

nbi new buildings institute

Grid-Interactive Building Project Roundup

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Audience Poll

- How many people have heard the term grid-interactive building before this conference?
- How many people feel like they could define what a grid-interactive building is?
- How many people know of a building in the world that has grid-interactivity measures?



Grid-Interactivity Basics



Graphic shows relative (normalized) circuit load intensity on a high-stress SCE distribution circuit near Los Angeles, CA.

SCE is working with NBI to assess the distribution grid implications of building electrification and building-grid integration.

Grid-Interactivity Basics



Grid-Interactive Building Demand Management



Hour of Day

Why Do We Need Grid-Interactive Buildings?

Decarbonization













Thermal Energy Storage Spotlight: Burr & Burton Academy – Founder's Hall

Manchester, VT



Burr & Burton Academy – Project Details

Building Type	K-12 School
Project Type	New Construction
Year Complete	2021
Site description	3 stories, 25,000 sf
Project Team	ZGF, KATO, The Rowland Project, Efficiency Vermont, SE Group, Integral Group, NBI
Measure	2,000-gallon thermal energy storage tank



Thermal Energy Storage Impact

7% Thursday, January 18 Monday, August 27 **Energy Savings** 100 Electricity:Facility (kWh) Electricity: Facility (kWh) 150 80 8% 60 100 **Emissions Savings** 40 50 20 2-30 0 6 PM 12 AM 6 AM 12 PM 6 PM 12 AM 12 AM 6 AM 12 PM 12 AM Hours of HVAC Hour Hour Load Shift Baseline Thermal Storage

Resiliency spotlight: GSA Federal Building

Oklahoma City, OK

Photo: U.S. General Services Administration

GSA Federal Building – Project Details

Building Type	Office	
Project Type	Retrofit	
Year Complete	2022	
Funding	Part of \$9 million UESC project including 5 GSA buildings. Partial funding from DOE AFFECT grant.	
Site description	4-stories, 178,342 sf	
Project Team	GSA, Ameresco, Oklahoma Gas and Electric (OG&E), NREL	
Measures	 300-kW solar PV array 250kW/500kWh battery energy storage with microgrid controls BAS, lighting and HVAC controls upgrades Transformer upgrades 	

UESC Project Highlights

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\$8.9 million in energy efficiency and infrastructure improvements



Year 1 cost savings of more than \$412,000



41% total energy use reduction



13% total water reduction for the smart irrigation systems



Greenhouse Gas reduction of more than 3,100 metric tons/yr.

Summary of service contract highlights (total for 5 buildings) Source: Federal Energy Management Program

GSA Federal Building - Results

- Bundling buildings and measures helps cost-benefit justification
- Battery Energy Storage System (BESS) provides resiliency benefits that are hard to quantify financially

Measure	Projected Annual Cost Savings	Projected Annual GHG Savings (Metric Tons CO ₂ e)
Lighting controls	\$3,021	41
BAS Upgrades	\$47,762	1,278
Advanced Power Strips	\$1,776	22
Solar PV	\$40,635	325
BESS	\$5,928	-9
Total	\$98,882	1,657



McKnight Lane – Project Details

Building Type	Affordable multifamily	
Project Type	New construction	
Year Complete	2016	
Project Cost	\$3.6 million; \$132,156 for storage systems	
Site description	14 modular homes @ 925 or 980 s.f. each	
Project Team	Addison County Community Trust, Cathedral Square, Clean Energy Group, Clean Energy States Alliance, Green Mountain Power, High Meadows Fund, Sandia National Laboratories, sonnen, US DOE Office of Electricity, VERMOD, Vermont Community Development Program, Vermont Community Foundation Sustainable Future Fund, Vermont Energy Investment Corporation, Vermont Housing and Conservation Board	
Measures	 All-electric, high efficiency appliances 6kWh/4kW AC energy storage systems 6kW rooftop solar arrays 	



McKnight Lane - Results

• Benefits of solar plus storage at McKnight Lane:

Occupants	Utility	Society
 \$5/month average energy bill 148 hours of resilience from outages 	 \$350-\$400/month transmission charge management savings 52% lower coincident grid peak contribution 	 GHG emission reduction of 32 metric tons CO₂e every year

 NREL analysis shows that dispatch strategies can be optimized to minimize energy cost, lifecycle costs, or climate costs



Advanced controls spotlight: Sonora Elementary

Costa Mesa, CA



Sonora Elementary – Project Details

Building Type	Education K-12
Project Type	Retrofit (controls only)
Project Year	Fall 2022
Funding	DOE Building Technologies Office
Site description	Two, 6-classroom buildings
Project Team	Community Energy Labs, LBNL, Newport- Mesa Unified School District
Measure	Two-level model predictive control to optimize HVAC



Source: Community Energy Labs

Sonora Elementary - Results

- Reduced peak power by 24%
- Shifted 16% of cooling load from on-peak to low price period



Incentive program spotlight: "Advanced Grid Responsive Technologies for Existing Multifamily Properties"

Austin, TX

Project Details



Forward-looking program spotlight: Distribution Circuit Bottom-Up Electrification Measure Impact Coincidence Analysis

Southern California Edison



Project Details



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Summary

Roundup Takeaways

- Grid-interactivity options to take home:
 - □ Smart thermostats
 - Energy storage (not just batteries)
 - Water heater controls
 - Advanced HVAC controls
 - □ Smart power strips
 - Others in further resources



Resources

- Find factsheets, webinars, articles, and other info:
 - https://newbuildings.org/gridoptimal/
- Upcoming ASHRAE Guide: Design and Operation of Grid-Interactive Buildings for Decarbonization
 - Includes additional international case studies!
- Upcoming electrification impact scenario resources and findings supported by Southern California Edison



Call to Action



- Existing dispatchable demand is about **1.2% of peak system GW**
- High adoption scenario in 2030 would reach about **5% of peak**

Peak system demand in 2020 is approx. 800 GW (NREL Cambium) Source: DOE GEB Roadmap



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Thank you

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