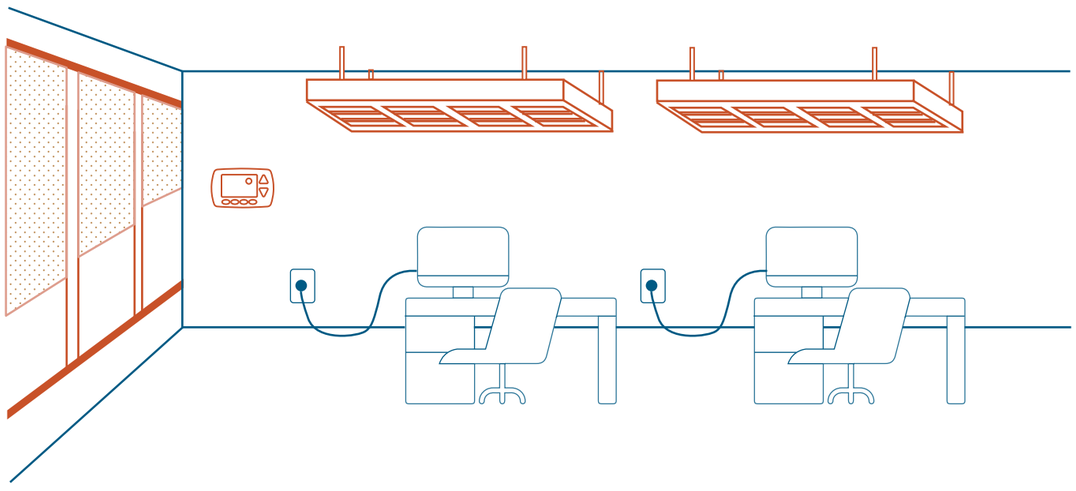
Net Zero Building Retrofit Guides

Lighting

Technology Companion Guide



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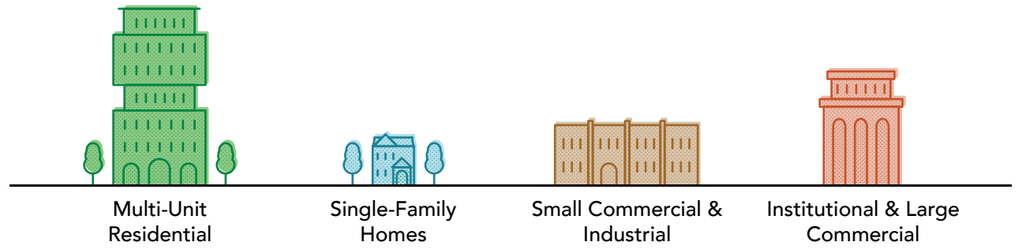

Co-benefits

Resilience	Indoor Air Quality	Occupant Comfort	Property Value
○○○○	○○○○	●●●○	●●○○

Impacts

Emissions Reduction	Utility Savings	Capital Cost	Maintenance Requirements
●○○○	●●●●	●●○○	●○○○

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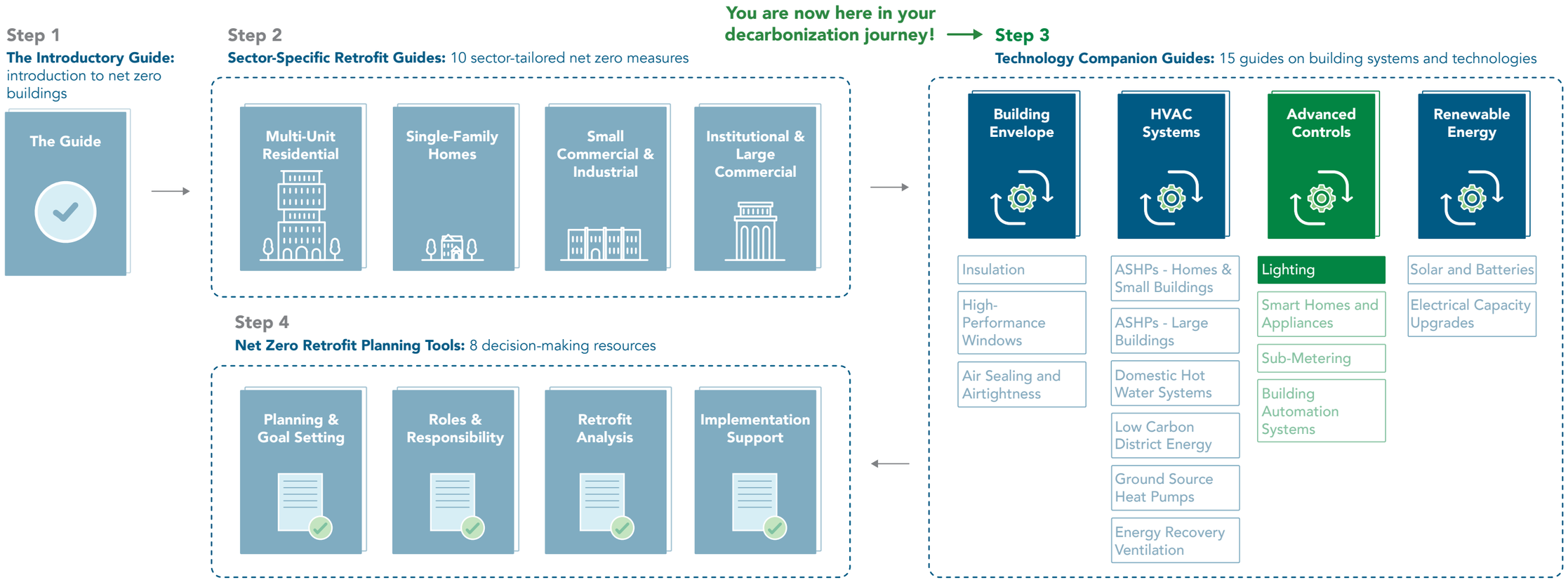
Navigating the Net Zero Building Retrofit Guides

Reducing Greenhouse Gas (GHG) emissions is a journey. It's also an opportunity to make your building more comfortable, healthier, valuable, and resilient to extreme weather events. Successfully arriving at your net zero destination requires careful planning and the right travel companions to ensure a smooth trip.

The City of Toronto's **Net Zero Building Retrofit Guides** include a range of documents designed to support home and building owners reduce GHG emissions from their buildings.

1. **The Introductory Guide** introduces the topic of "net zero buildings." The guide's goal is to familiarize all home and building owners with Toronto's net zero goals and concepts.
2. **The Sector-Specific Retrofit Guides** highlight net zero measures tailored to each building sector and type. These guides provide direction to plan and implement retrofit projects specific to your building.
3. **The Technology Companion Guides** provide technical information about building systems and technologies related to net zero measures and retrofits.
4. **The Net Zero Retrofit Planning Tools** provide decision-making resources to help home and building owners prioritize their retrofit projects. The tools include needs assessments, checklists, and support for contractor selection.

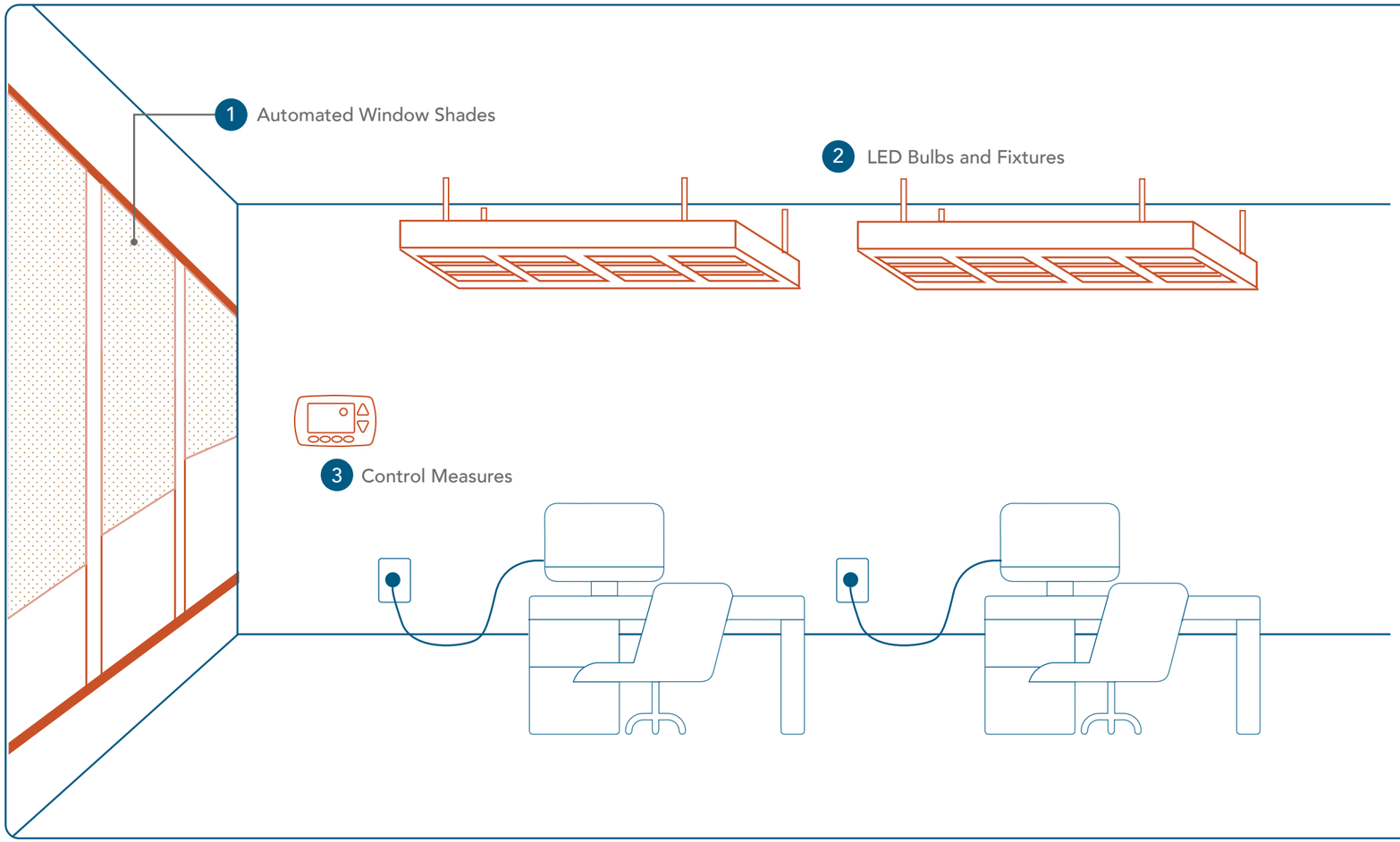


Net Zero Building Retrofit Guides Document Navigation

Lighting

What Is This Technology

Upgrading lighting and window shading systems can significantly transform a space, blending modern technology with energy efficiency to create a more inviting atmosphere. By incorporating automated solutions and energy-efficient fixtures, building occupants can enjoy enhanced comfort and improved control over their environment. These strategic enhancements not only reduce energy consumption and GHG emissions, they also promote better indoor environmental quality.



Retrofit technology explained

How Lighting Retrofits Work

Lighting retrofits involve upgrading old lighting systems by replacing conventional fixtures with LED and smart fixtures, incorporating advanced controls like occupancy sensors, using daylighting controls to optimize natural light, and adding shading systems to reduce glare and manage sunlight exposure.

Consider the following retrofitting options to elevate your lighting and shading systems:

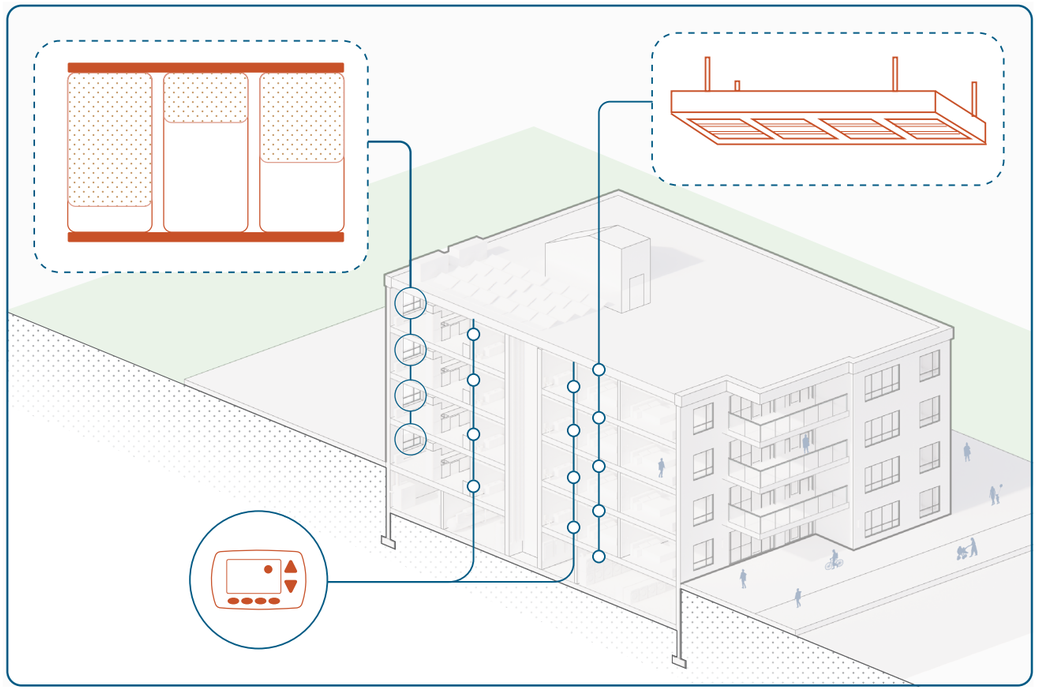
1. Install automated window shades optimizes natural light while reducing glare, enhancing the overall ambiance of the space.
2. Replace existing bulbs and fixtures with LED products to lower energy consumption and operating costs.
3. Upgrade or implement control measures, including occupancy sensors and a building automation system, to allow for connection and efficient use of lighting system components.

When to Retrofit This System

Lighting retrofits should be prioritized in the early stages of a retrofit project, especially if the building's lighting system is outdated or inefficient. This is particularly important in buildings with high lighting loads, such as commercial offices, educational institutions, and multi-unit residential buildings.

Why Retrofit This System

Retrofitting lighting systems helps to use less energy, lower energy bills, enhance occupant comfort, while contributing to net zero goals. By reducing energy consumption, you can decrease reliance on utilities and protect yourself from rising energy costs, all while lowering GHG emissions.



Typical locations in a building associated with this technology

Below are co-benefits and impacts to help you better understand this technology.

Co-benefits

Resilience:
Lighting retrofits do not directly impact building resilience.

Indoor Air Quality:
Lighting retrofits do not directly impact indoor air quality.

Occupant Comfort:
Improved lighting quality and the ability to adjust lighting levels based on occupancy and daylight enhances occupant comfort.

Property Value:
Energy-efficient lighting systems can increase property value by reducing operational costs and enhancing the building's environmental performance.

Impacts

Emissions Reduction:
Energy-efficient lighting and controls lowers reduce electricity usage, leading to lower GHG emissions.

Utility Savings:
Lower energy usage from efficient lighting systems leads to reductions in electricity bills.

Capital Cost:
Initial capital costs can be substantial, but long-term savings in energy and maintenance usually offset these expenses.

Maintenance Requirements:
LED bulbs and automated controls have long lifespans, reducing the need for frequent replacements. This results in lower maintenance costs and less disruption to building operations.

Types of Systems and Retrofit Solutions

Existing buildings often feature outdated lighting systems with traditional fixtures and manual controls. These systems may include inefficient fluorescent bulbs and basic on/off switches. Retrofits can introduce modern lighting solutions, improve energy efficiency, and enhance occupant comfort. An existing system can have more than one retrofit option.

Here are some typical lighting systems for existing buildings and how to retrofit them:

Fluorescent Bulbs

Fluorescent lighting is common in older buildings but is less energy-efficient compared to modern alternatives. These bulbs typically use more power and require more frequent replacement.

Retrofit: Replace outdated fluorescent bulbs with modern LED bulbs to improve energy efficiency and reduce maintenance costs. This retrofit focuses solely on upgrading the lighting source without changing the fixture itself.

Basic Manual Lighting Systems

This system uses basic on/off switches, offering no energy-saving features. It relies entirely on manual control, leading to inefficiencies due to lights being left on when not needed.

Retrofit: Upgrade to energy-efficient LED fixtures, which include both the bulbs and the fixtures. Install basic occupancy sensors to ensure lights are only used, when necessary, thereby reducing energy consumption.

No Lighting Controls

In systems without lighting controls, lights operate at full capacity regardless of occupancy or available daylight, resulting in higher energy consumption and reduced operational flexibility.

Retrofit: Implement advanced lighting controls, including daylight sensors, automated dimming systems, and modern control options such as mobile apps. Mobile apps provide users with the ability to easily adjust lighting settings, schedule lighting changes, and monitor energy usage remotely, offering greater flexibility and control over lighting efficiency. This retrofit enhances energy efficiency by adjusting lighting levels based on occupancy and daylighting, and it's suitable for systems without existing controls.

Minimal Daylight Integration

Spaces with minimal daylight integration rely heavily on artificial lighting, as they lack systems that harness natural light. This leads to increased energy usage, especially during daylight hours.

Retrofit: Incorporate basic daylighting strategies, such as installing window treatments and using reflective surfaces, to enhance natural light usage. This approach helps reduce dependence on artificial lighting and improves overall energy efficiency.

How to Implement

Before starting, refer to the **seven-step roadmap to net zero** in the **Introductory Guide** and in your **Sector-Specific Retrofit Guide**, to ensure your retrofit aligns with your overall strategy and goals. Here are a few steps to get you started with a lighting retrofit. They should be carried out with the help of an expert such as lighting designer or lighting engineer:

1. Evaluate your current lighting systems, including fixtures, controls, and natural light exposure, to identify low-efficiency areas and ensure sufficient lighting levels.
2. Plan and select energy-efficient lighting fixtures, controls, and systems tailored to your building's needs.
3. Integrate new lighting controls with existing systems or install standalone controls as needed. Ensure these controls are optimized to maximize energy efficiency and occupant comfort.
4. Implement the lighting retrofit in phases, starting with high-priority areas to minimize disruption.
5. Test and adjust lighting controls to ensure optimal performance and energy savings. Quality control during this phase is crucial for verifying system effectiveness.
6. Set up a regular maintenance program to ensure the new lighting systems remain efficient and functional. Assess if a licensed electrician is required for installation and any necessary electrical work.

What is Lighting Control Optimization?

Lighting control optimization involves fine-tuning lighting systems to maximize energy efficiency and occupant comfort. This includes adjusting lighting levels based on occupancy, daylighting, and time of day. By optimizing controls, you can achieve substantial energy savings, reduce costs, and contribute to net zero goals.

Opportunities

Evaluate how this retrofit can be integrated with the following building systems to maximize potential synergies and optimize overall performance.

Building Envelope

Upgrading windows to enhance natural light penetration can reduce reliance on artificial lighting, contributing to energy savings and occupant comfort.

Building Controls and Automation Systems

Lighting Controls

In combination with BAS, advanced lighting controls can automatically adjust lights based on people, daylight, and schedules. This makes lighting more energy-efficient, cuts costs, and keeps people comfortable by optimizing lighting in real time.

Challenges and Solutions

Retrofitting the lighting system of your building can be challenging. Below are some common challenges you may face and how to solve them.

Challenge 1: Disruption to Occupants

Solution: Plan and coordinate work to minimize temporary downtime and shutdowns, thereby maintaining occupant comfort and safety.

Challenge 2: Regulatory Compliance

Solution: Consult with experts during the design phase to ensure compliance with energy codes and standards. These can influence lighting design choices and may require additional adjustments.

Challenge 3: System Complexity

Solution: Provide adequate training and support for building staff to operate and maintain complex lighting controls.

Challenge 4: Tenant Engagement

Solution: Ensure buy-in and maximize energy savings by engaging and educating occupants on the benefits and proper use of new lighting control systems.

Toronto's Climate Considerations

Due to Toronto's climate, there are a few things to consider before implementing lighting retrofit.

Daylighting Availability

Consider the shorter daylight hours during winter months and longer periods of cloud cover throughout the year. Implement daylighting controls that optimize natural light usage while maintaining adequate artificial lighting levels for different seasons.

Lighting System Durability

Ensure outdoor lighting systems are designed to withstand Toronto's cold winters, heat in summer, and varying humidity levels. Choose materials and fixtures that are resistant to corrosion, UV degradation, and temperature fluctuations.

Emergency Lighting

Ensure that emergency and exit lighting systems are adequately designed to function in extreme weather conditions, including potential power outages during storms. Incorporate backup power solutions to maintain lighting functionality when needed.

Ready!

You should now have a better idea of what **Lighting** is, its co-benefits and impacts, and how to implement it in your building given potential synergies and challenges!

Also check your building **Sector-Specific Retrofit Guide** for steps to achieve net zero and visit the other **Technology Companion Guides** to learn more about retrofit measures.

Other guides in the Advanced Controls Technology Companion Guides:

- Building Automation Systems
- Smart Homes and Appliances
- Sub-Metering

Other resources in the Net Zero Building Retrofit Guides:

- The Introductory Guide
- Sector-Specific Retrofit Guides
- Net Zero Retrofit Planning Tools

For more information, please refer to these other City of Toronto resources:

- Net Zero Existing Building Strategy
- Transform TO Net Zero Strategy
- Toronto Green Standard
- Better Buildings Partnership
- Better Homes: Green Resources for Residents
- Energy & Water Reporting for Buildings

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