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Welcome & Infrastructure Investments for the Climate and Economy

Maria Robinson
Director of the Grid Deployment Office of United States Department of Energy

Karen Wayland
CEO, GridWise Alliance

Gil Quiniones
CEO, ComEd & Chair, GridWise Alliance

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Electricity and Telecom Convergence to Deliver Energy and Information

Gil Quiniones
CEO, ComEd & Chair, GridWise Alliance

Chris Guttman-McCabe
Chief Regulatory and Communications Officer, Anterix

Karen Wayland
CEO, GridWise Alliance

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Architecture for a Carbon-Free Grid

Rick Maldonado
Vice President, T&D Engineering & Grid Transformation, CPS Energy

David Bobzien
Director, Nevada Governor's Office of Energy

John Haysbert
VP and Head of Government Relations & External Affairs, Hitachi Energy

Deepa Poduval
Senior Vice President, Global Advisory Practice, Black & Veatch

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Digital Transformation – What's Next in IT/OT Convergence

Justin Driscoll
Interim President & CEO, NYPA

Adrienne Lotto
Senior Vice President of Grid Security, Technical and Operations Services, American Public Power Association

Mahesh Sudhakaran
General Manager of Grid Software, GE Digital

Russell Boyer
Global Energy Field Director, Utilities, Dell Technologies

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Integrated Planning for Infrastructure Projects

Gary Brinkworth
Director of Enterprise Research & Technology Innovation, Tennessee Valley Authority

Kamran Ali
VP Transmission Planning, AEP

Michelle Fay
Partner, Energy, Sustainability, and Utilities, Guidehouse

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Foundational Investments to Maximize EV Fleet Benefits

Marie Steele
Vice President, Electrification & Energy Services, NV Energy

Karen Glitman
Senior Director, Center for Sustainable Energy

Amy McGuire
Director of Market Development, Highland Electric Fleets

Sue Gander
Director, Electric School Bus Initiative, World Resources Institute

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Foundational Investments to Maximize EV Fleet Benefits

12/5/2022

Karen Glitman, Senior Director

Center for Sustainable Energy®

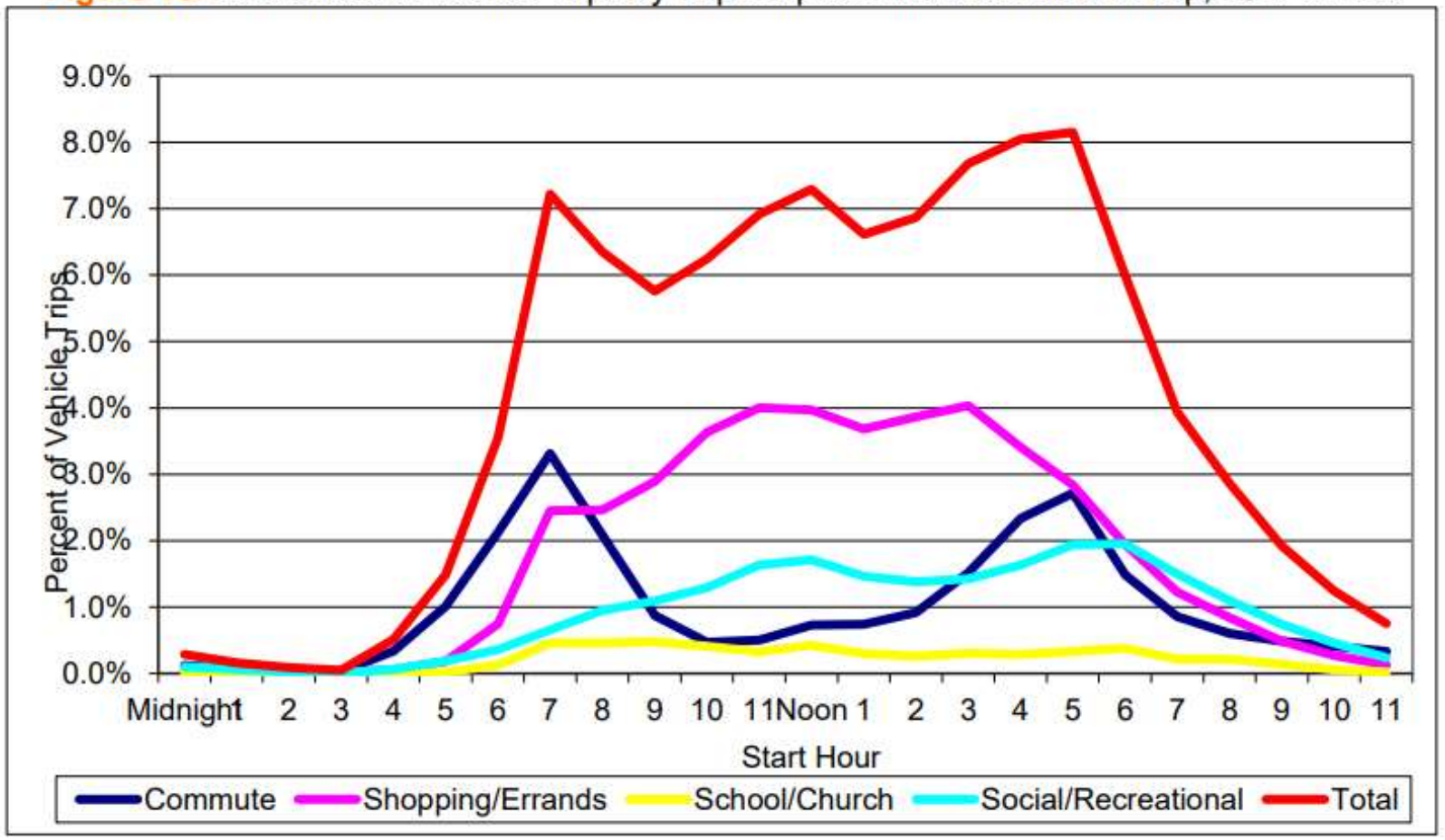
How Much (potential)Capacity/Need Exists?

Segment	Number of Vehicles	Average Battery Capacity	% Of Time Vehicle Not in Use	Daily Average Vehicle Miles Traveled (VMT)	Average Holiday Travel VMT
Light-Duty	194 million	6.6 kW	95%	35 miles	250 miles
School Bus	0.5 million	106 kW	89%	75 miles (during average 180 days school in session)	NA
Transit	1.1 million	450 kWh	66% (varies greatly)	120 miles	NA

Center for Sustainable Energy™

When Might the Capacity be Available?
When Might Peak Charging Occur?

Figure 15. Distribution of Vehicle Trips by Trip Purpose and Start Time of Trip, 2017 NHTS



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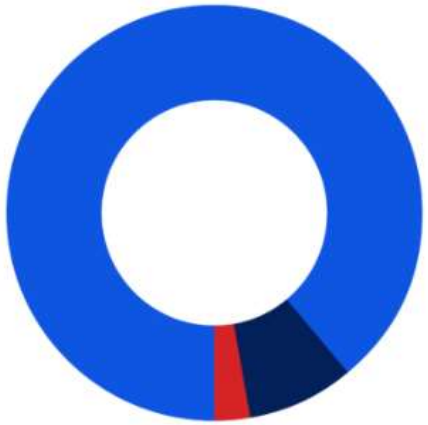
New Holiday Peaks?

2022 Thanksgiving Holiday Travel Forecast

Share of Travelers by Mode



Number of Travelers by Mode

	Auto	Air	Other	Total
2022 (forecast)	48.7M	4.51M	1.43M	54.6M
2021	48.5M	4.18M	1.16M	53.8M
2019	49.9M	4.58M	1.49M	56.0M
Growth* (2021 to 2022)	0.4%	7.9%	23.5%	1.5%
Growth* (2019 to 2022)	-2.54%	-1.38%	-3.92%	-2.49%

*Percentages may differ due to rounding.

Source: AAA

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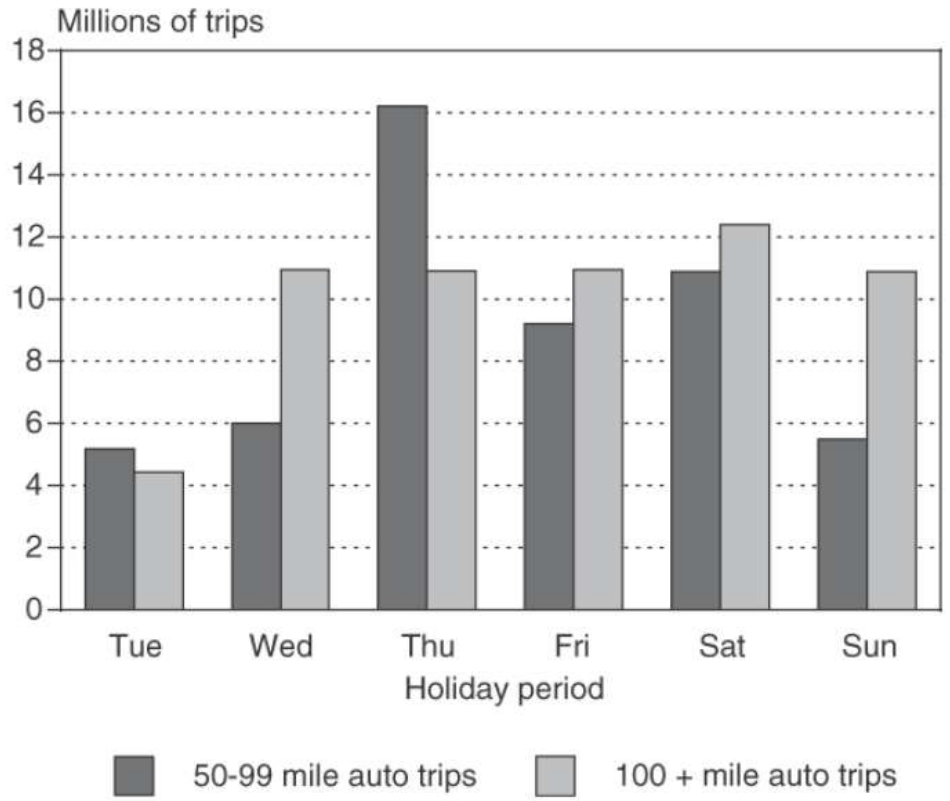
How Far do People Drive for Holidays?

Figure 3. Long-Distance Thanksgiving Driving Trips By Distance

Thursday, December 22, 2011

Excel | CSV | Table Version



Source: BTS

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NV Energy Transportation Electrification Plan

Docket 22-09006

Overview

powershift by NVEnergy

December 2022

Building the Energy Foundation for Nevada's Electric Vehicle Transition

The Transportation Electrification Plan is designed to meet these objectives:

- Accelerate transportation electrification with support for all customer classes
- Design programs to maximize benefits including flexibility and minimize grid impacts
- Provide significant investment early in the electric vehicle transition to ensure Nevada has the infrastructure in place to maximize the benefits from this energy transition while maintaining the safety, reliability and efficiency of the electric grid

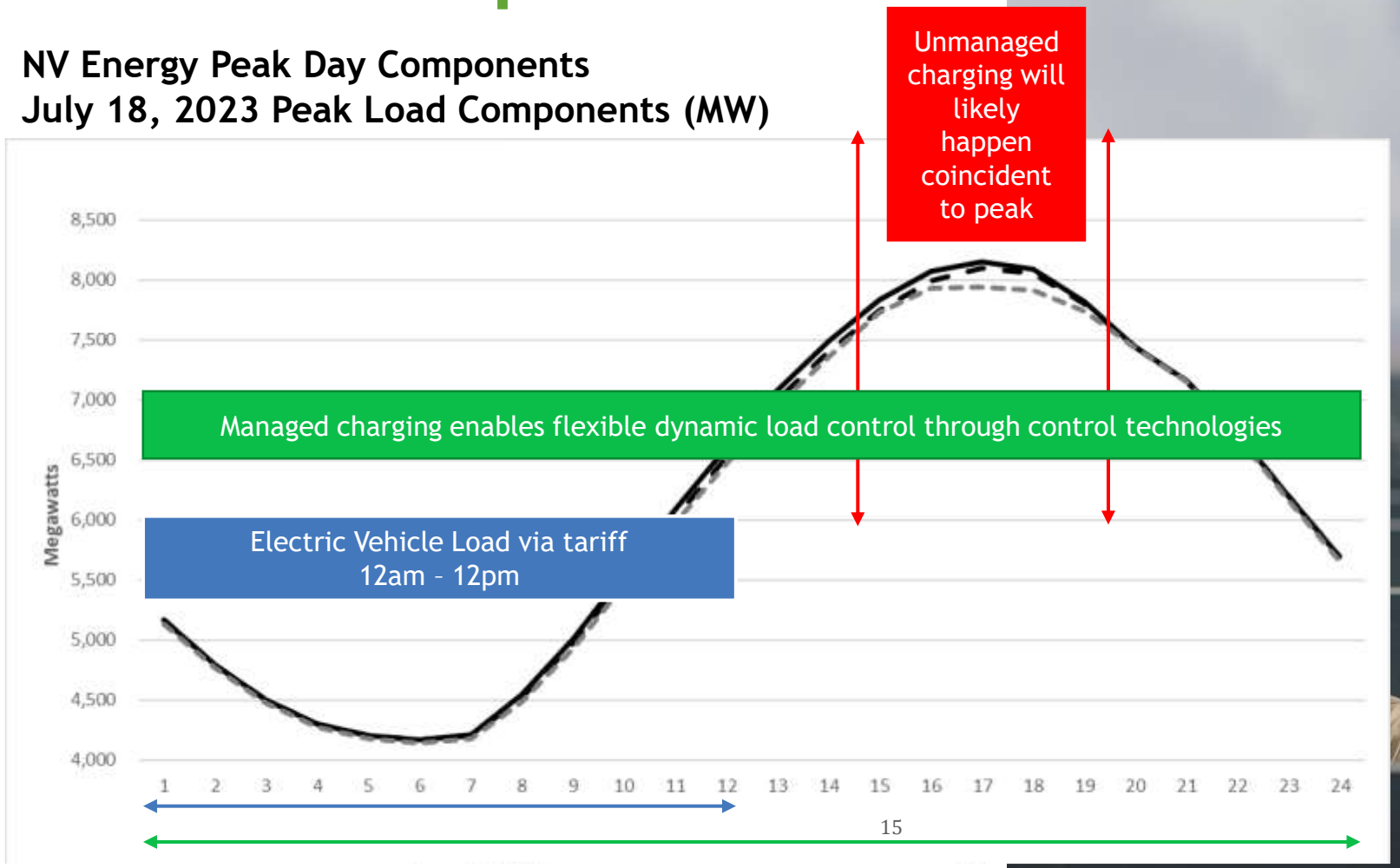
New Electric Vehicle Load is Coming – To Benefit, Nevada Must Prepare Now

Nevadans have the unique opportunity to benefit from transportation electrification.

Due to the energy required to serve NV Energy customers during Nevada's hottest periods, excess capacity exists for most of the year.

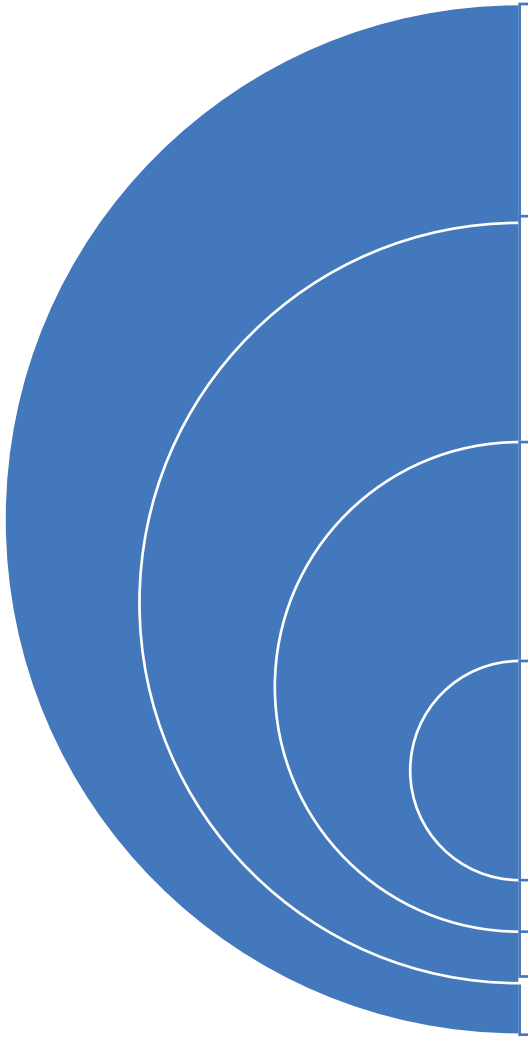
It is imperative to ensure electric vehicle load is flexible, through technology or tariffs, so that all Nevadan's can benefit from this new load by more efficiently utilizing existing resources.

NV Energy Peak Day Components
July 18, 2023 Peak Load Components (MW)



Source: 2021 Third Amendment Figure LF-12

Setting a Blueprint for the Future (proposed)



Planning for Future Needs & A Skilled Workforce	• Transportation Analytics/Planning Tool • Electric Vehicle Load Identification & Disaggregation • Residential Rule 9 Electric Line Extension "EV Allowance Adder" • Installer requirements
Technology Co-Optimization	• Smart Panel Integration Trial • Inflation Reduction Act Innovation Demonstration • Residential Charging Incentive Program & Residential Turnkey Program
Optimal Grid Integration via System Integration	• Technical requirements • Performance requirements • Integration with advanced Distributed Energy Resource Management System ongoing implementation • Investigate direct NV Energy billing integration
Enabling Flexible Load	• **Managed Charging** program (new) • **Electric Vehicle Rate Rider** ("EV TOU") adjusts off-peak to 12am-12pm to utilize excess capacity and absorb surplus morning renewable energy (modified) • changes will flow through all EV-TOU tariffs, including the Electric Vehicle Commercial Charging Rider Time-Of-Use and the NV Energy Electric Vehicle Charging Network • **Electric School Bus Vehicle To Grid Trial tariff** (expanded eligibility)

NV Energy Transportation Electrification Plan

Docket 22-09006

Overview

powershift by NVEnergy

December 2022

Highland

GridCONNEXT

December 2022

Amy McGuire

The Highland Story

Founded in 2019

$253M capital raised

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: 375+ buses under contract

V2G Program

EV TRANSITION

Why Lead with the School Bus?

- School buses are the perfect electric vehicle use case – predictable routes, single charging location, equitable benefits.

- Predictable

Defined routes, limited range & uniform depots

- Versatile
- Large & underutilized bidirectional battery

- Available

4+ EV models with fierce OEM competition

*Sample savings, not guaranteed

Vehicle-to-grid (V2G) with Highland

# 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 emergency power to the grid.

- 500k electrified buses add 60GWh of storage capacity.

Highland uses V2G participation to offset the upfront cost of electric buses and make your fleet more affordable.

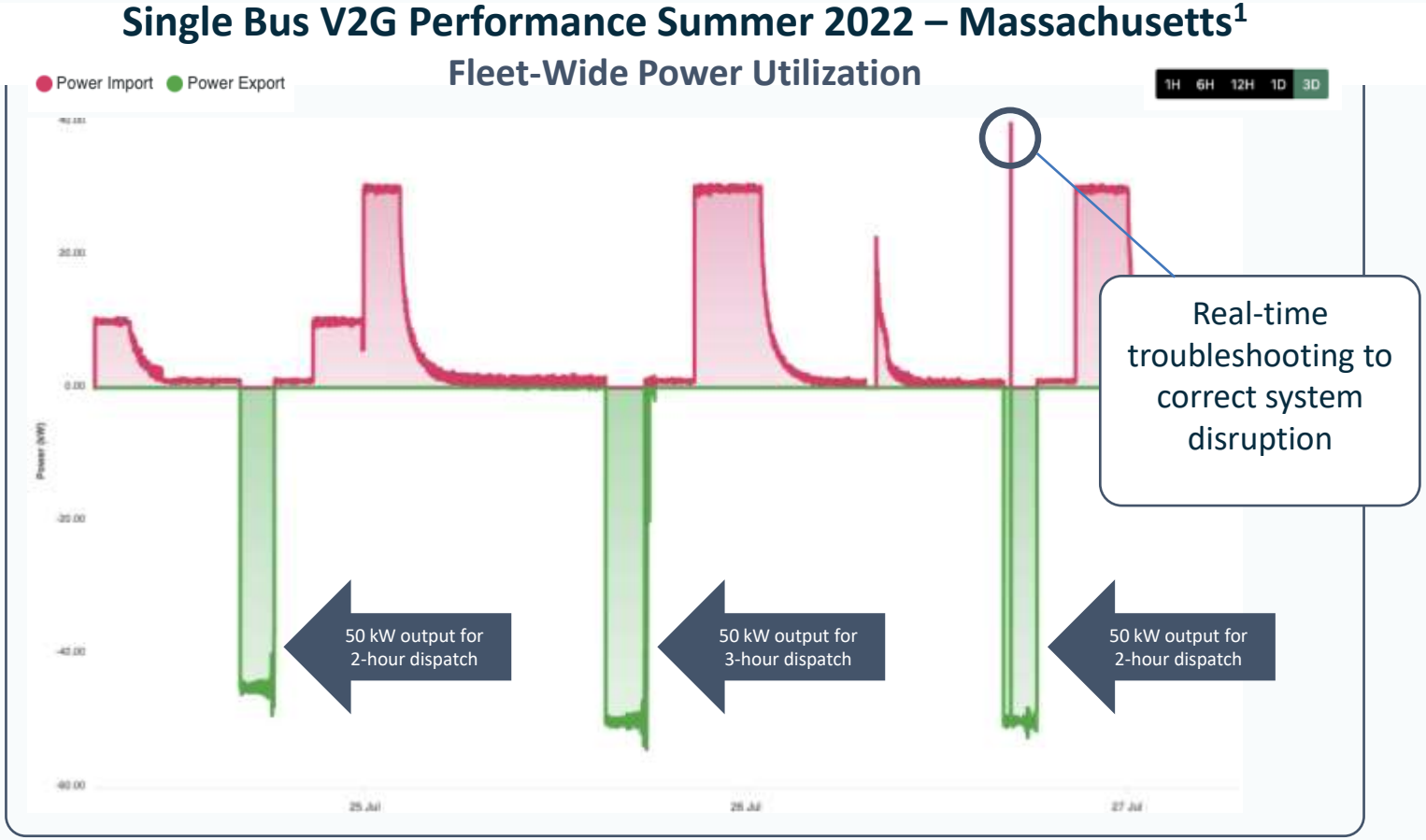
REAL RESULTS

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]



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

V2G Conceptual Diagram

- Provide up to **nine hours of 60kW output** with a three-bus bidirectional charging system:

600 kWh of mobile dual-use EDSI assets[1]

Three interconnected 60 kW bidirectional chargers[2]

Single 60 kW bidirectional inverter for charge / discharge[3]

Backflow energy to anywhere with a bidirectional charger: installation distribution grid, microgrid, or critical infrastructure[4]

A single 3-bus system (pictured) services a peak electric power output of 60 kW for 9 hours

40 systems (4,000-amps) will support 2.4 MW of power output for 9 hours (or 60 kW for 360 hours)

1. Based on 200kWh of usable battery capacity on Thomas Built Jouley (2022 vintage); actual capacity varies by OEM model
2. Sequential discharge format requires cycling between ports; simultaneous discharge capabilities expected in 2023
3. System capable of continuous backflow of 60 kW until bus batteries are depleted; DC-to-AC conversion results in approximately 5% line losses in Highland operating projects
4. Additional electrical panels and controls required for interconnection; dependent on localized project dynamics

Grid Champion on the “Hot Seat”

Congressman Paul Tonko (NY-20)
United States House of Representatives

Lee Krevat
Founder, Krevat Energy Innovations

Karen Wayland
CEO, GridWise Alliance

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