Ameren ILLINOIS | Energy Efficiency PROGRAM

BUSINESS SYMPOSIUM

Smart Buildings: Leveraging Automation and Energy Management Technologies

Public School Carbon-Free Assessment Program

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Register your School District today!

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PUBLIC SCHOOL CARBON-FREE ASSESSMENT PROGRAM

AmerenIllinoisSavings.com/PSCFA

LLLC University: Luminaire Level Lighting Controls Workshops

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Date	City	Location
November 6	Decatur	**Millikin University** 1184 W. Main St., Decatur, IL 62522
November 7	Carbondale	**Southern Illinois University Carbondale** 1785 University Press Dr., Carbondale, IL 62901
November 12	Peoria	**Bradley University** Business and Engineering Convergence Center Room 1122 1500 W. Main St., Peoria, IL 61606
November 13	Edwardsville	**Southern Illinois University Edwardsville** 6 Hairpin Dr., Edwardsville, IL 62026

Experience hands-on exercises and demonstrations from live systems.

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Agenda

- **Smart Buildings: Leveraging Automation and Energy Management Technologies**
  - Mark Mathis, Maintenance Director for CUSD #3, Fulton County
  - Jessica Loos, Ruyle Mechanical
  - Tom Loos, Ruyle Mechanical
- **Question & Answer Session**

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Smart Buildings

Shifting to Automatic

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Smart Building Keywords

- Smart Thermostats
- Furnace/Central Air Conditioners
- Rooftop Unit (RTU)
- Advanced (Smart) Rooftop Controls
- Supply/Return Fans
- Dampers (*think louvers*)
- Variable Frequency Drives (VFDs)
- Boilers
- Monitored Steam Traps
- Hot Water Pumps

Smart Building Keywords

- Chillers
- Chilled Water Pumps
- HVAC Controls
- Pneumatics
- Building Automation Systems (BAS/BMS)
- Scheduling
- Rooftop Units (RTU)
- Variable Air Volume (VAV)
- Demand Control Ventilation (DCV)
- Outdoor Air Temperature
- Economizer

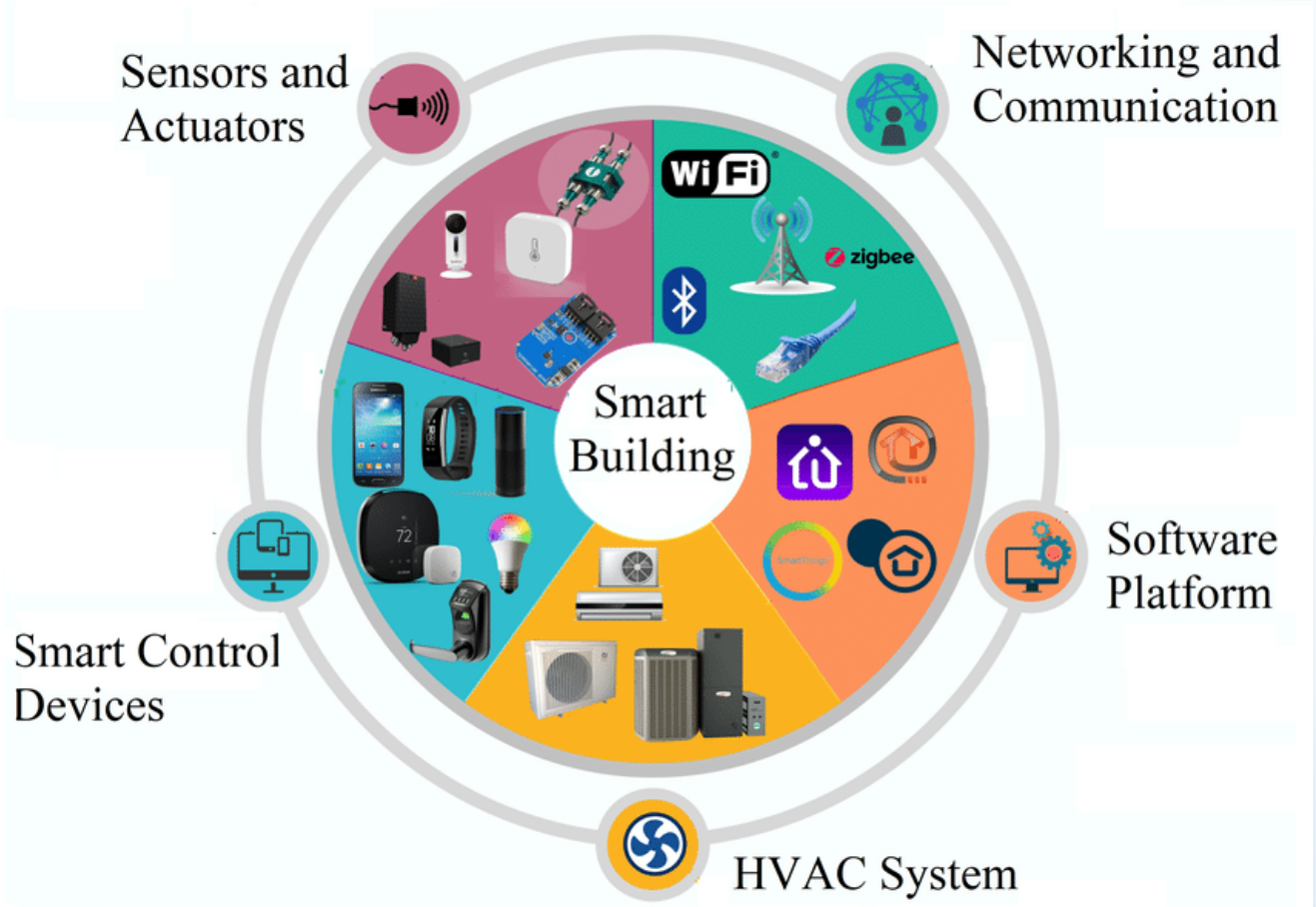
What is a Smart Building?

This will make the building **an adaptive, “living” organism, able to react and change gears automatically as needed without human intervention.** This will promote content-driven behavioral change by optimizing the building in an integrated way.

Source: *Facilitiesnet.com,* Kurnatz, Knight and Szcodronski, 2016

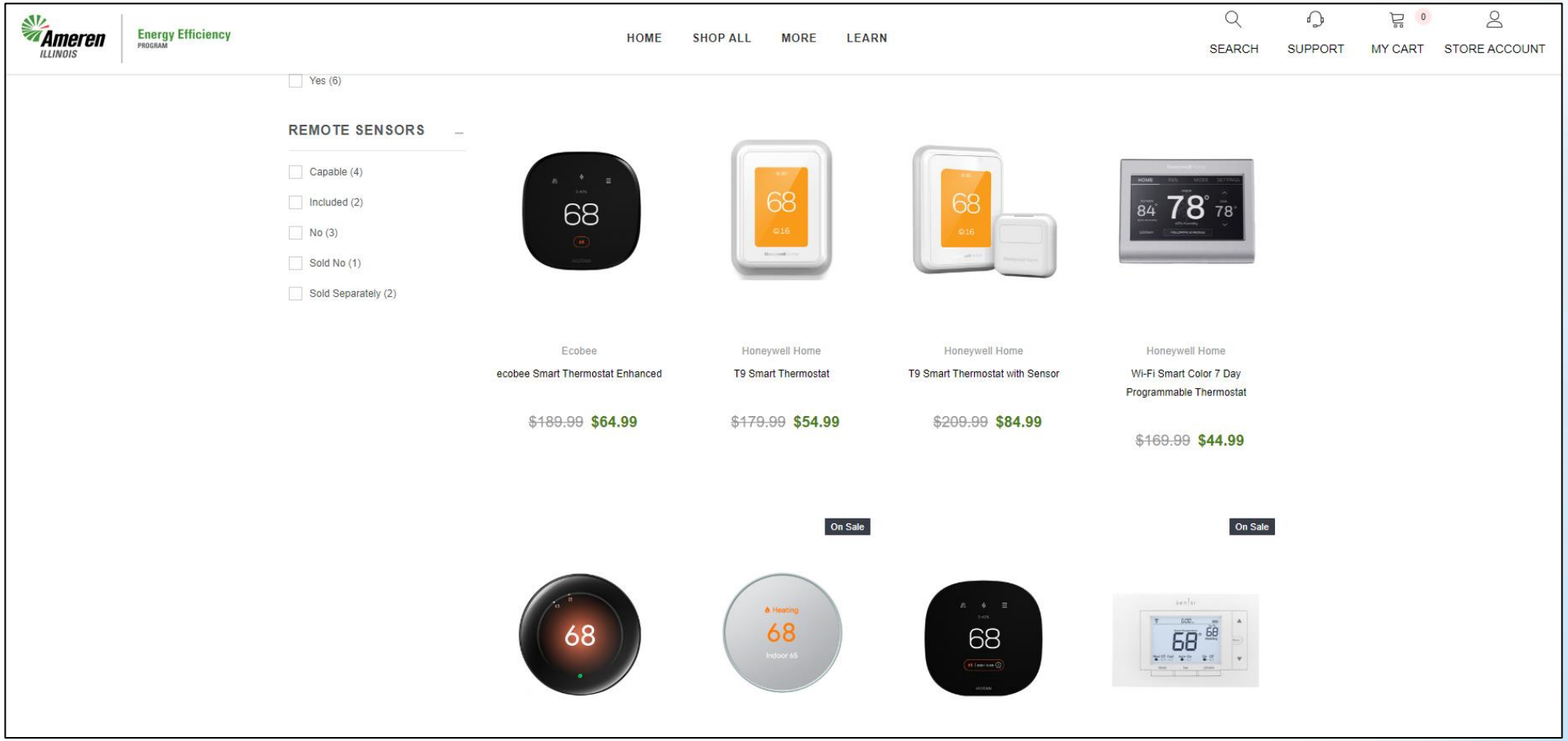
https://www.facilitiesnet.com/buildingautomation/tip/What-Is-A-Smart-Building--36968#:~:text=This%20will%20make%20the%20building,building%20in%20an%20integrated%20way.

Components of a Smart Building

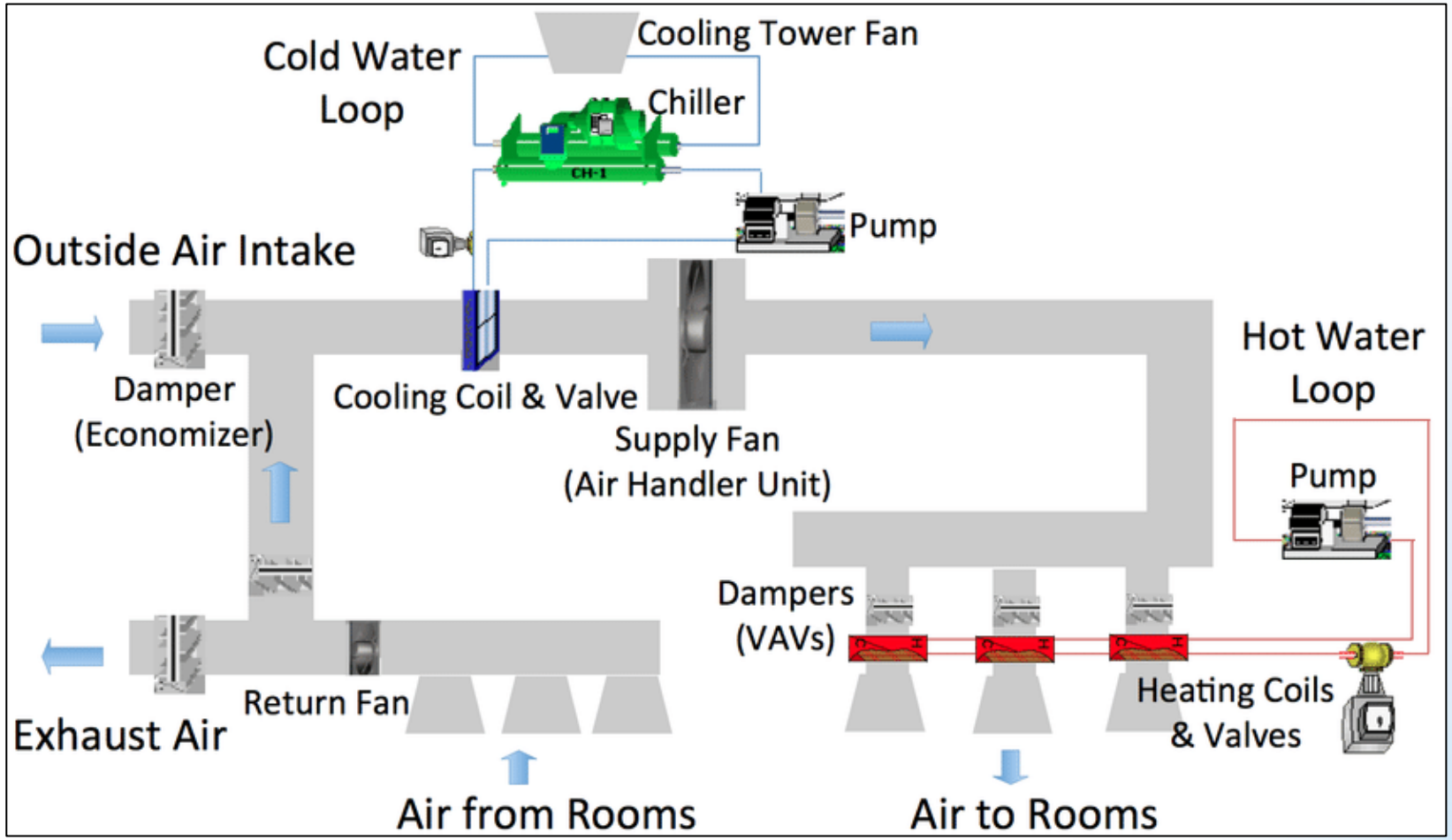


Researchgate.net

Leveraging Automation



Energy Management Technologies



https://www.researchgate.net/figure/A-typical-HVAC-system-for-a-commercial-building_fig1_261269500

Summary

- **Listen** for keywords or equipment in your facility.
- **Ask**: ”Am I leveraging automation?”
- **Ask**: ”Do I have an energy management strategy?”
- **Ask**: “Which Ameren Illinois incentives can help me leverage automation and manage energy?

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CUSD #3, Fulton County

Mark Mathis

Maintenance Director

Savings Per Year

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Gross Energy (kWh) Savings	$ Savings Per Year	Gross Therm Savings	$ Savings Per Year	Total $ Savings Per Year
390975.384	$ 39,097.54	939.0241339	$ 469.51	$ 39,567.05
0	$ -	0	$ -	$ -
15651.84706	$ 1,565.18	0	$ -	$ 1,565.18
0	$ -	0	$ -	$ -
6244.02	$ 624.40	0	$ -	$ 624.40
0	$ -	929.7782135	$ 464.89	$ 464.89
0	$ -	0	$ -	$ -
0	$ -	727.0348842	$ 363.52	$ 363.52
0	$ -	0	$ -	$ -
0	$ -	0	$ -	$ -
12806.94908	$ 1,280.69	0	$ -	$ 1,280.69
6234.7	$ 623.47	0	$ -	$ 623.47
21739.7949	$ 2,173.98	3446.55285	$ 1,723.28	$ 3,897.26
78668.78571	$ 7,866.88	4889.72	$ 2,444.86	$ 10,311.74
11712	$ 1,171.20	3967.744	$ 1,983.87	$ 3,155.07
133598.5671	$ 13,359.86	0	$ -	$ 13,359.86
107832.3639	$ 10,783.24	0	$ -	$ 10,783.24
3575.9254	$ 357.59	0	$ -	$ 357.59
95466.39757	$ 9,546.64	0	$ -	$ 9,546.64
98054.55119	$ 9,805.46	0	$ -	$ 9,805.46
982561.2859	$ 98,256.13	14899.85408	$ 7,449.93	$ 105,706.06

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High School Hot Water Heaters

Greenhouse Heater Upgrades

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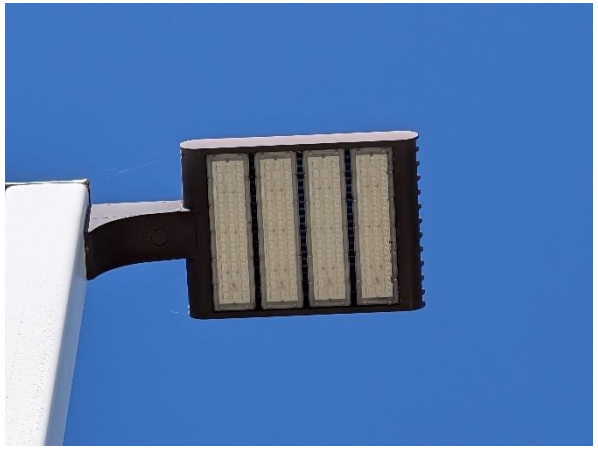
High School Window Glazing

New and Old Outside Lighting



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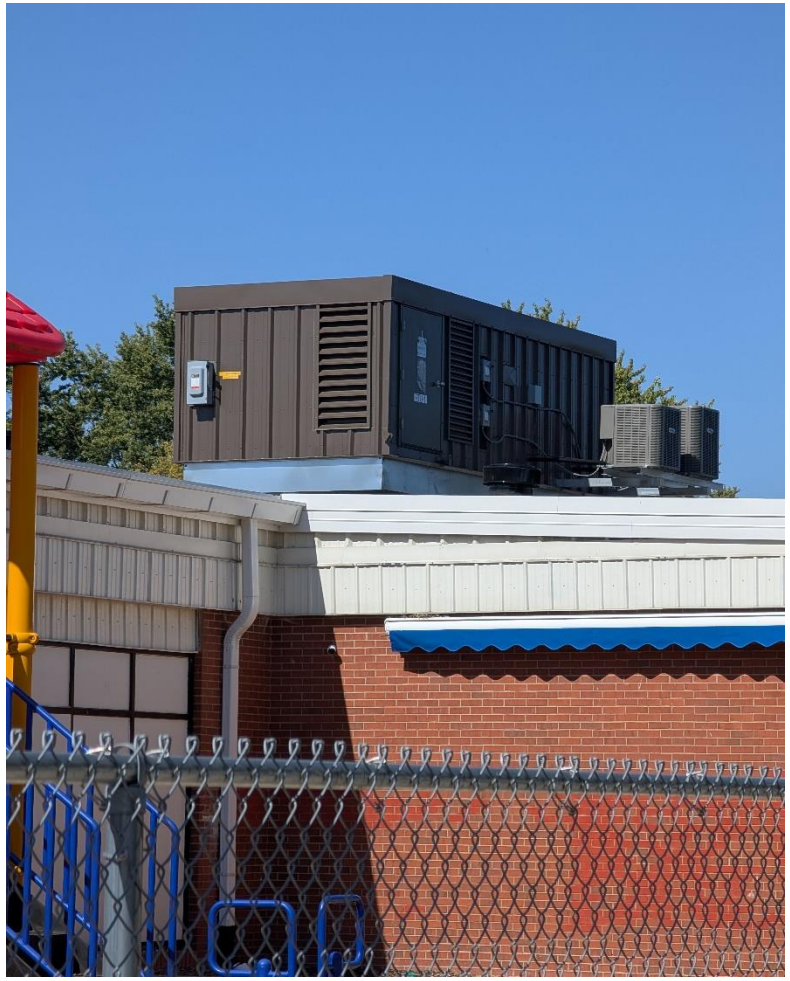
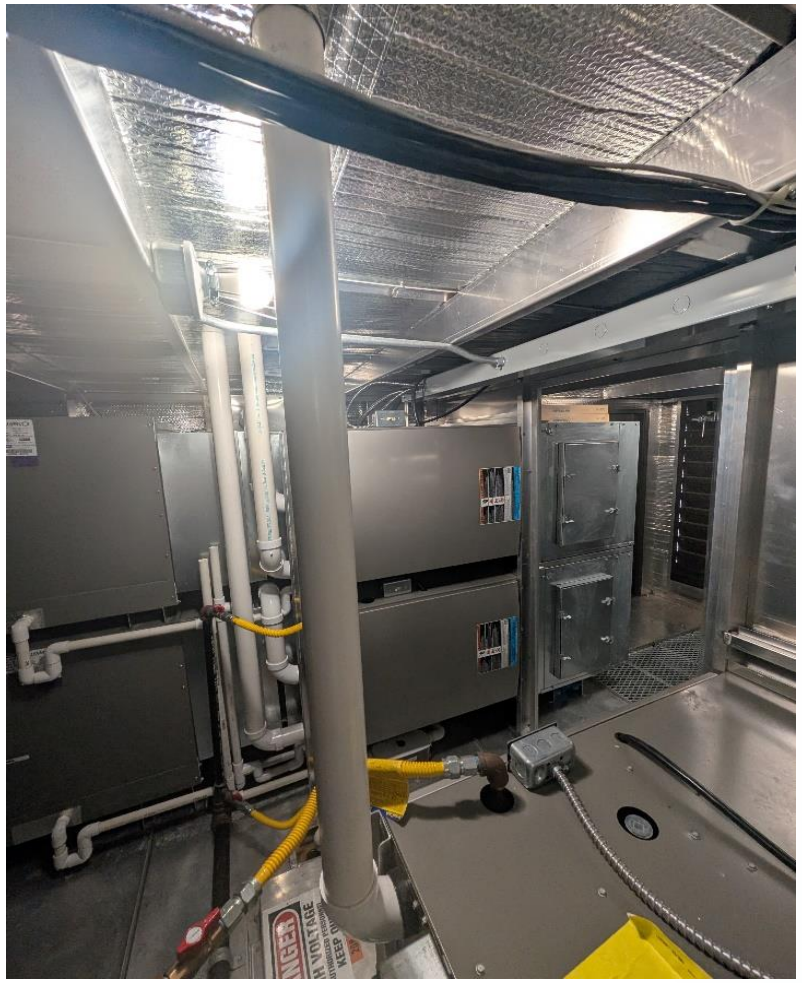
Cuba Elementary RTU





Bus Garage (*currently pending project*)

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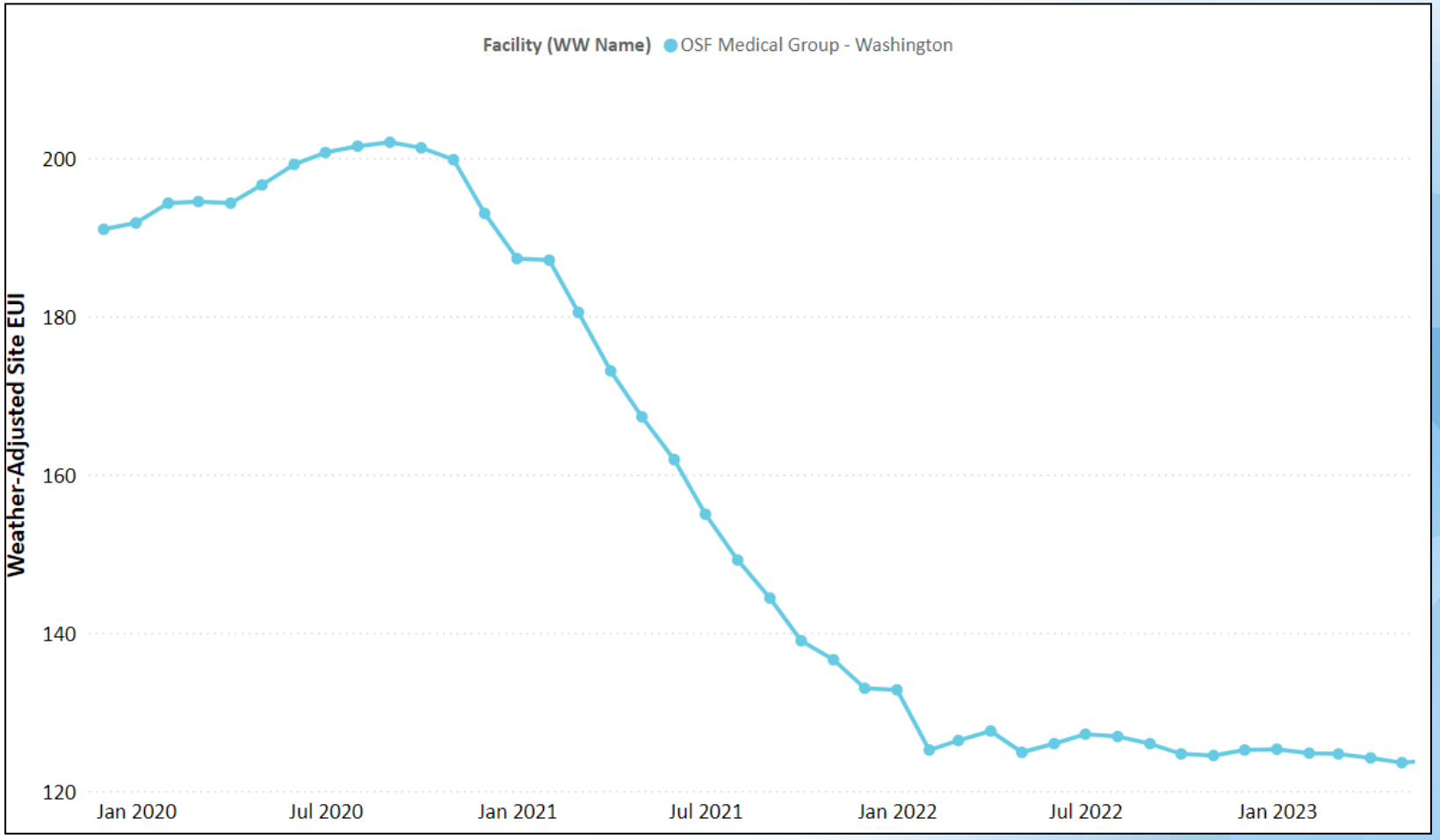
Building Control Strategies

Jessica Loos, CEM

OSF St. Clare Washington

- Installed mini-splits to schedule building



Bradley University

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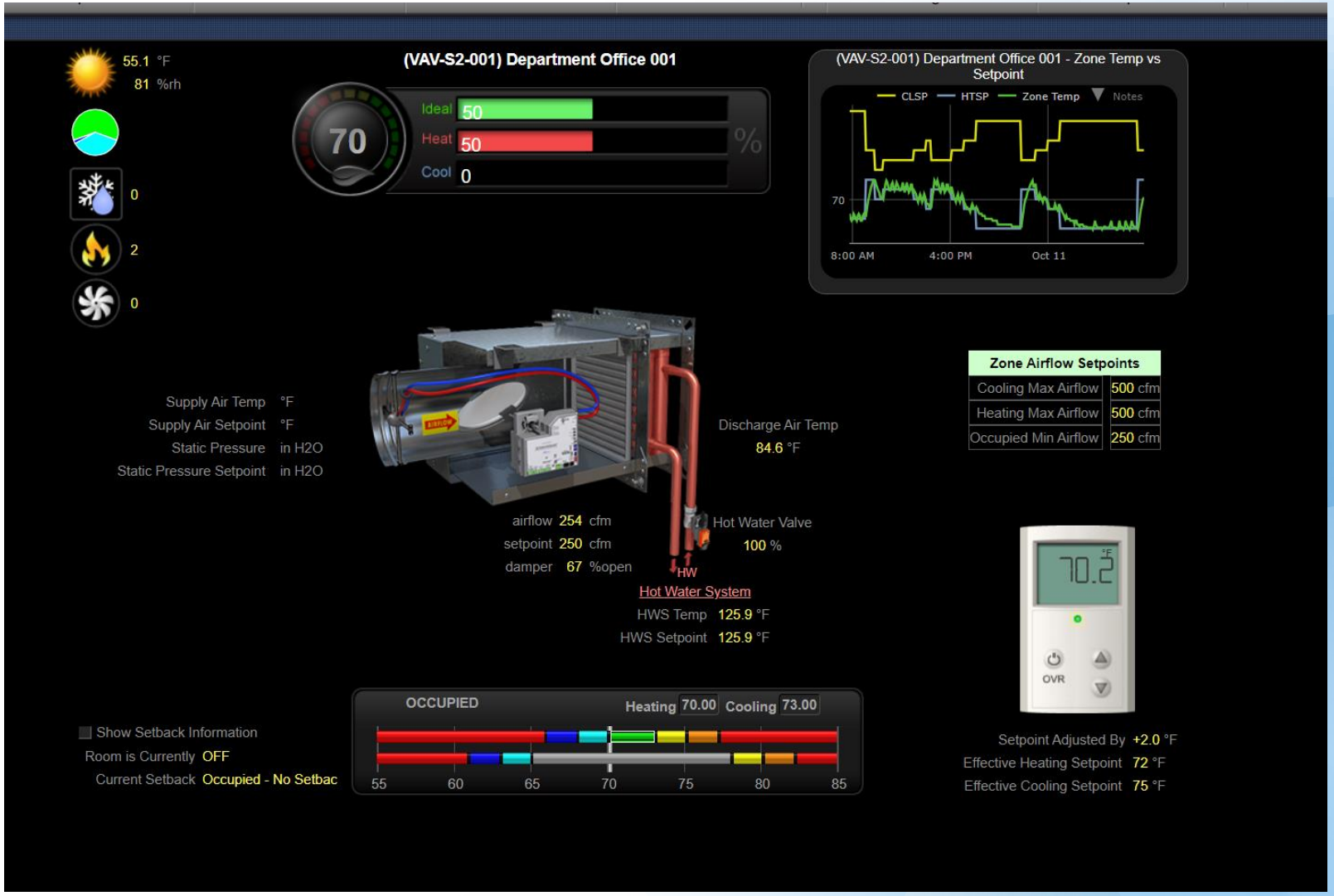
- Installed Occupancy Sensors on the VAV level



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Ways to Save

Our process to building energy-efficient projects

Thomas M. Loos, CEM

Agenda

- How we categorize and calculate all of our projects
- Overview of design and electric utility incentives for the Dominican Sisters Convent Project
- Highlight specific analytic platforms that we utilize
- Final thoughts and comments

How to Identify a Project

1. We identify if a study of the HVAC system is required.

2. Ameren conducts one of several studies:
   - Feasibility Study / Metering
   - Monitoring / Retro Commissioning
   - Monitoring-Based Retro Commissioning

3. Based on the study results, we categorize the project as either **Standard** or **Custom.**

Description of Standard Projects

Standard incentive opportunities include:

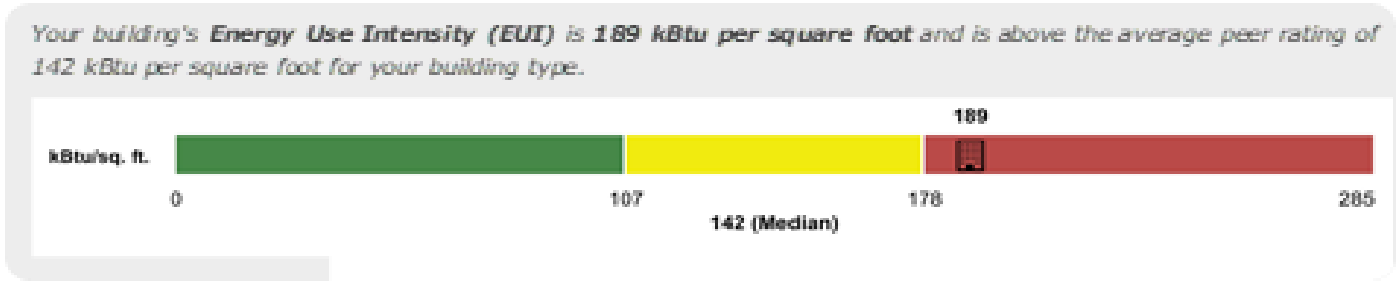
- Variable Speed Drive Installations
- RTU replacements
- CO2 sensor installations
- Boiler tune-ups
- Space-cooling chillers upgrades
- Steam traps

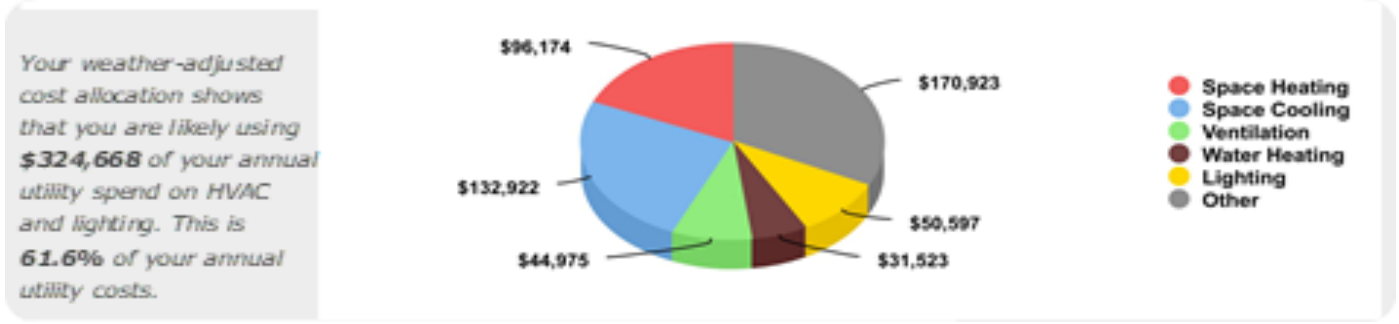
Description of Custom Projects

Custom project qualifications include:

- BAS upgrades
- Boiler economizer
- Boiler condensate return
- Chilled water energy valves (plant with low Delta T syndrome)
- Process chiller upgrades

Benchmark Software to Estimate Energy Use Intensity





Dominican Sisters Convent Project Overview

By utilizing Ameren Illinois' gas-saving incentive, we were allowed to upgrade the Building Automation System in various ways that would benefit the institution.

- Our work included upgrading existing variable air volume (VAV) dampers and providing local support to insufficient control systems.
- Installations of discharge temperature sensors in VAV’s, allowing gas savings through the control of high-limit discharge air temperatures emitted by the boxes.
- Through the completion of our work, the customer is now equipped with a better control and insight of their HVAC system.

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Layout of Ductwork and VAVs at Dominican Sisters Convent

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Dominican Sister Convent Proposal: Control Upgrades

Project Overview:

- **Energy Conservation Target:** The existing VAV box controller is out of date and the dampers do not operate correctly.
- **Energy Conservation Measures – Scope of Work**: Install new controls and dampers on the VAV boxes

Total Project Cost (before incentive)
$335,428

Financial Breakdown:

Simple Payback	**4.61**	**Net Present Value ($)**	**$819,495.00**
Return on Investment	**21.68%**	**Savings-to-Investment Ratio**	**4.14**
Internal Rate of Return	**24.49%**	**Modified Internal Rate of Return**	**11.14%**

Calculations of incentives and savings accumulated:

Estimated Electric Savings Calculated 1st year ($0.13/kWh)	16,392.00
Estimated Gas Savings Calculated 1st year ($0.65/therm)	$40,230.00
Ameren Gas Standard Incentive	$ 74,271.80
Owners Out-of-Pocket for this Project	**$261,156.20**

Environmental Impact:

499.36 acres

or

46,971.36 gallons

or

92.97 cars

=

417.43 Metric Tons of CO_2

Designing a Automation Analytic Platform

Function: A data collection platform that analyzes applications to provide users with significant insight into the operation of their buildings and equipment.

Utilization: This tool easily integrates to the building automation platform, allowing energy and building control data to be harvested and stored in a variety of database types. It also provides the means to organize data from multiple buildings and integration projects.

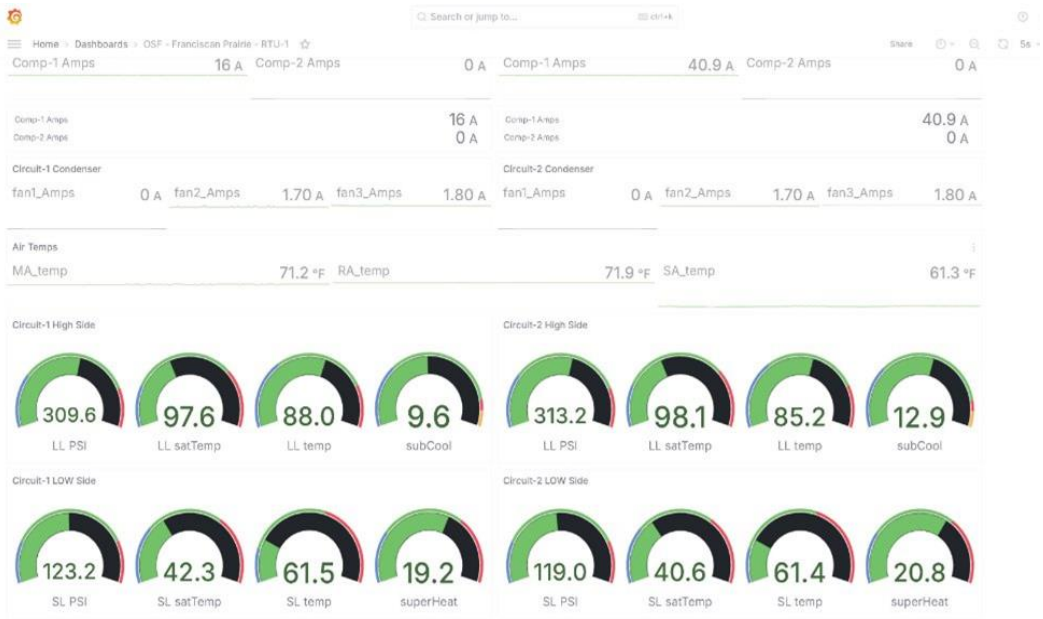
Benefit: This tool allows consistent analysis across buildings to gain valuable insights into energy use patterns and operational behaviors. It also helps identify opportunities for improving the operation of a building and reducing wasted energy through cost avoidance measures.

Rooftop and Air-Cooled Chillers Analytics

Function: An IoT device that utilizes sensors and end devices to transmit large amounts of data over a cellular data network at a very low cost.

Physical Connection

Cellular Connection



Designed as a service tool that conducts:

- Remote diagnostics
- Troubleshooting
- Critical alarms

Cloud Server

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Steam Trap Analytics

Function: This monitor is an ideal solution for large industrial and commercial facilities looking to leverage IoT to detect steam trap failures or water hammer.

Mechanical Properties		Regulatory Compliance	
Battery Life	12-15 years		
Operational Temperature	-40°C to +60°C	Safety	UL 61010-1; 2016
Operation Humidity	0 - 100%		CAN/CSA C22.2 No. 61010-1-12
Ingress Protection	IP67		EN 61010-1; 2010
Size	116 x 69 X 30mm	Regulatory	FCC Part 15.247
Weight	0.3 kg		EN 300 220 v3.1
Materials			EN 301 489-1 v2.2.0
Battery	Saft LS14500 3.7V 2.6Ah		EN 301 489-3 v2.1.0
Housing	Die cast aluminum, powdercoated	Hazardous Locations	UL 913 8th Ed. (Class 1 Div 1)
Pipe Clamp	Cast Iron, electroplated		UL 60079-0
Waveguide Stud	Zinc Plated Steel, 3/8"-16 x 3"		UL60079-11
Size	116 x 69 X 30mm		CAN/CSA C22.2 No. 157-92
Weight	0.3 kg		EN/IEC 60079-0 (ATEX/IECEx)
Functional Specifications			EN 60079-11
Radio	LoRaWAN Class A, 860-930MHz	ROHS	Compliant
Transmit Power	Up to +18.5dBm		
Receiver Sensitivity	-135.5dBm @ 1% PER, 125kHz BW		

Utilization: Simple to install, superior range and battery life utilizing LoRaWAN. The dashboard can be containerized to run locally on a virtual machine or hosted in the cloud. A variety of backend options permit integrations with DCS or other cloud services.

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Thank you!

Please ask questions or share your thoughts.

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