Net Zero Building Retrofit Guides

Sub-Metering

Technology Companion Guide

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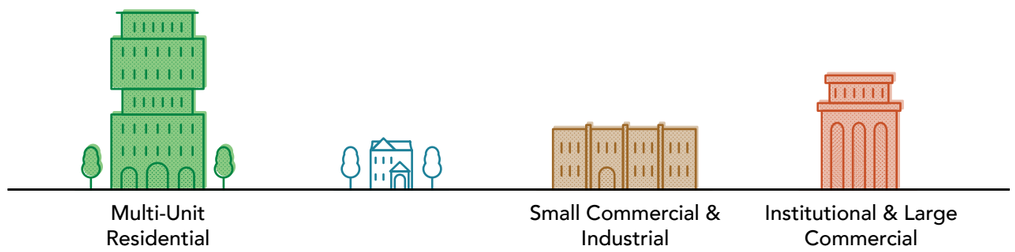

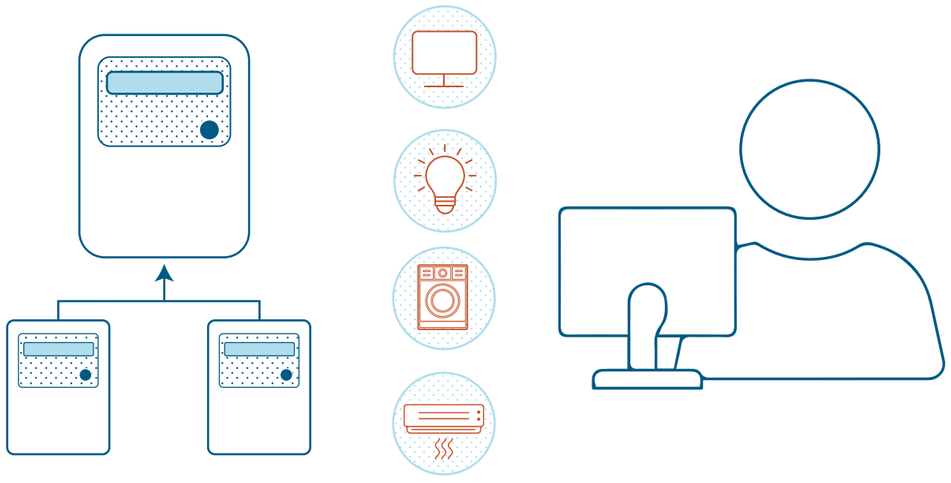

Co-benefits

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

Impacts

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

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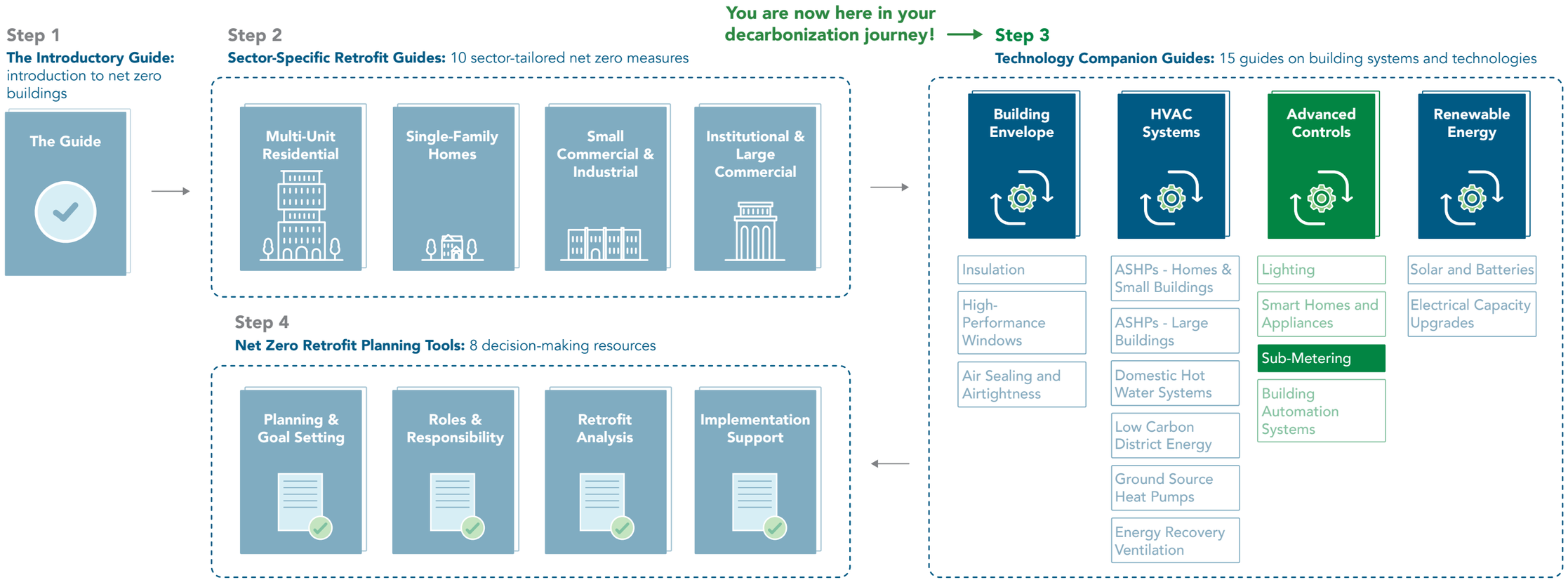
Navigating the Net Zero Building Retrofit Guides

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.

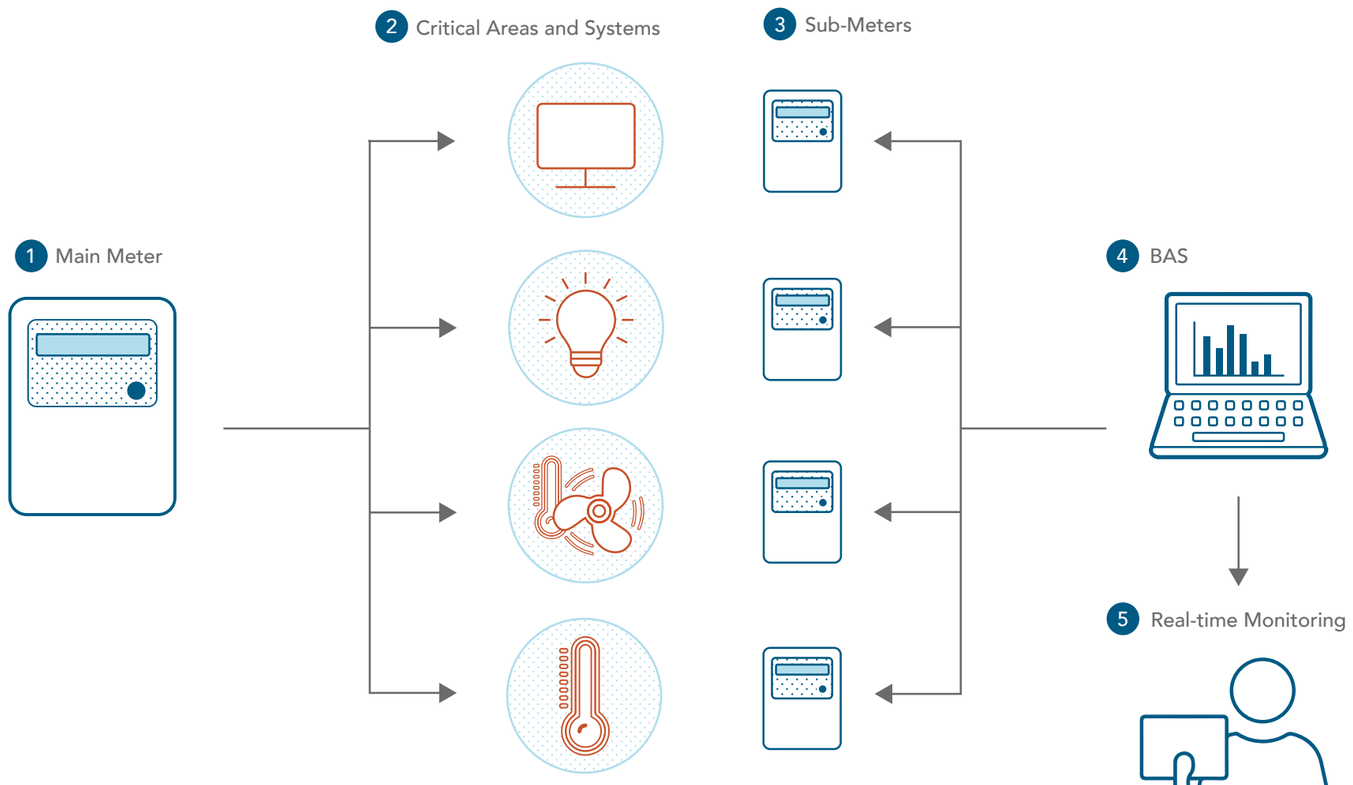


Net Zero Building Retrofit Guides Document Navigation

Sub-Metering

What Is This Technology

Sub-metering involves installing individual meters to measure and monitor energy consumption in a specific area or system within a building. This provides detailed energy consumption data, rather than just total consumption from the main meter. Sub-metering can be also applied to a multi-tenant building, where each unit is equipped with its own meter to track utility usage.



How Sub-Metering Works

To implement an effective sub-metering system and optimize energy management in a building, follow these steps:

1. A main meter provided by Toronto Hydro (electricity) or Enbridge Gas (gas) is installed to track overall energy consumption.
2. Identify critical areas and systems within the building to monitor energy use.
3. Select and install the appropriate meters for the identified critical areas or systems that require detailed monitoring.
4. Integrate sub-meters with the building's Building Automation Systems (BAS) for real-time monitoring, accessible via web browser or touchpad display.
5. Regularly review the data collected by the sub-meters to identify and act on energy-saving opportunities.

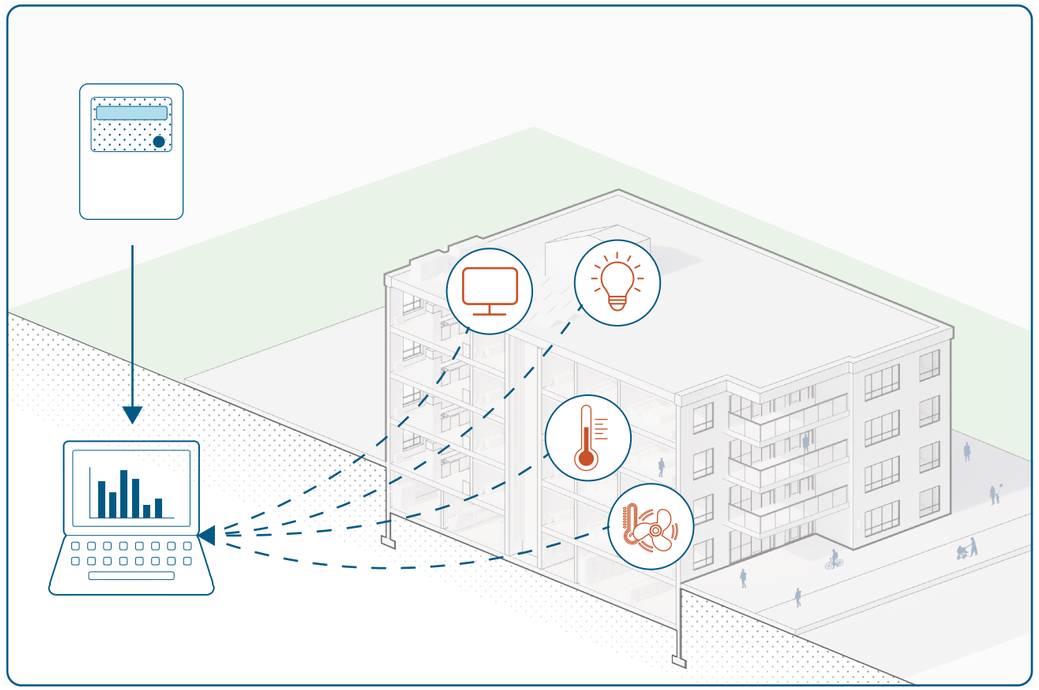
Retrofit technology explained

When to Retrofit This System

Sub-metering should ideally be planned and integrated during the design phase, as it helps to provide immediate feedback and guide energy-saving efforts. However, it can also be implemented as a standalone measure. Data from sub-metering is valuable for guiding other retrofit decisions and monitoring post-retrofit performance to verify savings. This retrofit should be considered by default when your related existing equipment reaches end of life.

Why Retrofit This System

Sub-metering is essential for achieving net zero buildings. It enhances energy management, supports data-driven decisions for retrofits, ensures compliance with regulations, and engages tenants by making them accountable for their energy use. 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:
Sub-metering provides real-time energy data, enabling quick responses to inefficiencies or system failures. This capability strengthens a building's ability to maintain critical operations during emergencies or disruptions.

Indoor Air Quality:
Sub-metering does not impact indoor air quality.

Occupant Comfort:
Sub-metering provides data to improve energy management, leading to better system performance and enhanced occupant comfort.

Property Value:
Buildings equipped with sub-metering are more attractive to buyers or tenants who value efficient use of energy. This can lead to higher property value and a competitive edge in the real estate market.

Impacts

Emissions Reduction:
Sub-metering helps to reduce energy waste, leading to lower GHG emissions.

Utility Savings:
By monitoring specific energy usages, sub-metering allows for targeted efficiency improvements, resulting in utility cost savings.

Capital Cost:
Installing sub-metering systems can require high upfront capital expenses, including equipment and installation costs.

Maintenance Requirements:
Sub-metering systems require regular calibration and maintenance to ensure accurate and reliable performance over time.

Types of Systems and Retrofit Solutions

Many existing buildings lack sub-metering systems entirely, resulting in no detailed data for energy and water consumption. Retrofit solutions can introduce sub-metering systems to improve accuracy, enable detailed monitoring, and enhance energy management.

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

Centralized Metering with Basic Analytics

A centralized metering system measures consumption of utilities at multiple points throughout the building. It only provides aggregated data that has basic analytics to monitor usage trends or verify billing accuracy.

Retrofit: Upgrade to advanced sub-meters with real-time data collection and enhanced analytics to monitor individual systems like HVAC and lighting. This enables more accurate tracking of energy usage and system performance.

Legacy Metering

Legacy meters refer to older, traditional meters that provide limited data accuracy and functionality.

Retrofit: Replace outdated legacy meters with modern digital sub-meters that offer real-time data, enhanced accuracy, and the ability to track specific systems or areas.

These meters can be integrated with energy management platforms for improved monitoring and control.

Single Main Meter

Some buildings may only have a single main meter, providing overall energy consumption data without distinguishing between specific areas or systems. Others may have a few basic sub-meters, offering limited insights into select areas or systems but lacking comprehensive coverage.

Retrofit: Install sub-meters to track specific systems and equipment, such as heating, cooling, ventilation units, lighting, elevators, and other major equipment like water pumps and boilers. This enables detailed monitoring of energy usage not just by zones but also by individual systems and critical equipment within the building.

Integrating sub-meters with an energy management system provides real-time data, allowing for better control and optimization of energy performance.

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 sub-metering retrofit:

1. Evaluate your existing metering infrastructure and identify if there are any areas or systems, like HVAC and lighting, that lack sub-metering.

2. Hire experts, like sub-metering specialists and contractors that are Electrical Safety Authority licensed, to design a system that meets your building's needs and goals. Select and install sub-meters to capture detailed energy usage data. Your experts will help you with the following steps.

    - Determine which areas or systems require detailed monitoring.
    - Select meters that are suitable for your goals and ensure they are compatible with your building's infrastructure.
    - Make sure that the new sub-meters are integrated with your BAS or energy management system.
    - Set up, configure, and test them for accurate data reporting and functionality.
    - Use the data to find energy consumption patterns, inefficiencies, and areas of improvement.

3. Maintain and calibrate sub-meters regularly. Update software and fix any issues to keep the system running smoothly.

What is the Difference Between Metering and Sub-Metering?

Metering refers to the main utility meter that is provided by the utility provider. Your electrical meter is supplied by Toronto Hydro and your natural gas meter is supplied by Enbridge Gas. These meters measure total energy consumption to be billed by the utility provider.

Sub-metering involves additional meters installed by the building owner within specific areas or systems to track detailed energy use. Sub-meters provide precise data of individual tenants or systems, allowing for better energy management and cost allocation.

Opportunities

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

HVAC Systems

Heating Systems

Sub-metering can identify inefficiencies and improve your HVAC and heating system performance by analyzing the detailed consumption data now available.

Domestic Hot Water

Sub-metering can monitor your hot water usage to identify opportunities to reduce your hot water usage.

Building Controls and Automation Systems

Lighting Controls

Lighting

In combination with a BAS, sub-metering enhances automation and controls. For example, the data can be used to refine your lighting schedule to better align with building occupancy, reducing energy waste.

Energy Generation

Energy Storage

Sub-metering tracks energy use across building systems and their interaction with energy solutions. It can monitor usage before and after solar integration or during peak demand. This helps optimize performance and identify energy savings opportunities.

Challenges and Solutions

Adding a sub-metering system to your building can be challenging. Below are some common challenges you may face and how to solve them.

Challenge 1: Compatibility with Existing Systems

Solution: Work with experienced professionals to ensure seamless integration with existing systems.

Challenge 2: Data Overload

Solution: Use data analytics tools and trained staff to manage and analyze the large volume of sub-metered data.

Challenge 3: Initial Costs

Solution: Consider long-term savings and potential financial incentives to help with this high level of investment.

Challenge 4: Operational Disruptions

Solution: Plan installation during off-hours or low-occupancy periods to avoid any building operation disruptions.

Toronto's Climate Considerations

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

Energy Use Patterns

Seasonal variations require data analysis and change management to adjust to seasonal energy demand.

Maintenance and Monitoring

Sub-meters must be strategically located to effectively monitor heating systems, as heating demands can vary in cold climates.

System Calibration

Annual calibration of sub-meters is essential to ensure accurate measurement of energy consumption. This prevents potential inaccuracies in readings caused by temperature extremes, supporting effective energy management and optimization.

Ready!

You should now have a better idea of what **Sub-Metering** 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
- Lighting
- Smart Homes and Appliances

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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