COMMERCIAL & INSTITUTIONAL ENERGY SAVING OPPORTUNITIES

February 28, 2024

BOMA Manitoba

EFFICIENCY MANITOBA

WHO IS EFFICENCY MANITOBA?

- Provincial crown corporation created by Manitoba legislation on April 1, 2020
- Manitoba's one-stop-shop for energy efficiency programs and information
- Incentives from energy savings

INTRODUCTION & AGENDA

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Electrical Systems Engineer

Lighting Controls

Anna Schappert

Mechanical Systems Professional

HVAC & Controls

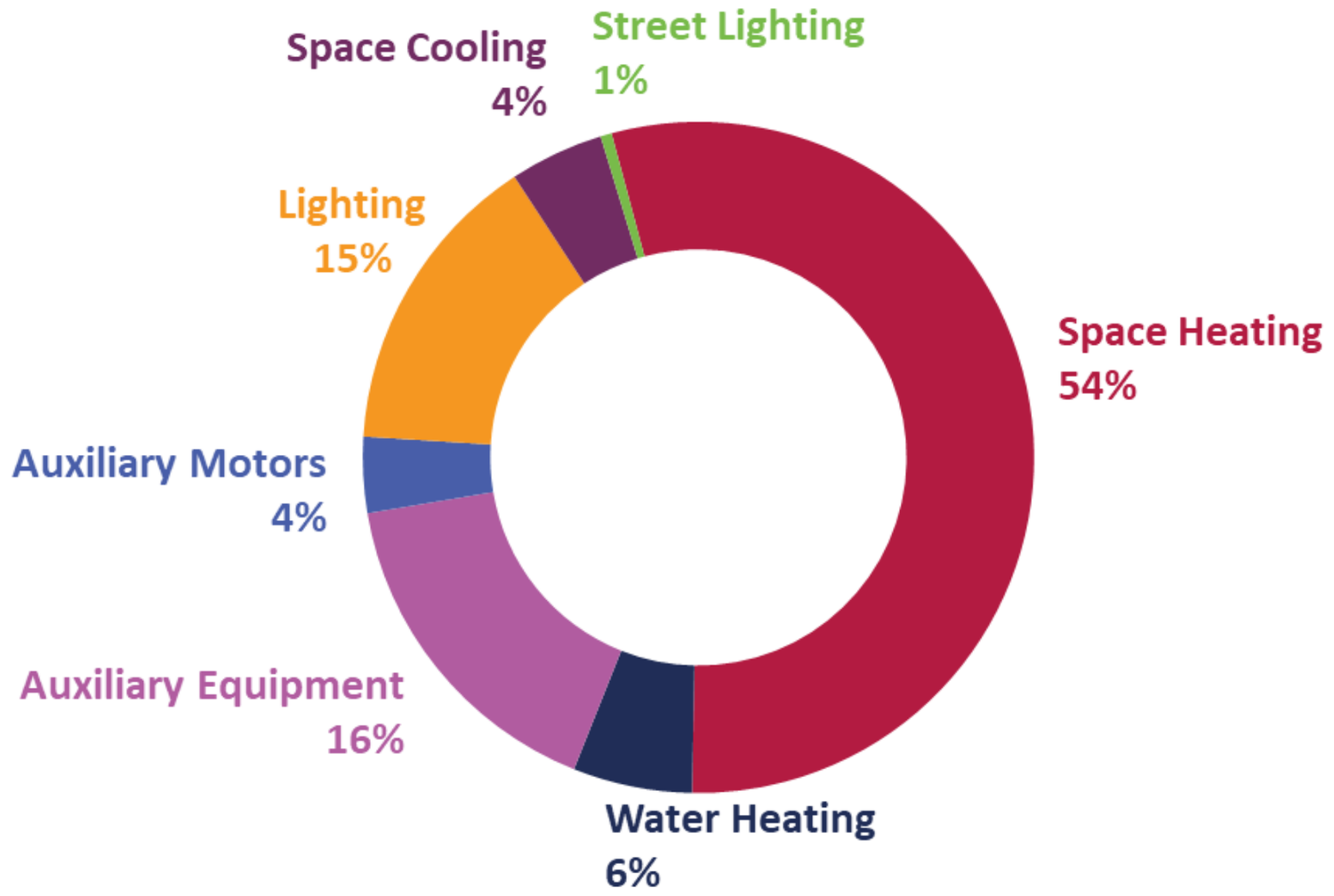
Rob Boresky

Mechanical Systems Engineer – Technical Lead

Energy Audits

COMMERCIAL/INSTITUTIONAL ENERGY USE

Distribution of commercial/institutional energy use by end use, 2019



Source: Natural Resources Canada: Office of Energy Efficiency

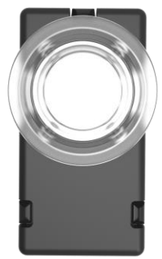
Business Lighting Program

LIGHTING CONTROL DEVICES

- Occupancy Sensors (wall /ceiling/corner mounted, embedded, etc.)
- Photocells
- Timers
- Dim/On/Off Controllers (One zone, Multi-zone)
- Power packs/Relay packs
- Gateways
- Controllers







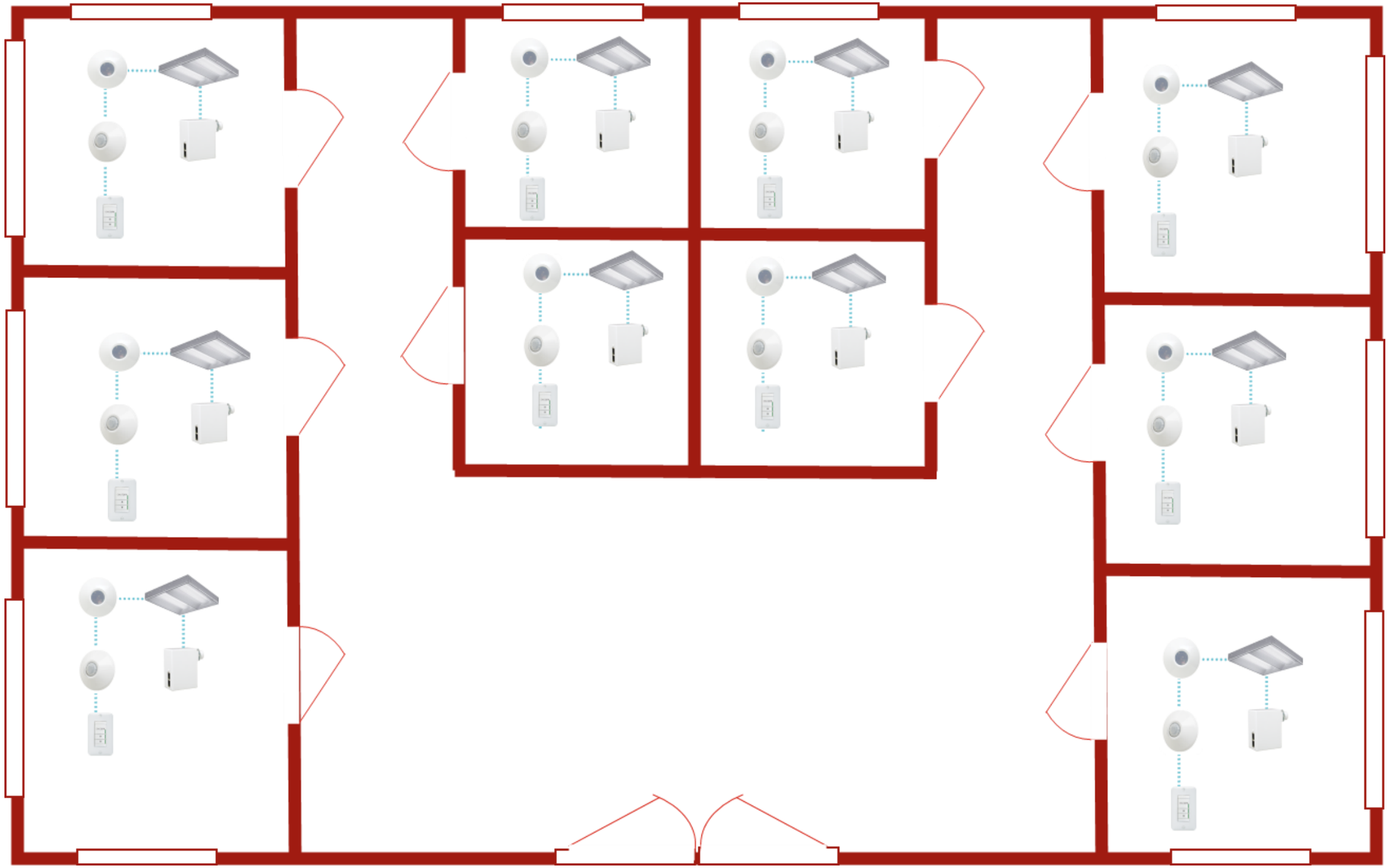


LIGHTING CONTROL TOPOLOGIES - STANDALONE

- Standalone devices provide control independently
- Basic control without network hardware
- Most configurations are plug & play, simply wire-in devices
- Easy to upgrade
- Start simple, scale up when needed

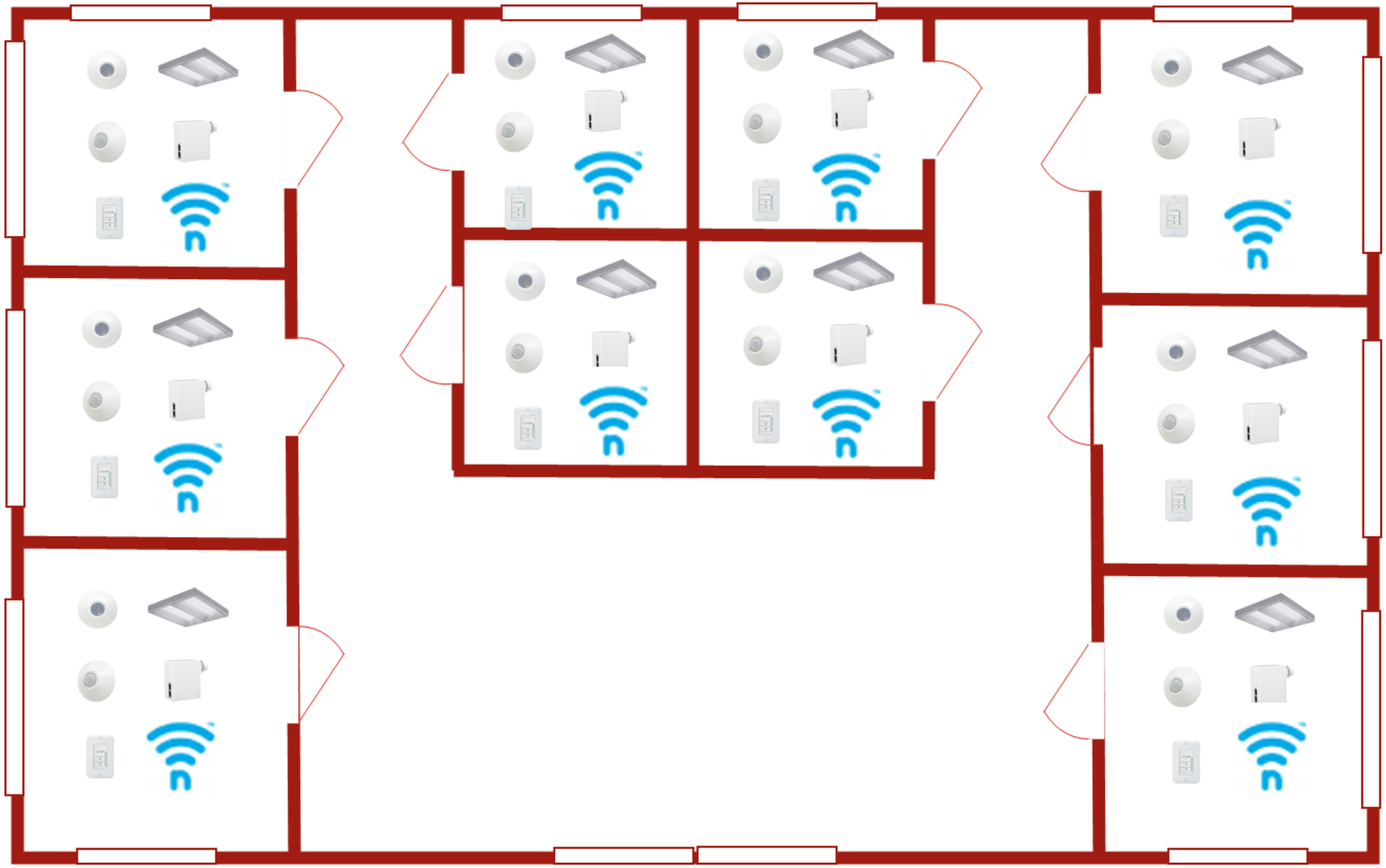
LIGHTING CONTROL TOPOLOGIES - STANDALONE

WIRED STANDALONE



LIGHTING CONTROL TOPOLOGIES - STANDALONE

WIRELESS STANDALONE

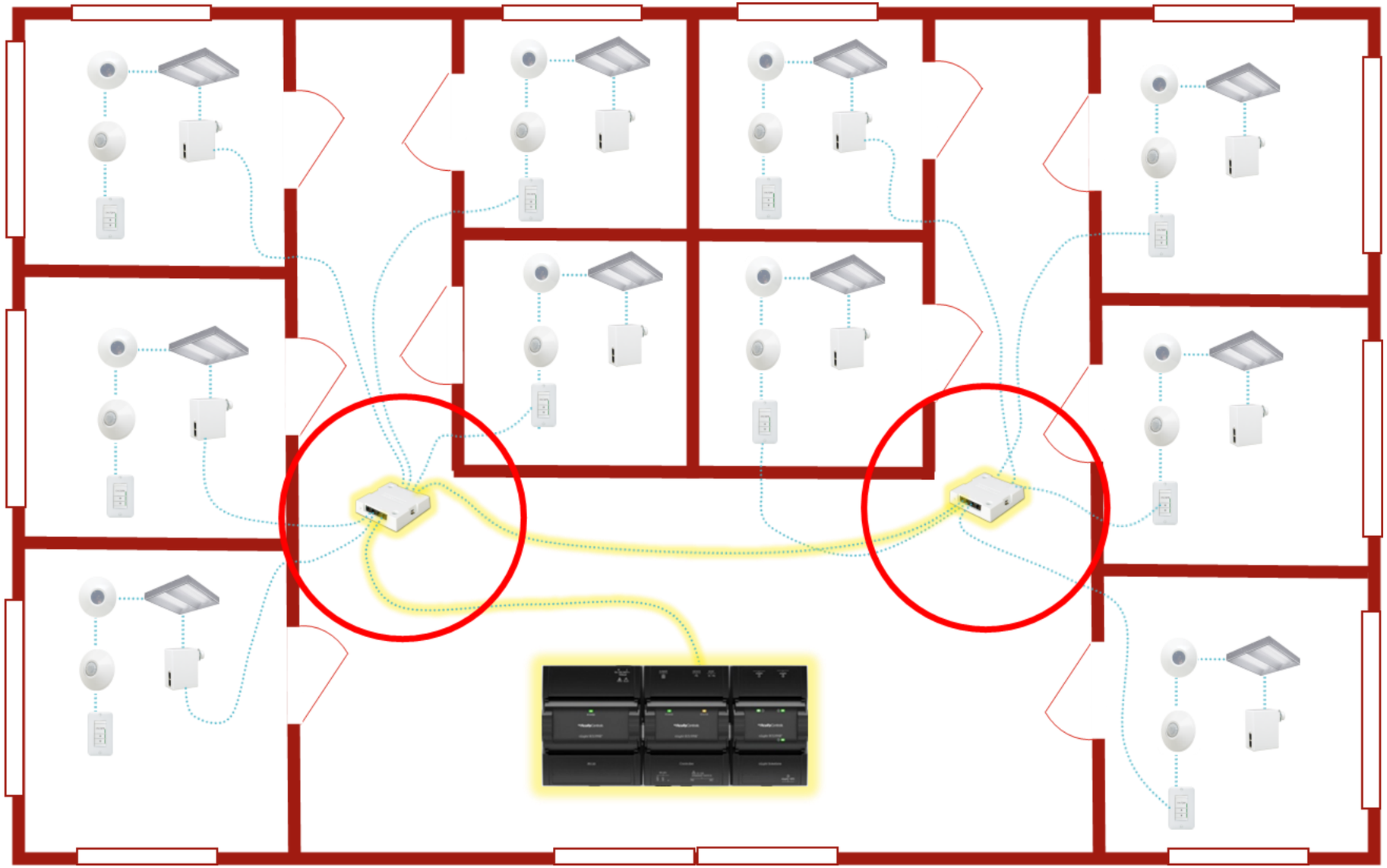


LIGHTING CONTROL TOPOLOGIES - NETWORKED

- Involve connecting lighting fixtures and control devices to a centralized network
- Allows for communication and coordination between devices
- Allows for sophisticated control strategies allowing for higher energy savings and occupant comfort
- Requires more equipment and programming, leading to higher upfront costs
- Can be centralized or distributed
  - Centralized systems concentrate control functions at central point
  - Distributed system delegate control functions from multiple local control devices or nodes throughout the building
- Highly customizable

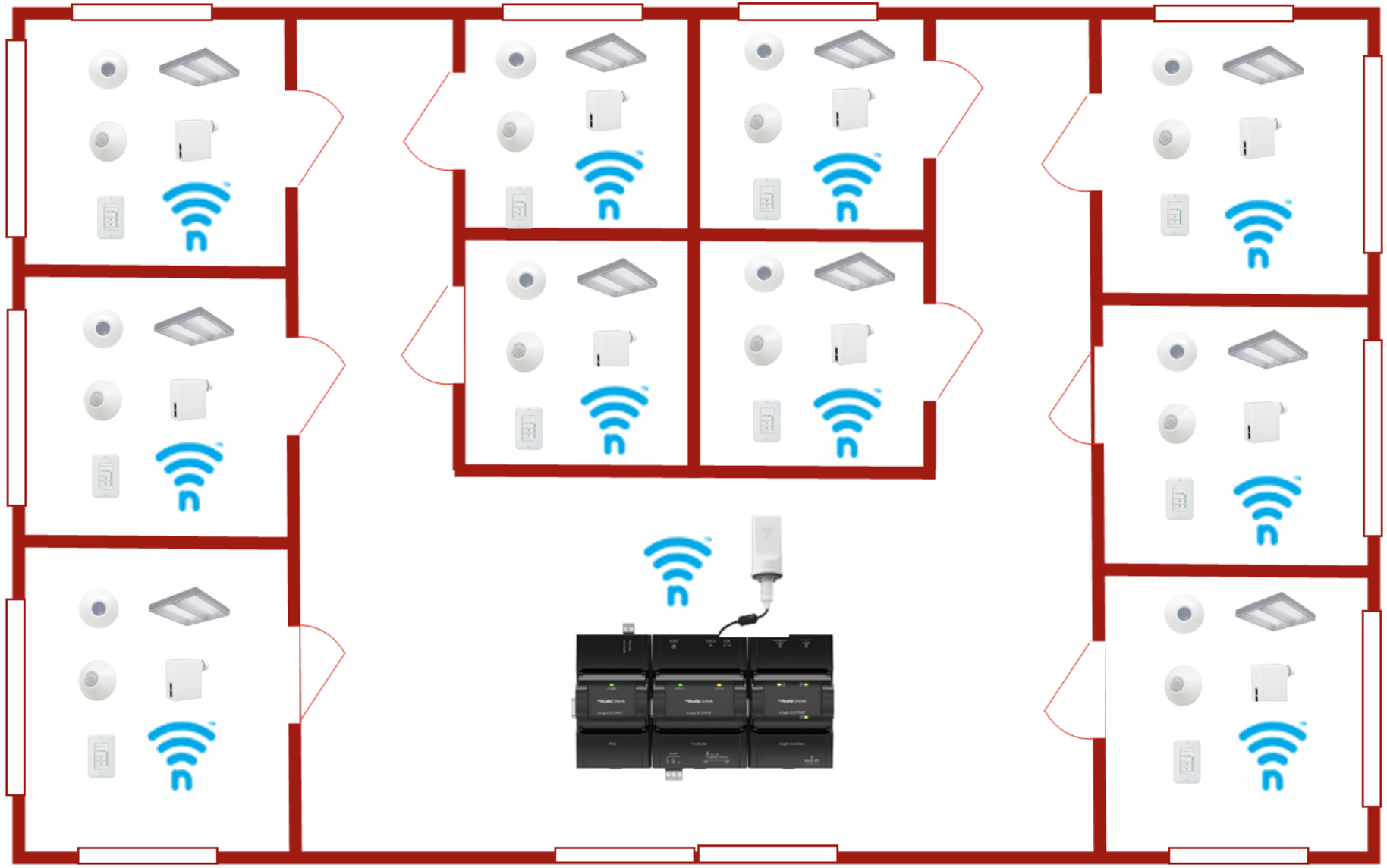
LIGHTING CONTROL TOPOLOGIES - NETWORKED

WIRED NETWORK



LIGHTING CONTROL TOPOLOGIES - NETWORKED

WIRELESS NETWORK



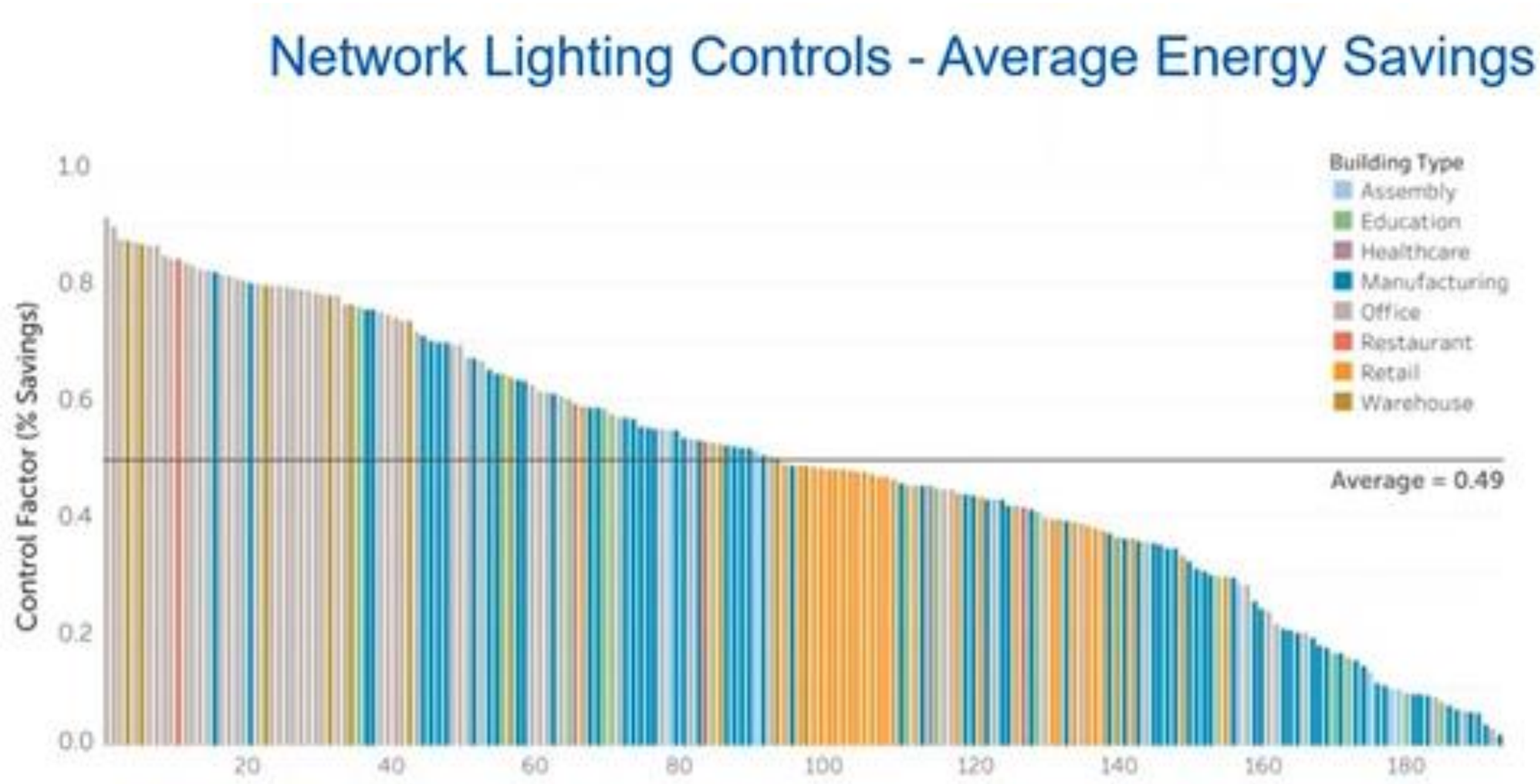
LIGHTING CONTROL STRATEGIES

- **Dimming:** Adjusting lighting levels to match needs or preferences within a space.
- **High-End Trim/Task Tuning:** Dialing down the lighting output of a fixture from factory setting to limit the highest level of illumination.
- **Occupancy Sensing:** Using sensors to detect occupancy in a space and automatically turn lights on or off based on presence of or absence of occupants.
- **Daylight Harvesting:** Using sensors to measure natural light levels to adjust artificial lighting accordingly.
- **Time-based Scheduling:** Programming lighting systems to operate based on predetermined schedules.
- Combination of Strategies

ENERGY SAVINGS POTENTIAL - STANDALONE

- **Occupancy-based** control (occupancy sensors, time scheduling): **24%**
- **Personal tuning** (occupant control of light levels using dimmers, workstation-specific control, preset scene control): **31%**
- **Institutional tuning** (light levels tuned to space needs by application, task tuning, lumen maintenance, group controls): **36%**
- **Daylight harvesting** (photosensors): **28%**
- **Multiple strategies** (any combination of the above): **38%**

ENERGY SAVINGS POTENTIAL - NETWORKED



Application	% Savings
Assembly	28%
Education	41%
Healthcare	52%
Manufacturing	40%
Office	64%
Restaurant	59%
Retail	44%
Warehouse	68%
Overall	**49%**

DESIGNLIGHTS CONSORTIUM

Source: Design Lights Consortium®, "Energy Savings from Networked Lighting Control (NLC) Systems with and without LLLC"
https://www.designlights.org/news-events/webinars/energy-savings-from-networked-lighting-control-systems-with-and-without-lllc/

BUSINESS LIGHTING – CONTROLS INCENTIVES

4. Lighting Controls

Category	Product Requirements	Application Requirements	Sensor Type	Incentive/Sensor
A. Occupancy sensors	To be approved by EM based on spec sheet	Apply online for approval Include: - Spec sheet	Built-in fixture sensor	$25
			Fixture-mounted sensor	$50
			Wall or ceiling-mounted sensor	$100

Category	Product Requirements	Application Requirements	System Type	Incentive
B. Centralized/distributed control systems	To be approved by EM based on spec sheet	Apply online for approval Include: - Spec sheet - Material quote	Lighting control systems	Up to $0.50/kWh of annual savings

LIGHTING CONTROL SYSTEMS - INCENTIVE EXAMPLE

Dimming control system information

Description of proposed lighting system

Do you turn off your lights after business hours? Yes ☐ No ■

Location	Manufacturer	Model no.	Fixture power	No. of fixtures	Total power	Power level	Annual hours of lighting operation	Material cost
Manufacturing Shop	Wally's Lighting Co	ABC-XYZ-260-24L-347	260 W	320	W	80 %	2600 h	$ 75000.00
						10 %	6160 h	
						%	h	
						%	h	
						%	h	
						TOTAL ▶		$ 75000

Occupancy sensors and switching control system information

DIMMING CONTROLS ADD AS PART OF INCENTIVE: YES

Location	Fixture Type	W/Fixt. [W]	Fixture Qty	Total Power [kW]	Power Level [%]	Annual Hours [hrs/year]	Total Hours [hrs/year]	High-Low Occ Sensors: Sensor Qty	High-Low Occ Sensors: Sensor Type		kWh	kW
Plant	LED	260	320	*83.200*	80	2600	*8760*				43264	16.64
					10	6160					461260.8	74.88

Average POWER SAVINGS [kW] 57.594 ENERGY SAVINGS [kWh] 504524.800 INCENTIVE $252,262.40

(Total switched power [kW]) 83.200

Incentive adjusted to current level

SUMMARY

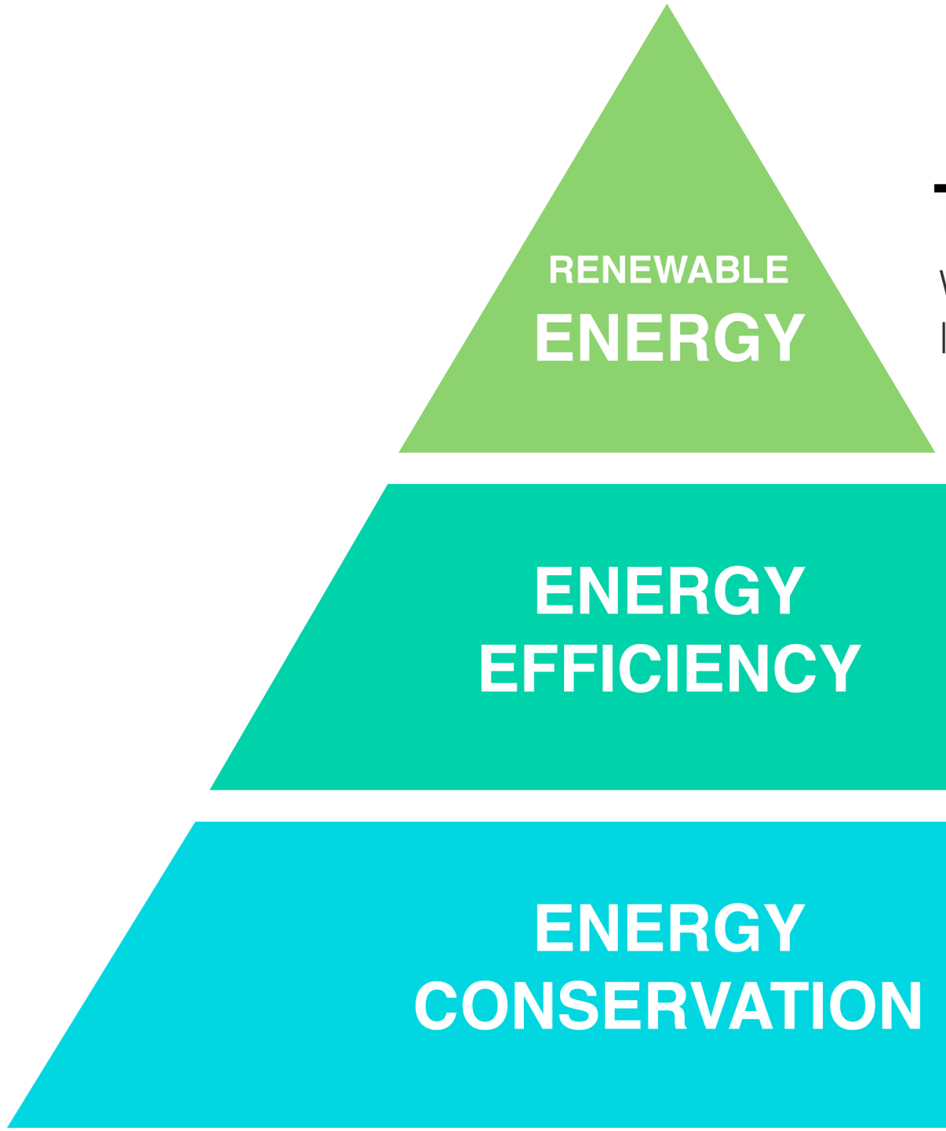
	Demand Savings [kW]	Energy Savings [kWh]	Material Cost [$]	Rebate [$]
Switching Controls	0.000	0.000		$0.00
Dimming Controls	57.594	504524.800		$252,262.40
TOTAL INCENTIVE available	**$252,262.40**	**TOTAL POWER SAVINGS (from energy savings)**	**57.594kW**	**504524.800kWh**

COMMENTS

capped at 100% material cost

MECHANICAL SYSTEM OPPORTUNITIES

ENERGY SAVINGS OPPORTUNITIES



Tier 3

When the system is modified to use efficiency, less renewable energy is needed

Tier 2

Purchasing and installing efficient equipment and processes

Tier 1

Largely based on behavioural & operational practices.
Best return on investment.

WASTE REDUCTION OPPORTUNTIES

REPAIR AND ADJUST MALFUNCTIONING

OUTDOOR, EXHAUST, ECONOMIZER

DAMPERS AND CONTROL

RESULT:

- DECREASED FAN ENERGY USE
- INCREASED UTILIZATION OF FREE COOLING
- DECREASED HEATING CONSUMPTION
- REDUCTION OF PREMATURE EQUIPMENT DEGRADATION AND REPLACEMENT.

WASTE REDUCTION OPPORTUNTIES

REPAIR DEFECTIVE INSULATION

RESULT:

- REDUSE THERMAL LOSSES AND GAINS IN UN-NEEDED AREAS.

WASTE REDUCTION OPPORTUNTIES

FIND AND REPAIR LEAKS

RESULT:

- REDUCE UNNECESSARY WATER CONSUMPTION
- REDUCE ENERGY REQUIRED TO TEMPER WATER TO HYDRONIC SYSTEM REQUIREMENTS.

ENHANCED:

- INTRODUCE BAS LEAK DETECTION EQUIPMENT ON HYDRONIC MAKE UP WATER SYSTEMS. DETECT AND ALARM WHEN LARGE VOLUMES ARE INTRODUCED.

WASTE REDUCTION OPPORTUNTIES

REGULAR FILTER REPLACEMENT

RESULT:

- REDUCED ENERGY CONSUMPTION FROM FANS OVERCOMING HIGHER STATIC PRESSURE DUE TO CLOGGED FILTERS.

ENHANCED:

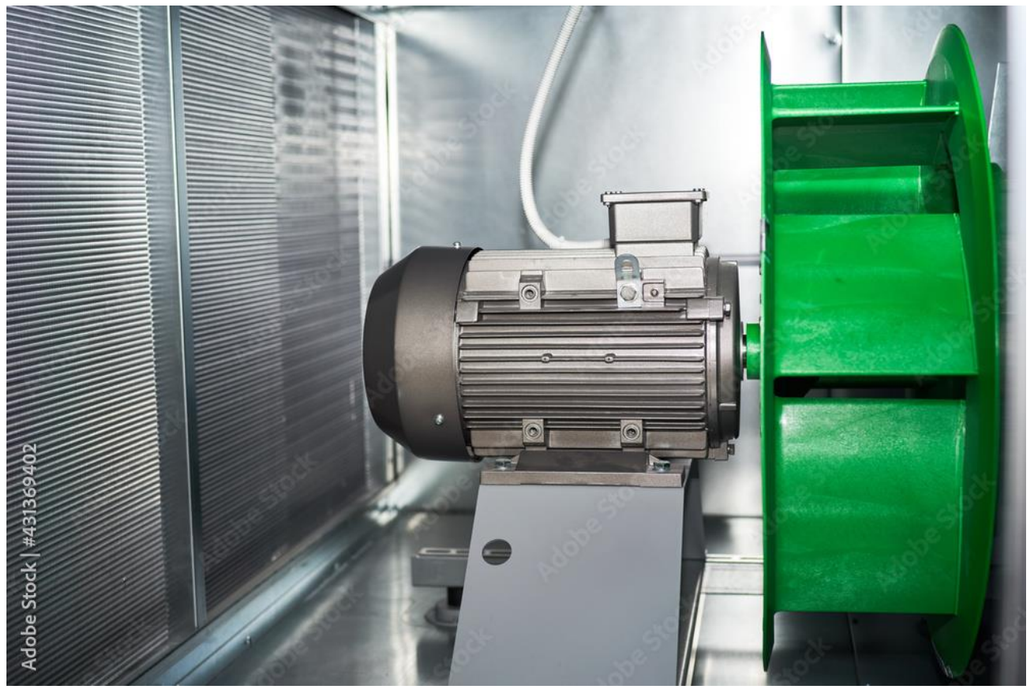
- INTRODUCE DIFFERENTIAL PRESSURE SENSORS TO OPTIMIZE FILTER REPLACEMENT TIMING.

OPERATIONS OPTIMIZATION

OCCUPANCY SCHEDULES/SET-BACKS

- INTRODUCE UN-OCCUPIED SET BACKS
- REVIEW AND ADJUST TENANT OCCUPANCY SCHEDULES.

OPERATIONS OPTIMIZATION



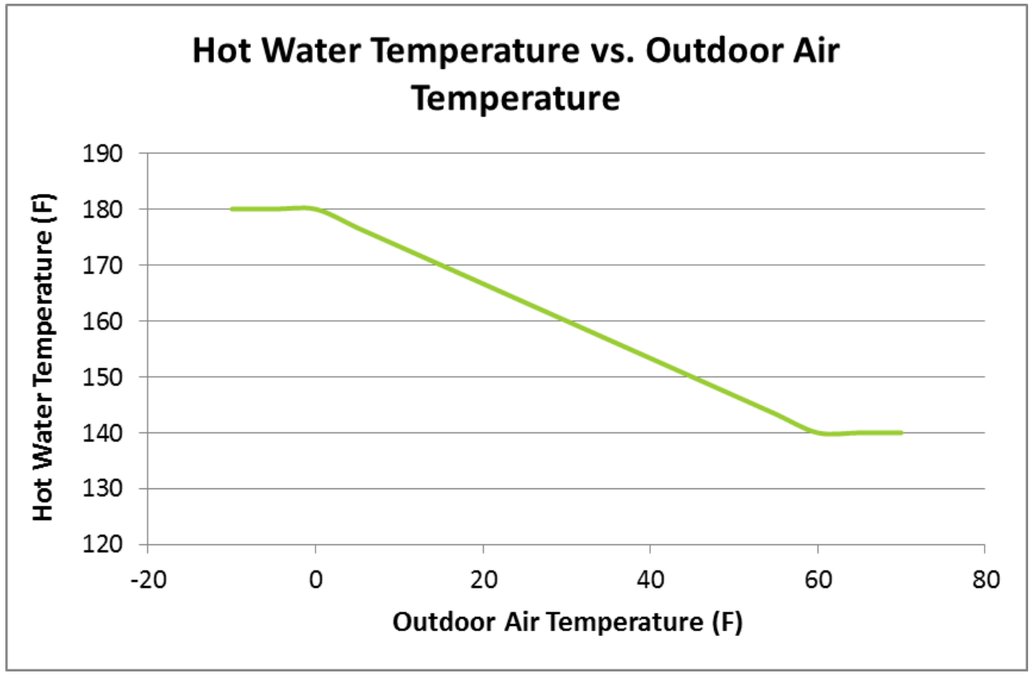
EQUIPMENT START UP

- OPTIMIZE EQUIPMENT START UP PERIODS TO SEASONAL DEMANDS AND OPERATIONS
- STAGGER EQUIPMENT START UPS TO REDUCE PEAK DEMAND
  - IDENTIFY AND PRIORITIZE EQUIPMENT FROM LARGEST TO SMALLEST ELECTRICAL LOADS DURING BUILDING'S PEAK ELECTRICAL DEMAND PERIODS.

OPERATIONS OPTIMIZATION

TEMPERATURE RE-SET

- REVIEW, CALIBRATE AND ADJUST.
- TEMPERATURES CAN DRIFT OVER TIME.
- IMPLEMENT OUTDOOR AIR RESET SCHEDULES.
- OPTIMIZE CHILLED OR HOT WATER TEMPERATURES.
- OPTIMIZE SUPPLY AIR TEMPERATURES.



OPERATIONS OPTIMIZATION

PERSISTENCE PLANNING

- DEVELOP AN ON-GOING PLAN AND SCHEDULE FOR REVIEWING THE PREVIOUSLY MENTIONED OPERATIONAL OPTIMIZATIONS.
- ADDRESS CHANGES MORE FREQUENTLY TO MAXIMIZE SAVINGS OPPORTUNITIES.

VARIABLE FLOW PUMP & FAN SYSTEMS

Qualify:

Commercial buildings with mechanical upgrades to variable flow pump and fan systems using variable frequence drives or permanent magnet motor

Benefits:

- ✓Improve the building's HVAC system's efficiency by adjusting motor speeds to match the required process demand.
- ✓Extend service life of the building's equipment and reduce operating and maintenance costs.

VARIABLE FLOW PUMP & FAN SYSTEMS

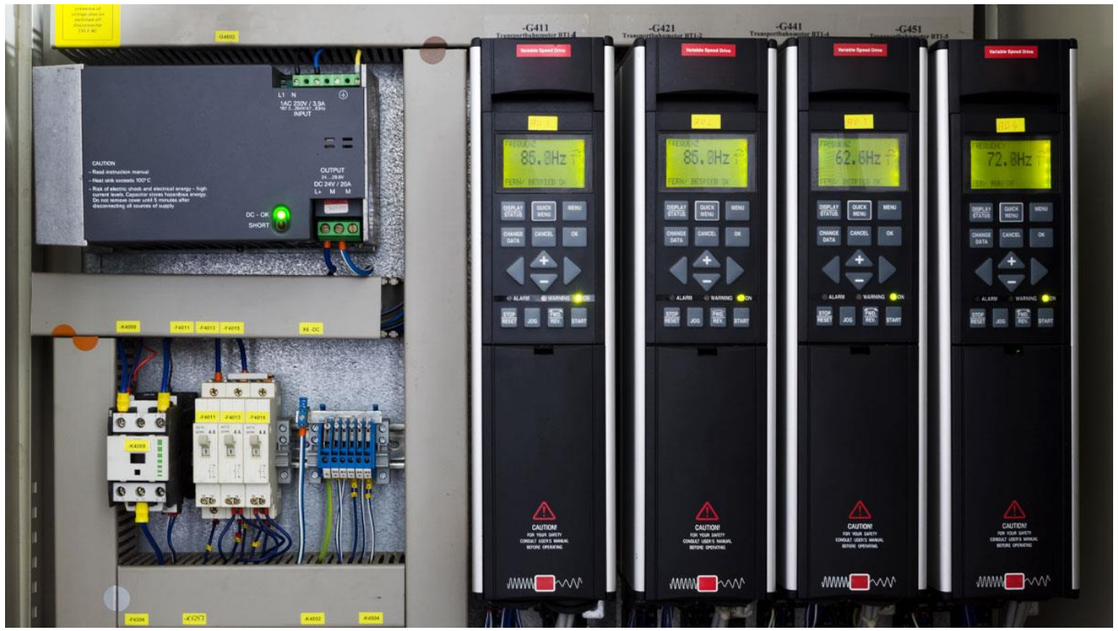
How to apply:

- Online application through qualified installer.

System eligibility criteria:

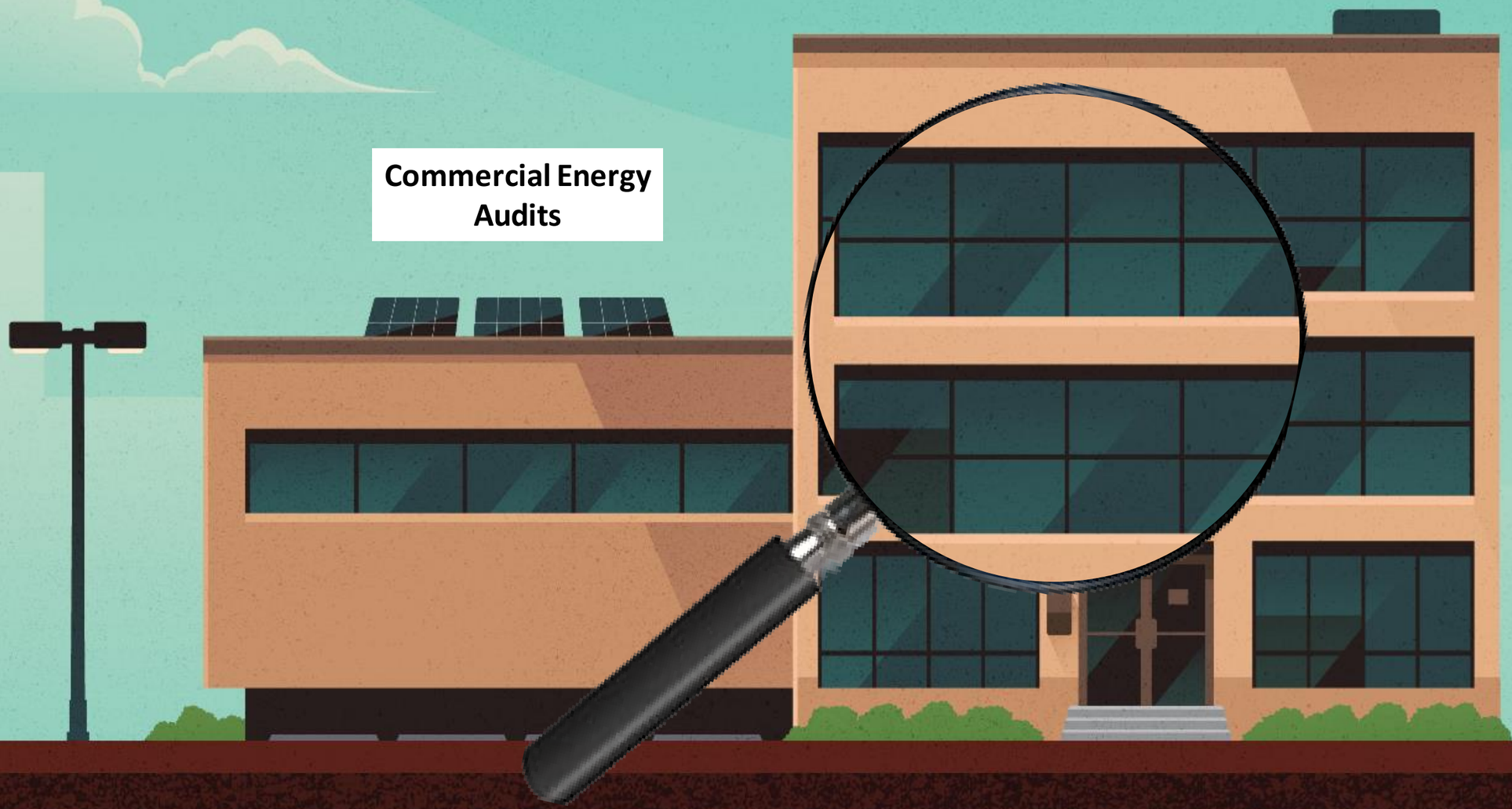
- All pump or fan applications must be used in variable flow (variable torque) applications or constant flow (non-constant torque) applications.
- Inverter duty rated motor
- 1,600 hours minimum use per year
- Motor sizes up to 100 HP
- Defined facility power quality requirements
- All products shall be electrically certified for use in Manitoba
- Installed in compliance with all current Canadian Electrical Code requirements

VARIABLE FLOW PUMP AND FAN SYSTEMS – OFFER DETAILS

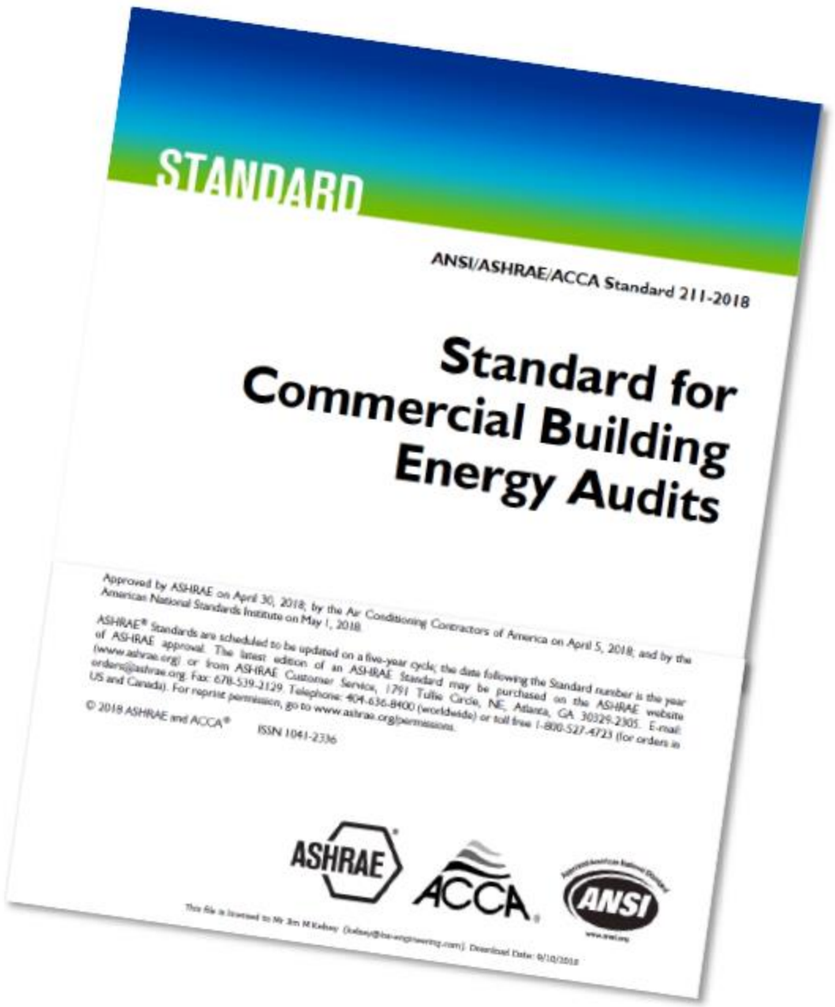


- Variable frequency drives used with inverter duty induction motors:
  - $50 per horsepower for fans up to 100 horsepower
  - $70 per horsepower for pumps up to 100 horsepower
- Variable speed permanent magnet motors:
  - $70 per horsepower for fans up to 100 horsepower
  - $100 per horsepower for pumps up to 100 horsepower
- Motors over 100 horsepower can apply to the Custom Energy Solutions program

Commercial Energy Audits



COMMERCIAL ENERGY AUDITS – OVERVIEW



- A process for assessing a building's current systems and operation, and for identifying opportunities to reduce energy and/or costs by analyzing possible upgrades and/or modifications to:
  - Building envelope
  - Lighting and related controls
  - Heating/Cooling/Ventilation and related controls
  - Service water heating
  - O&M practices

- ANSI/ASHRAE Standard 211
  - Defines consistent practices, procedures and reporting guidelines for Level 1, 2 or 3 energy audits

COMMERCIAL ENERGY AUDITS – OUTCOMES

- Building energy benchmarking
- Utility billing summary (electricity, NG, water, etc.)
- End-use breakdowns
- Identify comfort and IAQ issues
- Assessment/documentation of building systems: age, condition, control strategies, O&M practices
- Upgrade recommendations: Low-cost/no-cost, capital projects, renewable energy
- Financial analysis

COMMERCIAL ENERGY AUDITS – OUTCOMES (CONT'D)

Often an energy audit report might become the best and most up-to-date documentation of a building's existing equipment and controls (a "lite" facility guide, of sorts):

- Mechanical and lighting equipment inventories
  - Quantity
  - Tags/IDs
  - Capacity/nameplate specs
- Intended control strategies – setpoints, sequences, limitations
- Current O&M / ongoing commissioning practices

COMMERCIAL ENERGY AUDITS – LEVEL DESCRIPTIONS

0

Preliminary Benchmarking ("Level Zero" Audit)

- Calculate energy use intensity (e.g. ekWh/sqft, MJ/sqm, etc.)
- Compare to buildings with similar occupancy, end uses
  - Possible sources: ASHRAE/IES 100, Energy Star, DOE Building Performance Database, DOE Commercial Building Energy Consumption Survey (CBECS), or your own portfolio
- Can set overall energy performance, and the savings needed to reach it

1

Level 1 – Walk-through analysis

- Basic walkthrough, operator survey
- Energy benchmarking (essentially "level zero" above)
- Review utility bills
- Review building operations, space functions, system age/condition, O&M practices
- Identify both low-cost/no-cost EEMs and potential capital upgrades
- Basic (rough) cost/savings assessments

COMMERCIAL ENERGY AUDITS – LEVEL DESCRIPTIONS

2

Level 2 – Energy survey and analysis

All elements of Level 1, plus:

- Detailed site visit
- Review of systems condition, O&M practices
- Recommended O&M changes
- Detailed descriptions and costs/savings analyses of EEMs (with interaction), including:
  - Annual electricity, fuel, and water savings
  - Demand savings (as applicable)
  - Ancillary benefits (improved comfort, reduced O&M costs, reliability, IAQ, etc.)
  - Cost of implementation
  - Utility incentives
  - Financial evaluation (simple payback, simple ROI)
- Meet with owner/operator(s) to review results and recommendations

Most commonly requested level

COMMERCIAL ENERGY AUDITS – LEVEL DESCRIPTIONS

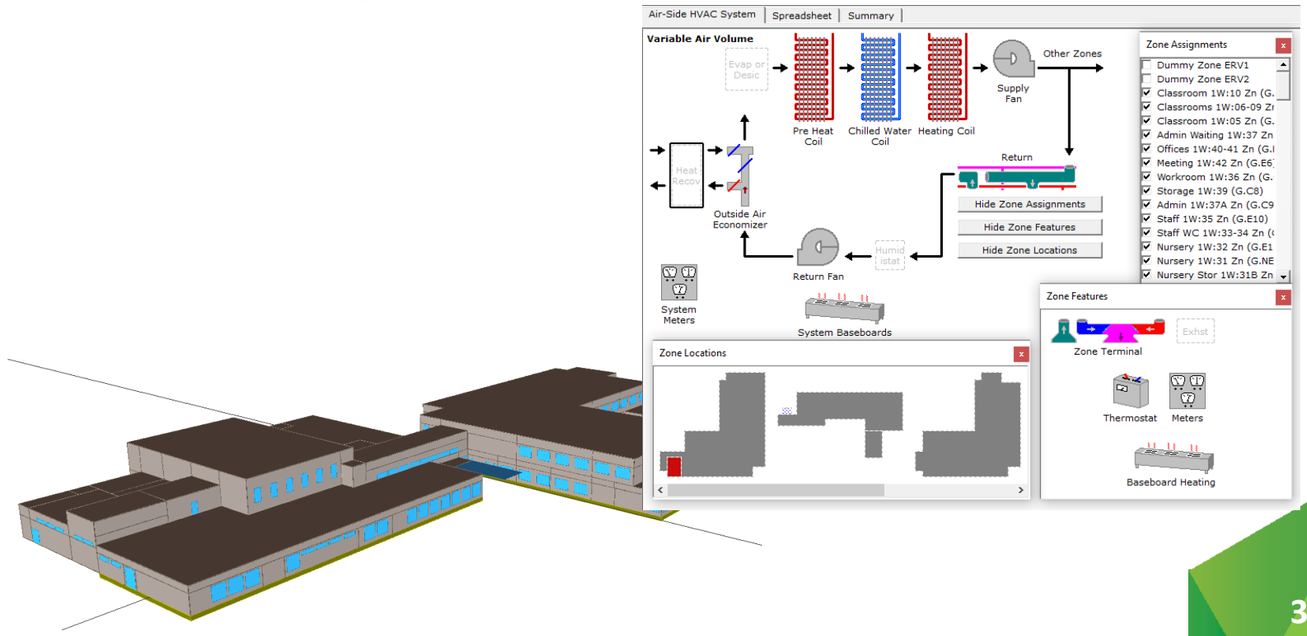
3

Level 3 – Detailed analysis of capital-intensive upgrades/modifications

All elements of Level 2, plus:

- Greater detail in EEM analysis (include equipment specs, cut sheets)
- Typically includes whole-building (hourly) energy simulation (sample below right), and/or detailed measurement/monitoring
- Provide schematic layouts for upgrades
- Reduce risk through fine-tuning financial cost/payback analyses:
  - Life cycle cost assessments, NPV
  - Often referred to as “investment-grade”

Often occurs through a request for design/implementation assistance.



MEASURE EXAMPLES

Common Low-Cost/No-Cost Measures

- Envelope air sealing
- Repair defective / add missing pipe insulation
- LED lamp replacements (with utility rebate)
- Optimize schedules: lighting, T-stat setpoints/setbacks, fans, outdoor air dampers, etc.
- Room-level occupancy/daylight sensors for lights
- Correct economizer/damper sequences
- O&M-related practices; filter replacements, coil cleaning, pipe leaks
- System recommissioning (low capital cost, though further investigation/labor work involved)

MEASURE EXAMPLES (CONT'D)

Common Capital Measures

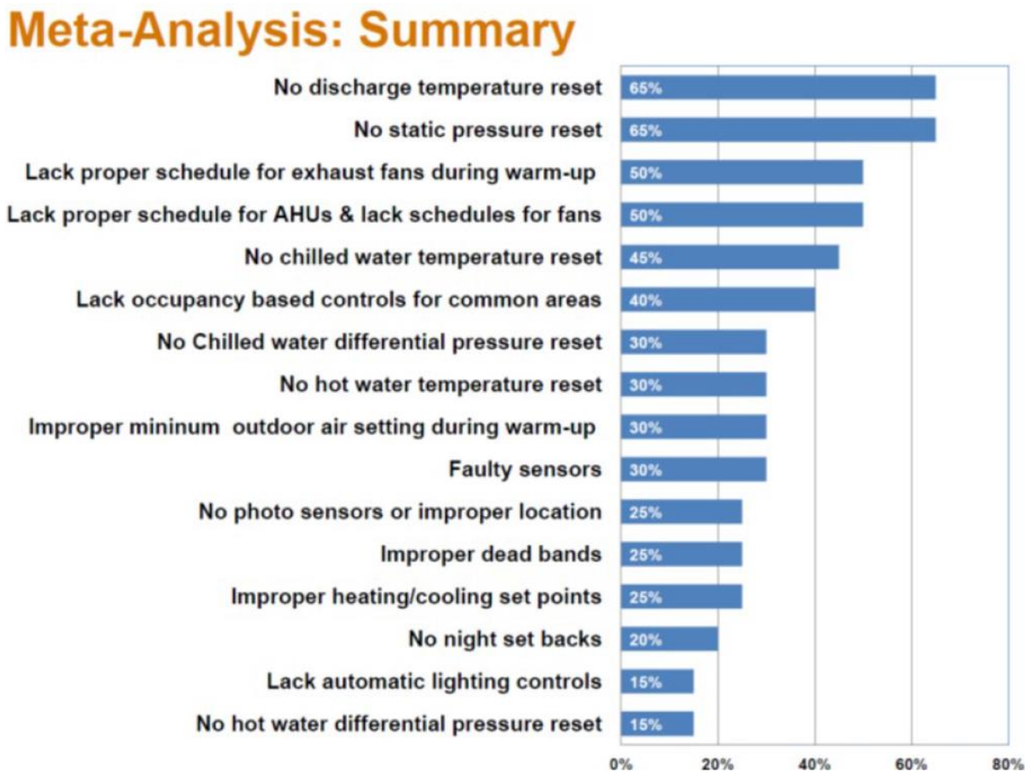
- Building envelope upgrades (windows, wall/roof insulation)
- VFDs for pumps and fans
- Central plant upgrades (boilers, chillers, hot water heaters)
- Low-flow fixtures (e.g. faucets, showerheads)
- Heat recovery systems (heat recovery chillers, ventilation air)
- Upgraded controls systems (optimal start/stop, demand control ventilation)
- Solar PV

MEASURE PERSISTENCE

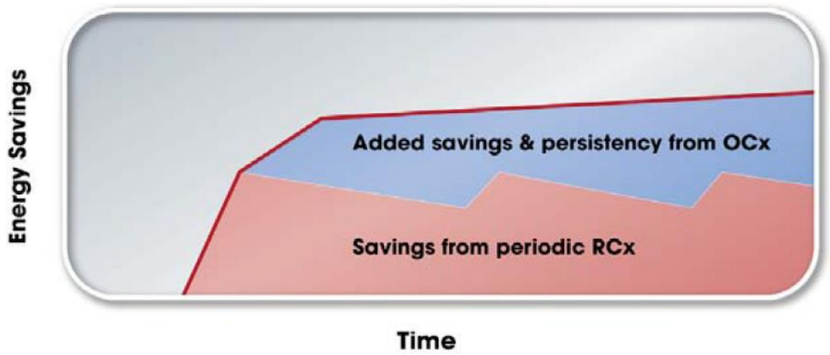
Regardless of the selected measures, both post-install commissioning and ongoing commissioning/monitoring plans are important to consider, to ensure the systems continue to operated as intended.

Operational characteristics and controls may change over time (e.g. occupancy/operational changes, changes in operating staff and/or O&M procedures, "sensor drift").

Often retro- or recommissioning (RCx) can be flagged in an audit report as a recommended measure. Average savings from a RCx process can often be in the range of 5-15% for a typical commercial building, and simple payback periods can often be around three years or less.



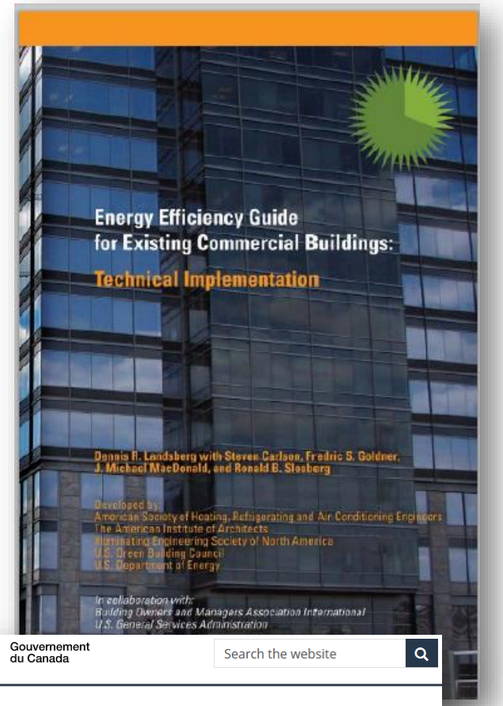
Source: Pacific Northwest Laboratory, *Improving Commercial Building Operations through Building Re-turning: Meta-Analysis*

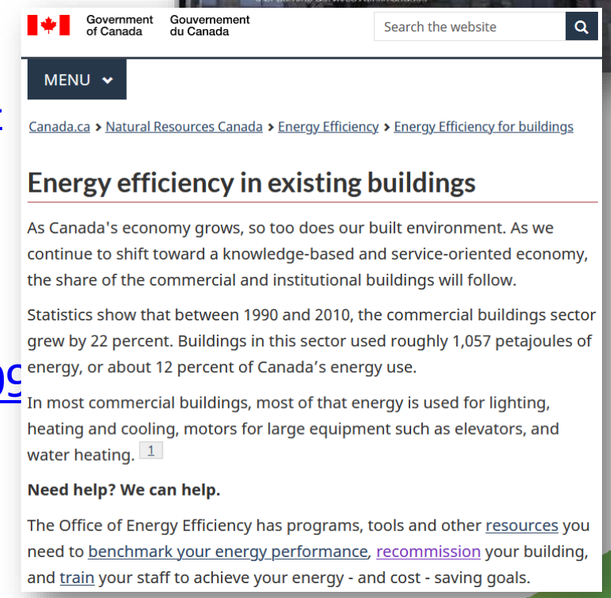


Source: CIET, *Introduction to Building Recommissioning (RCx)*

USEFUL RESOURCES

- *Energy Efficiency Guides for Existing Commercial Buildings, ASHRAE*
- *ASHRAE Standard 100, Energy Efficiency in Existing Buildings*
  - Informative Annex D – Operations and Maintenance Requirements for Building Systems and Elements
  - Informative Annex E – Energy Efficiency Measures
- *Checklists of Energy-Saving Measures*, ENERGY STAR: https://www.energystar.gov/buildings/save-energy-commercial-buildings/ways-save/checklists
- *Energy Efficiency in Existing Buildings*, Natural Resources Canada: https://natural-resources.canada.ca/energy-efficiency/buildings/existing-buildings/20682
- Procedures for Commercial Building Energy Audits, ASHRAE (EEMs to Consider): https://xp20.ashrae.org/PCBEA/Files/EEMs-to-Consider-2011-09-15.pdf





COMMERCIAL ENERGY AUDIT PROGRAM

https://efficiencymb.ca/business/commercial-energy-audit-program/

- Financial incentives and technical support offered for building owners looking to conduct an energy audit for their commercial building.
- ASHRAE level 2 and level 3 audits are incentivized.
- Energy audit report will identify savings and cost analyses of all practical Energy Conservation Measures.
- Audits must be done by a pre-qualified consultant.

PRE-QUALIFIED CONSULTANTS

CONSULTANT NAME	PHONE NUMBER	WEBSITE	EMAIL
Alliance Engineering Services Inc.	204-774-7859	allianceengservices.com	jeff@allianceengservices.com
Bouthillette Parizeau Inc.	780-440-2806	bpa.ca	rclark@bpa.ca
CES Engineering	204-289-0882 ext. 111	cesgroup.ca	bratkovich@cesgroup.ca
Crosier Kilgour	204-943-7501	crosierkilgour.com	phil.dompierre@crosierkilgour.com
Demand Side Energy Consultants Inc.	204-291-3721	demandsideenergy.com	alex.fleming@demandsideenergy.com
DGH Engineering Ltd.	204-334-8846	dghengineering.com	efficiency@dghengineering.com
Epp Siepman Engineering	204-453-1080	eppsiepman.com	tdefoort@eppsiepman.com dsiepman@eppsiepman.com
McCuaig & Associates Engineering Ltd.	604-255-0992	mccuaig.net	dmitrii@mccuaig.net
MCW Consultants Ltd.	204-779-7900	mcw.com	sreaburn@mcw.com egarfinkel@mcw.com
Nadine International Inc.	905-602-1850	nadineitnl.com	ag@nadineintl.com
SMS Engineering Ltd.	204-789-2320	smseng.com	cott@smseng.com
SNC-Lavalin Inc	204-786-8080	snclavalin.com	stephen.norsworthy@snclavalin.com
Summerhill Group Inc.	647-484-7613	summerhill.com	snarsiah@summerhill.com
Sustainable Projects Group	780-235-5932	suspg.com	adamt@suspg.com

11-21-2023

AVAILABLE INCENTIVES

BUILDING TYPE	BUILDING SIZE	MAXIMUM INCENTIVE (up to 50% of energy audit cost)	
		LEVEL 2	LEVEL 3
Offices, education, hotel, recreation/arena, healthcare, multi-unit residential, or industrial with offices	Greater than 60,000 square feet **and/or** 3 floors or more	$3,200	$12,500
	Between 30,000 and 60,000 square feet **and** 3 floors or less	$2,200	$8,000
	30,000 square feet or less **and** 3 floors or less	$1,200	$4,200
All other building types	Any size	$1,200	$4,200

POST-AUDIT & EFFICIENCY MANITOBA PROGRAMS

- Through Efficiency Manitoba's Commercial Energy Audits Program, the final energy audit report will also identify all applicable Efficiency Manitoba programs.

- Programs include both prescriptive, single-measure offers (e.g. VFD pumps/fans, heat pumps, lighting), as well as performance-based and/or whole-building programs (e.g. Custom Energy Solutions, Deep Energy Retrofit).

Efficiency Manitoba Commercial Program	Applicable (Yes or No)	Energy Efficiency Measure(s) Description
Building Envelope	☐ Yes ☐ No	
Business Lighting	☐ Yes ☐ No	
Commercial Refrigeration	☐ Yes ☐ No	
Heat Pump	☐ Yes ☐ No	
In-Suite Energy Efficiency	☐ Yes ☐ No	
Small Business	☐ Yes ☐ No	
Solar Rebate	☐ Yes ☐ No	
Variable Flow Pump & Fan Systems	☐ Yes ☐ No	
Commercial Deep Energy Retrofit	☐ Yes ☐ No	
Custom Energy Solutions	☐ Yes ☐ No	
• Air Compressors	☐ Yes ☐ No	
• Steam Trap Audit	☐ Yes ☐ No	
Enhanced Building Operations	☐ Yes ☐ No	

EFFICIENCY MANITOBA

PARTICIPATION STEPS

1) SUBMIT AN APPLICATION

- Application submitted online by owner or owner's representative.

2) RECEIVE APPROVAL AND SELECT A PRE-QUALIFIED CONSULTANT

- Once application is reviewed and accepted, building owner selects energy auditor from the pre-qualified consultant list (available online) and has six months to complete the audit.
- Multiple quotes are recommended.

3) COMPLETE THE ENERGY AUDIT

- Submit draft report online to Efficiency Manitoba.

PARTICIPATION STEPS (CONT'D)

4) **MEET** TO REVIEW THE ENERGY AUDIT REPORT

- After draft report is approved, consultant presents final report to building owner.
- Submit copy of final report with meeting minutes and invoice.

5) **RECEIVE** YOUR INCENTIVE

- Incentive payment sent to specified payee.

PROGRAM ELIGIBILITY

- The building must be used in a commercial capacity.
- The energy auditor must be a pre-qualified consultant.
- The building owner is a current Manitoba Hydro customer paying a commercial service rate.
- The building is being heated primarily by electricity or natural gas supplied by Manitoba Hydro.
- The application must be approved prior to on-site assessment work.

ONLINE RESOURCES

PROGRAM GUIDE

FAQS

HOW-TO-VIDEOS

CONTACT INFORMATION

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QUESTIONS?