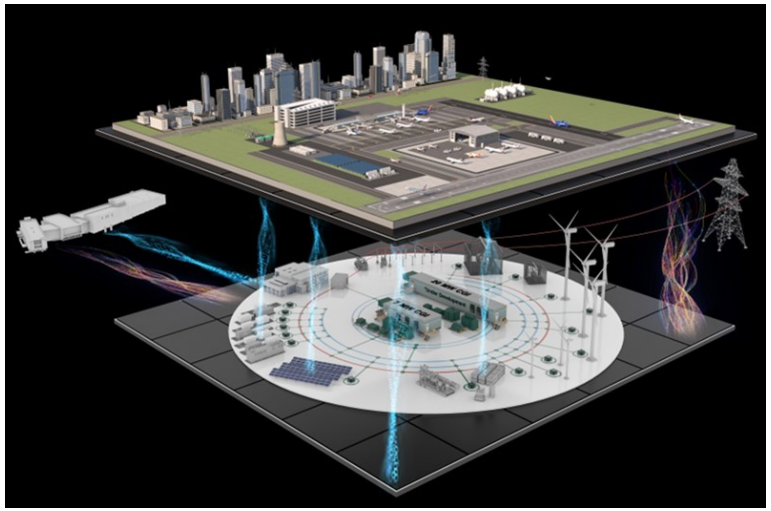
1. EV Charging Load & Infrastructure
2. Building & Utility Info
3. Weather Info

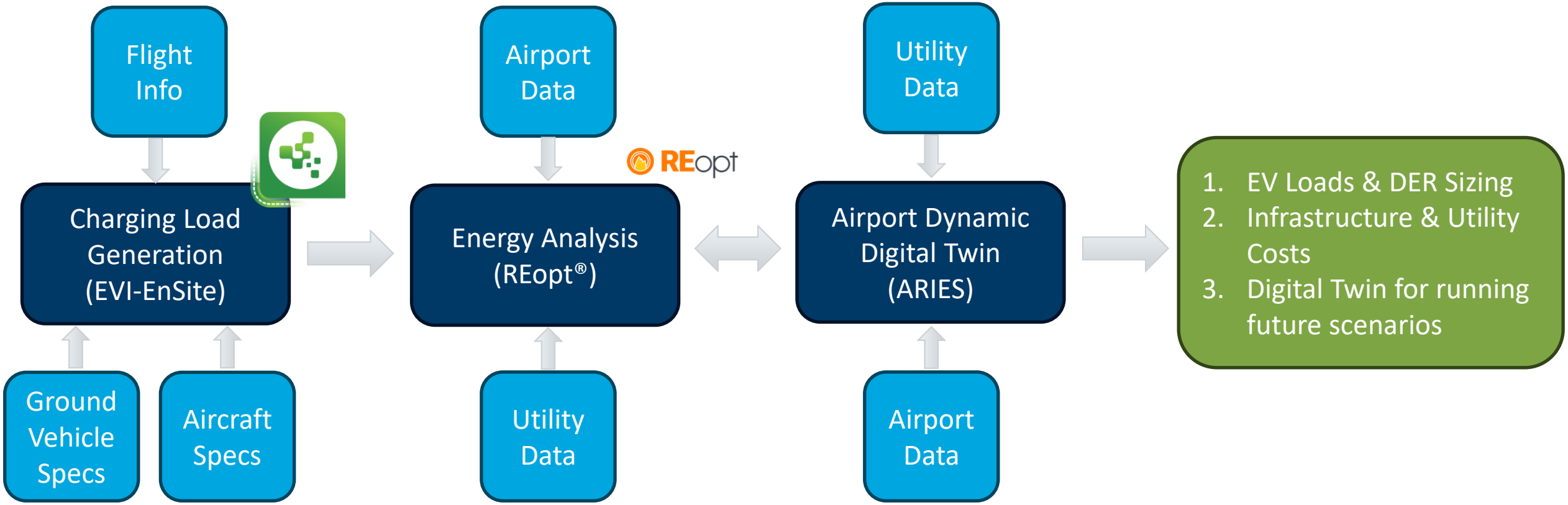
1. Equipment Sizes
2. Utility Cost Savings
3. Control Solutions
4. Investment Tradeoffs & Sensitivity
5. Resiliency Analysis

Applications for Aviation

ÆNodes

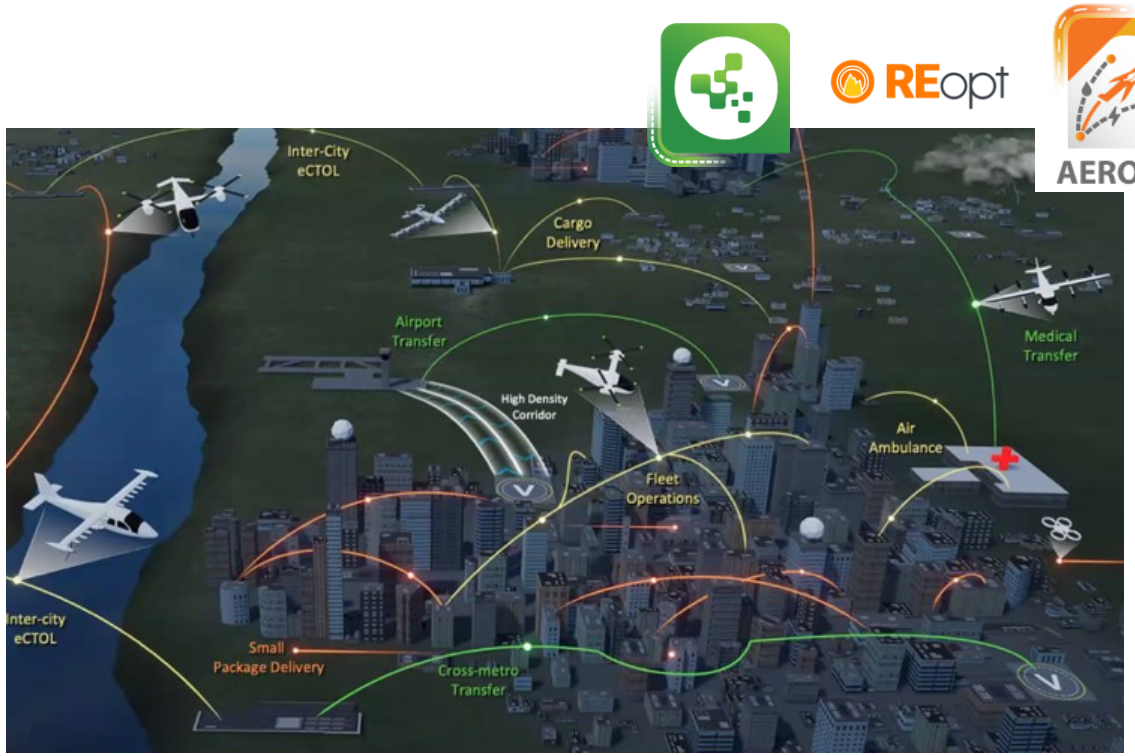
How can **local** airports be utilized to accommodate AAM traffic and help grow adoption? Can the airport also serve as a generation source for the surrounding community in an emergency?





Vertiport Electrification

How will advanced air mobility (eVTOL and fully/hybrid-electric) traffic impact airports and metropolitan areas?



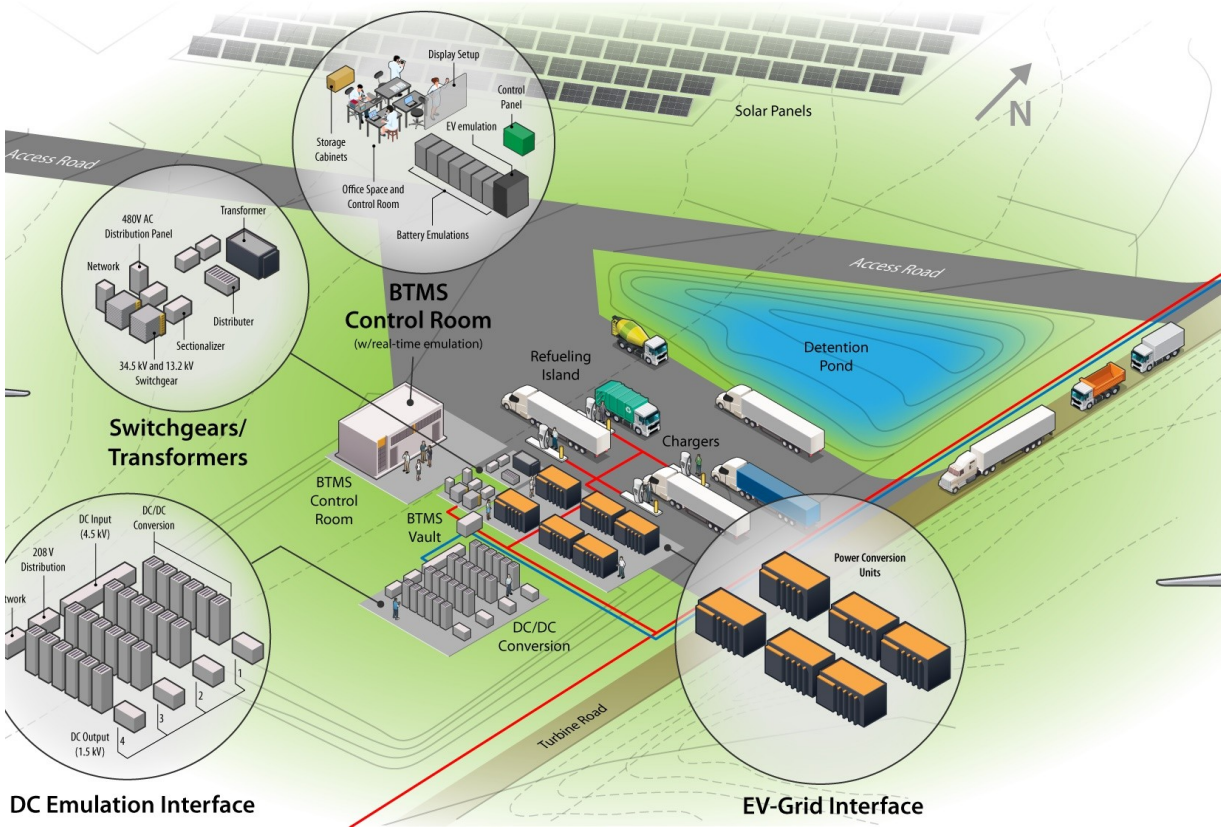
- Model AAM traffic and charging loads at three sites in two different metropolitan areas
- Generate DER sizes and perform grid impact analysis to analyze potential overloading, power quality issues, and infrastructure upgrades.

Integration of MW Charging with the Grid

EV Charging Capabilities at Flatirons Campus for Site Levels up to 10 MW

MW-Scale Charging Objectives

- Develop a world-class facility for MW-scale battery emulation to support grid integration with technologies across the ARIES portfolio (wind, solar, hydrogen, vehicle, buildings).
- Develop the world's pre-eminent research capabilities around high-power vehicle charging with a focus on:
  - component design/validation
  - smart charge management
  - versatile and large-scale emulation
  - multi-MW experimentation
  - systems integration with the distribution grid and site resources.
- Provide DOE and industry with critical RD&D capabilities to accelerate and scale aggressive transportation energy system goals for on-road, off-road, and aerospace fleets.



Current Status of BTMS / MW-Charging Site

(Photo from 11/2025)

Key Capabilities of this Site

- NLR specializes in multi-MW charging for medium- and heavy-duty vehicles (MHDVs), leading several activities focused on charging technology development—from the research and evaluation of novel charging architectures to the characterization of charging technologies (presently at ESIF).
- The site can host charging equipment at 13.2kV for multi-megawatt charging of MHDVs. This new 10-MW site will leverage existing grid emulation for charging integrated with MW-scale solar, wind, building loads, and battery storage for optimized operation that will demonstrate innovative flexible charging capabilities.

Thank You!

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