May 13, 2021

Using Energy Management Systems for Whole Building Efficiency

Virginia Energy Efficiency Council

Sponsored by VIRGINIA DHCD

VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

Partners for Better Communities

Session Speakers

Tim Bernadowski

Project Developer & Energy Engineer

Siemens

Lee Dunfee

Managing Director, Energy & Engineering

Cushman & Wakefield

Chris Perry

Research Manager, Buildings Program

ACEEE

Dawn Oleksy (moderator)

Climate Action Program & Operations Supervisor

City of Richmond

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VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

VAEEC
VIRGINIA ENERGY EFFICIENCY COUNCIL

Presentation Outline

- Public Buildings: capabilities of EMS systems, new system recommendations, client education
- Multi-Tenant Commercial: real-world experience, building performance challenges and solutions
- Research & the Future of EMS

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Smart Buildings

Building Energy Management Systems, What's Hot and the Future

usa.siemens.com/smartbuildings

The need for smart buildings

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By 2030, millennials will make up

75%

of workforce driving new work models and flexible work spaces

On average

30%

of energy is used inefficiently or unnecessarily

Up to

33%

of commercial real estate space is unused or underutilized

Up to

9%

increase in employee productivity in high-performance buildings

Due to competition for talent

40%

of companies have difficulties in retaining employees

Facilities staff spend

> 45%

of every day troubleshooting problems and managing repairs

Financial case for smart buildings

Significantly improve the bottom line

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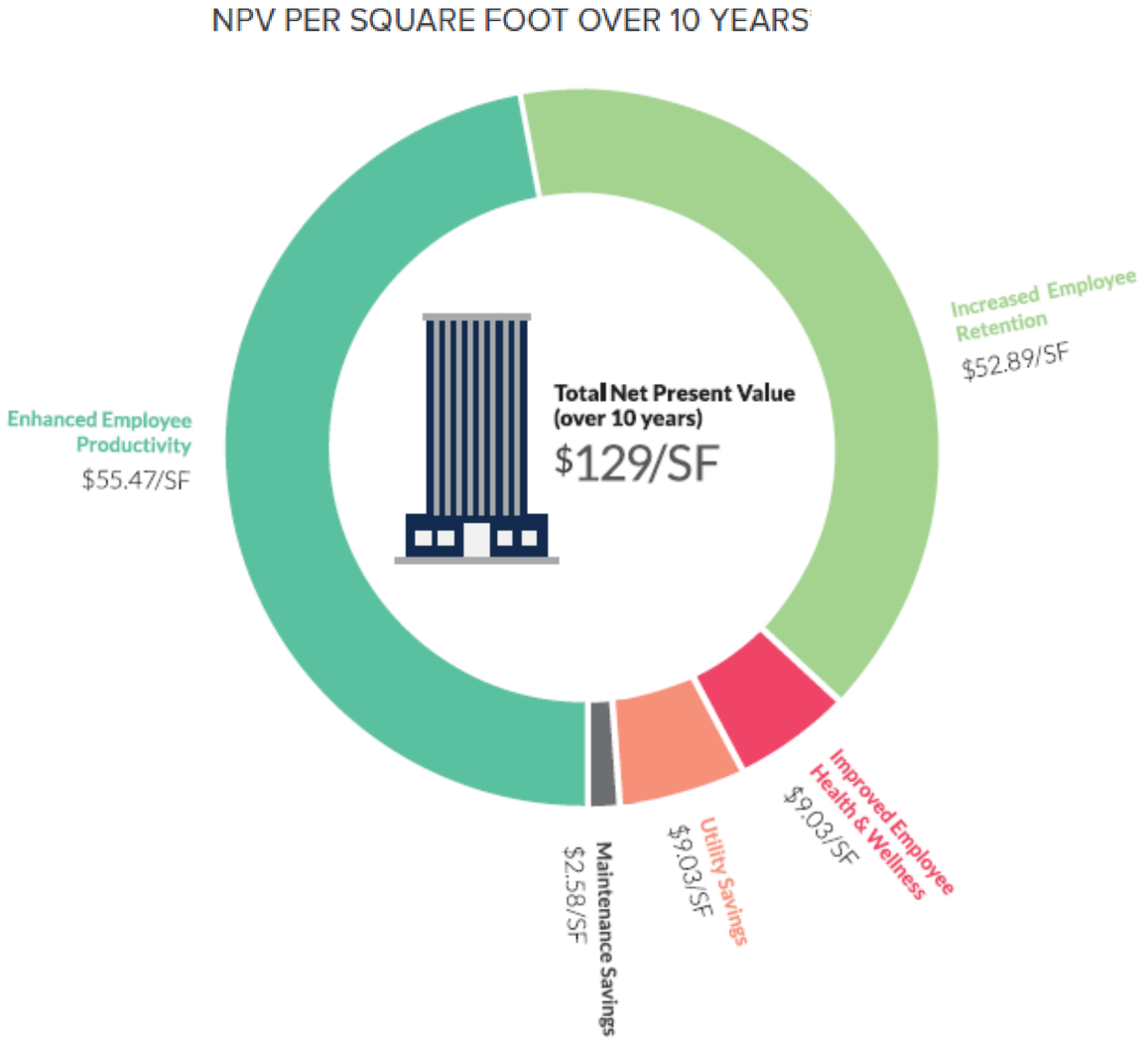
COMBINED BENEFITS PER HIGH PERFORMANCE BUILDING / SPACE*

DUE TO OCCUPANT PRODUCTIVITY, RETENTION, AND WELLNESS BENEFITS

$3,395
ANNUAL PROFIT PER EMPLOYEE

$18.56
ANNUAL PROFIT PER SQUARE FOOT

*Based on assumption of company in 150,000 SF building or tenant space, with 183 SF per employee. See Figure 8 (p. 9) for complete list of baseline assumptions in calculations.



Source: The Financial Case for High Performance Buildings, Stok

The journey towards smart buildings
Evolution of building technology

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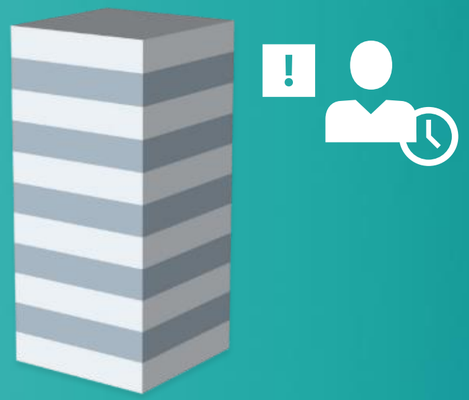
Traditional building



Siloed, on-premise systems
Preventive maintenance, on-site

Integrated building

+ Integrated building management
+ Remote diagnostics

Smart building

+ IoT applications
+ Real-time data analytics

Future of smart building

+ Simulation and artificial intelligence based on building twin
+ Prescriptive maintenance

Smart Building Revolution

Delivering Operational Excellence & Enhanced Occupant Experience

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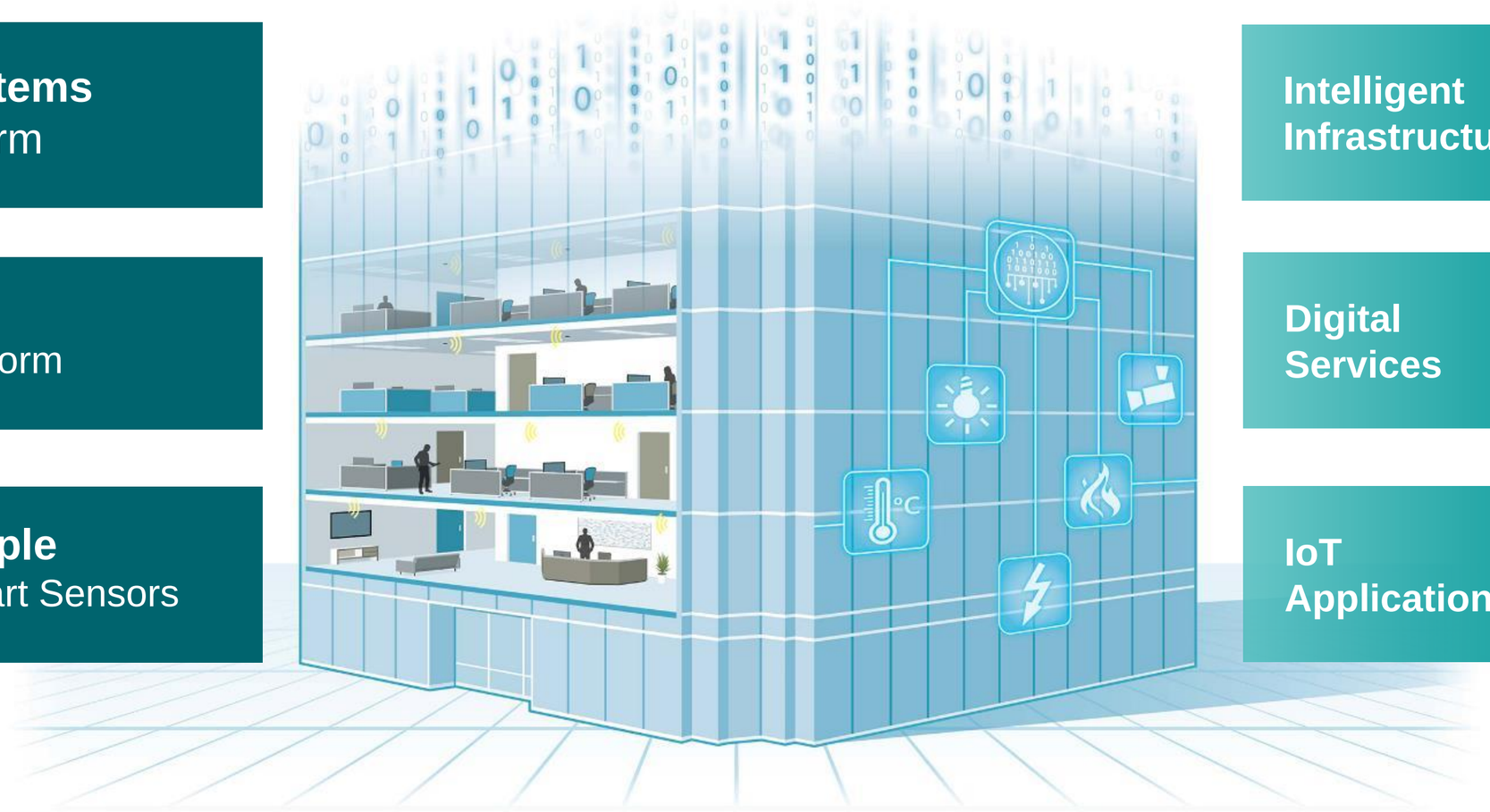
Connecting Systems
Integration Platform

Analyzing Data
Data Analytics Platform

Connecting People
IoT Network of Smart Sensors



Intelligent Infrastructure

Digital Services

IoT Applications

What’s hot with smart buildings and energy management systems

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- Air Quality Monitoring & Control
- New Monitoring/ Data Capability, IOT
- Integrate Building Data & Systems
- Optimization of Building Operations
- Optimize Safety and Security
- Document Actions and Conditions

What's hot with smart buildings and energy management systems

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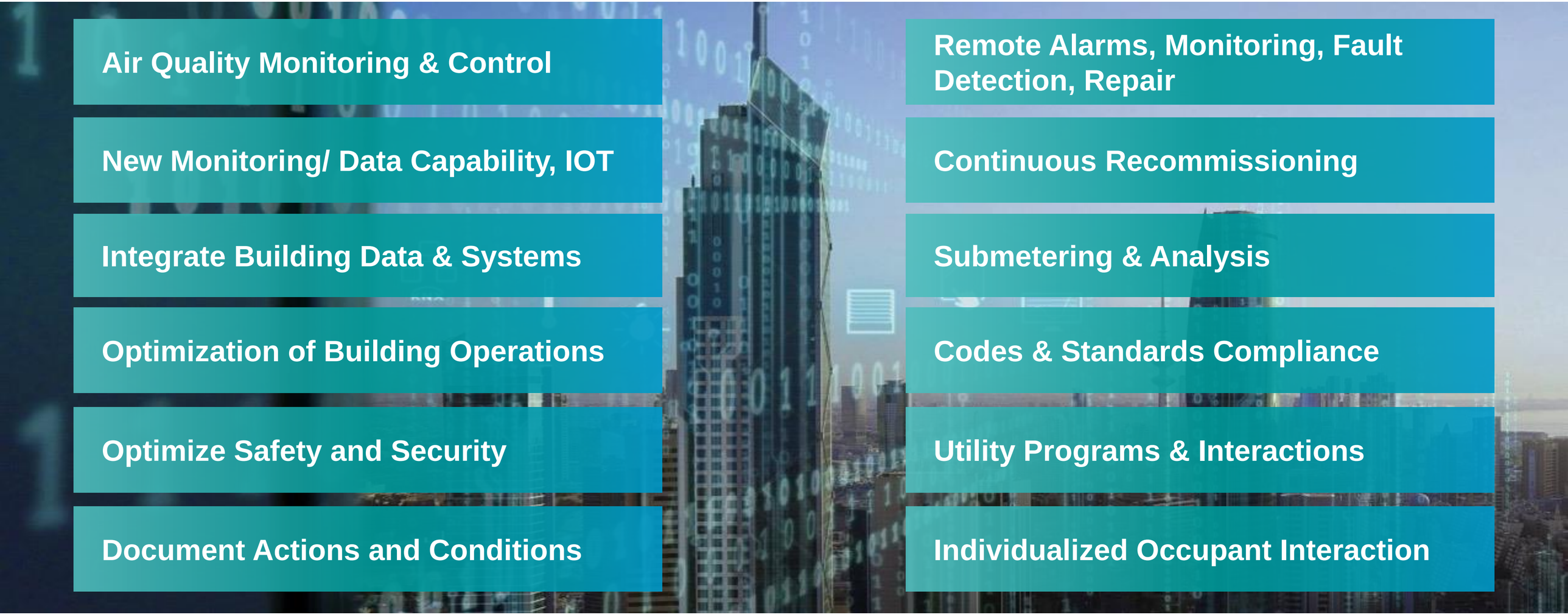


- Air Quality Monitoring & Control
- New Monitoring/ Data Capability, IOT
- Integrate Building Data & Systems
- Optimization of Building Operations
- Optimize Safety and Security
- Document Actions and Conditions
- Remote Alarms, Monitoring, Fault Detection, Repair
- Continuous Recommissioning
- Submetering & Analysis
- Codes & Standards Compliance
- Utility Programs & Interactions
- Individualized Occupant Interaction

A day in the life of smart building occupant

Way to work
Fastest way to work is calculated and suggested.

Parking
Reserve parking spaces in advance on the app. Access granted via license plate recognition.

Seamless access
Seamless access via smart-phone, also for visitors.

Find and book desks
Book the suggested desk based on your preferences or check availabilities.

Personalized settings
Machine learning enables personalized settings such as temperature and lighting.

Integrated services
3rd-party integration such as restaurants, public transportation, gym classes and more.

Book rooms and run frictionless meetings
Find rooms close to you and book instantly – integrated to the calendar system.

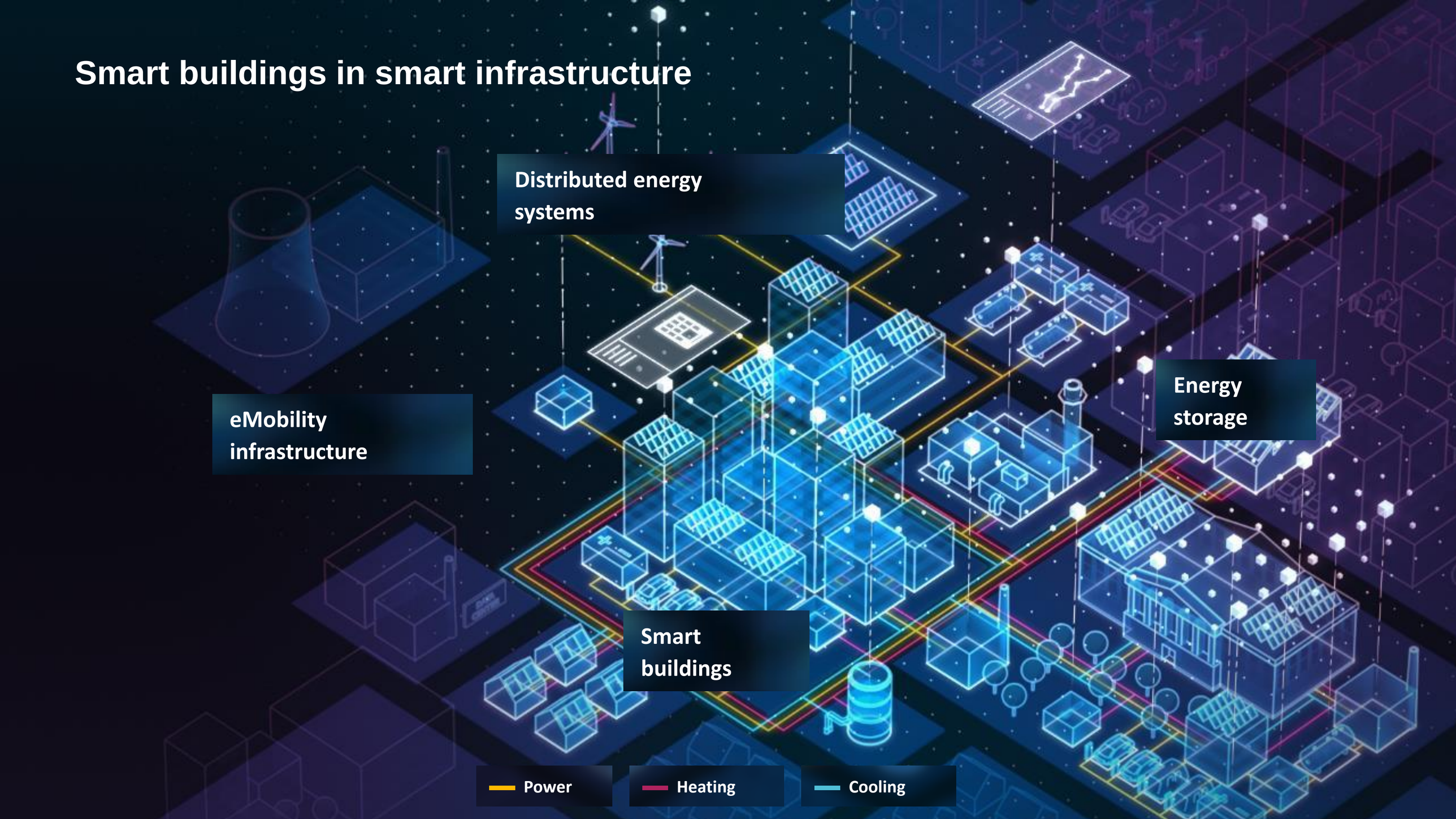
Report issues
Something doesn't work? Report issues to the facility manager via the app.

Track assets and find colleagues
Find things and people quickly while optimizing space utilization.

Notifications
Receive notifications on your smartphone
about events, incidents and more.

Way home
Departure time suggested based on personal schedule.

Smart buildings in smart infrastructure



Get started on your smart building journey today

Tim Bernadowski, PE, CEM, CLEP, CDSM
Project Developer & Energy Engineer

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Tim.Bernadowski@siemens.com

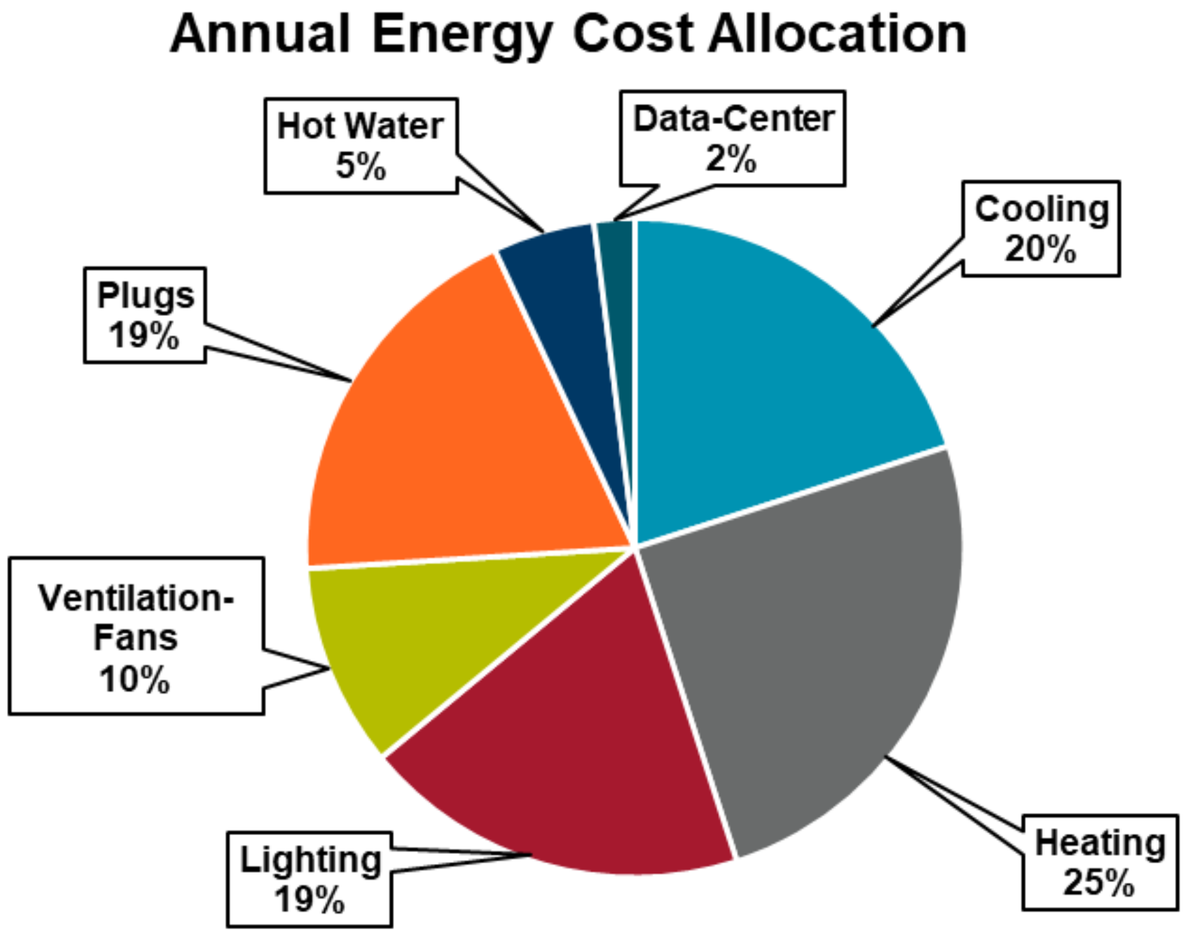
usa.siemens.com/smartbuildings

ENERGY & SUSTAINABILITY SERVICES

CUSHMAN & WAKEFIELD

Objectives

- BAS and Varying **Levels of Automation**
- Basic **Strategies and Sequence** of Operation
- More **Advanced Control** Strategies
- **Gaps** from Design/Construction to Operations
- **Case Studies**



- How does a building use energy?
- Estimated load allocation
- Industry information, experiences, real life data
- HVAC remains the largest opportunity

Understanding the **Level of Control** of the BAS

- Glorified “**time-clock**”
- **Partial DDC** automation with remaining pneumatic controls
- **Fully automated** with DDC controls
- DDC controls with **advanced control sequences**
- **Fault Detection and Diagnostics** (FDD)

Commonly found control sequences

- Computerized **optimized start**
- Limited occupant **adjustability**
- **Fixed setpoints**; like discharge air temps, chilled-water setpoints, Economizer changeover, etc.
- **Lockouts** that limit the opportunity for simultaneous heating/cooling

Advanced Control Strategies

More Advanced Control Sequences

- Eliminate **unnecessary runtimes**
- Narrowing the window of **simultaneous heating and cooling**
- Managing cooling to **match loads**
- Heating and cooling **lockouts**
- Understanding the **use of outside air** for ventilation

Gaps are more common than you might think……

- Meaningful operator **orientation and training** is missing
- User interface is not **operator friendly**
- Focus on **comfort more than efficiency** *(You can have both!)*
- Proper **commissioning**

Just because it's built to high efficiency standards, doesn't mean it automatically operates that way

CUSHMAN & WAKEFIELD

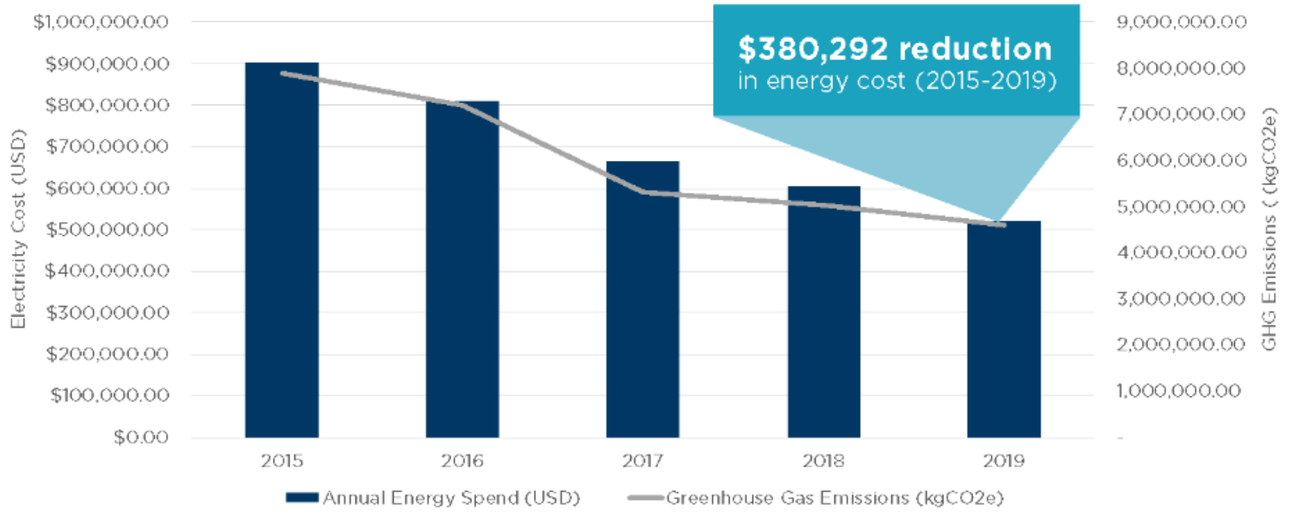
ANONYMOUS

Washington, DC
222,847 SF
Class A – GSA Tenant

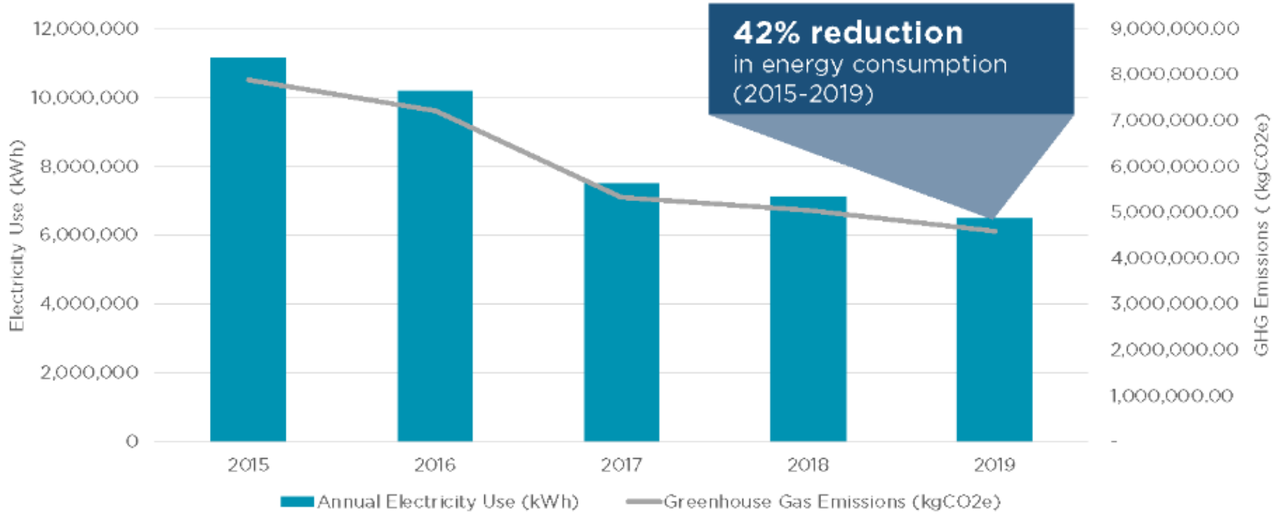
ENERGY CONSERVATION MEASURES			
LEVEL	ITEM	COST	EST PYBK (YRS)
Low	Optimized Start Time	$-	Immediate
Low	Improved Use of Discharge Air Reset	$-	Immediate
Low	VAV Inventory and Inspection Testing	$-	Immediate
Low	Night-Time Walk Through	$-	Immediate
Low	Real Time Monitoring	$6,000	0.50
Low	Unoccupied Setback Function	$2,000	0.32
Low	Vent Schedules on Individual Time of Day	$3,000	0.60
High	Expand Use of LED Lights (not yet implemented)	$75,000	2.76
High	Domestic Hot Water Thermostat and Circulator Pump Control (not yet implemented)	$5,000	2.88
High	Electric Heat Lockout (not yet implemented)	$36,000	4.96

	ENERGY USE (2018-2019)	COST SAVINGS
Jan	-24%	$19,091
Feb	-4%	$2,050
Mar	3%	-$1,367
Apr	-16%	$8,792
May	7%	-$3,161
Jun	-11%	$5,827
Jul	-12%	$6,243
Aug	-6%	$3,042
Sep	-21%	$11,161
Oct	-13%	$5,903
Nov	-31%	$18,288
Dec	-4%	$1,869
Total	**-12%**	**$77,741**

Annual Energy Cost vs. Greenhouse Gas Emissions



Annual Electricity Use vs. Greenhouse Gas Emissions



1320 NORTH COURTHOUSE

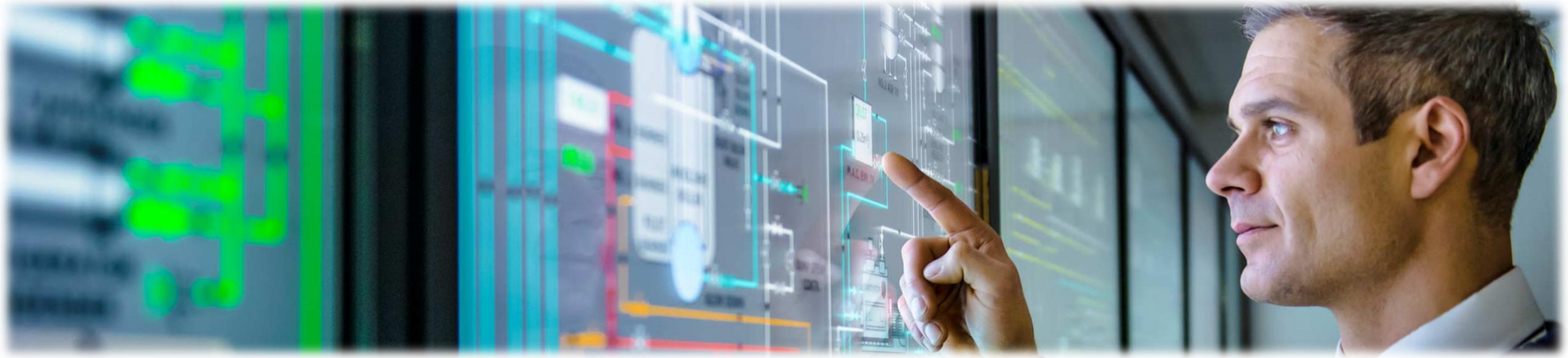
Metlife Real Estate
360,050 SF
Class A Multi-tenant

Thank You!

CUSHMAN & WAKEFIELD

The Future of Energy Management Systems and Grid-Interactivity

VAEEC Virtual Spring Forum
May 13, 2018



Chris Perry

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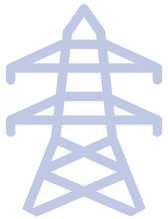
Research Manager, Buildings Program

ACEEE
American Council for an Energy-Efficient Economy

Outline

Background: Energy Management Systems



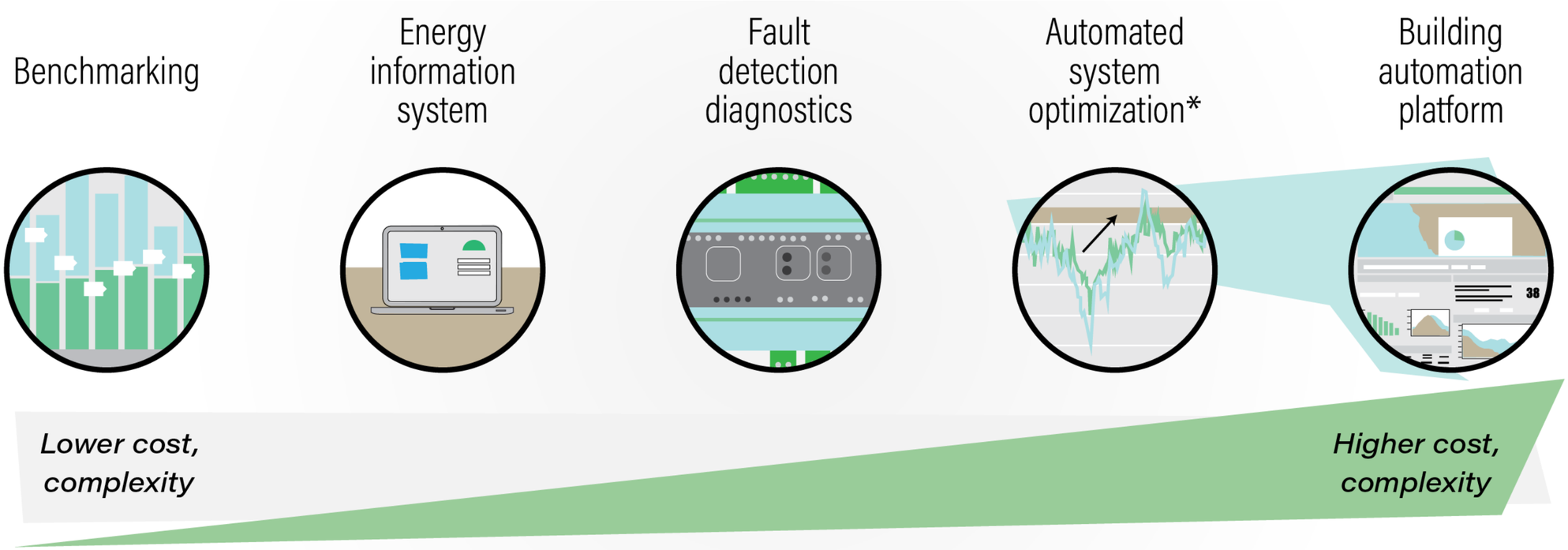
Background: Grid-interactive Efficient Buildings (GEBs)

The Future of Energy Management Systems and Grid Interactivity

Background: Energy Management Systems

American Council for an Energy-Efficient Economy

We use DOE's terminology on Energy management and Information Systems (EMISs)



Energy management & information systems (EMISs) range in cost depending on their level of complexity.

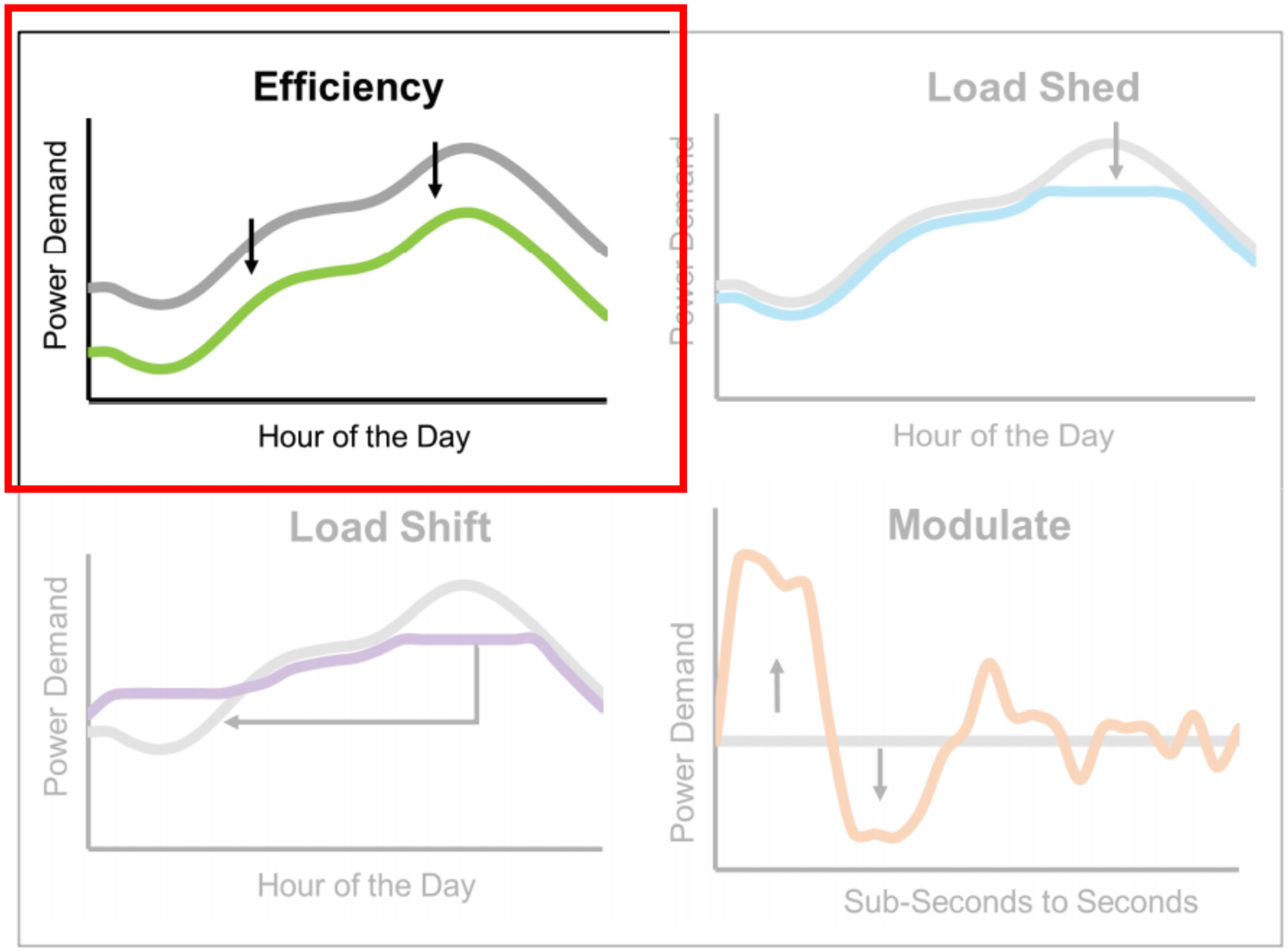
Cost	Savings
Initial: < \$0.01-\$0.40/ ft^2 Monthly: < \$0.01-\$0.10/ ft^2	5-15% whole building

buildpulse GRIDPOINT BuildingIQ SIEMENS

ACEEE American Council for an Energy-Efficient Economy

Background: Grid-interactive Efficient Buildings (GEBs)

Historically, ACEEE's research focused on kWh, however we are increasingly interested in kW.



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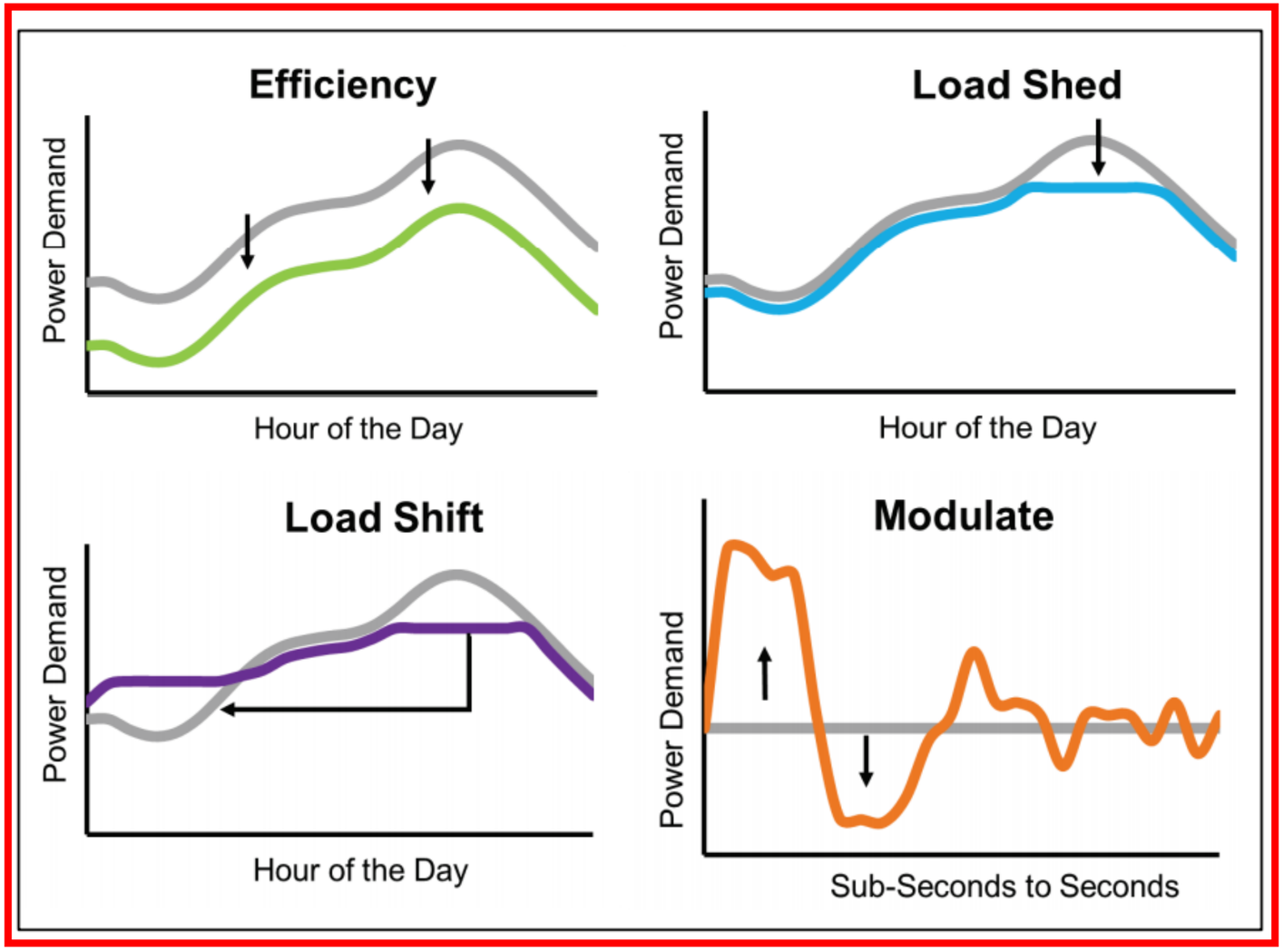

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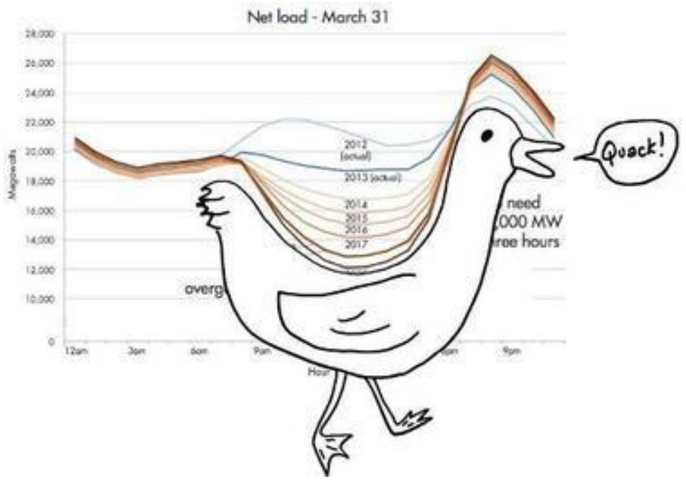
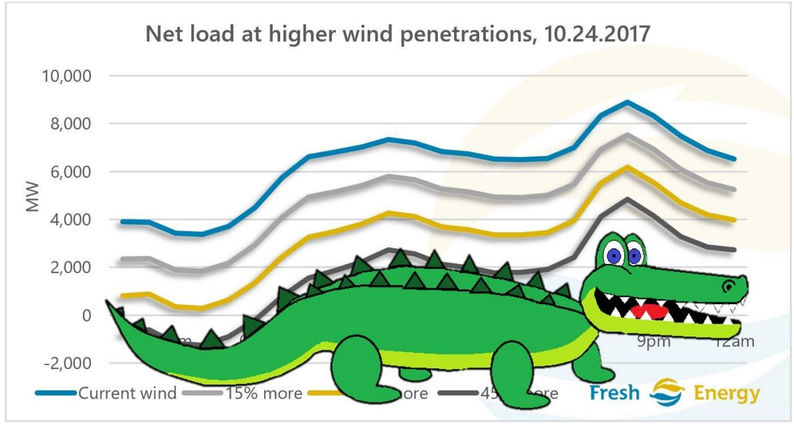
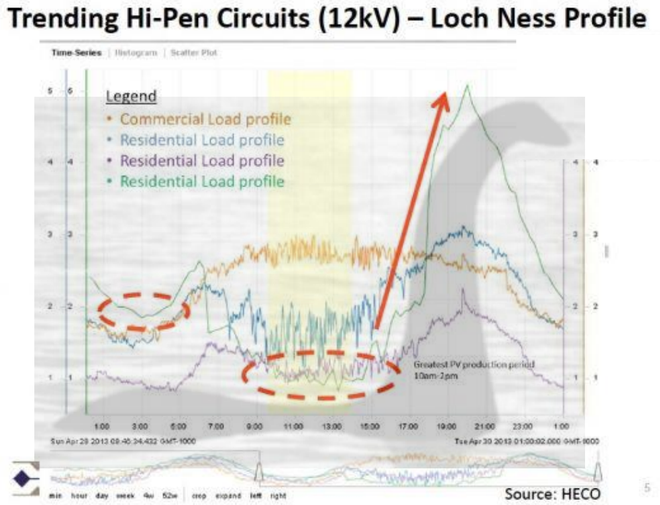
The adoption of new electric technologies *like solar PV and electric vehicles* and policies *like electrification* can cause strain on the grid if left unchecked.



California ‘Duck’ Curve



Midwest ‘Gator’ Curve



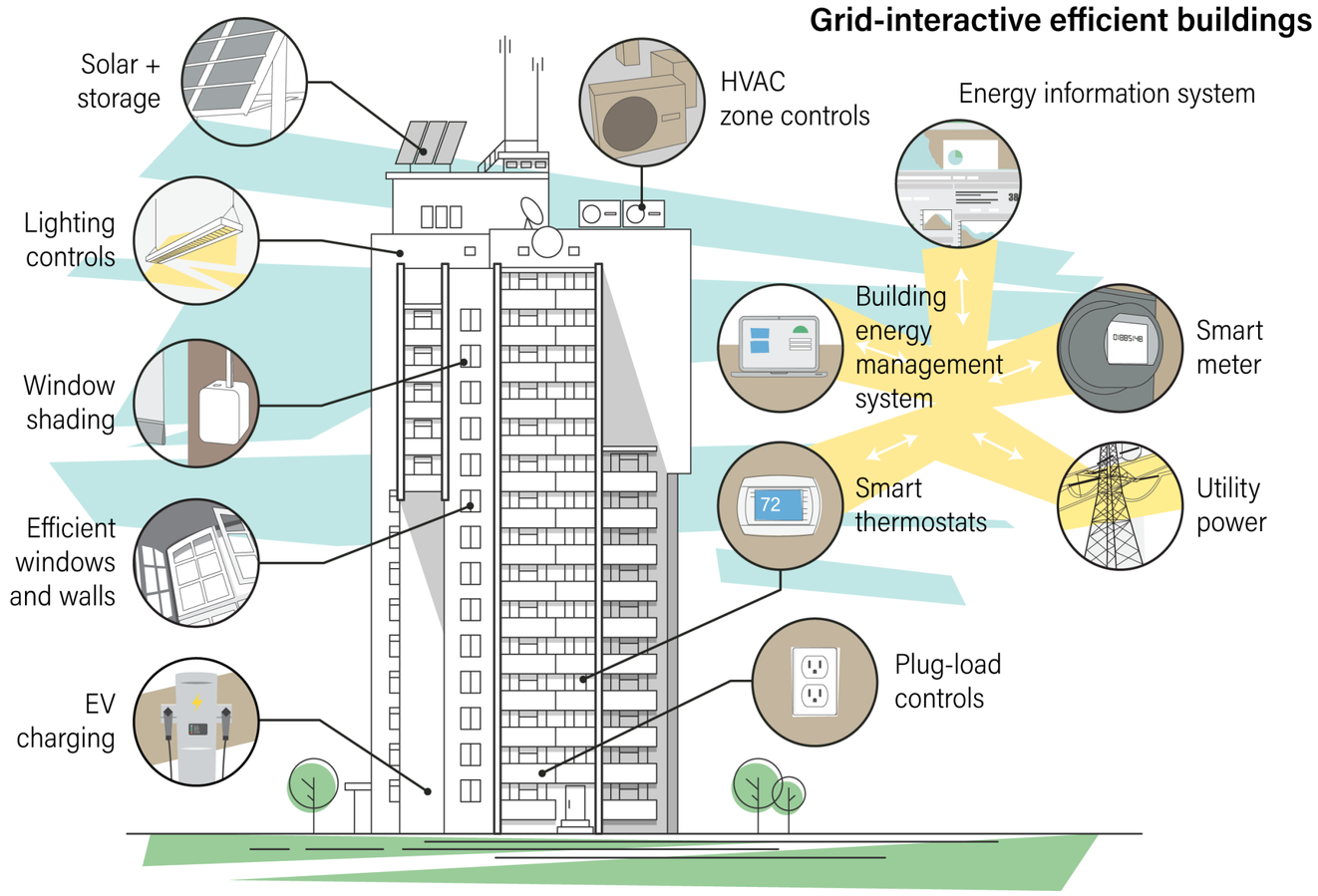
Hawaii ‘Nessy’ Curve

insideenergy.org/2014/10/02/ie-questions-why-is-california-trying-to-behead-the-duck/

www.greentechmedia.com/articles/read/renewables-integration-in-the-midwest-is-a-whole-other-animal

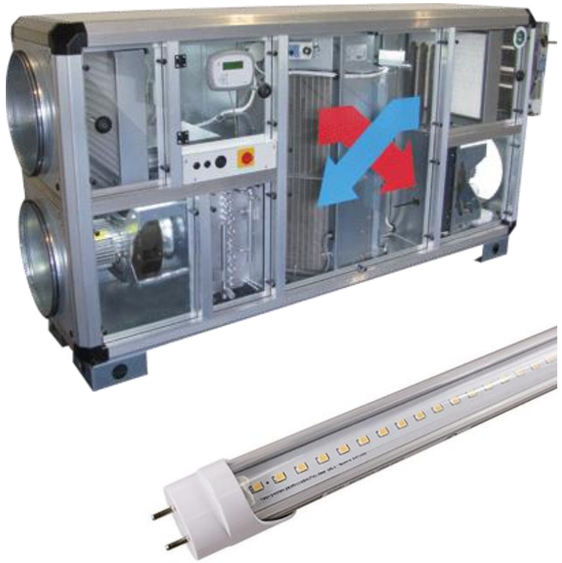
https://www.greentechmedia.com/articles/read/hawaiis-solar-grid-landscape-and-the-nessie-curve

Grid-interactive efficient buildings (GEBs) are highly-efficient buildings that can communicate with and serve as a resource for the grid (e.g., shift or shed loads).

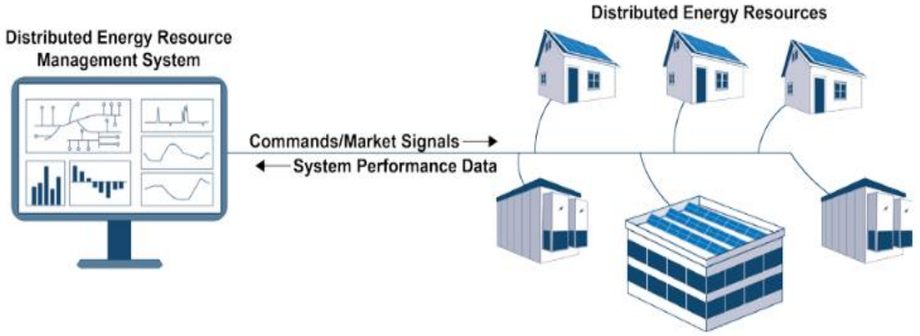


aceee.org/white-paper/gebs-103019

Grid-interactive efficient buildings (GEBs) are energy-efficient and grid-connected.



Energy efficiency reduces overall consumption.



Two-way grid connectivity enables automatic load shifting, shedding, and modulating.

The Future of Energy Management Systems and Grid Interactivity

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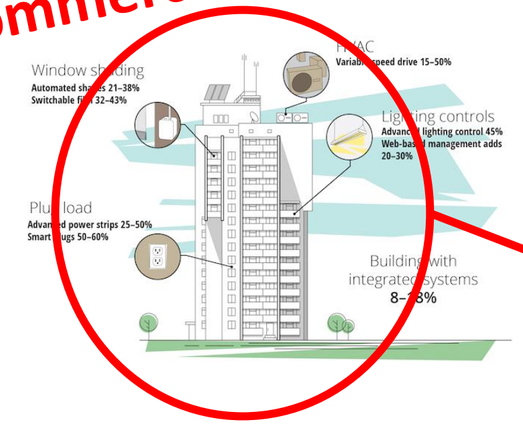
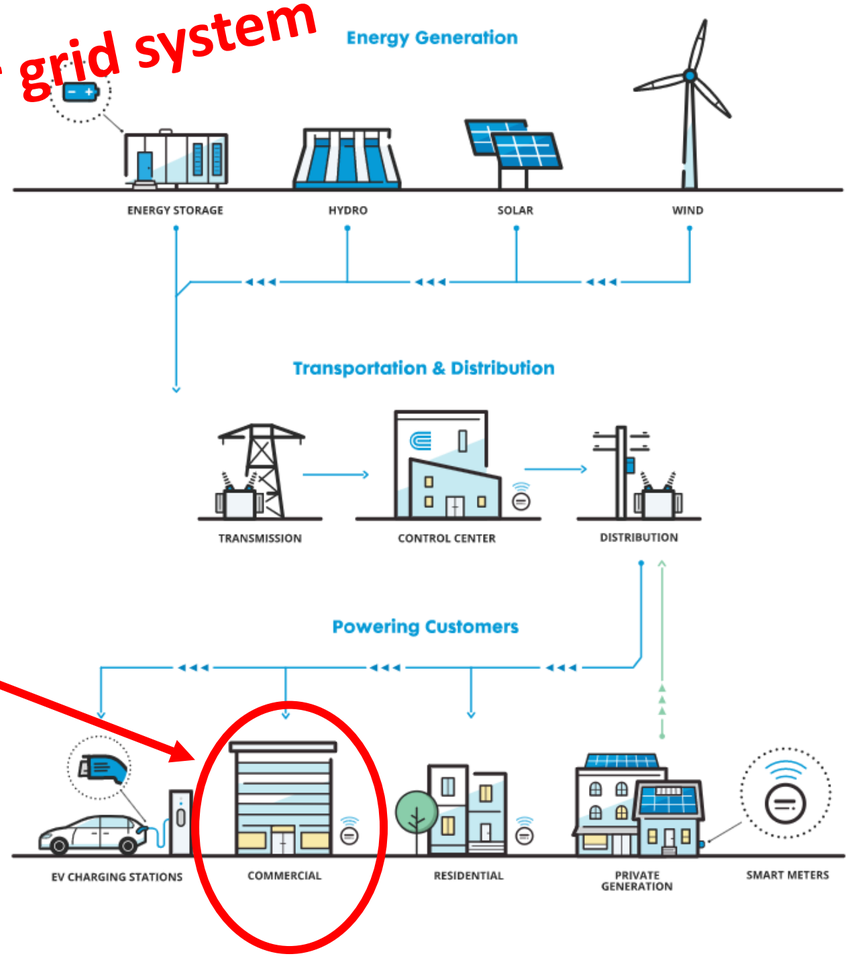
We traditionally think about how an EMS can save energy within a building. But it can also provide benefits to the larger grid system.

One commercial building



Larger grid system



https://www.coned.com/en/our-energy-future/technology-innovation/smart-grid

For residential and some commercial customers, third party aggregators can act as intermediaries to the utility.

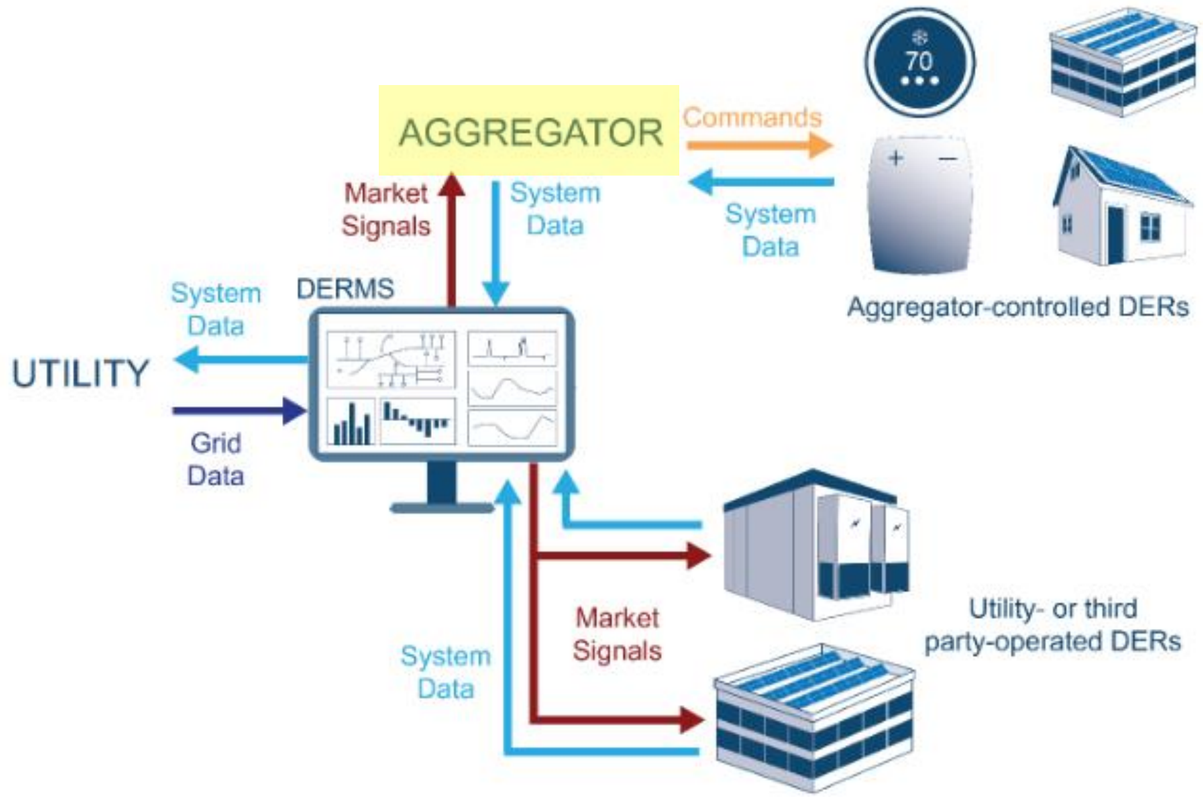


Figure 1. Example DER aggregation program structure and component interaction

https://www.nrel.gov/docs/fy19osti/71984.pdf

For larger commercial customers, the EMS may interact with a utility's management system.

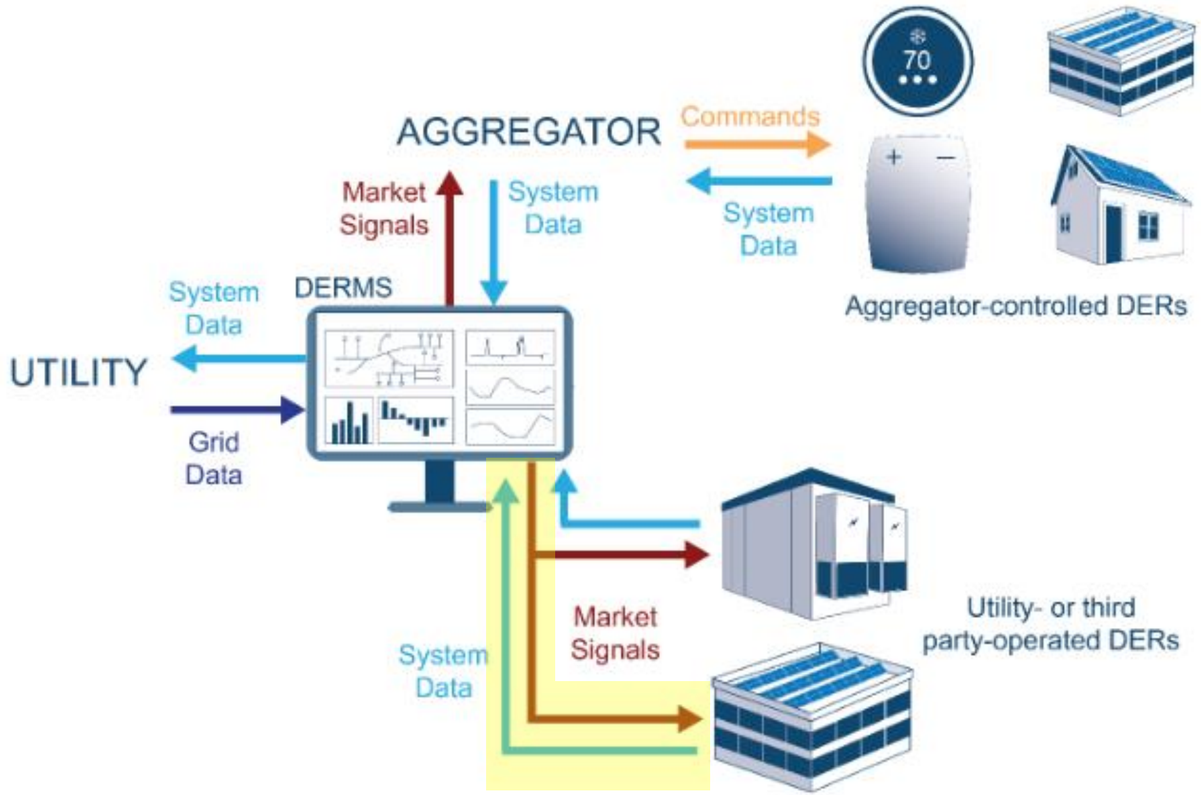
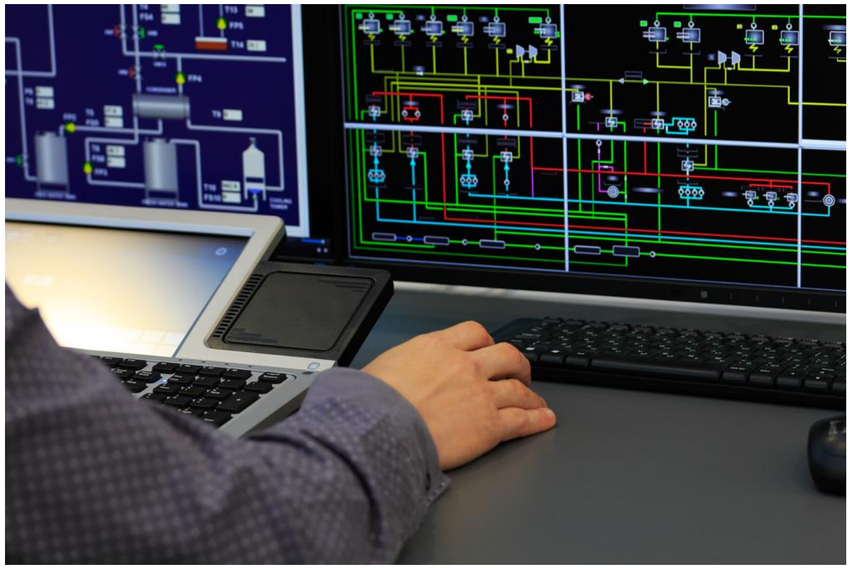
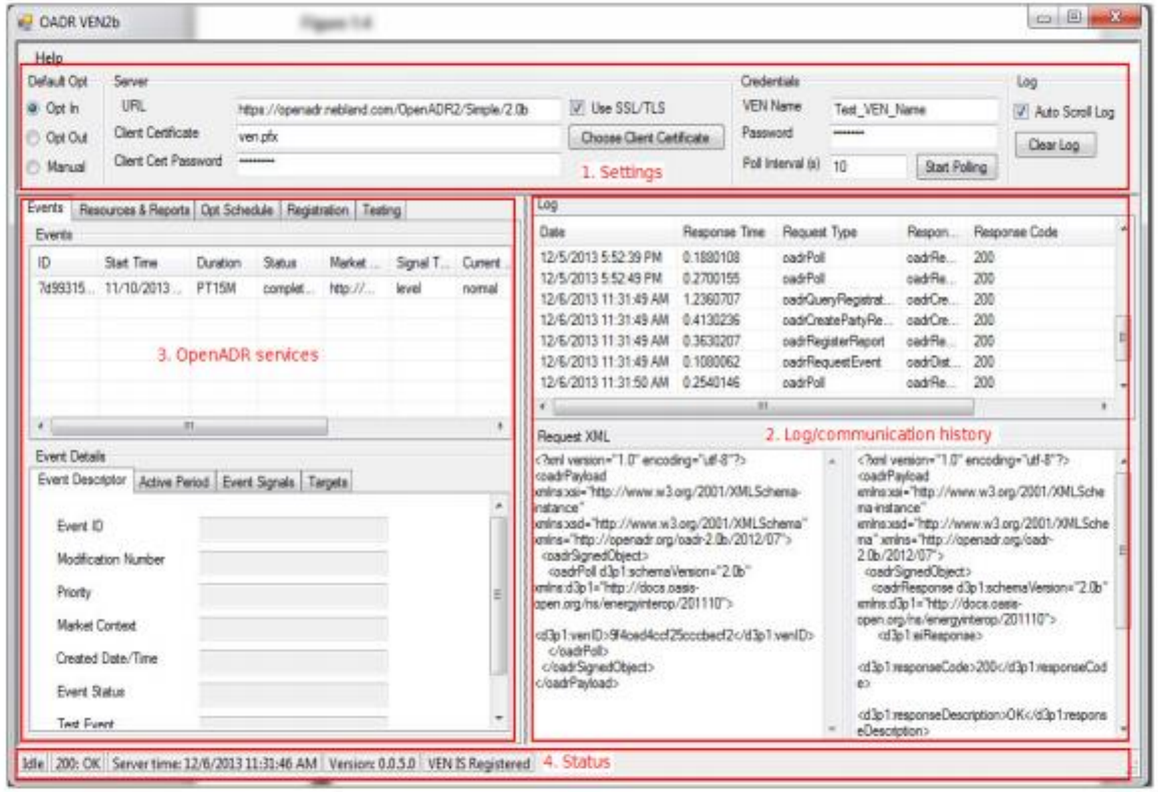


Figure 1. Example DER aggregation program structure and component interaction

https://www.nrel.gov/docs/fy19osti/71984.pdf

Standards like OpenADR can help shift the EMS industry from the manual demand response to be more automated and instantaneous.





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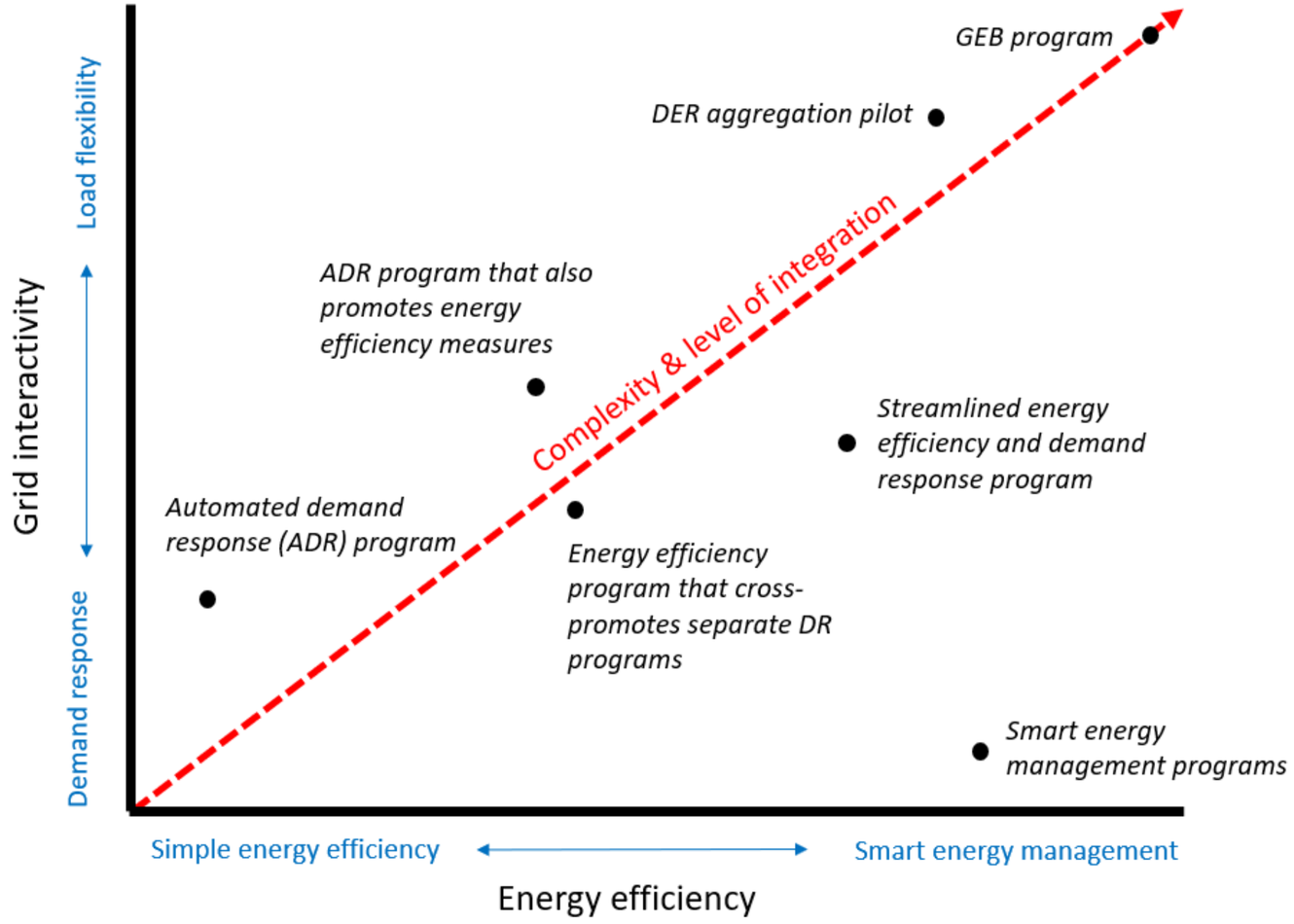
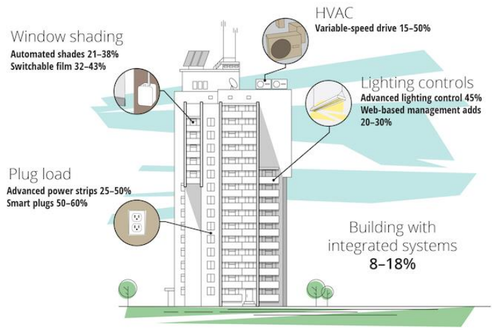
www.openadr.org/assets/docs/2_wj%203rd-party%20resources.pdf

As grid stability becomes more important, utilities will increasingly develop **programs** and **rates** that incentivize grid connectivity.



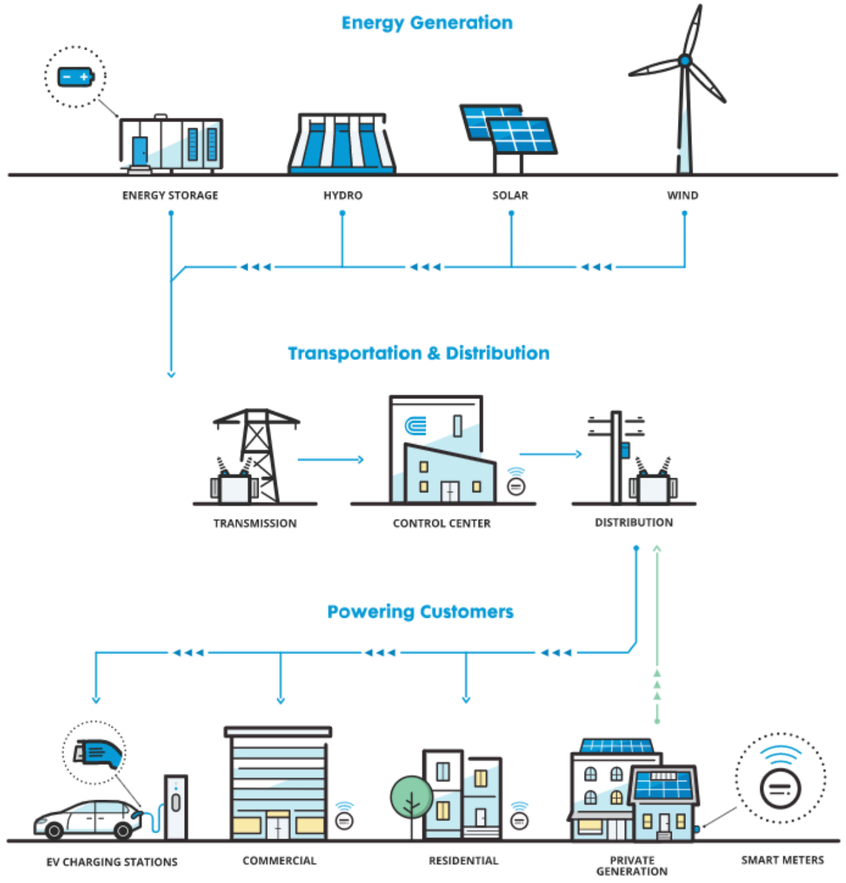
aceee.org/white-paper/gebs-103019

To conclude, the EMS of the future can enable both an energy-efficient building and a stable grid.



Energy efficient building

+



Stable and secure grid

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American Council for an Energy-Efficient Economy

Questions?

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Research Manager, Buildings Program

www.aceee.org/grid-interactive-efficient-buildings-gebs

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Q+A

Thank you for participating.

Tim Bernadowski

Project Developer & Energy Engineer

Siemens

Lee Dunfee

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Breakout Session Discussions

1. Using Energy Management Systems for Whole Building Efficiency

2. Making a Difference in Low-Income Housing: How the RGGI Auctions Affect EE Work

3. Pandemic Problem Solving: Facing Energy Challenges Across Sectors

If you would like to attend a different discussion group, leave this breakout room to return to the main room. VAEEC staff will be there to assist you.

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VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

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Breakout Session Discussions

Using Energy Management Systems for Whole Building Efficiency

Facilitator: Dawn Oleksy, City of Richmond

VIRGINIA DHCD
VIRGINIA DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

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Event Agenda

Updates, Business Meeting, Member Spotlight	10:00-10:45 am
Networking Session *Sponsored by Virginia Energy Sense*	10:45-11:15 am
Break	11:15-11:30 am
Concurrent Breakout Sessions	11:30 am-12:30 pm
Breakout Session Discussions	12:30-12:50 pm
Closing Remarks	12:50-1:00 pm

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