Better Buildings Webinar Series

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Building Resilient Communities: State and Local Perspectives

September 15, 2020
3:00 – 4:00 pm EDT
Virginia Castro
U.S. Department of Energy
Today’s Presenters

Will Lauwers
Massachusetts Department of Energy Resources

Megan Levy
Wisconsin Office of Energy Innovation

Peter Brandom
City of Hillsboro, Oregon
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Please go to www.slido.com and enter code #DOE to respond
Today’s panelists will discuss:

- What resilience means to them
- Federal funding, tools, and strategic partnerships
- Best practices and lessons learned

Resources will be linked at the end of this presentation
Will Lauwers
Massachusetts Department of Energy Resources
Massachusetts’ Energy Resilience

DOER Director of Emerging Technology
Will Lauwers
Defining Resilience

• Presidential Policy Directive 21-- Critical Infrastructure Security defines “resilience” as
  ‘the ability to prepare for and adapt to changing conditions and withstand and recover rapidly from disruptions. Resilience includes the ability to withstand and recover from deliberate attacks, accidents, or naturally occurring threats or incidents’

• Resilience is not 100% provision of service 100% of the time
  • Resilience is instead a time varying description of the level of service provided following a disruptive event

Figure 2.2 from RAND Study RR883

Measuring the Resilience of Energy Distribution Systems
MA Executive Order 569
Establishing an Integrated Climate Change Strategy for the Commonwealth

• Key Objectives
  • Mitigate and reduce greenhouse gas emissions
  • Build resilience and adapt to the impacts of climate change

• Tasks
  • Statewide Hazard Mitigation and Climate Adaptation Plan
  • Establish Municipal Vulnerability Preparedness program to enhance state and local partnerships, and provide direct support and technical assistance
  • Assessment of each Agency’s vulnerabilities and adaptive capacity

Resilience grants to facilities that provide critical services will help make Massachusetts a safer place.
- Governor Baker, Sept 2016, Announcing $14 million to the Energy Resiliency Grant Program

North Andover, Massachusetts
Greater Lawrence Sanitary District
$4.4 million DOER Clean Energy Resilience grant recipient
Massachusetts energy context is typically stated simply as the end of a pipeline; **Methods to reduce cost and improve reliability and resilience at the end of a supply chain**

1. **Action Plan**
   ✓ Identify hazards, plan enduring strategies and acute responses
   ✓ Massachusetts Hazard Mitigation & Climate Adaptation Plan

2. **Reduce consumption and reliance**
   ✓ Massachusetts ranked #1 in efficiency 9 consecutive years
   ✓ Distributed generation programs to incent generation co-located with load

3. **Harden load to impact of disruption**
   ✓ $40M Energy Resilience Initiative & Municipal Vulnerability Preparedness

4. **Diverse & redundant supplies** (prevent single-points-of-failure)
   ✓ 2016 Energy Diversification Bill; procure off-shore wind and hydroelectric resources

5. **Harden supply chain**
   ✓ Grid Modernization docket for Utilities to automatically resection the distribution system to mitigate the impacts of outages
It’s much easier to receive approval for a capital intensive project with a positive ROI.

Energy Efficiency is cost effective, particularly when resilience is a concern. Every kW of demand reduction is a kW that doesn’t need to be backed up.

Blue Sky ROI
- Energy Charge Offset
- Demand Charge Management
- Continuous Operations & Maintenance

Resilience Valuation
- Differentiate the value of providing service during blue sky vs. outage conditions
- Tier loads; varying generation can support varying load profiles e.g. solar in summer may provide power to more loads than solar in winter

“For conventional sewage treatment plants, around 30 percent of the annual operating costs is usually required for energy.”
Waste Water Engineering: Treatment and Reuse 4th Edition
Massachusetts Policy
Supporting Energy Resilience

• Collaborate with Municipalities
  • Green Communities program provides technical assistance and grants
  • Municipal Vulnerability Preparedness program provides technical assistance and grants

• Collaborate across State Agencies

• Lead by Example
  • State facility energy resilience grants

• Energy Efficiency Incentives
  • MA ranked #1 in Energy Efficiency by ACEEE 9 years in a row

• Distributed Generation Incentives
  • Nation leading Clean Peak Standard includes a Resilience Multiplier
  • New SMART solar program incents energy storage with solar
  • SMART program provides additional incentive for public consumers of solar energy
  • CHP and Fuel Cells incentivized through the Alternative Portfolio Standard (APS)
    • Also incents renewable thermal (solar thermal, air source heat pumps, ground source heat pumps, bio-fuels)
  • Demonstration grants: $20M Energy Storage Initiative, $40M Clean Energy Resilience

• Provide the tools for informed decision making
  • Resilience clearinghouse http://www.resilientma.org/
Massachusetts Policy
CCERI Round 2: Municipal Services; Sterling, MA

• CCERI Round 2 focus on: Water, Wastewater, Police/Fire dispatch
  • Improve energy resilience of critical services
  • Lessons: complex and capital-intensive project management can be difficult for municipalities

• Sterling Project in Focus
  • Distribution connected energy storage system at a Municipal Light Plant substation
  • Police and Fire dispatch is close to the substation, and the battery can provide backup power for over a week of operations
  • The storage can also keep other circuits with substantial solar development online, enabling continuous operations
  • The MLP is looking into extending the circuit section supported by the battery, enabling incremental resilience improvements by backing up other municipal buildings
  • First distribution scale energy storage in MA
  • Ground breaking to installed and operational in <6 months
  • $400k/year savings passed on to MLP ratepayers
    • Transmission & Capacity savings
Massachusetts Policy
CCERI Round 3: Hospital Energy Resilience

• Hospitals provide critical services & moving patients is hazardous to patients and time intensive on emergency responders and equipment.

• Program focus on resilient Combined Heat and Power plants
  • Grants include Existing & new CHP, Reciprocating & Turbine, with and without absorption chillers, with and without energy storage, and with and without solar PV onsite

• Why CHP focus?
  • Hospitals are typically a good CHP fit due to substantial and predictable thermal loads
  • CHP are maintained and operated 100% of the time for an ROI, and are therefore likely to be in good operating condition at the time of an emergency event
  • as compared to diesel generators which sit idle for long periods, are designed for short duration operations, and have a history of failures during emergencies

• Funded engineering & equipment to enable CHP black start and island
  • Black start is the ability to turn on without an external power source
    • need power to turn-over CHP
      • blackstart generator, compressed air, or battery energy storage
  • Island is the ability to operate and serve local load without an external power source
    • Grid disconnect
      • CHP often have minimum import requirements which trip CHP, need to adjust CHP trip settings to permit islanding, which likely requires modifications to interconnection agreements.
    • CHP controls to prevent trips
    • Load controls and/or energy storage to balance electric load with thermal & prevent trips
• Additional Considerations
  • Synchronization procedures
    • Automatic load controls vs. Manual
    • **Ride-through** vs. blackstart
      • Ride-through means the system will attempt to continue to operate through the outage event.
      • If no ride-through, system will trip with outage, UPS will cover through backup genset turn-on, and CHP is then blackstarted
  • **Procedure manual** onsite to ensure staff onsite know how to initiate black start & island
    • For example, if load isn’t automated, process may include staff located across facility communicating via radio to incrementally increase load as CHP ramps up. Too much load too fast and CHP can trip, too slow and CHP can trip.
      • Synchronization procedures thus are drafted based on common loading on various circuits to plan which order and timing to add loads.
      • Energy storage is an alternative which can vary its output to match the CHP ramp. This simplifies the process, but requires investment in ESS and a controls scheme
  • Site Service Feed configuration
    • Most critical infrastructure have **switchgear** served by 2 independent distribution circuits to increase reliability
    • Often switchgear needs to be replaced to enable island mode & communications to site generation
  • If the broad outage is associated with natural gas supplies, then a CHP system likely goes down due to the same event conditions
Electric Building Resilience

- Electrification of the thermal sector is core to meeting our GHG objectives
  - MA DOER 2018 Comprehensive Energy Plan
    - https://www.mass.gov/service-details/massachusetts-comprehensive-energy-plan-cep

- Cost effective electrification of buildings requires high-performance envelopes
  - We’ve seen passive house high-performance envelopes with incremental cost of just 1.4%
    - https://www.masscec.com/emerging-initiatives/passive-house

- Electric buildings only need to make a single energy source resilient, while combustion heated buildings need to enhance resilience of their electric supply and their fossil fuel supply

- High performance buildings can self-produce a higher percent of their energy needs with renewables, reducing reliance on external supply

- High performance buildings remain habitable for extended periods of time, even without operational heating & cooling systems

Energy storage paired with distributed generation can effectively buy down risk while providing a positive return on investment to the facility.
THANK YOU
Megan Levy
Wisconsin Office of Energy Innovation
Building Resilient Communities: A Wisconsin Perspective

MEGAN LEVY
WISCONSIN OFFICE OF ENERGY INNOVATION
BETTER BUILDINGS WEBINAR SERIES
SEPTEMBER, 2020
Climate Resilience & Adaptation

- **Climate resilience** is the ability to anticipate, prepare for, and respond to hazardous events, trends or disturbances related to climate.

- Improving climate resilience involves assessing how climate change will create new, or alter current, climate-related risks, and taking steps to better cope with these risks.

- **Climate adaptation** is the “adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”
Department of Defense (DoD) concern about energy resilience is being captured in policy, directives, and instructions

- DoD Directive 4180.01 – DoD Energy Policy is to strengthen energy security by improving the energy performance of installations
- DoD Instruction 4170.11 Installation Energy Management
  - Establishes requirements for energy resilience on military installations and allows for the use of integrated, distributed, and renewable energy sources for energy resilience
  - Requires alignment between energy requirements and critical mission operations, and maintaining primary and emergency energy systems
- DoD Directive 4715.21: Climate Change Adaptation and Resilience (2016) requires DoD to:
  - Consider climate change resilience in installation planning to include impacts on built and natural infrastructure
  - Engage with subnational government to promote compatible development
  - Assess and manage risks to built and natural infrastructure

Source: Converge Strategies: Summary briefing for energy officials July, 2019
https://convergestrategies.com/
Military Service Energy Resilience Policies

**Army**
- Army Directive 2017-07 – 14 days energy and water requirement for critical missions
- Army Energy Security and Sustainability (ES2) strategy provides a roadmap to foster a more adaptable and resilient force

**Air Force**
- Air Force Policy Directive (AFPD) 90-17 – 7 days power requirement for mission essential critical infrastructure
- Air Force Energy Flight Plan sets goal that all mission critical functions have assured access to a reliable energy supply at all times by 2036

**Navy**
- Navy Energy Security Framework (ESF) describes the three pillars of energy security: 1) resiliency, 2) reliability, 3) efficiency
- Up to 7-day back-up power requirement, depending on type of facility

Source Converge Strategies: Summary briefing for energy officials July, 2019
Emerging Federal Opportunities for Community Energy Resilience Planning
What Does Climate Change Mean to Wisconsin?

- Flooding
- More hotter days coupled with an increase in annual precipitation of 3.1 inches, primarily in south and west with some drying in north
- Economic impacts
- Society & the built environment
- Changing habitat
The Big Audacious Goal That Will Make A Difference In The Next Decade?

- Develop strategies and steps to build Wisconsin’s capacity for community and ecological resilience and adaptation to climate change.
- Identify, frame, and strategize approaches focused on *anticipation and prevention*—not just disaster recovery.
- Quantify and communicate the *economic impact* of doing nothing vs well-thought out climate adaptation and resilience strategies.
We need new goals for Energy Efficiency. Consider critical infrastructure microgrids around municipal water/wastewater loads.
Water Utility Analysis

Quartile Statistical Benchmarks where 1 = Top Quadrant 25% Best, 2 = 2nd Quadrant Good, 3 = 3rd Quartile below Median & 4 = 4th Quadrant Bottom 25% Poorest

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<tbody>
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<td>3740</td>
<td>Mineral Point Mun Water Utility</td>
<td>kWh/1000 Gallons</td>
<td>2.89</td>
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<td>Mineral Point Mun Water Utility</td>
<td>% Water Losses</td>
<td>34.07%</td>
<td>41.59%</td>
<td>31.15%</td>
<td>43.07%</td>
<td>47.78%</td>
<td>34.77%</td>
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<td>Mineral Point Mun Water Utility</td>
<td>$ per kWh Pumping</td>
<td>$0.08</td>
<td>$0.10</td>
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<tr>
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<td>$ per 1000 Gallons</td>
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<td>$0.26</td>
<td>$0.24</td>
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<td>$0.28</td>
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Water utilities with benchmarks of 3 (Yellow) and 4 (Red) can request that MEETAP prepare a system analysis of wells, towers and pumps to estimate demand, energy and cost savings (capacity and average operating characteristics – on-peak, capacity factor, constant flow high pressure control vs variable flow constant pressure, etc.)

Utilities with benchmarks of 3 (Yellow) and 4 (Red) can request that MEETAP prepare a system analysis of wells, towers and pumps to estimate demand, energy and cost savings (capacity and average operating characteristics – on-peak, capacity factor, constant flow high pressure control vs variable flow constant pressure, etc.).
Facility Performance and Benchmarking Analysis

Water and/or wastewater utility managers index their facility’s energy usage through a production or demand index, such as kWh/MDG or kWh per 1,000lb of Biological Oxygen Demand (BOD). This index is called a Key Performance Index (KPI) or Energy Performance Index (EPI). Establishing an energy baseline helps facility managers understand the relative efficiency or change in efficiency relative to the core purpose of the operation, i.e., water production or wastewater treatment. It is recommended utilities set a goal to save five to ten percent of its energy after it has implemented energy efficiency measures, a new annual average line is set as the targeted KPI level with monthly Monitoring & Verification (M&V).
Challenges & Barriers to Pursuing Solutions

- A regulatory framework to advance and support resilience in the face of climate change in Wisconsin
- Coordination across agencies (local-county-state-federal)
- Capacity to develop and implement solutions
- Becoming proactive rather than being reactive
- Building public support

1. Flooding
2. Human health & safety
3. Agriculture & land use
4. At-risk species & habitat
5. Energy security
6. Resilience in rural communities
7. Institutions & support

Source: https://www.wisconsinacademy.org/sites/wisconsinacademy.org/files/Track%203.pdf
Climate Fast Forward Recommendations

• Resilience Recommendations:
  {Near term 1-3 years}
  • Create a state-funded and state-run AmeriCorps-like program to coordinate resilience
  • Pilot microgrids for critical infrastructure
  {Long term 4-10 years}
  • Develop a new message for community engagement and education
What Next?

Local Governments, Tribal Nations & Facility Operators/Owners

- PLAN- Grants available (state and Federal)
- Think outside the macro-grid- consider alternatives, particularly public purpose microgrids, community resilience centers, flexible grid
- What could the impact of privately owned microgrids be?
- COMMUNICATE- with utilities, emergency management, local government.

- Be Creative
- Be Practical
- Be Prepared
What Can You Do?

Local Governments & Tribal Nations

- Set a Goal
- Plan with electric, water, wastewater utilities, critical infrastructure owners, businesses,

- Understand and prioritize infrastructure in your jurisdiction
  - What facilities perform life safety functions?
  - What facilities enable responders to function during emergencies?
  - What facilities provide basic essential services (water, wastewater, power, etc.)
  - Which facilities already generate renewable energy? Is it all grid-tied?
  - Consider the value of resilience- NREL working on this
OEI NEXT STEPS

- Statewide Assistance For Energy Resilience and Reliability (SAFER2 grant)
- Recruit Tribes and Communities to participate in “deep-dive analysis”
  - Deep-dive components (customized to participants’ needs and goals):
    - Wisconsin Clean Cities fleet assessment
    - Grant review- provided by OEI & WEM- listing of all available funding sources
    - Micro-grid feasibility study of critical infrastructure

Current project example:
The Oneida Nation has already deployed a significant amount of solar PV, this analysis will consider linking loads to storage, associated costs, and practicality of alternative back-up power to diesel or propane generators.
CASE STUDY- ONEIDA NATION
CASE STUDY- ONEIDA NATION

Figure 2: Map of Critical Facilities Targeted for Study
CASE STUDY CONTINUED

- Technology Alternatives
  - Conventional Fuel back-up Generators
  - Renewable DERs
  - Storage
  - Controls
  - Load Management

- Facility Alternatives
  - Single Facility microgrid
  - Partial-feeder campus microgrid serving multiple critical facilities
  - Full-Substation microgrid serving multiple campuses
Defining Critical Infrastructure
Defining Critical Infrastructure

Partial-feeder campus microgrids:
Defining Critical Infrastructure
Questions?

Contact OEI:
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Megan.levy@Wisconsin.gov
Peter Brandom
City of Hillsboro, Oregon
Building Resilient Communities – a Local Perspective

Peter Brandom | Senior Project Manager

U.S. DOE Better Buildings Challenge Webinar - September 15, 2020
• Tualatin Valley, home to the Atfalati or Tualatin or Wapato Lake tribe of the Kalapuya Native Americans
• Population growth from less than 50,000 in 2000 to over 105,000 today
• Will approach 150,000 by 2035
• High tech economy anchored by Intel, largest and most advanced chip factories in the world
• Diversity of cultural and ethnic backgrounds
• History of racial exclusion, oppression and segregation in Oregon by the white majority
Main threats to our community

• Pandemics!
• Earthquake – Cascadia Subduction Zone and others
• Wind and flooding
• Ice storms
• Climate change
  • Water supply
  • Climate migration
  • Economic impacts
Goals & Achievements

- 10+ years of focused effort
- Facility energy use 26% since 2009
- Facility/fleet GHG emissions 30% since 2007
- Leaders in supporting electrified transport
- U.S. DOE resiliency modeling
- Community-wide and city purchase of renewable power
Sustainability Revolving Grant Fund

- Established in 2011
- Seeded with $50,000 from avoided energy costs
- Dedicated City fund
- Has funded 12 projects from 14 applications
- Awards range from $3,800 to $15,500
Sustainability Revolving Grant Fund Projects

- Mechanical and lighting retrofits
- Underwater swimming pool lights
- Telematics
- Renewable energy
- Smart irrigation technology pilot
- Propane powered mowers
- Bicycle maintenance stations
Paradigm Shifting with Partnerships

- Portland General Electric Smart Grid Test Bed
- Green Tariff
- Climate mitigation and adaptation imperatives
Q & A

Submit Questions
www.slido.com event code DOE
Additional Resources

DOE's Better Buildings Initiative’s Resilience Webpage:
https://betterbuildingsinitiative.energy.gov/resilience

How Distributed Energy Resources Can Improve Resilience in Public Buildings: Three Case Studies and a Step-by-Step Guide

Energy Efficiency and Distributed Generation for Resilience: Withstanding Grid Outages for Less:
https://www.energy.gov/sites/prod/files/2019/06/f64/EEDG-Resilience.PDF

Energy Efficiency and Renewable Energy Resources for State and Local Leaders:

FEMA and WIP Webinar Series on Energy Lifelines Mitigation

HUD and WIP Webinar Mitigating Natural Hazard Risks in the Energy Sector

RMI Hours Of Safety In Cold Weather: A Framework For Considering Resilience In Building Envelope Design And Construction

PHIUS Assessing Passive Survivability in Multifamily Buildings

MA DOER Mobile Energy Storage Study
https://www.mass.gov/service-details/mobile-energy-storage-study
YOU HAVE A DATA CENTER – NOW WHAT?
STORIES FROM THE FIELD
Tue, Apr 6, 2021 | 3:00 - 4:00 PM ET

2020-2021 Better Buildings Webinar Series

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STATE AND LOCAL PERSPECTIVES
Tue, Sep 15, 2020 | 3:00 - 4:00 PM ET

PLANNING FOR RESILIENCE IN MULTIFAMILY HOUSING:
A PORTFOLIO-WIDE APPROACH
Tue, Nov 17, 2020 | 3:00 - 4:00 PM ET

RISK ASSESSMENTS:
EVALUATING BUILDING SITES FOR PORTFOLIO RESILIENCE
Tue, Feb 2, 2021 | 3:00 - 4:00 PM ET

INNOVATIVE ENERGY EFFICIENCY FINANCING IN PUBLIC HOUSING
Tue, Sep 22, 2020 | 3:00 - 4:00 PM ET

SCALING IMPACT:
MULTI-BUILDING APPROACHES TO ZERO ENERGY
Tue, Dec 1, 2020 | 3:00 - 4:30 PM ET

PERSPECTIVES ON RESILIENCE:
INSURANCE AND CREDIT UNDERWRITING
Tue, Feb 9, 2021 | 3:00 - 4:00 PM ET

PLANNING FOR RESILIENCE IN MULTIFAMILY HOUSING:
A PORTFOLIO-WIDE APPROACH
Tue, Nov 17, 2020 | 3:00 - 4:00 PM ET

RISK ASSESSMENTS:
EVALUATING BUILDING SITES FOR PORTFOLIO RESILIENCE
Tue, Feb 2, 2021 | 3:00 - 4:00 PM ET

WASTEWATER TREATMENT 2.0:
THE NEXT PHASE OF ENERGY EFFICIENCY AND RECOVERY
Tue, Oct 6, 2020 | 3:00 - 4:00 PM ET

DAVID & GOLIATH:
FINANCING ENERGY RETROFITS FROM THE TINY TO THE GIANT
Tue, Jan 19, 2021 | 3:00 - 4:00 PM ET

SMART TOOLS FOR SMART LABS
Tue, Mar 2, 2021 | 3:00 - 4:00 PM ET

BEYOND ENERGY SAVINGS:
QUANTIFYING THE ADDITIONAL BENEFITS OF ENERGY EFFICIENCY
Tue, Jan 12, 2021 | 11:00 AM - 12:00 PM ET

CPACE FINANCING TURNS 10:
IMPACTS, CHALLENGES, AND WHAT COMES NEXT
Tue, Oct 6, 2020 | 3:00 - 4:00 PM ET

RISK ASSESSMENTS:
EVALUATING BUILDING SITES FOR PORTFOLIO RESILIENCE
Tue, Feb 2, 2021 | 3:00 - 4:00 PM ET

BEYOND ENERGY SAVINGS:
QUANTIFYING THE ADDITIONAL BENEFITS OF ENERGY EFFICIENCY
Tue, Jan 12, 2021 | 11:00 AM - 12:00 PM ET
Energy and water efficiency upgrades in public housing can free up operating funds while reducing tenant utility bills and improving resident health and comfort. However, Public Housing Authorities (PHAs) face persistent financial barriers that often prevent them from accessing capital for retrofits. This webinar will present innovative solutions from three PHAs that successfully financed efficiency projects. Panelists will spotlight the proven, replicable approaches that made their projects possible.
ON-DEMAND BETTER BUILDINGS WEBINARS

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EXPLORE BY TOPIC


Indicates the session was a part of the 2020 Virtual Summit. To view a full list of the Summit Sessions, click here.

BUILDING ENVELOPE

A building’s envelope (walls, windows, roof, and foundation) accounts for approximately 30% of the primary energy consumed in residential and commercial buildings. Explore all previously recorded webinars on this topic by pressing MORE.

- Unsealed: The Building Envelope Campaign (2020)
- Sneak Peek of the Building Envelope Campaign (2020)
- Addressing the Envelope: Recognizing Building Enclosure Improvements (2020)
- Innovative Wall Technologies for Commercial Buildings (2019)
- Building Envelope/Enclosure Commissioning and Retro-commissioning (2017)

Learn more at: https://betterbuildingssolutioncenter.energy.gov/webinars-on-demand
BETTER BUILDINGS

Better Buildings is an initiative of the U.S. Department of Energy (DOE) designed to improve the lives of the American people by driving leadership in energy innovation. Through Better Buildings, DOE partners with leaders in the public and private sectors to make the nation’s homes, commercial buildings and industrial plants more energy efficient by accelerating investment and sharing of successful best practices.

2020 SUMMIT
JUNE 8–10 | ARLINGTON, VA

DOE Recognizes Mat. Is Investment Management for Energy Efficiency

Program Website Better Buildings Webinar Series
Additional Questions?

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