

RESILIENTPOWER

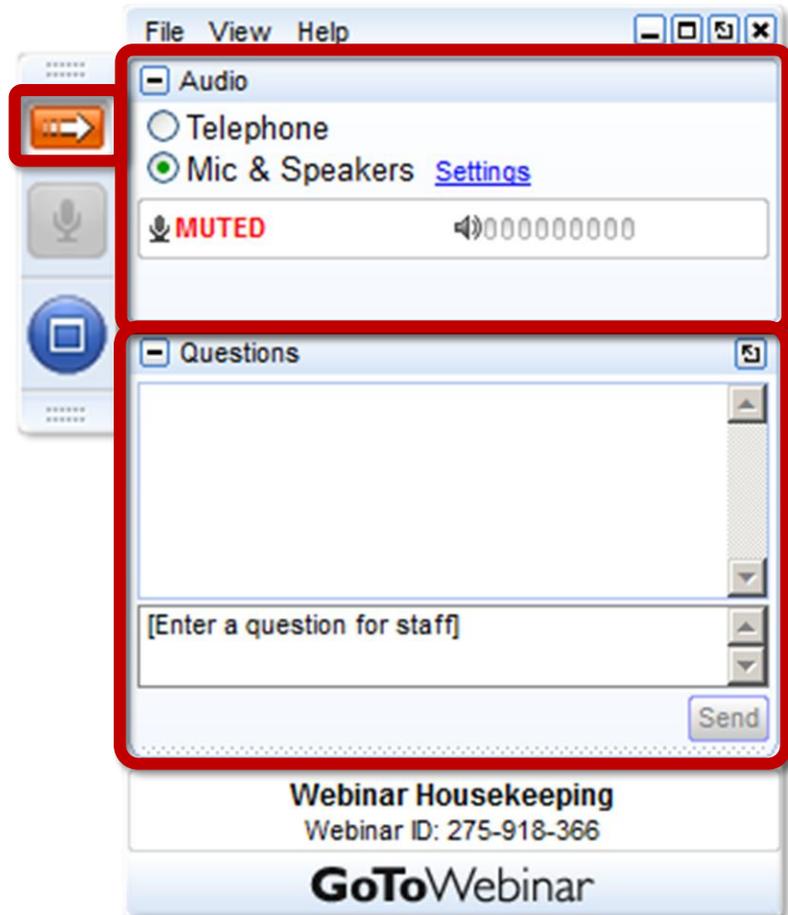
A project of CleanEnergyGroup



Supporting Housing and Mobility with Resilient Power in Boulder

October 11, 2018

Housekeeping



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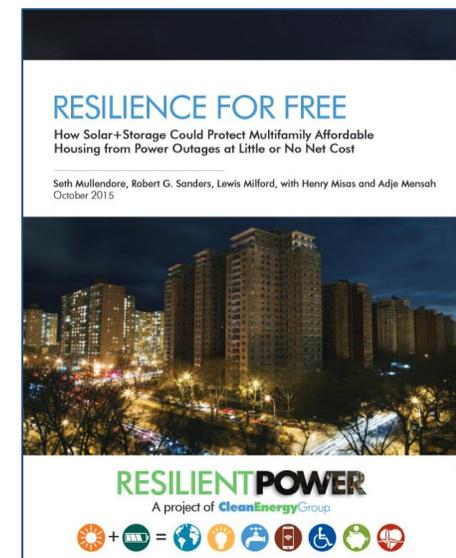
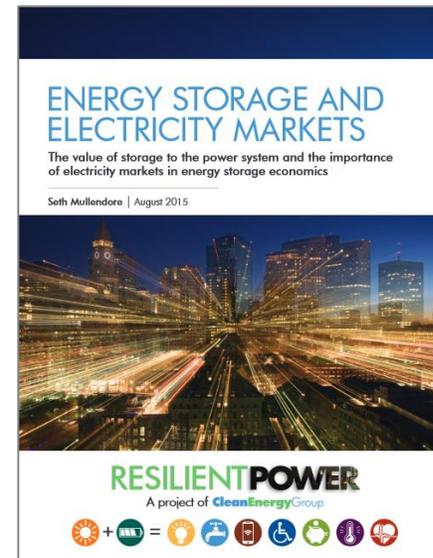
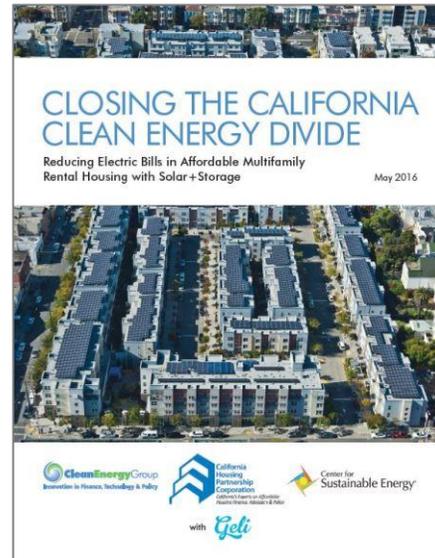
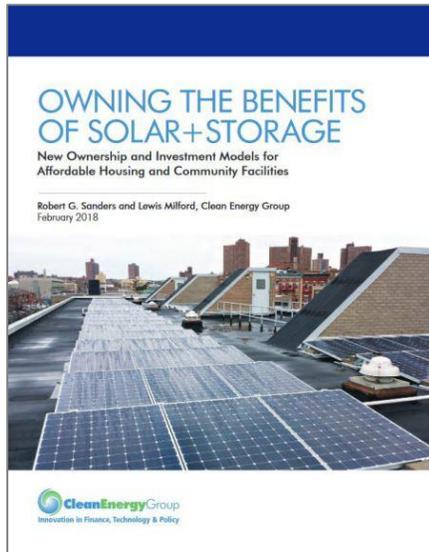
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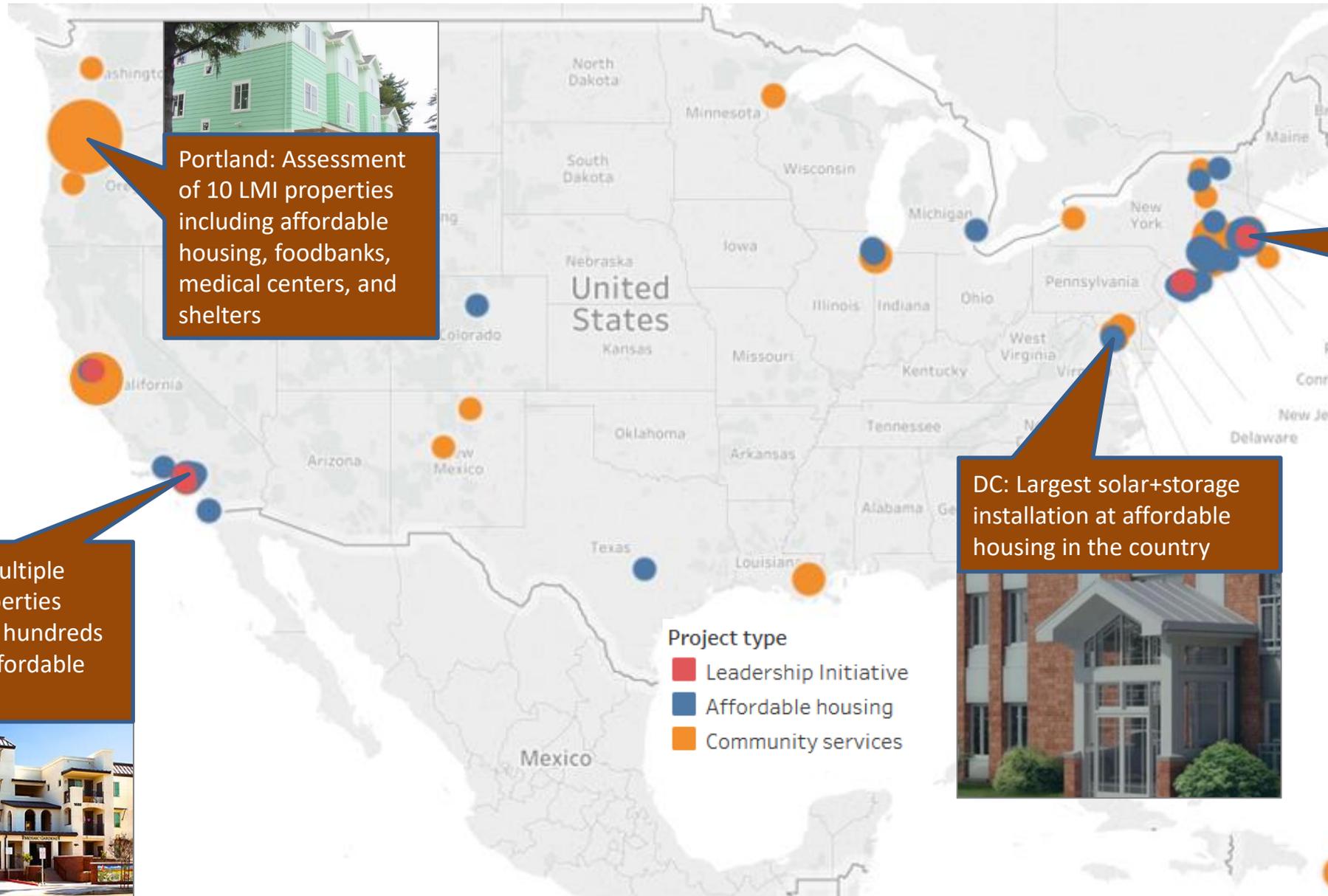


THE RESILIENT POWER PROJECT

- Increase public/private investment in clean, resilient power systems (solar+storage)
- Protect low-income and vulnerable communities, with a focus on affordable housing and critical public facilities
- Engage city, state and federal policy makers to develop supportive policies and programs



SUPPORTING 100+ PROJECTS ACROSS THE COUNTRY



Portland: Assessment of 10 LMI properties including affordable housing, foodbanks, medical centers, and shelters



Boston Medical Center: One of the first hospitals in the country to install storage for resiliency

California: Multiple housing properties representing hundreds of units of affordable housing



DC: Largest solar+storage installation at affordable housing in the country



Puerto Rico: Supporting the installation of solar+storage at more than 60 medical clinics

Supporting Housing and Mobility with Resilient Power in Boulder

Webinar Speakers



Lex Telischak
Electrical
Engineer, City
of Boulder



Tim Beal
Director of
Sustainable
Communities,
Boulder Housing
Partners



Tony Boniface
President,
Independent
Power Systems



Bill Patterson
Chief Financial
Officer, Via
Mobility
Services



Ben Gregory
Director of
Business
Development,
Pos-En



Seth Mullendore
Vice President
and Project
Director, Clean
Energy Group



Energy Resilience in Boulder, Colorado

Presented by:

Lex Telischak - Project Manager & Electrical Engineer - City of Boulder

Tim Beal - Director of Sustainable Communities - Boulder Housing Partners

Tony Boniface - Owner and President of Independent Power Systems

Department of Energy - Resilient Energy Delivery Infrastructure (REDI) Grant

This material is based upon work supported by the Department of Energy under Award Number DE-OE0000785

What is Energy Resilience?

Energy Resilience is the capacity and active ability to maintain the provision of an adequate energy supply to meet critical load demands. This typically is focused on periods of disruption of conventional energy delivery systems such as electricity and natural gas.

Renewable Energy Resilience is the capacity and active ability to maintain the provision of an adequate energy supply to meet critical load demands with renewable (non-fossil fuel) generating resources.

True Resilience is the capacity and active ability to maintain the provision of an adequate energy supply to meet critical load demands in the absence of all conventional energy delivery systems such as electricity and natural gas, potentially for an extended period of time.

City of Boulder: Objectives & Goals



- Foster community resilience through the ensured availability of core community services
- Provide resilience in the face of electric system disruptions and natural disasters
- Enable resilient & electric transportation options at Via
- Ensure Boulder Housing Partners and Via Mobility Services remain online and operational during grid events
 - Boulder Housing Partners acts as a command post for over 3000 lower income community residents
 - Via Mobility Services plays a critical role as a second responder

Original Project - Operational Resilience for a Critical Water Treatment Facility



Community Resilience

Via Mobility Center

Storage, Inverters, & Power Conditioning



Generator



Solar



University of Colorado @ Boulder

Boulder Housing Partners



Boulder Housing Partners - Introduction



The Boulder Housing Partners Mission

Our mission is to **provide** quality, affordable housing, **inspire** vibrant communities, and **create** the opportunity for change in people's lives.

We envision a diverse, inclusive and sustainable Boulder as a result of our efforts.

- Housing Authority of the City of Boulder
- Provide 1,400 dwelling units of affordable rental housing
- Own and operate 35 communities spread throughout the City of Boulder

Who BHP Serves

WHO WE SERVE

Includes Housing Choice [Section 8] Voucher residents living in local community and residents living in Boulder Housing Partners (BHP) Communities.



1,622
Households

with



3,221
People

Composition
of People

2,014

People
Living in
Households
with
Children

1,037

Seniors &
People w/
Disabilities

170
Other

earning

\$15,537
Median Income



73%
Percentage of Households who
earn 30% AMI[†] or less

Affordable Homes &
Housing Choice Voucher

Data as of
1/25/2018

[†] 30% Area Median Income in Boulder County [2017]: Household of one: \$20,640 | Household of four: \$29,460

- Serve a diverse population
- Combination of some with incredible resiliency skills and others who are very vulnerable

Challenge - Become More Resilient



- Match sustainability and renewable efforts to achieve more resiliency
- Develop emergency response center to support operations and help residents
- Prepare to be first responder if necessary



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ABOUT US

For the past 20 years, IPS has been on the front lines of renewable energy development by delivering and installing premium solar products and wind systems for residential and commercial customers. Our team of highly skilled engineers, electricians, and installers is committed to being on the cutting edge, pushing the boundaries of innovation, and invoking change within the systems of energy in which we have been entrenched as communities, nations, and the world.

Boulder Housing Partners

Resilient Power

Overview

The goal for this project was to provide a highly resilient, battery-based power system that would work in conjunction with a 22 kW solar array (provided by others) that would provide long-term backup power to critical loads for Boulder Housing Partners and for a common center for firefighters and police.



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Boulder Housing Partners

Technology

- *System output voltage:* Three phase 120/208 VAC
- *System continuous output power:* 18 kW
- *System peak output power:* 25 kW
- *Battery energy storage capacity:* 44 kWh AGM
- *Generator capacity/type:* 6 kW



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Challenges

- Integrating a separate solar contractor's design and installation into our system

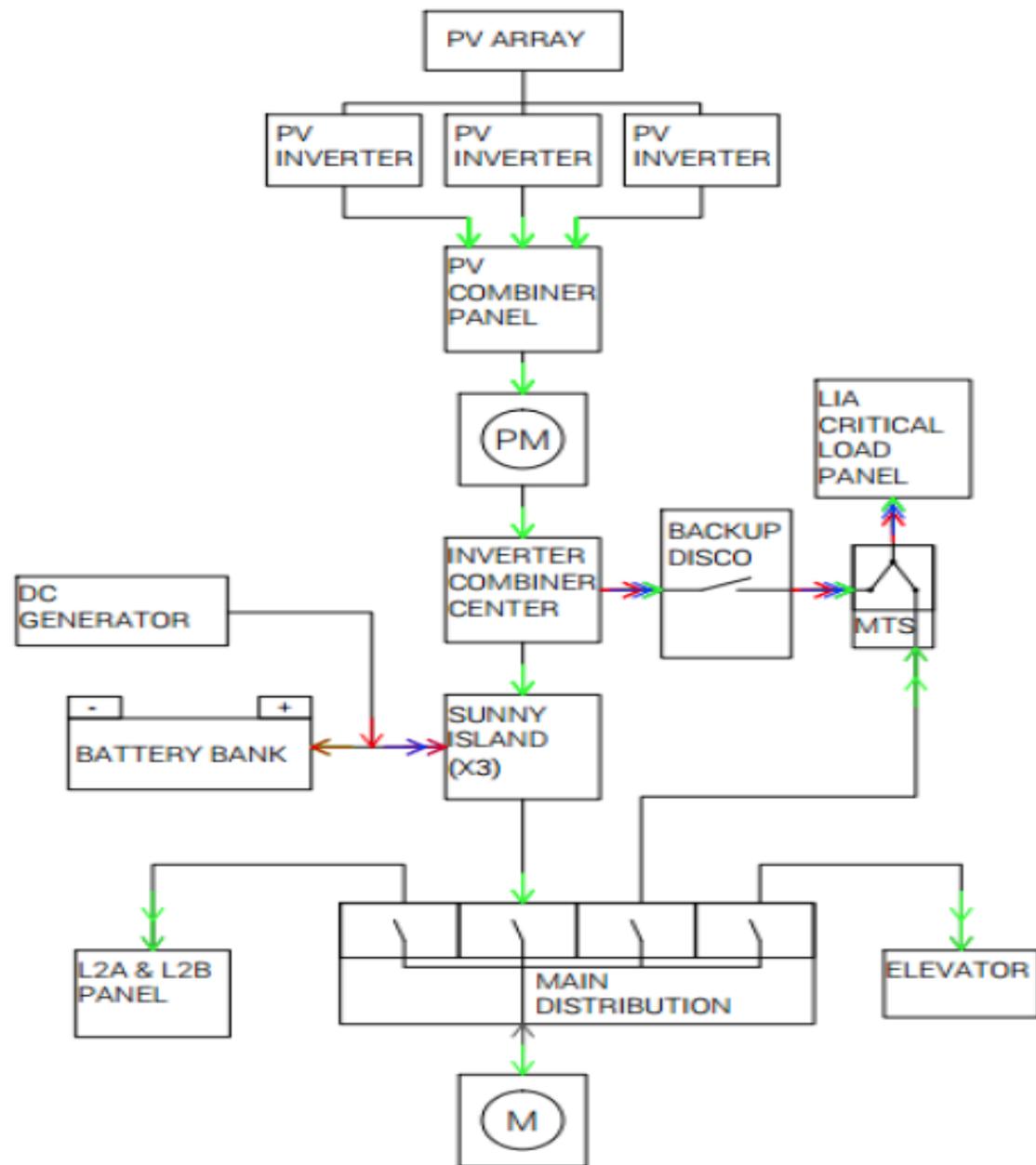
Lessons Learned

- Cooperation among stakeholders is key to success
- Having a technology-friendly and technology-experienced jurisdiction made the permitting process smooth



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LEGEND:
GREEN - PV POWER
BLACK - UTILITY POWER
RED - GENERATOR POWER
BLUE - BATTERY POWER





VIA MOBILITY SERVICES: RESILIENT MICROGRID

RESILIENT POWER WEBINAR: 11 OCTOBER 2018



PHASE 1: PROJECT BACKGROUND

- **Department of Energy Grant**
 - Resilient Electricity Delivery Infrastructure
 - Matching funds Pos-En and Boulder County
 - Secured jointly by Pos-En and City of Boulder
- **Via as Second Responder During Emergencies**
 - Transportation logistics
 - Call center
 - Server room
- **Via and City of Boulder Vision**
 - Zero Carbon transportation
 - 100% renewable energy
 - Decreased cost



VIA MOBILITY CENTER RESILIENCE + EFFICIENCY

Technology: Combined heat and power (CHP)

Fuel types: Renewable natural gas (RNG), compressed natural gas (CNG), propane

Generator efficiency:

Without heat recapture: 36%

With heat recapture: 85%

Financial impact: Energy cost savings of \$2,500 per month on average; 10-year payback

Auxiliary Benefits: Enables continuous off-grid operation, enables market adaptability, monetized resilience, increased resilience on critical loads



VIA MOBILITY CENTER RESILIENCE + EFFICIENCY

Technology: Solar + Storage nanogrid

Power types: Generator, grid, solar, battery

Solar + storage capacity: 10kW solar,
15kWh/60kW battery

Efficiency:

Solar dc-dc: 99.4%

Inverter: 97%

Operational impact: Enables continued operation without AC generation; solar continues to work when grid goes down; 2 hours of backup with no generation

Auxiliary Benefits: Building block for larger DC-integrated power system (lights, motors, critical loads, server equipment), design architecture enables charging infrastructure buildout



VIA GOAL: ELECTRIFY THE HOP ROUTE

- Current HOP fleet of 15 vehicles, 30' and 35' diesels
- Funding in hand for 2-3 new electrics – delivery 12 months
 - Could use these to expand the fleet
- Repower by Lightning – Up to 10 diesel buses converted to EV at 33-50% the price of a new electric
- Find non-traditional funding source(s)



VIA MOBILITY CENTER DC FAST CHARGING

Technology: DC coupled solar + storage, DC distribution, DC fast charging

Fuel types: Solar, natural gas (backup)

System efficiency: 94% RTE

Financial impact: Cost of operation reduced from approximately \$18,000 per month to <\$1,000 per month.

Diesel Cost: \$0.748/mile

EV Cost: \$0.14/mile

Auxiliary Benefits: Eliminates over 1,000 tons of CO₂ per year in diesel emissions, reduces NO_x and SO_x emissions almost entirely, no increased grid capacity required, flat rate energy payment for life of system, increased efficiency of chargers, increased value of solar (onsite use), enables resilient infrastructure (provides power to facility)



175 KW PRIME
TIER 4 NG
GENERATOR (WITH
EASYGEN
CONTROLS)



310KW SOLAR,
1.5MWH BATTERY

EV BUSES AS MOBILE ENERGY STORAGE

Resilience master planning: When planning City transit routes, EV buses and chargers can be viewed as a mobile power plant for the City during emergency events

Control system optimization: By incorporating fleet charging on route, optimizing a control system that determines real-time charging and generation requirements increases cost benefit

Modes of operation: During normal conditions, the buses' charging needs are cost-optimized based on system inputs; during emergency event, some portion of the buses are allocated to providing critical system power delivery, while utilizing onsite generation—other buses are used for critical personnel transport until normal conditions are restored

Coordination: Teaming with local universities, state assets, federal assets, and businesses creates a comprehensive master plan that truly enables resilient transportation infrastructure



Thank you for attending our webinar

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Vice President and Project Director

Clean Energy Group

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Find us online:

www.resilient-power.org

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Upcoming Webinar



Energy Storage in the Clean Peak Standard

Thursday, November 8, 1-2pm ET

Clean Peak Standards (CPS) are being implemented or considered by several states as a way to focus renewable generation at peak demand hours. Energy storage is expected to play a major role in these efforts. Navigant's Lon Huber will present.

Read more and register at www.cesa.org/webinars