U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Welcome and Announcements – FUPWG Day 2

Tracy Niro – DOE FEMP

FEMP
Federal Energy Management Program

Welcome to FUPWG Day 2!

- Highlights from day one
- Reminder: slides and speaker bios are posted on the **FEMP FUPWG website**
- Registration numbers
- Invite your colleagues – registration is still open!
- No live Q&A – FEMP Assistance Portal or contact speaker

VIRTUAL FEDERAL UTILITY PARTNERSHIP WORKING GROUP SEMINAR

May 5-6, 2021

Enhancing Performance Contracts with Monitoring-Based Commissioning (MBCx)

Hosted by:

FEMP

Federal Energy Management Program

MBCx Opportunity

- **Recommissioning and Monitoring-based Commissioning (MBCx) underutilized in energy performance contracts**
  – ~6% of IDIQ projects include RCx or MBCx…but growing
- **Successful growth in project scope and scale demands effective, sustained, and documented performance of each ECM installed in a federal building**
- **MBCx provides an opportunity to ensure savings persistence, increase energy savings, automate many M&V functions, and empower facility managers with tools to improve O&M performance**

MBCx in Performance Contracts

- **MBCx is the ongoing application of the commissioning process to a building or energy system**
  - Commissioning requirement under EISA 2007 (42 USC 8253)
  - Energy Act 2020 exception states: *recommissioning shall not be required every 4 years if the facility is under 'ongoing commissioning'*
  - MBCx automates this process and would significantly reduce cost required to RCx facilities every 4 years
- **Utilize MBCx with appropriate O&M to monitor and sustain ECM performance**
  - Benefits agency, utility, and ESCO

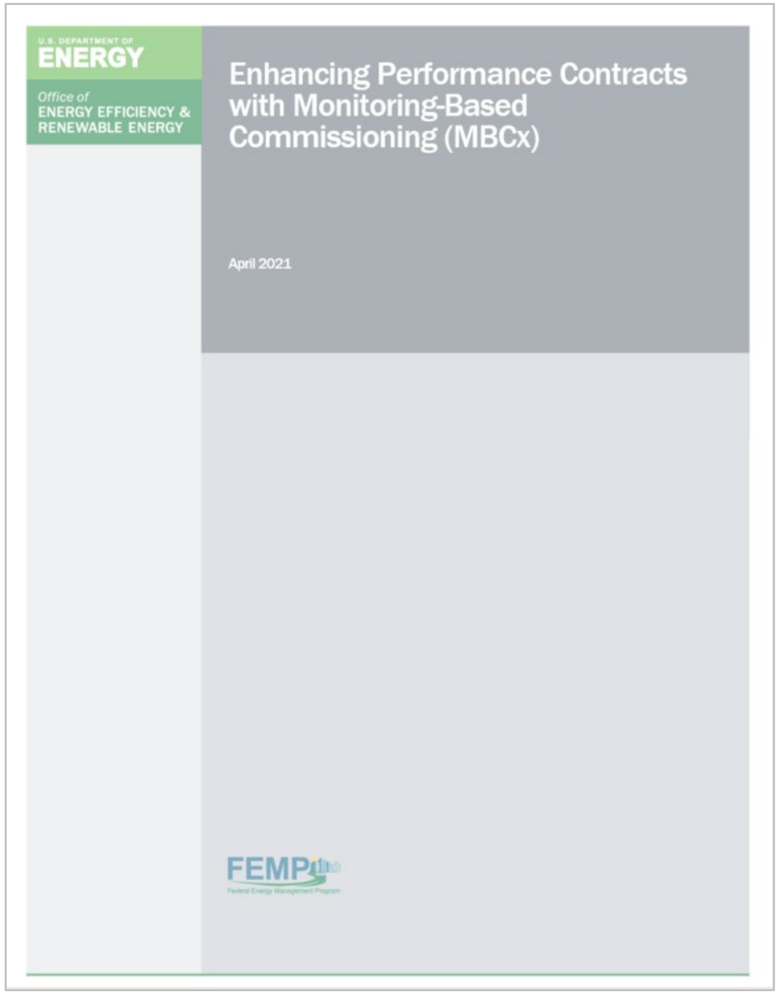
Enhancing Performance Contracts with MBCx

Jesse Dean | NREL

- MBCx overview and applications
- Considerations and site selection for MBCx

Phil Voss | NREL

- MBCx applications in performance contracting

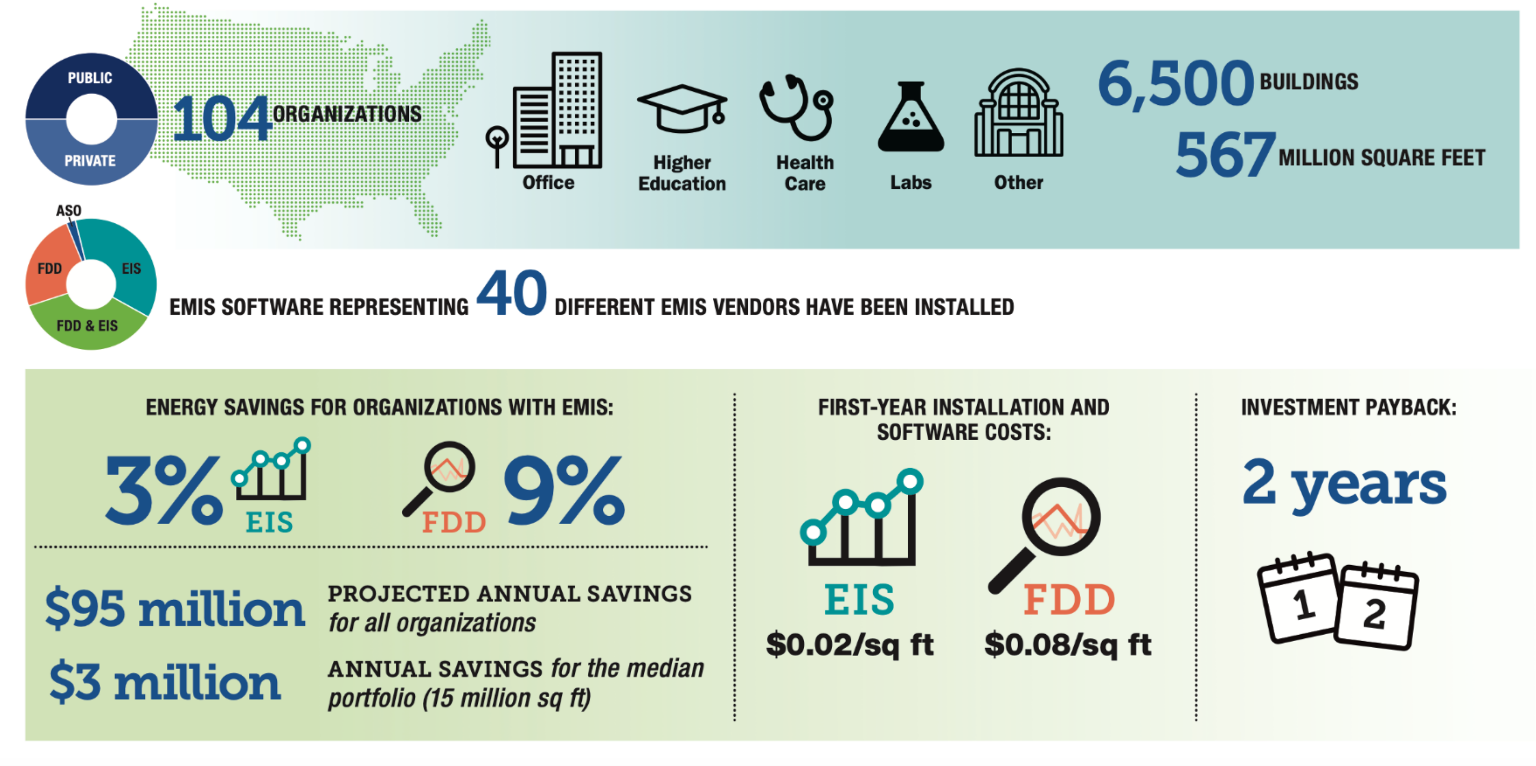


MBCx Overview

Smart Energy Analytics Campaign Results

MBCx deployment is increasing nationwide

- DOE BTO and LBNL ran SEAC from 2016 to 2020
- EMIS installed on 567 million ft^2
- Median MBCx energy savings 9% and median SPP of 3.2 years

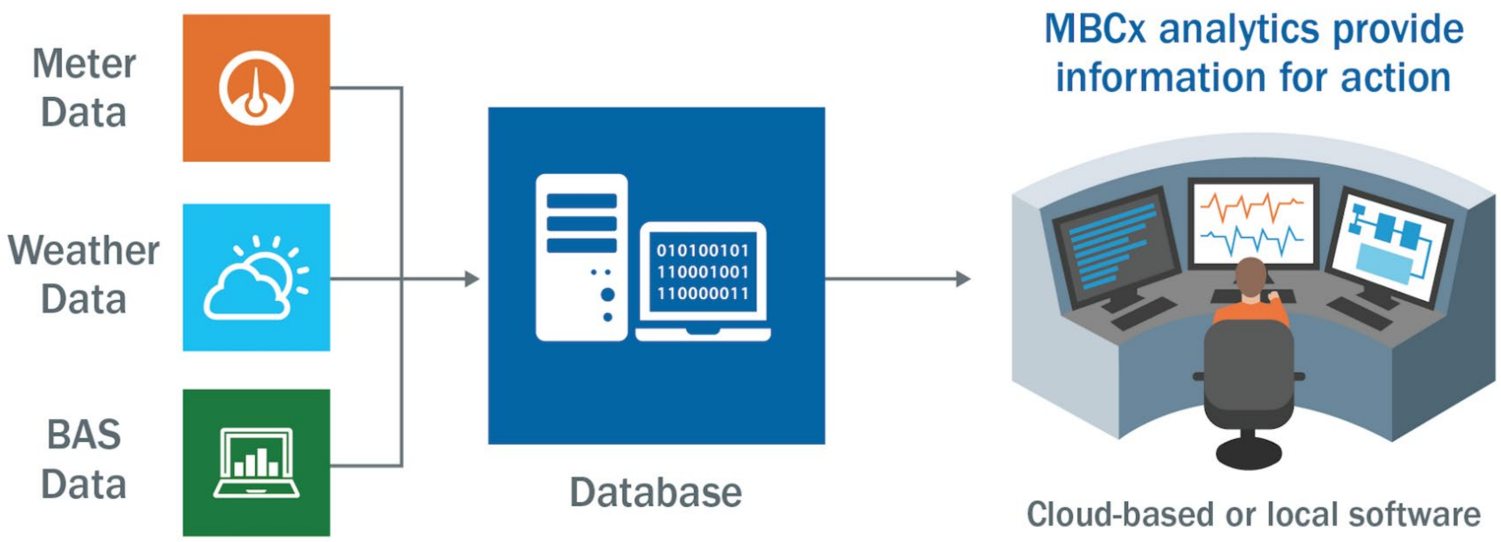


Reference: https://smart-energy-analytics.org/assets/Building%20Analytics_2020sep16.pdf

What is MBCx?

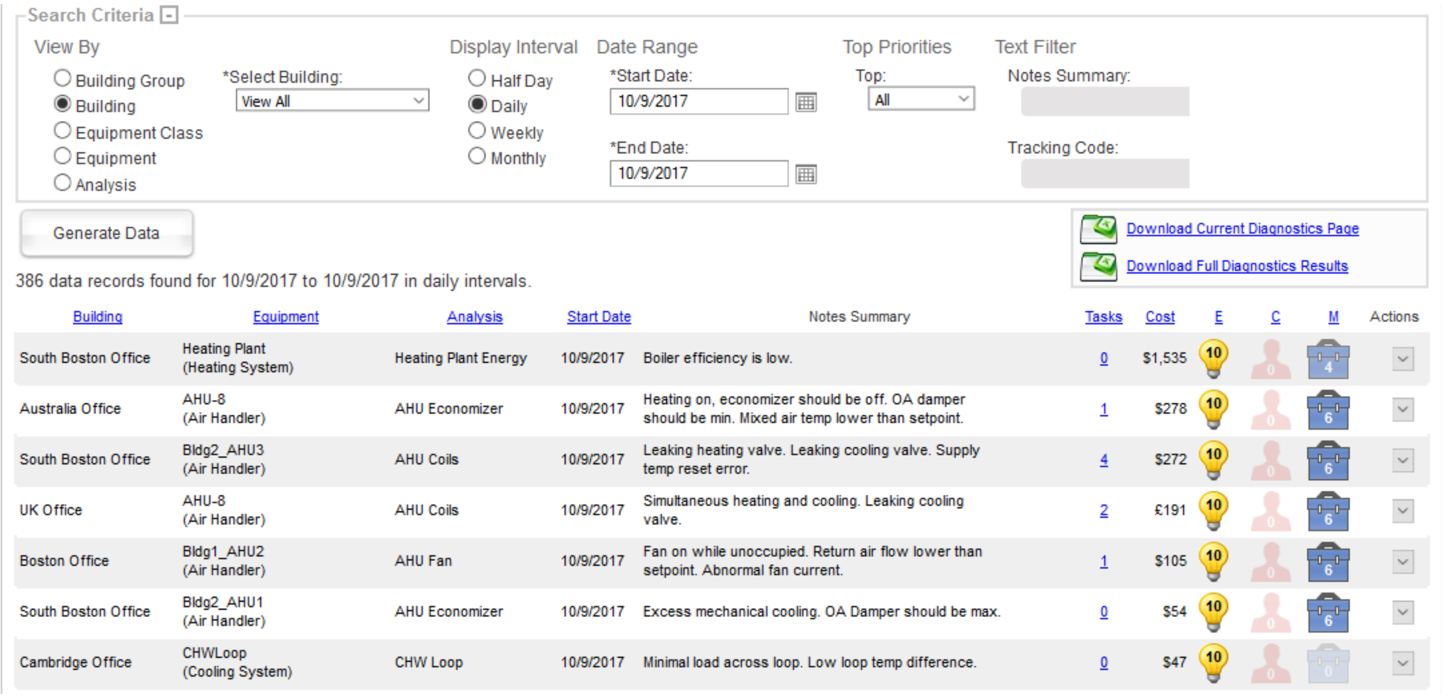
The term MBCx is used to describe:

- Software tools that collect data from BAS and advanced metering infrastructure (AMI) and perform analytics to identify performance improvements
- Processes for implementing and verifying improvements made based on the analytics



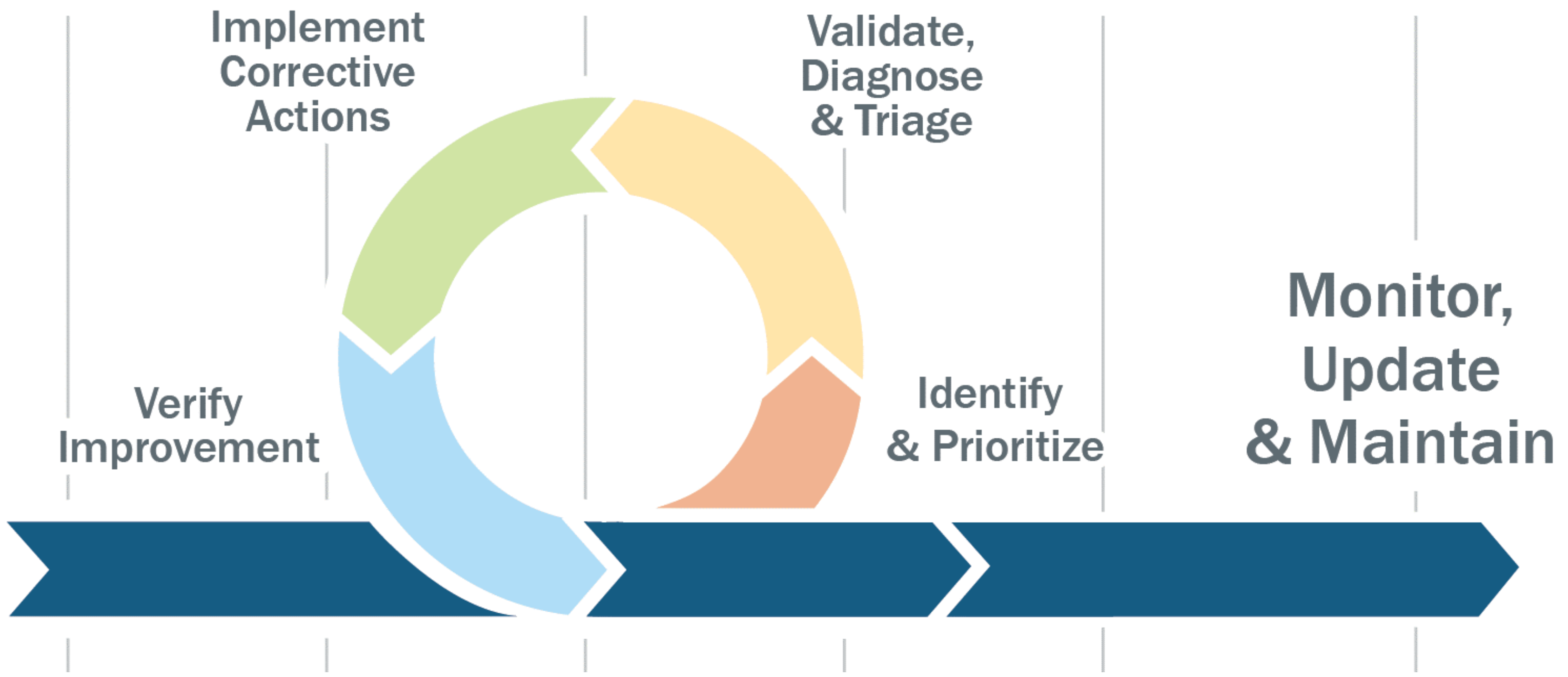
Automated Fault Detection & Diagnostics (AFDD)

- AFDD is primary ‘capability’ in MBCx software
- Data points constantly monitored and stored
- Programmed ‘rules’ automatically detect ‘faults’ or issues
- One way communication – info requires human action



Prioritized list of faults detected (Image Credit: KGS Buildings 2020)

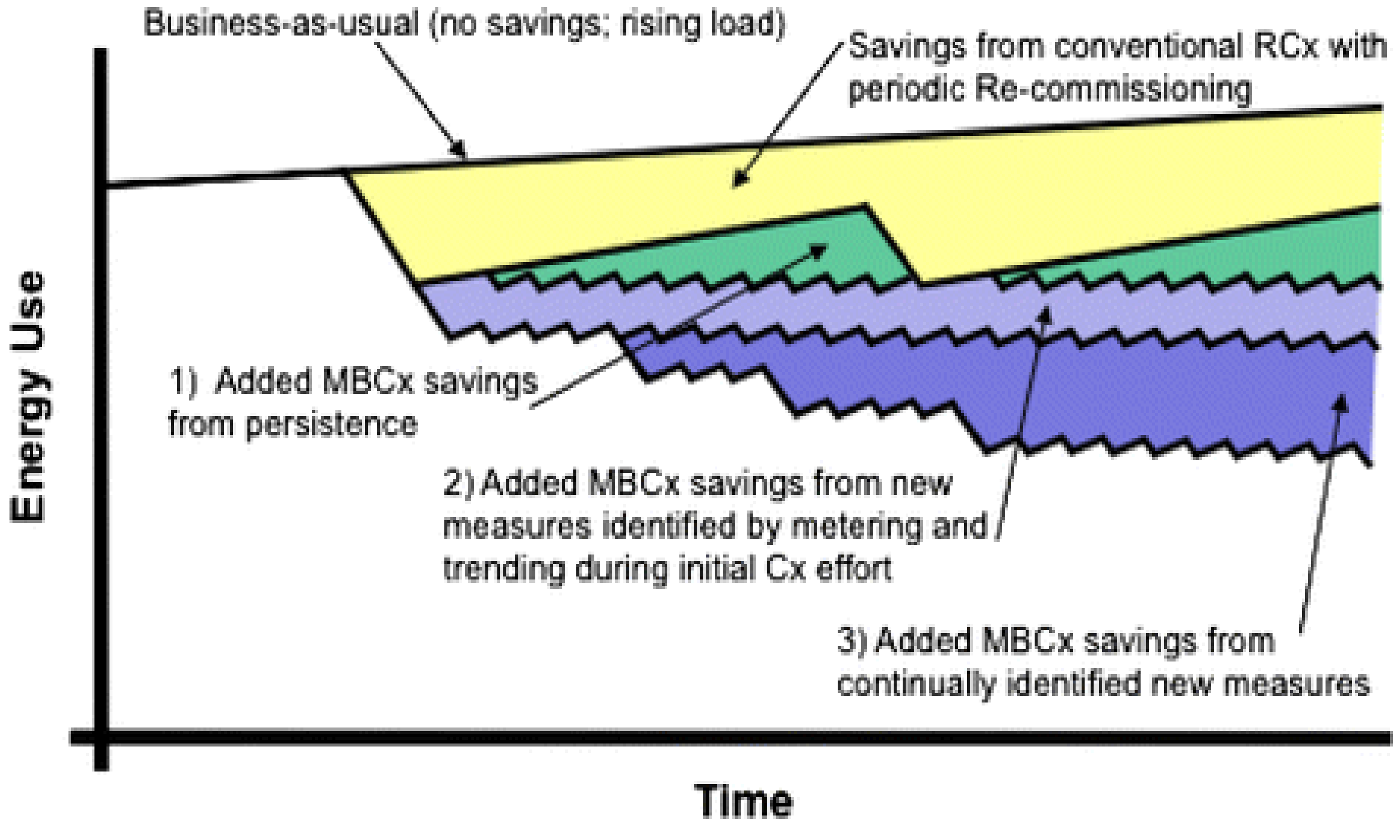
MBCx Process



- Use automated prioritization tools
- Use data analysis tools to validate issues, determine root causes
- Implement solutions and track performance
- Repeat at regular intervals

Increased Energy Savings from MBCx

- Data shows that RCx savings degrade over time
- MBCx and FDD with BAS / AMI data can sustain and even increase energy savings over time



Ongoing building energy use optimization from MBCx
(Image Credit: LBNL)

MBCx Considerations

- **Good candidates:**
  - Facilities upgrading pneumatic controls to DDC systems
    - Could be considered after DDC upgrade is completed
  - Facilities installing new BAS/controls, AMI or have significant HVAC control ECMs
- **Upfront / ongoing costs**
  - Software license, submeters, Software-as-a-Service (SaaS) contract
- **Cybersecurity**
  - ATO required for MBCx software and connected systems (e.g., AMI or BAS)

MBCx in Performance Contracts

Drivers for MBCx in Performance Contracts

- **RCx and MBCx underutilized in and can benefit performance contracts**
- **Recent LBNL study - median MBCx energy savings 9% and median SPP of 3.2 years**
  - GSALink MBCx savings for 60 sites is 15.9% energy savings /year
  - MBCx is a low SPB measure that can help subsidize DER and resilience ECMs

Benefits of Integrating MBCx into Performance Contracts

Top Benefits

- Data from AMI meters can be tied into MBCx to track energy savings
- FDD rules are applied to HVAC ECMs for performance assurance
- Increased precision in HVAC M&V
- Allows for remote and automated M&V of a subset of ECMs
- Can reduce the amount of field work / M&V costs
- Use MBCx data to ensure agency staff operates equipment correctly
- Standardized MBCx rules across building portfolio for consistency
- Ensures optimal ECM performance over entire TO term

**Note additional benefits outlined in FEMP MBCx report*

MBCx in each Performance Contract Phase

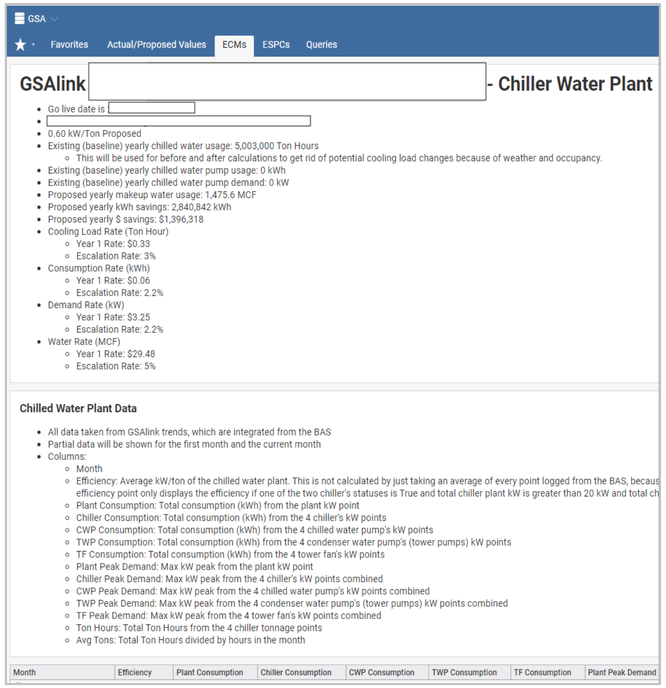
Phase	Activities
Preliminary Assessment*	• Initial ECM identification, including RCx opportunities*
Investment Grade Audit	• Baseline development/energy savings calcs* • Evaluate MBCx as an ECM • Incorporated in Cx and M&V Plans for HVAC ECMs
Implementation and Construction	• Implement MBCx as an ECM • Identify additional RCx opportunities or other ECMs • Assist in ECM Cx and post-installation M&V
Performance Period	• Automated trend analysis / reports for 'BAS trend logs' • ECM performance verification supporting annual M&V • Identification of additional retuning and RCx opportunities

Drivers for MBCx in Performance Contracts

- **Ensuring staff operates equipment correctly**
  - Example 1: Condenser water set point
    - Condenser water set point temperature is lowered in performance contract to save energy. AFDD ‘rule’ written to ensure operators maintain controls per contract
  - Example 2: AHU scheduling
    - Air handling unit schedules modified in 10 buildings, affecting 100 AHUs
    - AFDD rule written to provide alert if equipment operates outside schedule agreed to in performance contract
- **Alerts to ESCO and/or agency allow timely correction**
  - No need to wait for annual performance verification and potential savings shortfall

GSA Case Study

Scope of Integration	Building Count	Sum of Square Footage	Electric Meters Integrated	Water Meters Integrated	Gas Meters Integrated	Steam Meters Integrated
GSALink MBCx and Metering	103	63,018,781	748	183	89	42
Metering Only (No MBCx / FDD)	63	14,777,568	136	72	47	2
Grand Total	166	77,796,349	884	255	136	44



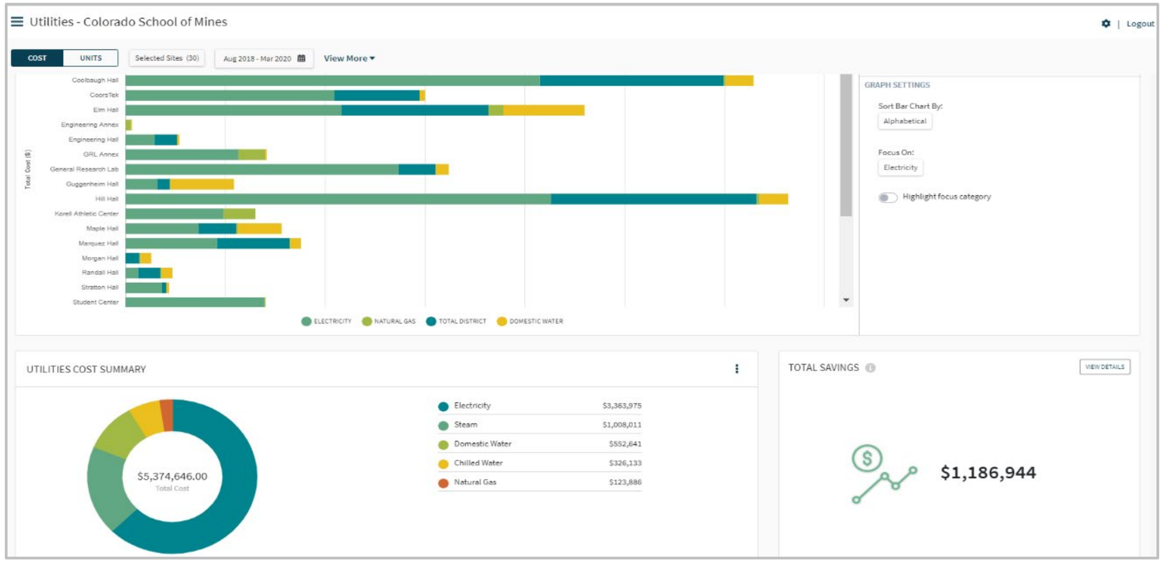
GSALink analysis of 60 sites:

- 15.9% yearly energy usage reduction
- 12.2% daily average demand reduction

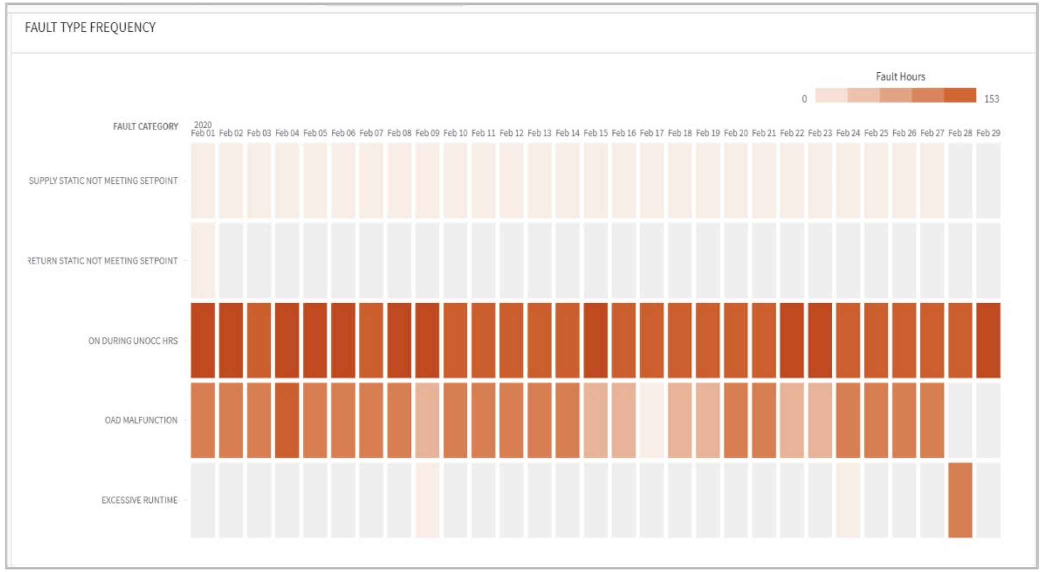
GSA has developed automated ECM reports to track ESPC M&V performance

University Case Study

- **ESCO has institutionalized MBCx as standard offering**
- **Combined with behavior changes as ECM under powerED for Universities**
- **2018 – deployed MBCx across 32 buildings for Colorado School of Mines**
  - Combined with RCx as ECM, used for ECM commissioning, generating automated M&V reports
  - $234,000 guaranteed annual savings



Colorado School of Mines performance dashboard #2



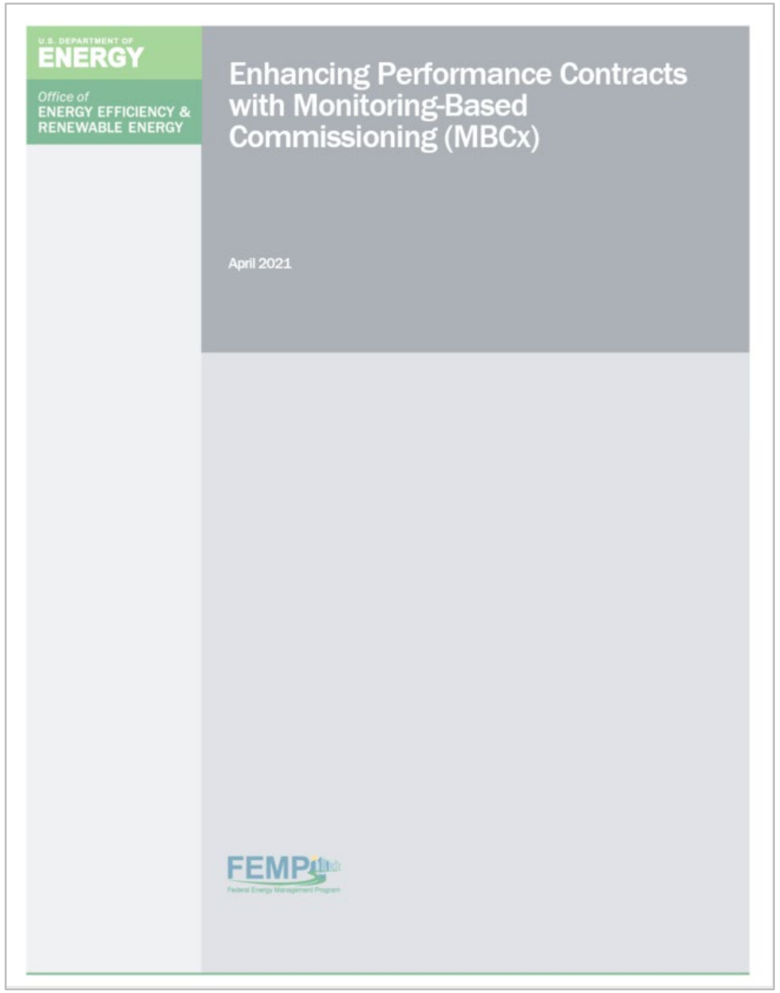
Colorado School of Mines platform diagnostics by fault category

Key Takeaways

- **Enables federal agencies to meet requirements for recommissioning and advanced metering**
- **MBCx in performance contracts benefits both the contractor and the facility**
  - Includes integration of AMI and BAS data
  - Helps identify 're-tuning', RCx, and other HVAC ECMs
  - Can enhance all M&V protocols (Option A, B, C, D)
  - Should reduce annual M&V cost / onsite ESCO work
  - Helps identify and prioritize O&M issues

More Information Forthcoming!

- **FEMP paper: “Enhancing Performance Contracts with Monitoring-Based Commissioning (MBCx)”**
  - In final FEMP review
- **FEMP webinar – September 14, 1:00pm EDT**
  - Enhancing Performance Contracts with Monitoring-Based Commissioning (MBCx)



Contact Information

Kurmit Rockwell, PE, CEM, LEED AP

ESPC Program Manager

Federal Energy Management Program

Kurmit.rockwell@doe.gov

Jesse Dean

Senior Engineer, M.S., CEM | IAC Applied Engineering

National Renewable Energy Laboratory (NREL)
jesse.dean@nrel.gov

Phil Voss

Senior Project Leader

National Renewable Energy Laboratory (NREL)
philip.voss@nrel.gov

FEDERAL UTILITY PARTNERSHIP WORKING GROUP VIRTUAL SEMINAR

May 5-6, 2021

UESC Financing Best Practices

- Chandra Shah, NREL *(Moderator)*
- Karen Gierhart, Bank of America
- Alan Riefenberg, United Financial
- Scott Foster, Bostonia
- Bruce Gross, Dominion Federal Corporation
- Leslie Ebert, National Rural Utilities Cooperative Finance Corporation
- Josh Mersfelder, Hannon Armstrong

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Panel Overview

Topic
• Financier Introductions o Company overview o Experience with UESC project financing
• Moderated Questions
• Wrap-Up and May 18 Financing Webinar

Financier Introductions

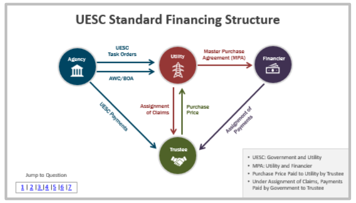
Name	Company	Email	Phone
Scott Foster	Bostonia	sfoster@bostonia.com	Office: 617-716-8251 Mobile: 703-887-0714
Karen Gierhart	Bank of America	karen.h.gierhart@bofa.com	Office: 401-278-7764 Mobile: 617-413-5259
Bruce Gross	Dominion Federal	bruce.gross@dominionfederal.com	Office: 703-761-1220 x-15 Mobile: 301-980-8255
Josh Mersfelder	Hannon Armstrong	jmersfelder@hannonarmstrong.com	Office: 410-571-6178 Mobile: 202-510-5750
Alan Riefenberg	United Financial	ARiefenberg@unitedfinancial.com	Office: 630-799-1053 Mobile: 847-927-2022
Leslie Ebert	National Rural Utilities Cooperative Finance Corporation	Leslie.Ebert@nrucfc.coop	Office: 703-467-1618 Mobile: 703-608-7066

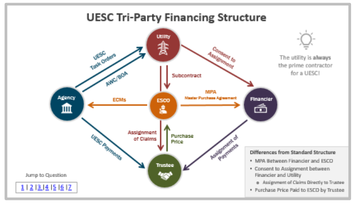
Question #1

How can the Cooperative Finance Corporation (CFC) and its electric cooperative members play a role in financing potential government utility energy service contracts (UESCs)?

Standard

Tri-Party

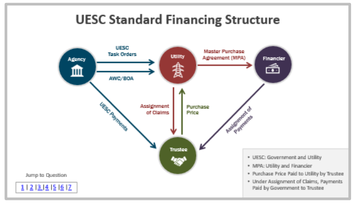


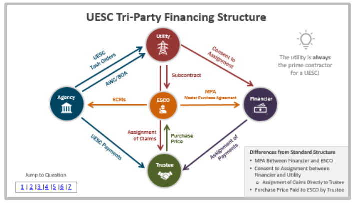


Question #2

What are the financing rate components and how are they determined?

[Standard](#) [Tri-Party](#)

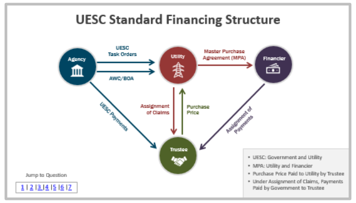


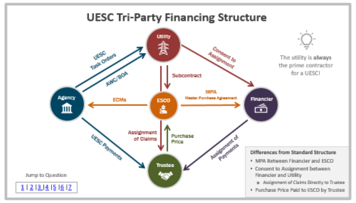


Question #3

What factors impact the financing rate (such as energy conservation measure (ECM) risk, creditworthiness, UESC contract length, certain UESC terms/conditions)? Describe a "perfect" project vs. a "problematic" project in terms of financing risk.

[Standard]   [Tri-Party]



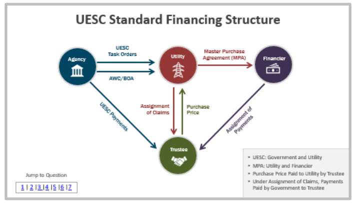


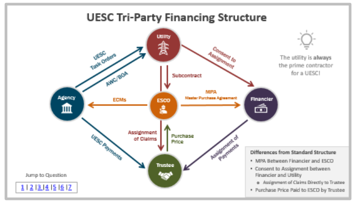
Question #4

*FEMP recommends that financing be competed amongst **at least three** companies, with the results shared with the agency.*

- *When should the financing competition occur and what is the recommended process for obtaining and evaluating UESC financing offers?*
- *How does this process change if the implementing energy service company (ESCO), rather than the utility, obtains the financing?*

Standard   Tri-Party





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Question #5

Financing transparency is critical. How can agency staff ensure the best value to the government and that there are no hidden financing costs?

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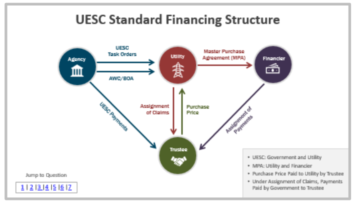

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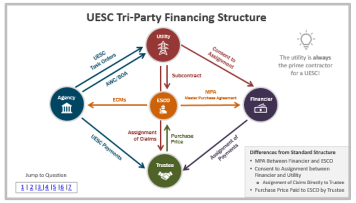

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Question #6

What might cause the financing rate and/or terms to change in the time between the financing competition and contract award?

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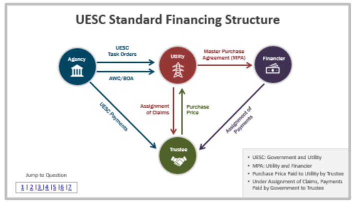
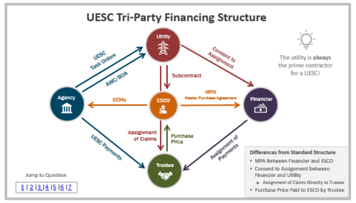


Tri-Party



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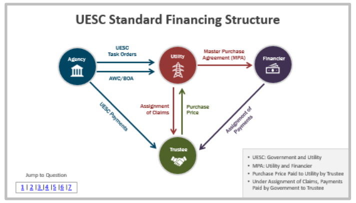
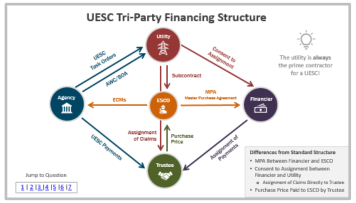
Question #7

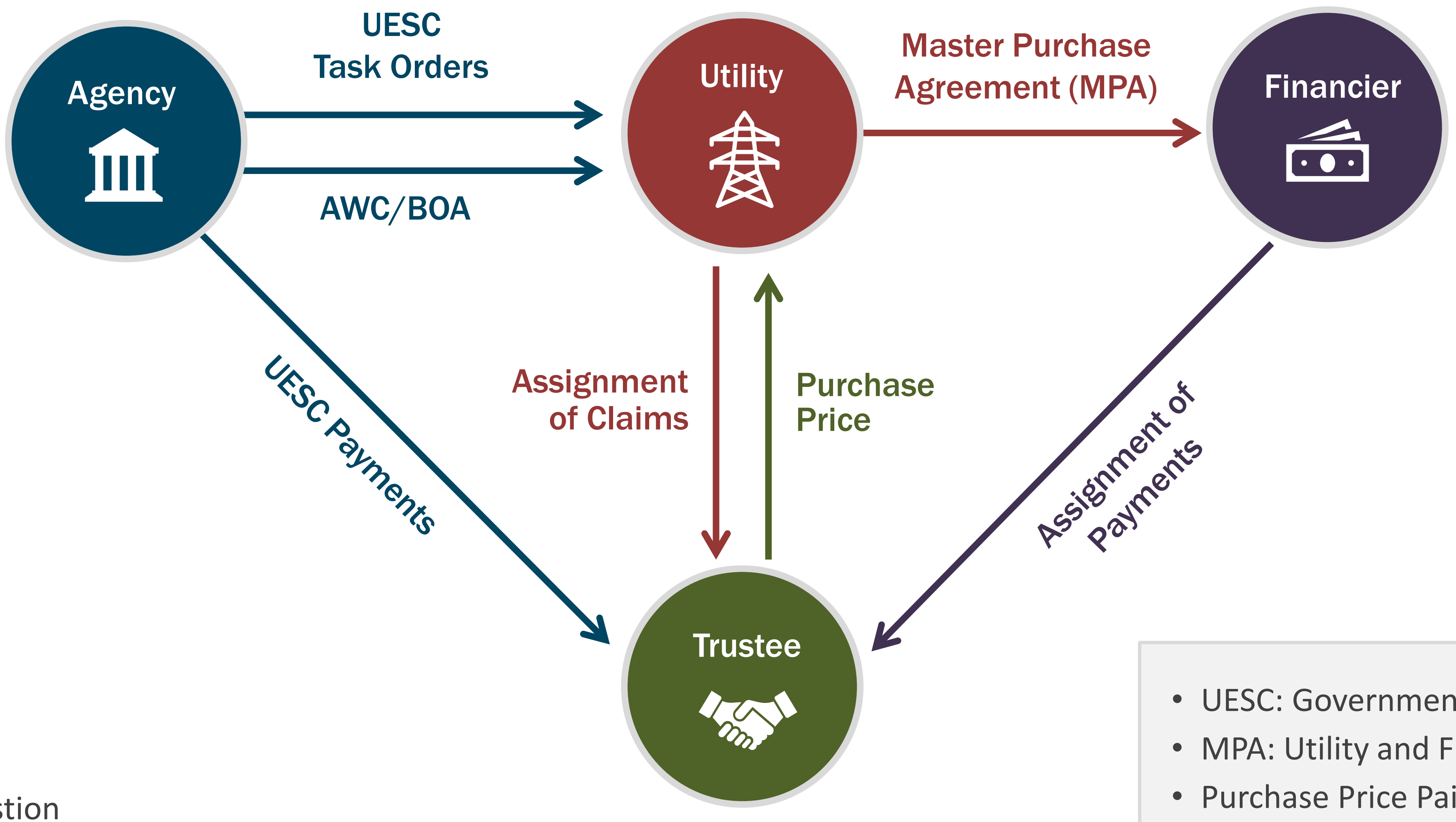
What advice or "rule of thumb" insights would you give to agencies related to UESC financing?

[Standard](#) [Tri-Party](#)





UESC Standard Financing Structure

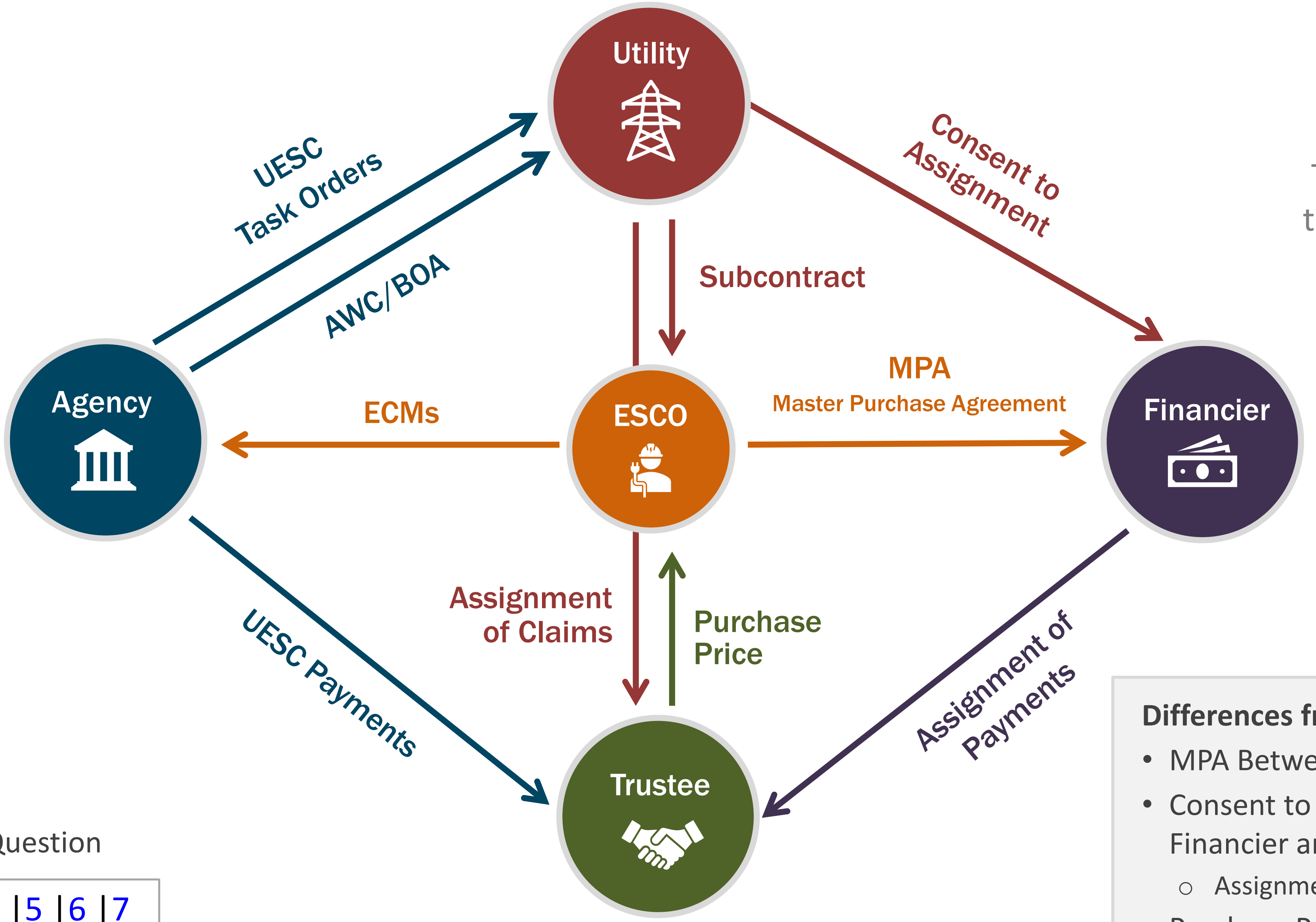


- UESC: Government and Utility
- MPA: Utility and Financier
- Purchase Price Paid to Utility by Trustee
- Under Assignment of Claims, Payments Paid by Government to Trustee

Jump to Question

1 | 2 | 3 | 4 | 5 | 6 | 7

UESC Tri-Party Financing Structure



The utility is **always** the prime contractor for a UESC!

Differences from Standard Structure

- MPA Between Financier and ESCO
- Consent to Assignment between Financier and Utility
  - Assignment of Claims Directly to Trustee
- Purchase Price Paid to ESCO by Trustee

Jump to Question

1 | 2 | 3 | 4 | 5 | 6 | 7

Thank You!

Want to Learn More?

Join us for the ***Financing for UESCs* Webinar** on May 18th!

- *Financing best practices*
- *Strategies for obtaining the best value*
- *Live Q&A with the financier panel*

?

Please submit your questions through the FEMP Assistance Portal.

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We will be in practice mode until the break is over

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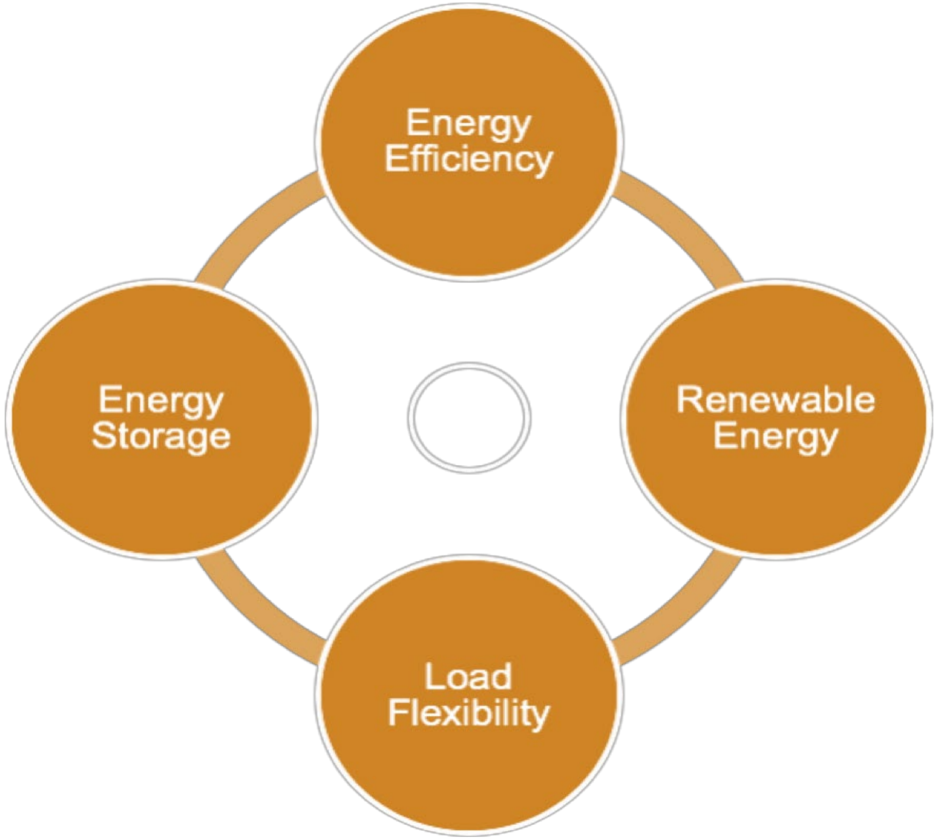
Grid-Interactive Efficient Building (GEB)

Moderator, Jay Wrobel (FEMP)
Kinga Porst Hydras (GSA OFHPGB)
Tyler Harris (PBS FM)
May 6, 2021

What are Grid-Interactive Efficient Buildings (GEBs)?

- A GEB strategy enables achievement of ambitious climate & resilience goals by bringing buildings & the grid together
- GEBs draw from a toolbox that includes energy efficiency, renewables, energy storage and load flexibility
- GEBs employ these capabilities to flexibly **reduce, shed, shift, modulate or generate** electric load as needed
- In response to utility price signals, a GEB can reduce costs and enhance resilience for both building and utility



Why Should GSA Be Interested in GEBs?

- Meeting climate goals will require huge leaps in efficiency & integration
- Necessary to increase building & grid resilience
- Opportunities for cost-savings:
  - Efficiency savings
  - Reduced demand charges
  - Demand response programs
  - Time of use rates
  - Utility rebates and incentives

GSA's Path to GEB Adoption

- **Identified opportunity**
  - DOE Building Technology Office (BTO) GEB Initiative and New Buildings Institute (NBI) Grid Optimal program
- **Consulted outside experts to develop recommendations**
  - GSA Green Building Advisory Committee
- **Developed internal analyses of feasibility, costs & benefits**
  - GSA-Rocky Mountain Institute (RMI) Value Potential Report
- **Initiated pilot projects to test and demonstrate the concept**
  - GSA Proving Ground (GPG) GEB RFI
  - Regional pilots
- **Developing policy and guidance for implementation**

Advisory Committee GEB Recommendations

- Developed:
  - Findings & Recommendations (2-21-19)
  - Proposed Federal Roadmap (12-9-19)
- Primary recommendations:
  - Set federal building & grid integration policies
  - Conduct grid and rate analyses
  - Develop design guidance for new & existing federal buildings
  - Incorporate demand savings into ESPCs/ UESCs
  - Develop building pilot projects

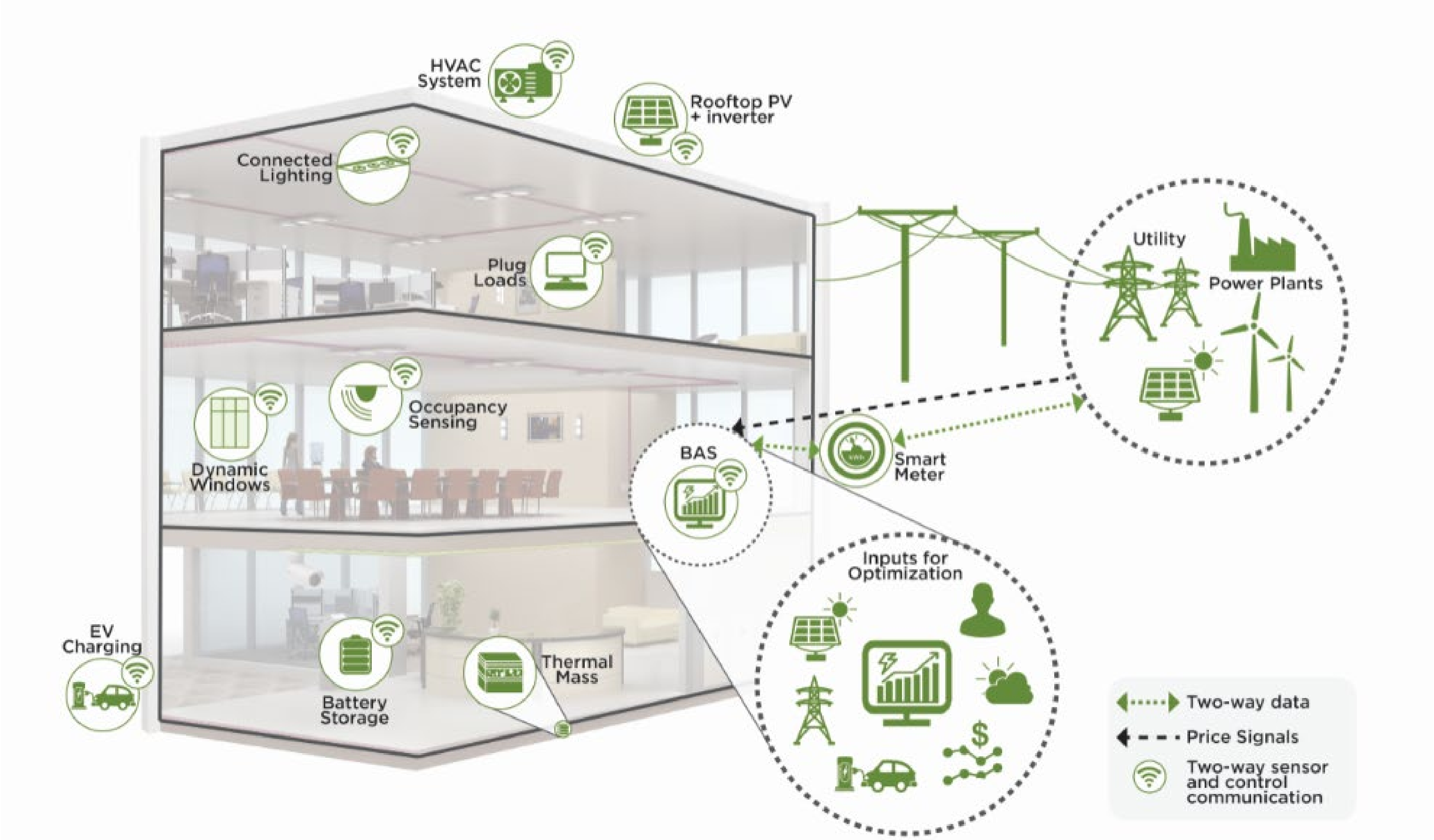
GSA-RMI Portfolio GEB Feasibility Study

- Available on Rocky Mountain Institute (RMI) website at https://rmi.org/insight/value-potential-for-grid-interactive-efficient-buildings-in-the-gsa-portfolio-a-cost-benefit-analysis

Background: **G**rid-interactive **E**fficient **B**uildings (GEBs)

Rocky Mountain Institute evaluated GEB strategy for GSA

- Modeled comprehensive GEB strategy across 6 representative locations
- Found broad deployment of GEB strategy across GSA's owned portfolio would deliver $50 million in annual cost savings
- Noted that GEB solutions are promising, but pre-commercial and will require field validation



Findings: The Value of GEBs to GSA

Direct Benefits to GSA	Grid and Societal Value	Indirect Value to GSA
• $50 MM in annual cost savings • $206MM in NPV • Project-level payback under 4 years • Futureproof: Accommodates future rate structure changes and helps manage costs	• Reduce grid-level T&D and generation costs up to $70MM/yr • These savings ultimately benefit the government and taxpayers • Future grid economic models will value savings (e.g. NWA's)	• Demonstrates federal and real estate industry leadership • Enables deeper savings in ESPCs and UESCs • Better building control can improve comfort, health, and productivity • CO_2 savings

Assumes GEBs are applied across the GSA portfolio of owned office buildings; Based on bundle of measures modeled by RMI.

Cost Effective GEB measures and Strategies

Measures

Cost-effective in almost every location	Cost-effective in some locations

• **LED lighting upgrades,** including tube retrofits, fixture retrofits
• **Staging to reduce peak demand:**
  • Laptop battery charging
  • AHU fans
  • Electric resistance heaters (all-electric only)
• **Space temperature setback to reduce peak demand**
	• **Advanced lighting controls,** which enable peak shaving and DR
	• **Electric Battery storage**
	• **Solar PV** energy generation
	• **A solar + storage "bundle"** – bundling enhances the value beyond investing in solar and storage individually

Strategies

1. The best returns are in locations with high demand charges, time of use rates, and seasonal variation.
2. Consistent demand management and peak shaving delivers greater value than demand response in most scenarios.

Key differentiators of Grid-Interactive Efficient Buildings

Attribute	Today	Future
1. Interoperability and intelligence from building to grid	•DR programs, often manual, fairly static	•Ability to receive and respond to utility price signals •Ability to send load flex potential
2. Interoperability and intelligence across building systems	•BMS system for major loads (HVAC) •Individual system controls (Lighting, storage)	•Single, overarching integrator to monitor and control all loads, inc. plug loads and storage •Ability to optimize for cost, carbon, reliability, etc.
3. Load flexibility and demand-focused optimization	•Thermal energy storage •Battery storage	•Intelligence to track and map demand, shift or shed rapidly based on inputs such as price, weather, carbon, events, etc.

GSA ESPC/UESC Pilot Projects

Oklahoma City Federal Building
- LED Lighting controls
- Solar PV
- Plug load controls

Richard Sheppard Arnold United States Courthouse
- Controls upgrade
- LED Lighting controls
- Solar PV
- Transformers
- Smart power strips

Ronald Reagan Building
- BAS upgrade
- Lighting upgrade
- Chiller replacement and optimization
- High efficiency transformers

GEB Blueprint

Key to the success of a GEB project is:

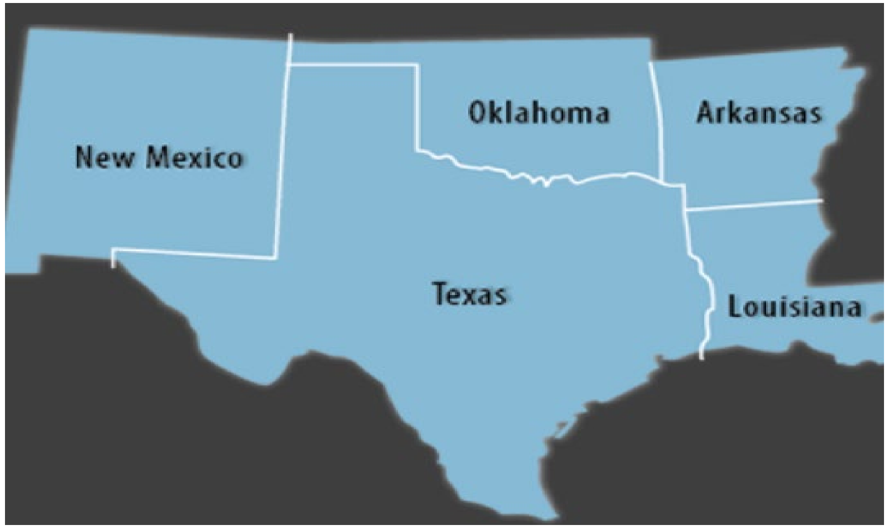
- Site selection with utility rates and incentives favorable to GEBs;
- Identification of GEB measures early;
- Stakeholder engagement;
- Integration of GEB measures within major building renovations; and
- Careful consideration of GEB measurement and verification methodologies.

Next Steps

- Publish GEB Blueprint and Case Studies 5/10/21
- Post SFTool.gov GEB page
- Identify low and no-cost measures for building managers that can help a building get GEB-ready - PBS review
- Conduct a portfolio analysis & prioritization for GEB value potential
- Education through interactive GEB workshops

GSA Region 7 Performance Contracting

- GSA Region 7
  - 200+ GSA Owned Facilities
  - 5 States, 67 cities
  - Federal Buildings, Courthouses, Special Use Buildings, Land Ports of Entry
- Performance Contracting
  - ESPC ENABLE Fort Worth (Near Acceptance)
  - UESC Oklahoma (Construction)
  - UESC New Mexico (Construction)
  - ESPC NDER IV, El Paso (IGA Phase)
  - UESC Eastern (IGA Phase)
  - ESPC GSA NDER V, Dallas/NOLA (Planned)

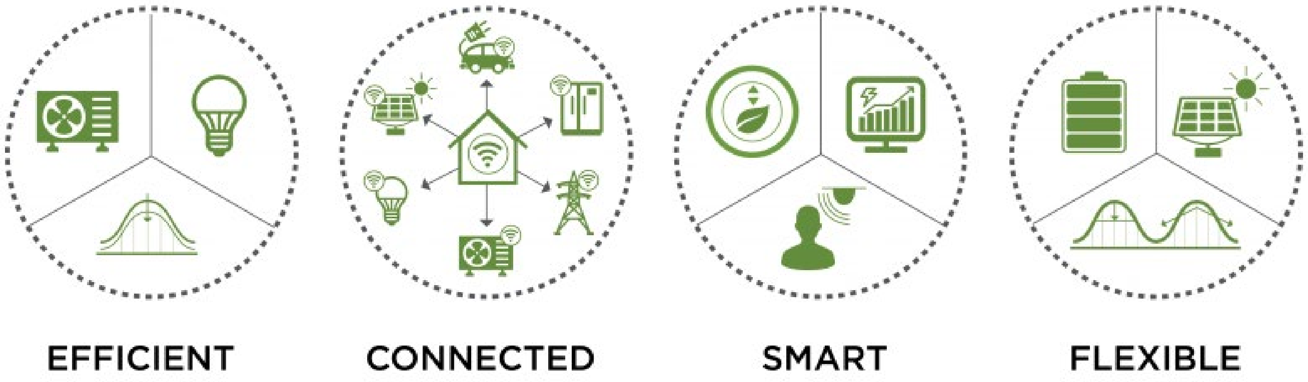


GSA Region 7	MMBTUs
FY19 Regional Baseline	**944,807**
Annual Energy Savings	**144,178**

Projected 15% annual reduction in energy consumption from FY19

GSA Region 7 AFFECT Grants

- Region 7 Applied for (4) 2020 AFFECT Grants
  - Oklahoma UESC BESS/Microgrid/GEB Solution **(Awarded)**
  - El Paso ESPC Solar/BESS/GEB/ESA Solution **(Awarded)**
  - New Mexico Generator/BESS/GEB Solution
  - Eastern UESC Dynamic BESS ESA/GEB Solution
- AFFECT Grant Lessons Learned
  - They are a lot of work! Need a strategic partner like an ESCO
  - Follow the instructions:
    - Replicability
    - Multiple areas of focus (efficiency, storage, ESA, GEB, etc.)



GSA Region 7 AFFECT Grant

Application Overview

1) Project Title; GSA Region 7 Campus Building UESC - Microgrid
2) Requested AFFECT Grant Funds; [redacted]
3) AFFECT Grant Funds Cost Leverage; [redacted]
4) Principal Investigator; Oklahoma Gas and Electric
5) Key Participants. Tyler Harris (GSA), Michelle Rodriguez-Pico (OG&E)

Areas of Interest Technology(ies) Pursued & Impact Summary

1) Explanation Of Proposed Project's Impact Relative To DOE Areas Of Interest:
    1) Resilient: This UESC project includes a 300kW solar rooftop PV system for renewable generation. The AFFECT Grant would fund a microgrid and a 250 kW Battery Energy Storage System (BESS) for additional resiliency.
    2) Efficient: The proposed UESC project includes the following energy efficiency infrastructure ECMs: LED lighting, lighting controls, HVAC controls, transformers, advanced power strips. and building insulation.
    3) Secure: The Grant would fund a microgrid interconnecting the solar PV with the existing emergency generator system so that the PV system and emergency generator can operate in island mode during the loss of grid power. This will also reduce the need for diesel fuel deliveries.
2) Explanation Of Proposed Project's Impact on Advancing Applicant Agency's Primary Mission:
    1) The microgrid/BESS will provide an additional, clean source of backup power, allowing the GSA to continue to operate during a grid outage.
3) Explanation Of AFFECT Grant Funds' Impact On:
    1) Proposed Project: The AFFECT Grant will fund the microgrid and BESS that could not otherwise be included.
    2) Advancement Of Project Success. Incorporating the microgrid and BESS adds value to the UESC's solar PV system by allowing the PV system to operate during loss of grid power. It also allows the GSA to participate in Grid-Interactive Efficient Building Strategies.

Summarize Proposed Project, Replicability And/Or Scalability

1) Proposed Project Energy Performance Contract Mechanism: Utility Energy Services Agreement (UESC)
2) Proposed Project ESCO (ESPC or ENABLE) Or Utility (UESC): Oklahoma Gas and Electric
3) Overview of Proposed Project:
    1) Goal(s)/Objective(s): Increase energy security and resiliency through micorgrid; employ GEB Strategies; and, create a replicable and scalable solution that can be implemented in future projects.
    2) Approach; Install a microgrid to allow the solar PV system and BESS to operate in island mode during a loss of grid power.
    3) Proposed Work Plan: Traditional UESC delivery. Microgrid and GEB solutions deployed and commissioned. Performance Assurance Plan in place to ensure sustained success.
    4) Project Development Schedule: Modification of contract immediately after notice of AFFECT grant award. Delivery of ECM 18 months? After award.
4) Demonstrated Replicability Plan And/Or Scalability.
    1) GSA intends to create case study and lessons learned document to disseminate through multiple channels within the federal government community.
    2) GSA also intends to develop shortlist of microgrid/GEB ready facilities where future performance contracts can pursue similar solutions.

Oklahoma City Federal Building GEB Strategy

APPROACH TO BUILDING RESILIENT ENERGY SYSTEMS

ENERGY EFFICIENCY

- Reduce annual loads through conservation measures
- Minimize capital investment requirement

ON-SITE GENERATION

- CHP
- Renewables
- Back-Up Generation

CONTROLS

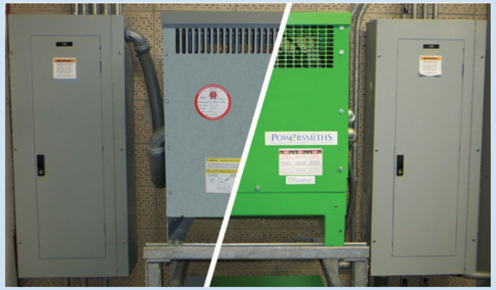
- Safely disconnect during LOU
- Fast Load Shed
- Demand Response Dispatch
- Manage generator assets in island mode

ENERGY STORAGE

- Support microgrid during LOU
- Self fund via savings/revenue
  (Utility Bill Management)
  (Demand Response)
  (Self Consumption of PV)

Oklahoma City Federal Building GEB Strategy

Energy Efficiency

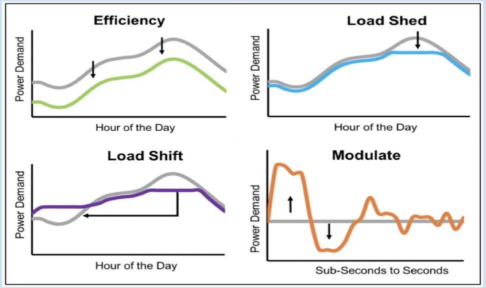


- LED Lighting
- Lighting Controls
- HVAC Controls
- Transformer Upgrades
- Advanced Power Strips
- Building Insulation

Renewable Energy

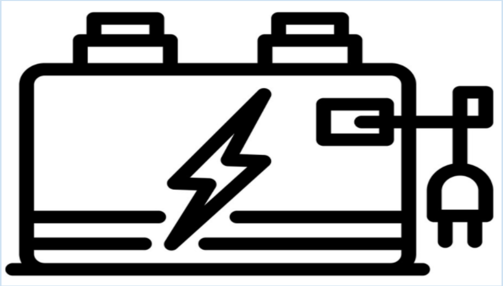
- 300 Kw Solar Rooftop PV
- Utility billing rate changes

Load Flexibility/Controls



- Microgrid Controller
  - Lighting Controls
  - HVAC Fans
  - PV Production
- Load Shedding
- Net Energy Exporting

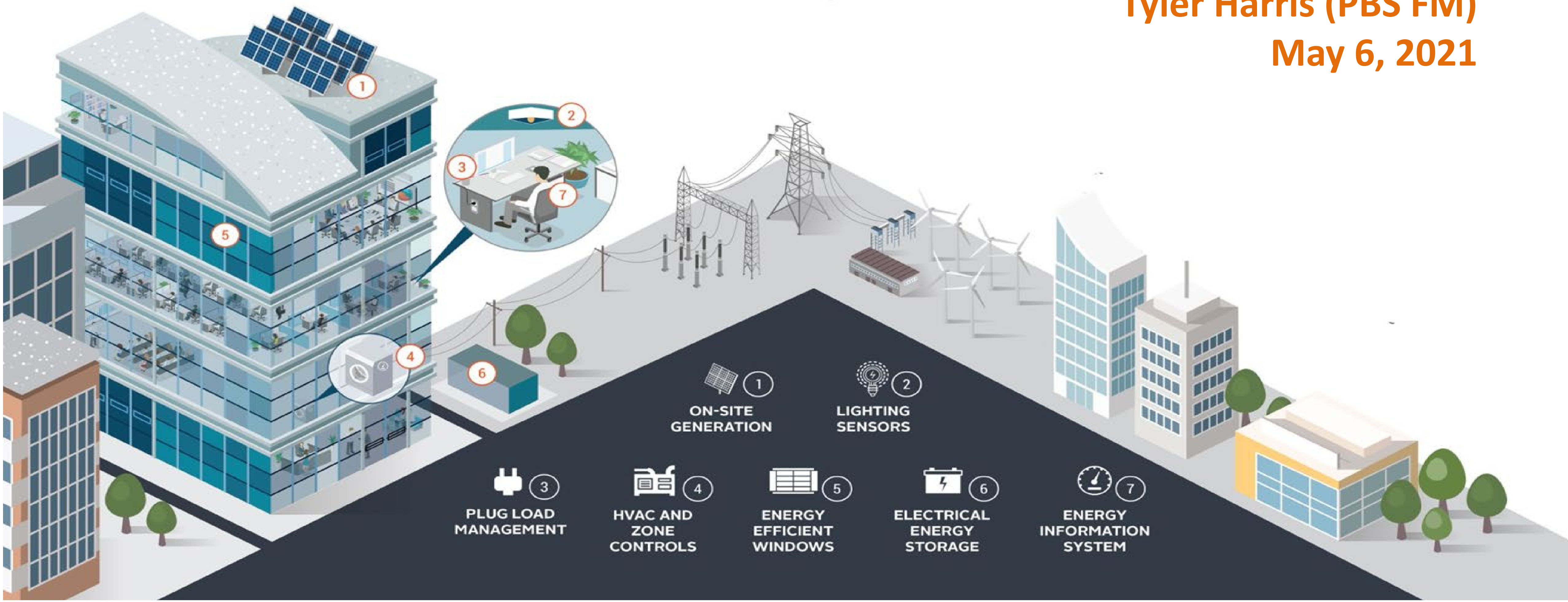
Energy Storage/Resiliency



- 250 kw / 500 kWh BESS
- 250 kW Emergency Generator (existing)
- Island Mode Operational Capability

Thank you!

Moderator, Jay Wrobel (FEMP)
Kinga Porst Hydras (GSA OFHPGB)
Tyler Harris (PBS FM)
May 6, 2021



Day 2 Closing Remarks

- Thank you for attending!
- Thank you to our presenters!
- Don’t forget these upcoming trainings:
  - Financing for UESCs: 1.5 hrs, May 18, 2021 (CEUs)
  - Comprehensive UESC Training: 3 hrs/day, June 15-17, 2021 (CEUs)
  - TVA Strategic Partnership Meeting, July 15, 2021
  - Leveraging Utility Partnerships for Fleet Electrification: 1.5 hrs, September 1, 2021
  - Registration - FEMP Training Catalog
- UESC Overview Part 2 training is next!