Highland

Considering Fleet EVs in Distribution and Transmission Planning

Amy McGuire

Section 1

Quick Background

The Highland story

Founded in Massachusetts in 2019

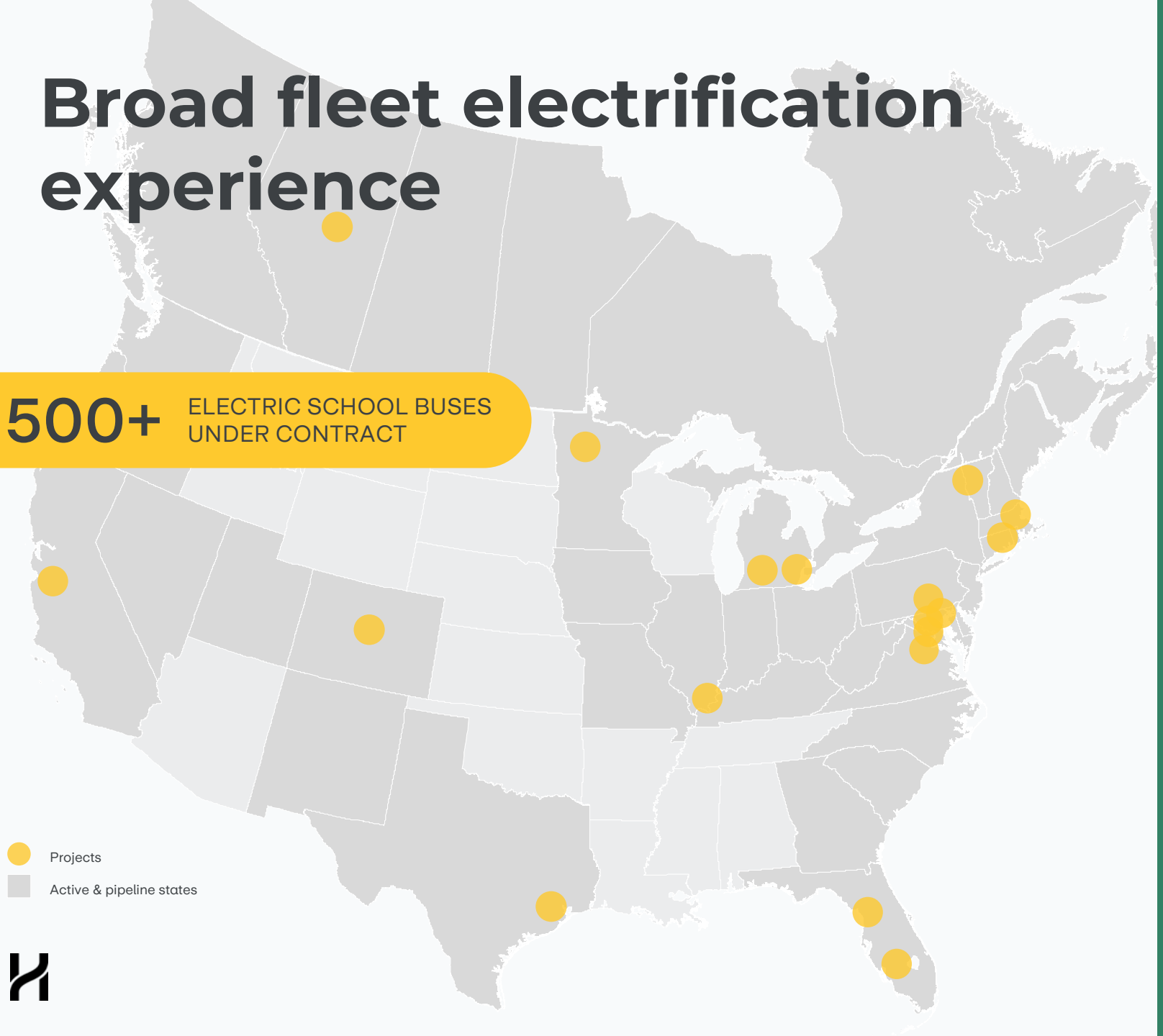
Largest electric school bus project in North America: MCPS, Maryland

First commercial electric school bus V2G program in the U.S.

Leader in public-private partnerships: 500+ buses under contract

Broad fleet electrification experience

500+ ELECTRIC SCHOOL BUSES UNDER CONTRACT



- South Burlington School District, VT
- Beverly Public Schools, MA
- Baltimore County Public Schools, MD
- Fleet Contractor, MA
- Baltimore City Public Schools, MD
- Montgomery County Public Schools, MD
- Unionville-Chadds Ford School District, PA
- Manassas City Public Schools, VA
- Cunningham Transport, Alberta, Canada
- Red Lakes, MN
- Salinas City Elementary School District, CA
- Peak to Peak Charter Schools, Inc., CO
- Hardin County Community District No. 1, IL
- Cypress-Fairbanks School District, TX
- Jackson Public Schools, MI
- Dearborn Public Schools, MI
- Dixie District Schools, FL
- Glades County School District, FL
- Red Lakes, MN

Section 2

State and Regional Goals and Forecasts

ISO-NE 2050 Transmission Study

Input Assumptions & Preliminary Lessons Learned

Assumptions

- Inputs based on MA “Energy Pathways” Study
- Significant new RE generation
- Retirement of all coal and oil generation, with some natural gas retained
- Significant transportation and heating electrification (and peaking load)
- Increased imports from Quebec and New York

Lessons Learned

- Reducing peak loads significantly reduces transmission costs
- Generator sizes and locations can affect overloads
- High-likelihood concerns can be prioritized
- Incremental upgrades can be made as opportunities arise

Source: ISO-NE presentation to CETWG, August 25, 2023

Climate Goals & Anticipated Load Growth

MA State Climate Goals

- 20 GW of solar
- 20 GW of offshore wind
- 10 GW of energy storage
- 5M EVs
- 3M decarbonized buildings

Predicted Peak Load Growth

- 29 GW by 2050

Source: National Grid presentation to GMAC; ISO-NE presentation to CETWG, August 25, 2023

Section 3

Fleet Electrification & V2G

Vehicle-to-grid (V2G) with Electric School Buses

# OF BUSES	ENERGY CAPACITY	IMPACT TO COMMUNITY
25	5 MWh	116 Local Homes for 1 Day
275	58 MWh	1,400 Local Homes for 1 Day
1,100	231 MWh	5,500 Local Homes for 1 Day

Electric school buses are essentially batteries on wheels. They're ideally suited to provide capacity, stability, and power to the grid.

500k electrified buses add 60GWh of storage capacity.

25k electrified buses add 3GWh

REAL RESULTS

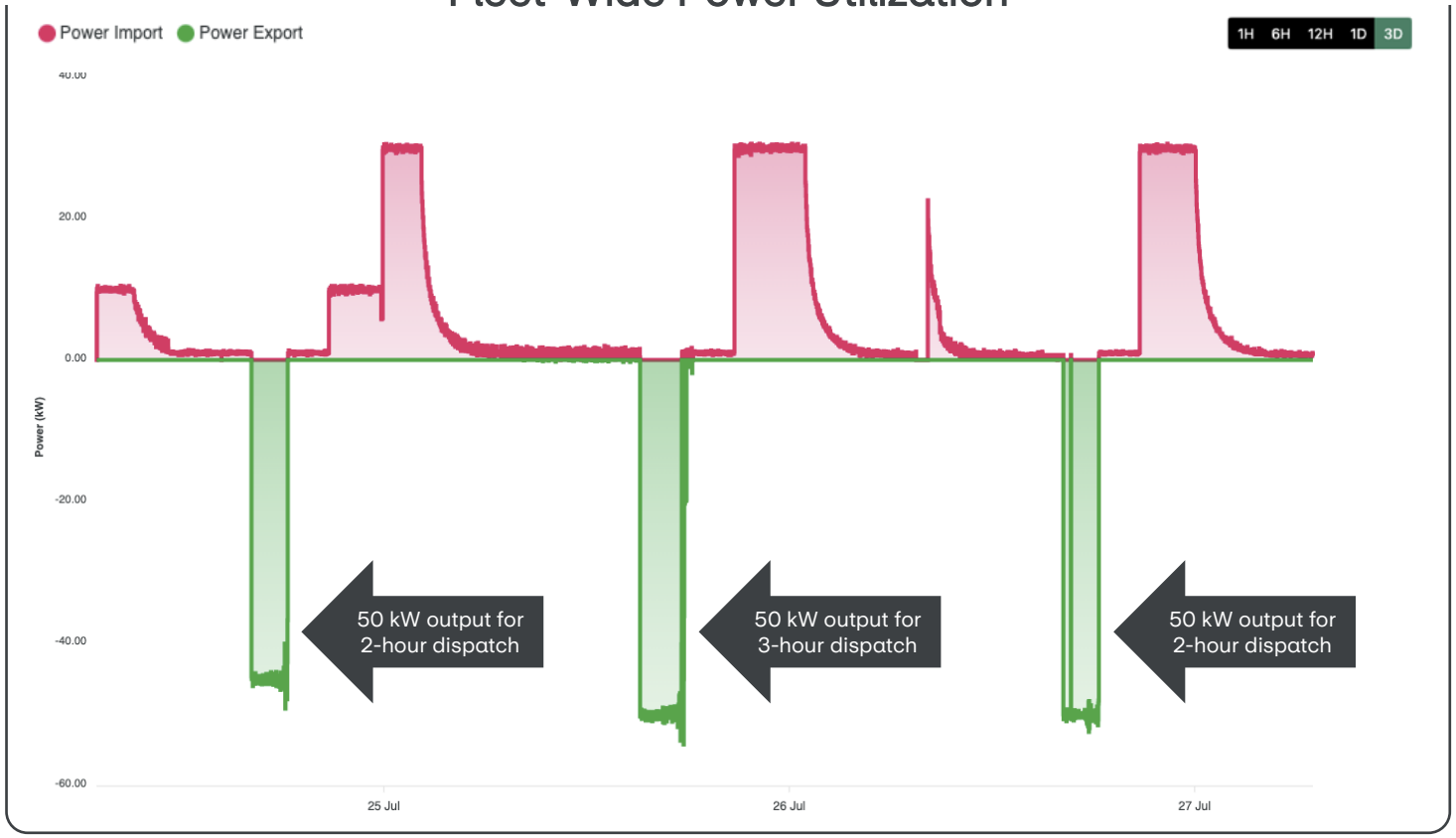
In the summers of 2021 and 2022, Highland orchestrated a commercial V2G program with National Grid in Massachusetts, that sent **10.8 MWh** back to the grid over **158 hours**.

V2G Operating Experience

Highland has two operating Vehicle-to-Grid projects for peak shaving

Single Bus V2G Performance Summer 2022 – Massachusetts[1]

Fleet-Wide Power Utilization



1. Snapshot from Highland's energy management software system, developed in coordination with partner Synop. Output not a guarantee of future performance.

Section 4

Considerations for Transmission & Distribution Planning

Transportation as a distributed energy resource

Incorporating all the uses and benefits of EVs will be critical to our climate goals and the grid

Transportation is anticipated to be a peak load

Transportation assets can also be (mobile) storage

Storage can act like a generator

Mobile storage (with a long dwell time and a predictable transportation use case) can be a distributed energy resource

Where we need to:

- Significantly reduce peak loads to reduce costs
- Precisely located right-sized “generators”
- Prioritize “high-likelihood concerns”, and
- Create opportunities to make incremental upgrades

Using an asset type that can meet all those needs only makes sense

Thank You

Amy McGuire

amy@highlandfleets.com

