



Energy Efficiency
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Smart Buildings: Leveraging Automation and Energy Management Technologies

Public School Carbon-Free Assessment Program



Register your School District today!



PUBLIC SCHOOL
CARBON-FREE
ASSESSMENT PROGRAM



AmerenIllinoisSavings.com/PSCFA



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LLLC University: Luminaire Level Lighting Controls Workshops



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.

AmerenIllinoisSavings.com/LLLC-University



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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**



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

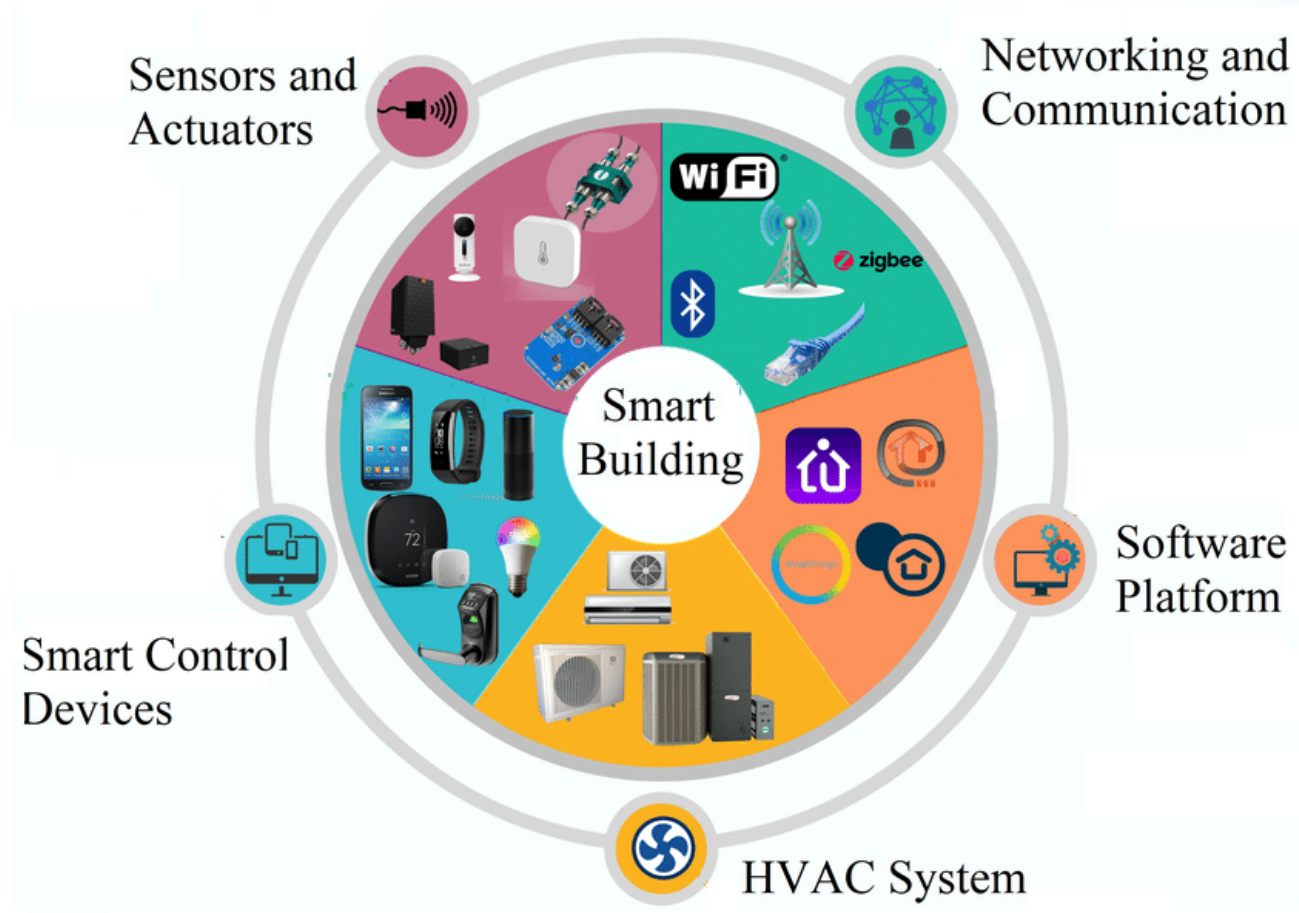


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<https://www.facilitiesnet.com/buildingautomation/tip/What-Is-A-Smart-Building--36968#:~:text=This%20will%20make%20the%20building,building%20in%20an%20integrated%20way.>

Components of a Smart Building



Leveraging Automation



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HOME SHOP ALL MORE LEARN

SEARCH SUPPORT MY CART STORE ACCOUNT

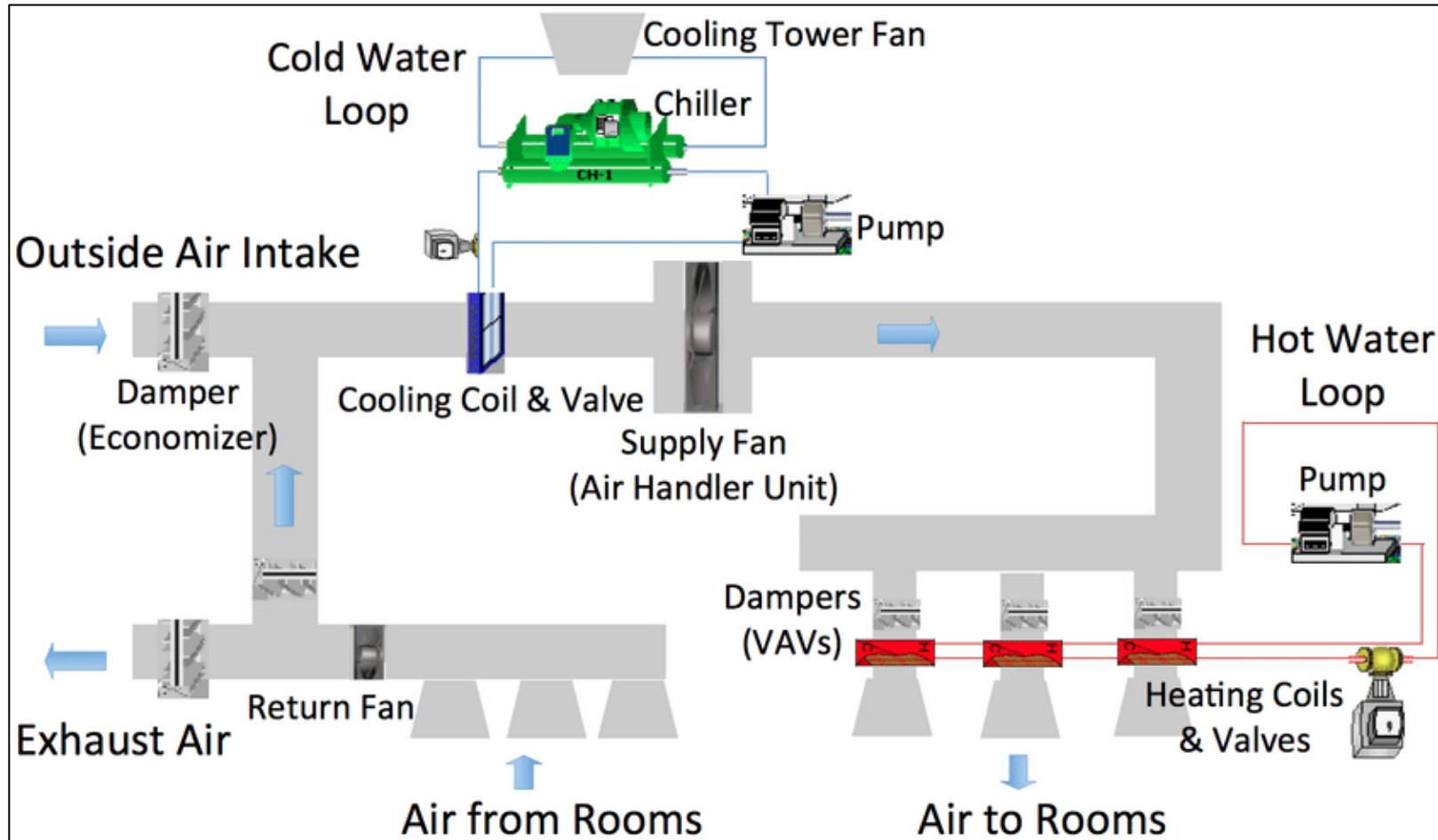
Yes (6)

REMOTE SENSORS

Capable (4)
 Included (2)
 No (3)
 Sold No (1)
 Sold Separately (2)

Product Name	Original Price	Current Price	Special Offer
ecobee Smart Thermostat Enhanced	\$189.99	\$64.99	
Honeywell Home T9 Smart Thermostat	\$179.99	\$54.99	
Honeywell Home T9 Smart Thermostat with Sensor	\$209.99	\$84.99	On Sale
Honeywell Home Wi-Fi Smart Color 7 Day Programmable Thermostat	\$169.99	\$44.99	On Sale
ecobee Smart Thermostat			
Honeywell Home Indoor 65			
ecobee Smart Thermostat			
Honeywell Home Programmable Thermostat			

Energy Management Technologies



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



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



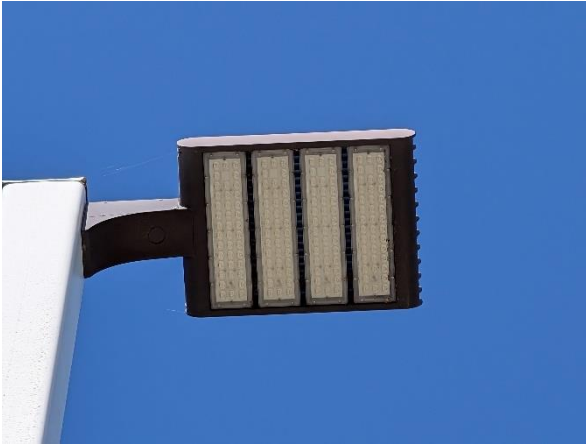
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High School Window Glazing



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New and Old Outside Lighting



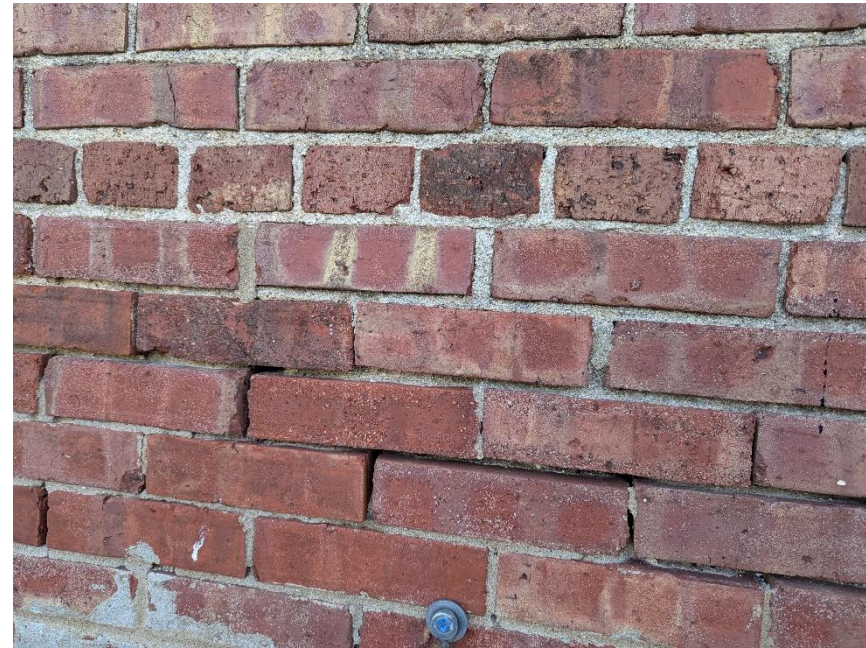
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Cuba Elementary RTU



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Bus Garage (currently pending project)



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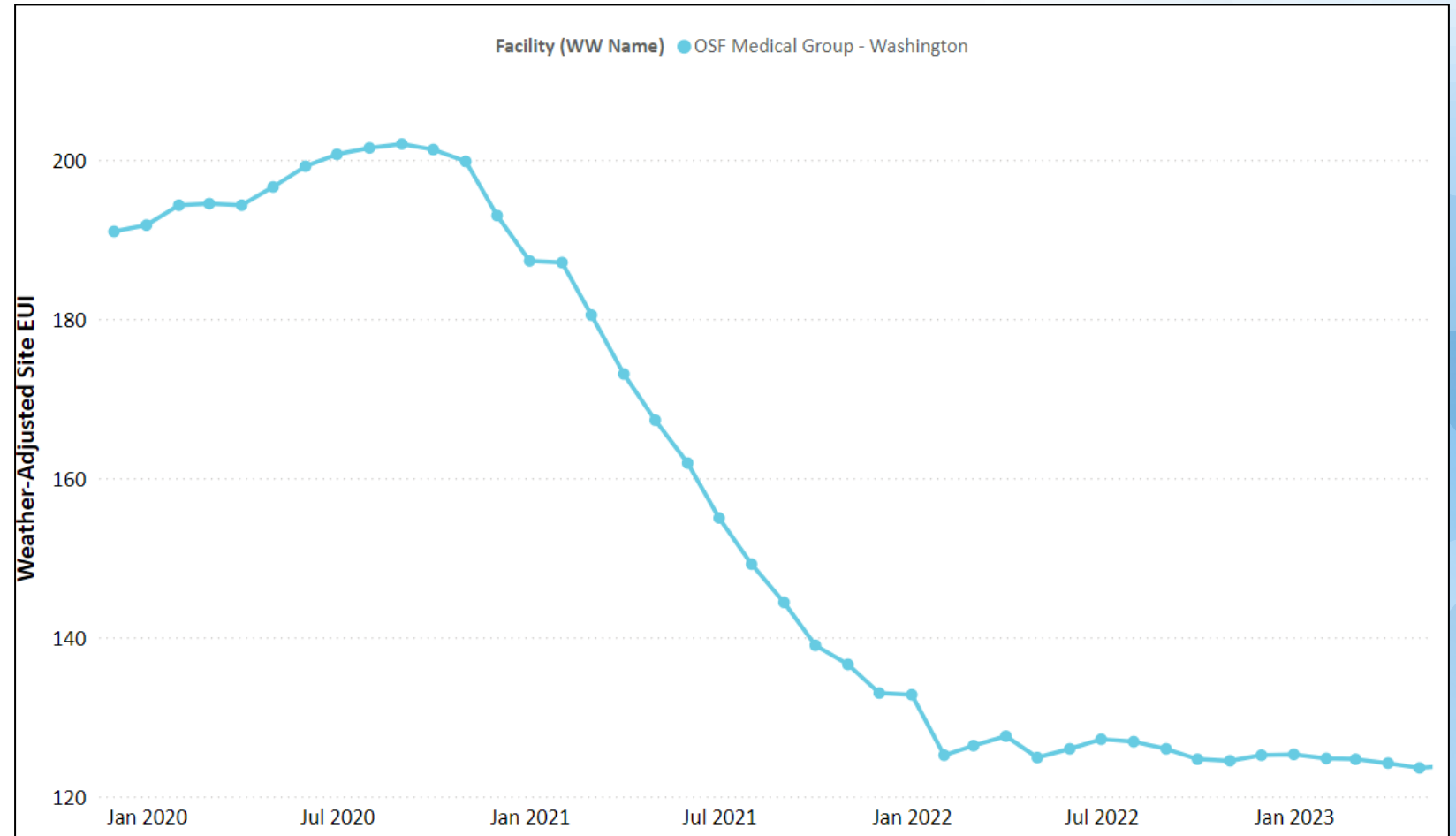
Building Control Strategies

Jessica Loos, CEM

OSF St. Clare Washington



- Installed mini-splits to schedule building



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Bradley University



- Installed Occupancy Sensors on the VAV level

(VAV-S2-001) Department Office 001

55.1 °F
81 %rh

Ideal: 50
Heat: 50
Cool: 0

(VAV-S2-001) Department Office 001 - Zone Temp vs Setpoint

CLSP HTSP Zone Temp Notes

8:00 AM 4:00 PM Oct 11

Supply Air Temp °F
Supply Air Setpoint °F
Static Pressure in H2O
Static Pressure Setpoint in H2O

airflow 254 cfm
setpoint 250 cfm
damper 67 %open

Discharge Air Temp 84.6 °F

Hot Water Valve 100 %

Hot Water System
HWS Temp 125.9 °F
HWS Setpoint 125.9 °F

Zone Airflow Setpoints	
Cooling Max Airflow	500 cfm
Heating Max Airflow	500 cfm
Occupied Min Airflow	250 cfm

70.2 °F

Setpoint Adjusted By +2.0 °F
Effective Heating Setpoint 72 °F
Effective Cooling Setpoint 75 °F

OCUPIED Heating 70.00 Cooling 73.00

Show Setback Information
Room is Currently OFF
Current Setback Occupied - No Setbac



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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

Energy Scorecard for Your Place, IL

Property Use: Facility
 Size: 610,473 square feet
 Reporting Period: Jul 2023 – Jun 2024

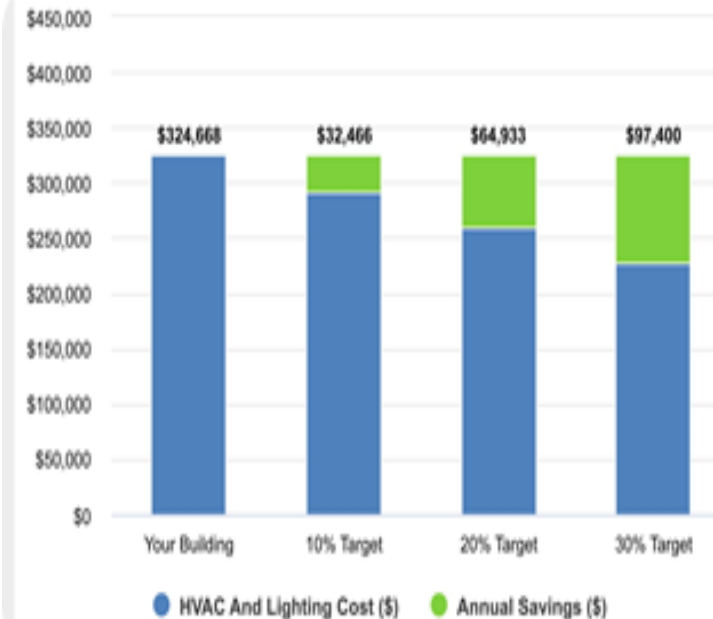
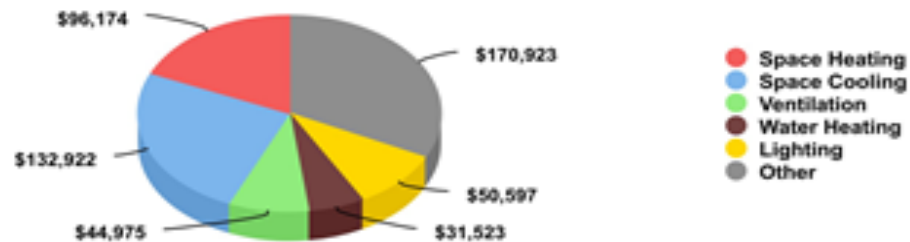
Your cost is **\$0.90 per square foot**. You spend **\$0.22 per square foot more than the median**, your building type.



Your building's Energy Use Intensity (EUI) is 189 kBtu per square foot and is above the average peer rating of 142 kBtu per square foot for your building type.



Your weather-adjusted cost allocation shows that you are likely using **\$324,668** of your annual utility spend on HVAC and lighting. This is **61.6%** of your annual utility costs.



A reduction of your HVAC and lighting energy consumption by 30% could generate **\$97,400 in annual savings**. Those savings could reach **\$487,000 over the next 5 years**. These expenses could be redirected from your utility to investments that generate a return in your facility. It is likely that, with further study, a good portion of these savings may be generated from low-cost measures not requiring capital. End use source CBECS 2012.

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



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
CO2**

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

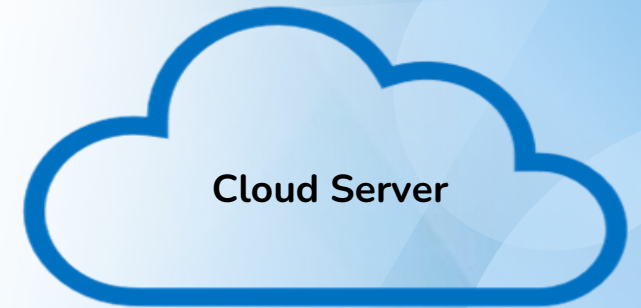
Function: An IoT device that utilizes sensors and end devices to transmit large amounts of data over a cellular data network at a very low cost.



Physical Connection



Cellular Connection



Designed as a service tool that conducts:

- Remote diagnostics
- Troubleshooting
- Critical alarms



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.

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.

Mechanical Properties		Regulatory Compliance	
Battery Life	12-15 years	Safety	UL 61010-1; 2016
Operational Temperature	-40°C to +60°C		CAN/CSA C22.2 No. 61010-1-12
Operation Humidity	0-100%		EN 61010-1; 2010
Ingress Protection	IP67	Regulatory	FCC Part 15.247
Size	116 x 69 X 30mm		EN 300 220 v3.3.1
Weight	0.3 kg		EN 301 489-1 v2.2.0
Materials			EN 301 489-3 v2.1.0
Battery	Saft LS14500 3.7V 2.6Ah	Hazardous Locations	UL 913 8th Ed. (Class 1 Div 1)
Housing	Die cast aluminum, powdercoated		UL 60079-0
Pipe Clamp	Cast Iron, electroplated		UL 60079-11
Waveguide Stud	Zinc Plated Steel, 3/8" - 16 x 3"		CAN/CSA C22.2 No. 157-92
Size	116 x 69 X 30mm		EN/IEC 60079-0 (ATEX/IECEX)
Weight	0.3 kg		EN 60079-11
Functional Specifications		ROHS	Compliant
Radio	LoRaWAN Class A, 860-930MHz		
Transmit Power	Up to +18.5dBm		
Receiver Sensitivity	-135.5dBm @ 1% PER, 125kHz BW		



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Thank you!

Please ask questions or
share your thoughts.



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A large graphic featuring the outline of the state of Illinois in blue. The words "BUSINESS SYMPOSIUM" are written in a bold, blue, italicized font across the center of the outline. A blue plug icon is positioned at the end of the word "SYMPOSIUM", with a line extending from its base that follows the bottom contour of the state outline.

**BUSINESS
SYMPOSIUM**