



# University of Windsor Carbon Neutrality Plan

*November 2023*



University of Windsor

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1 Project overview, objectives and methodology



# Project Overview

In September 2022, University of Windsor (UWindsor) administration hired Stantec to establish the first-ever campus carbon neutral plan.

The project was steered by a cross functional group of campus community members and other stakeholders (*Appendix A*).

Senior leadership established four core project objectives:

1. To increase the University's familiarity with its building's energy use and greenhouse gas (GHG) emissions
2. To determine what the University's net zero carbon emission targets should be
3. To establish a high-level roadmap for ways that the University can achieve such targets, recognizing that the path forward is likely to change over time
4. To determine some short-term (next five years) priorities for investment

The project is now complete. This report serves as a final report to the Resource Allocation Committee and the Board of Governors on the recommendations and findings.

Once accepted, the report will be issued to the campus community, and implementation will begin.





# Alignment with Aspire: Together for Tomorrow

The *Aspire: Together for Tomorrow* strategic plan establishes the importance of environmental sustainability very clearly, including within the institution's **values**:

## **Environmental Sustainability**

We are committed to working with on- and off- campus communities to ensure that climate action and environmental sustainability are integral to decision making. We are on a journey to greater sustainability through innovation, reciprocal partnership, collaborative action, and shared learning and knowledge.

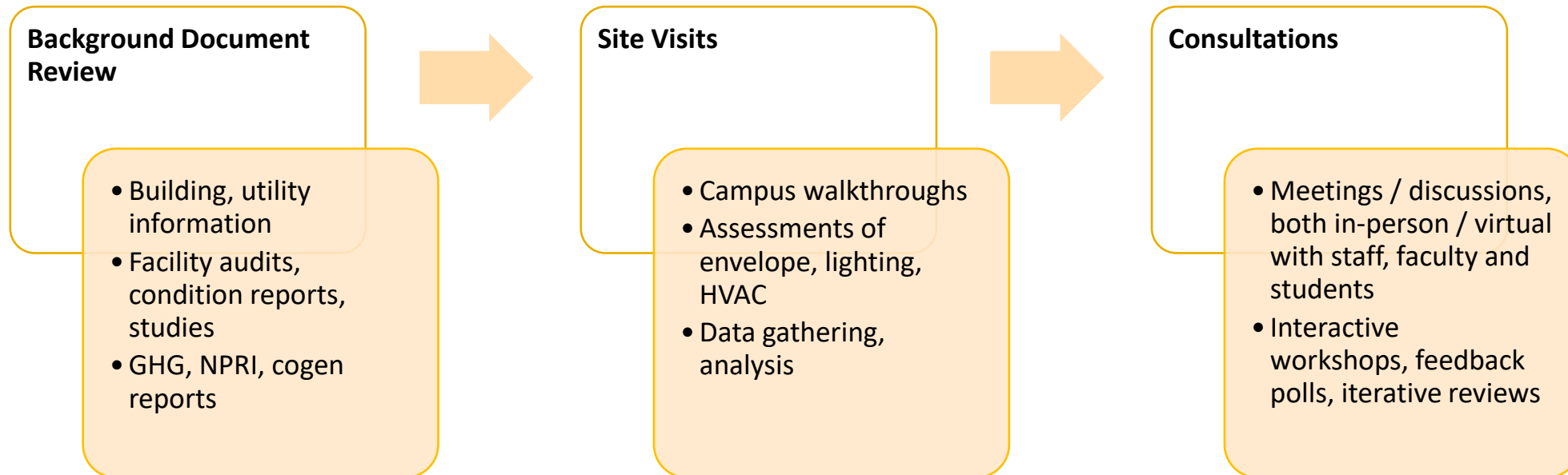
*Aspire* further articulates environmental sustainability as a critical strategic priority through objective **Fostering an engaged, healthy, safe and sustainable campus.**

The preparation of a **cascading sustainability strategic framework** has also been called for as part of *Aspire*. The net zero campus master plan's goals for carbon neutrality, as well as the campus's commitment to meaningful impact against the United Nations Sustainable Development Goals, are central to the framework. The framework will be published in 2024.



# Project Methodology

To initiate this process, UWindsor provided Stantec with extensive background documentation to assist with efforts to prepare for this study. The study was then complimented through a series of site visits and consultations where the consultant team was able to see the campus in detail and engage with stakeholders to obtain critical feedback to support execution of the study.



# Project Outcomes



Through completion of this study process, UWindsor now has a formalized Carbon Neutrality Plan to leverage for future use.

However, while conclusions and recommendations from this study provide potential pathways for achieving carbon neutrality, much uncertainty remains regarding future emissions and decarbonization strategies.

For this reason, the Plan is intended to be an **organic document**, with flexibility to consider future technologies, asset portfolio updates, along with government regulations and funding.

Work completed during the study will also support annual energy and greenhouse gas emission reporting processes to the Ministry.



## 2 Current state analysis



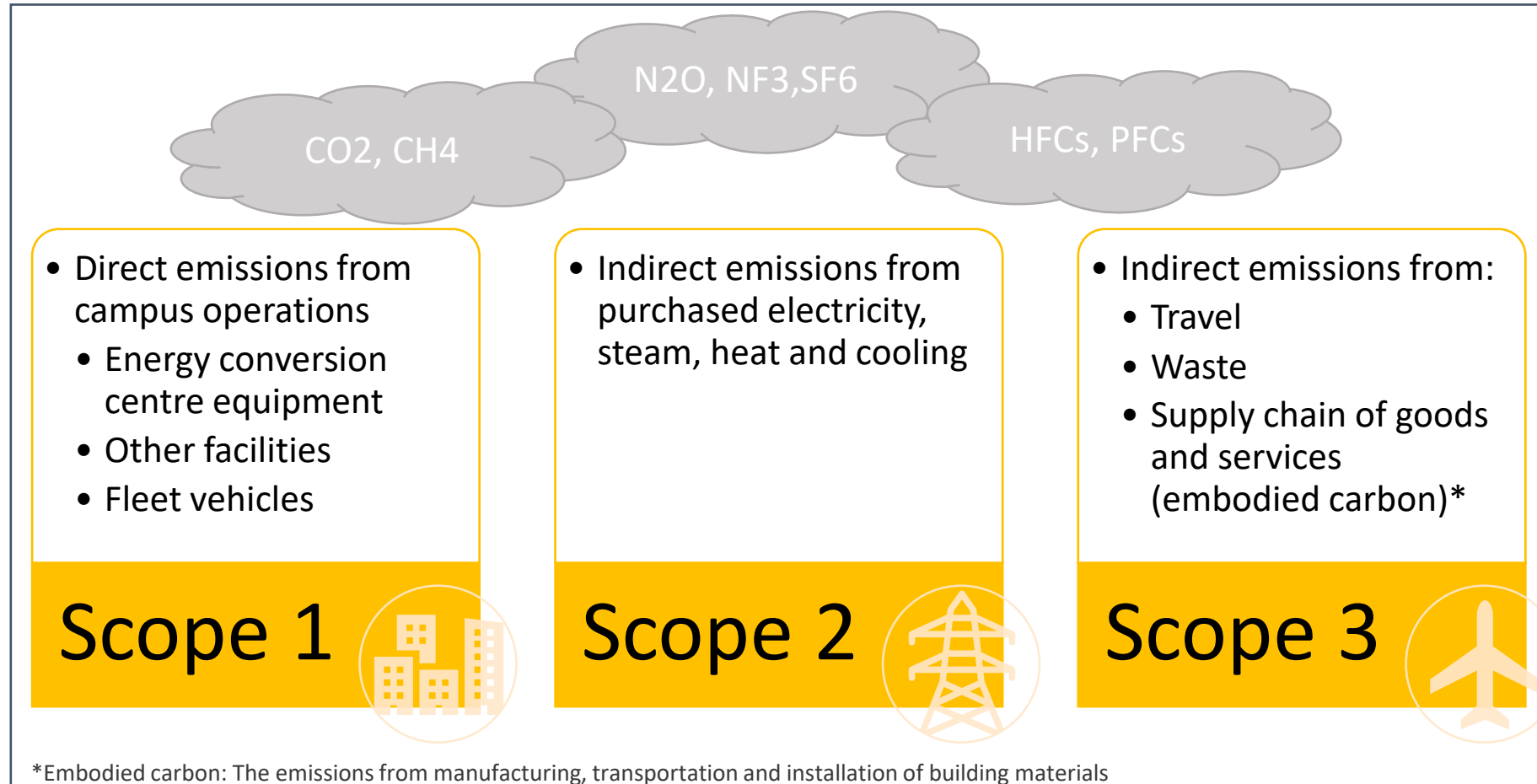


# Understanding GHG Emission Scopes

Before planning for a reduction in carbon footprint, an understanding of greenhouse gas emissions and how they are produced is necessary.

Currently, the University is measuring only Scope 1 and 2 emissions; Scope 3 emissions are much more difficult to measure. Administration will develop a plan to measure Scope 3 as part of the strategy.

## Visual Representation of Scope One, Two and Three Emissions



# UWindsor Energy Systems Overview

The University has a Central Refrigeration Plant (CRP) that is used during summer months to provide majority of cooling needs on campus.

The University also utilizes its Energy Conversion Centre (ECC) and extensive campus infrastructure to intake and process energy sources to produce and distribute electricity and steam (primarily for heat and hot water) to the campus.



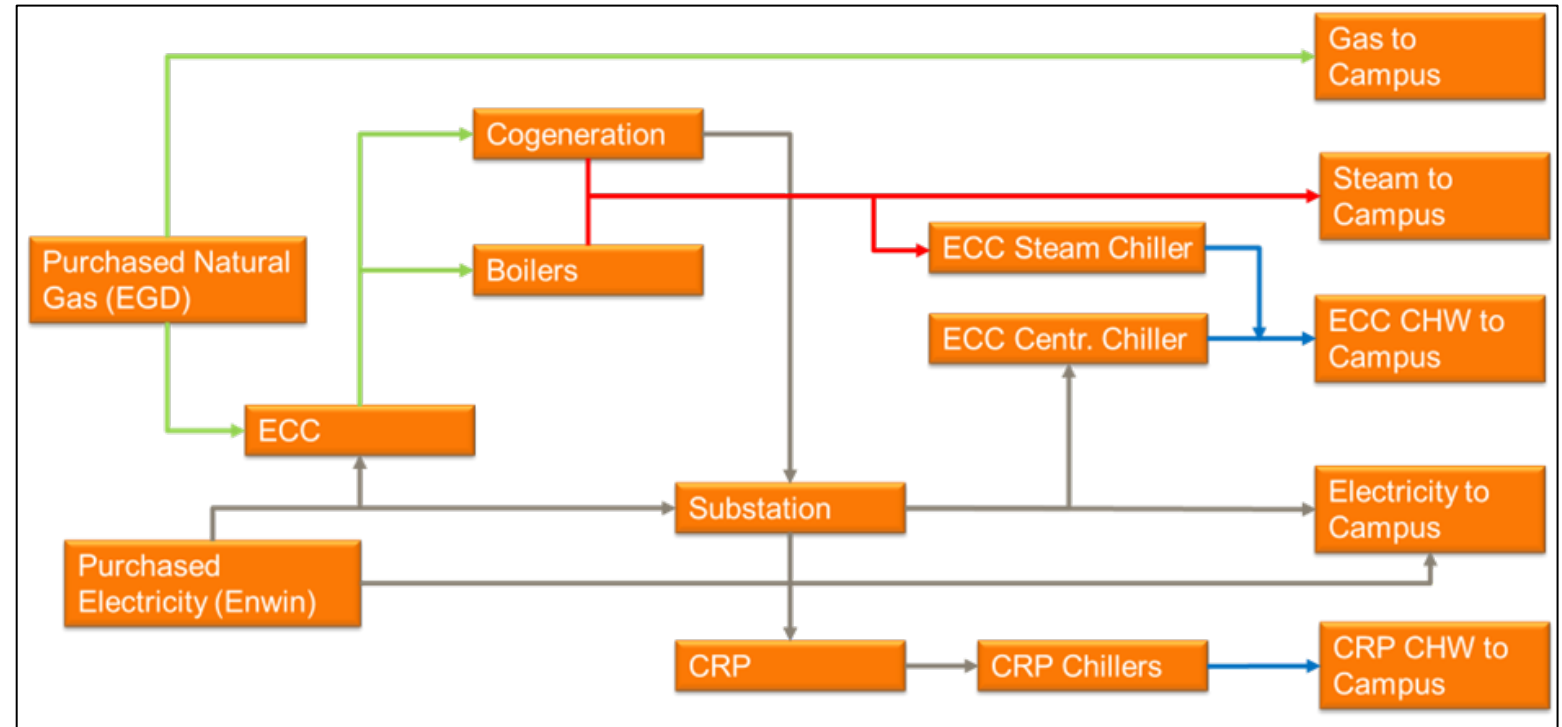
# UWindsor Energy Systems Overview

Within the ECC, several operations provide services to campus:

- The cogeneration system (turbine) produces 4MW of power
- The chillers produce 4,800 tons of refrigeration
- The boilers generate over 200,000 lbs/hr of steam
- A 100 bp main air compressor supplies compressed air for main campus building systems and laboratory use.

In all, the ECC provides approximately 40% of the total campus energy needs, while balance is purchased from traditional carriers (Enwin).

**UWindsor Main campus: Energy Flow**



# Current State – Campus Energy Use Summary

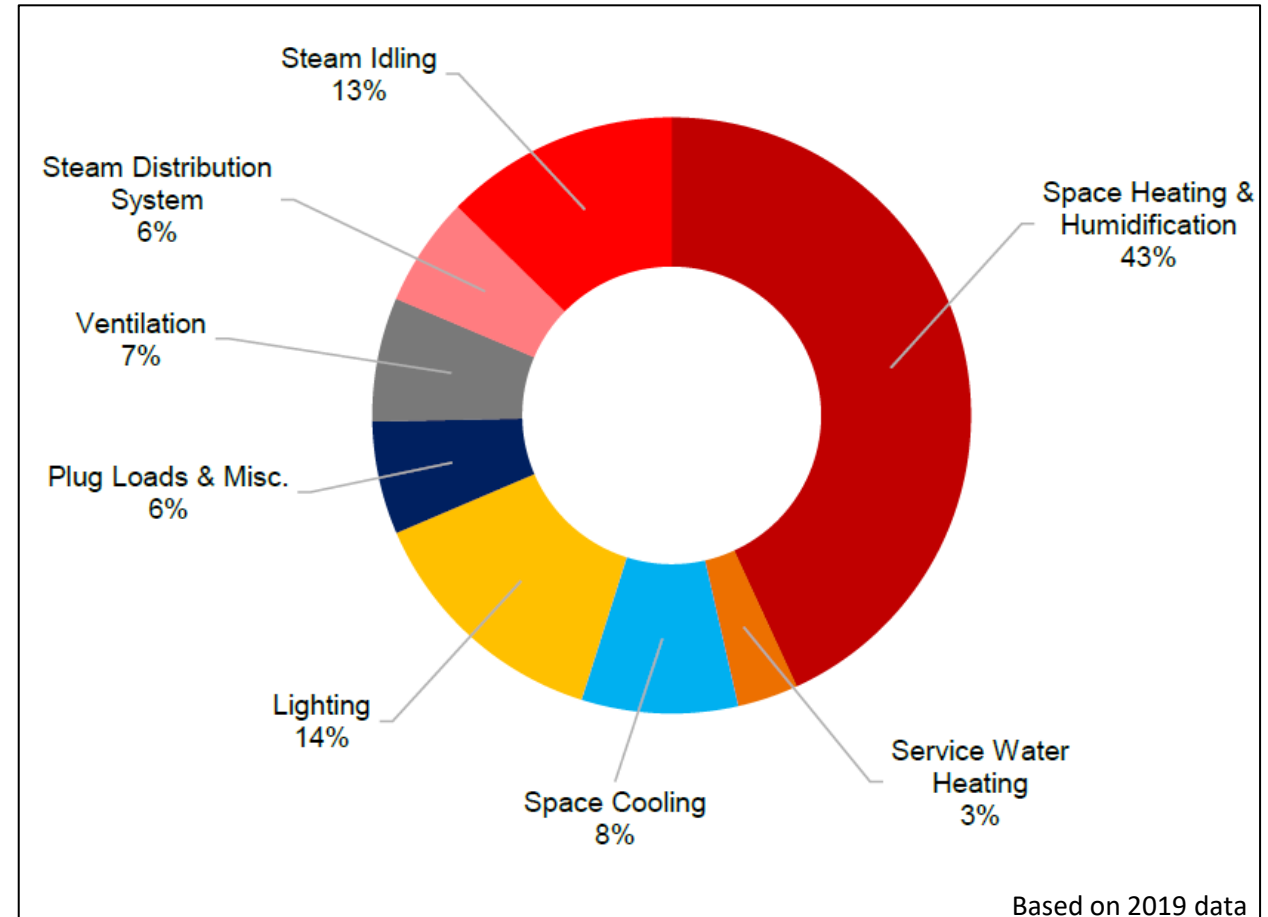
The Stantec study analyzed how energy generated by the ECC or purchased from the Ontario grid is used across campus

This is different than the ways by which greenhouse gases are generated because certain uses of energy are more efficient

Unsurprisingly, space heating and humidification are largest contributors to energy use on campus

Steam idling (boiler inefficiency) and the related steam distribution systems and lighting are also notable contributors

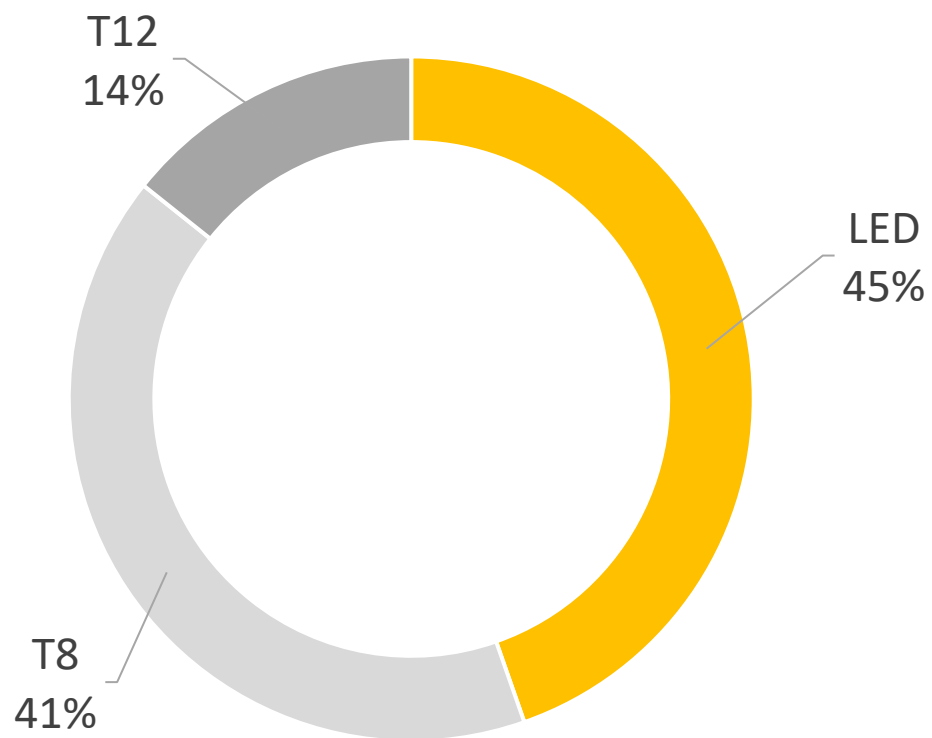
## How is energy used on campus?





# Current State – Lighting Types Across Campus

## Survey of current lighting types on campus



Lighting, while a heavy energy user (14%), produces only a small share of campus carbon emissions.

Currently only ~45% of campus buildings have been retrofitted with LED lighting.

Lighting projects are still an important component of any carbon neutral plan given that more efficient lighting will reduce the reliance on the grid.

- They also have a very good financial payback, creating utility budget savings that can be deployed for reinvestment into other energy efficiency projects.

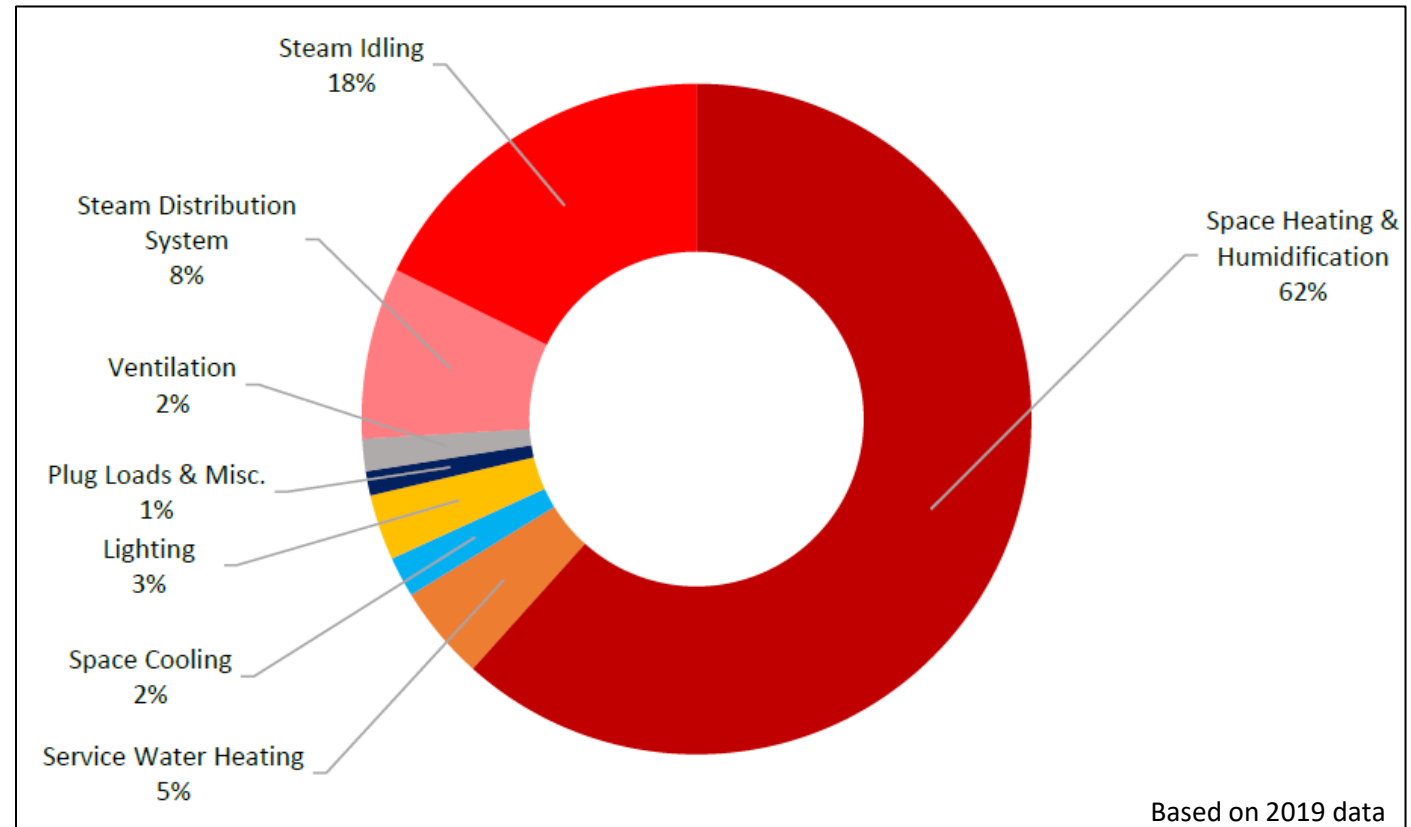
Lighting projects also have the added benefit of improving the student experience and increasing the physical safety on campus.

*Note: T8 and T12 are older generation, more inefficient fluorescent bulb lighting*

# Current State – Campus GHG Emissions Summary

- Depending how energy is created and used impacts the net carbon emissions that are generated:
  - The majority (88%) of emissions come from steam systems and heating
- Given the implementation of the new hybrid chiller, changes in the ECC's operating plan have been undertaken to only run the cogeneration equipment for electrical grid "peak demand" and as backup power
  - This operating change will significantly reduce amount of steam being used on campus

## How are greenhouse gases generated on campus?



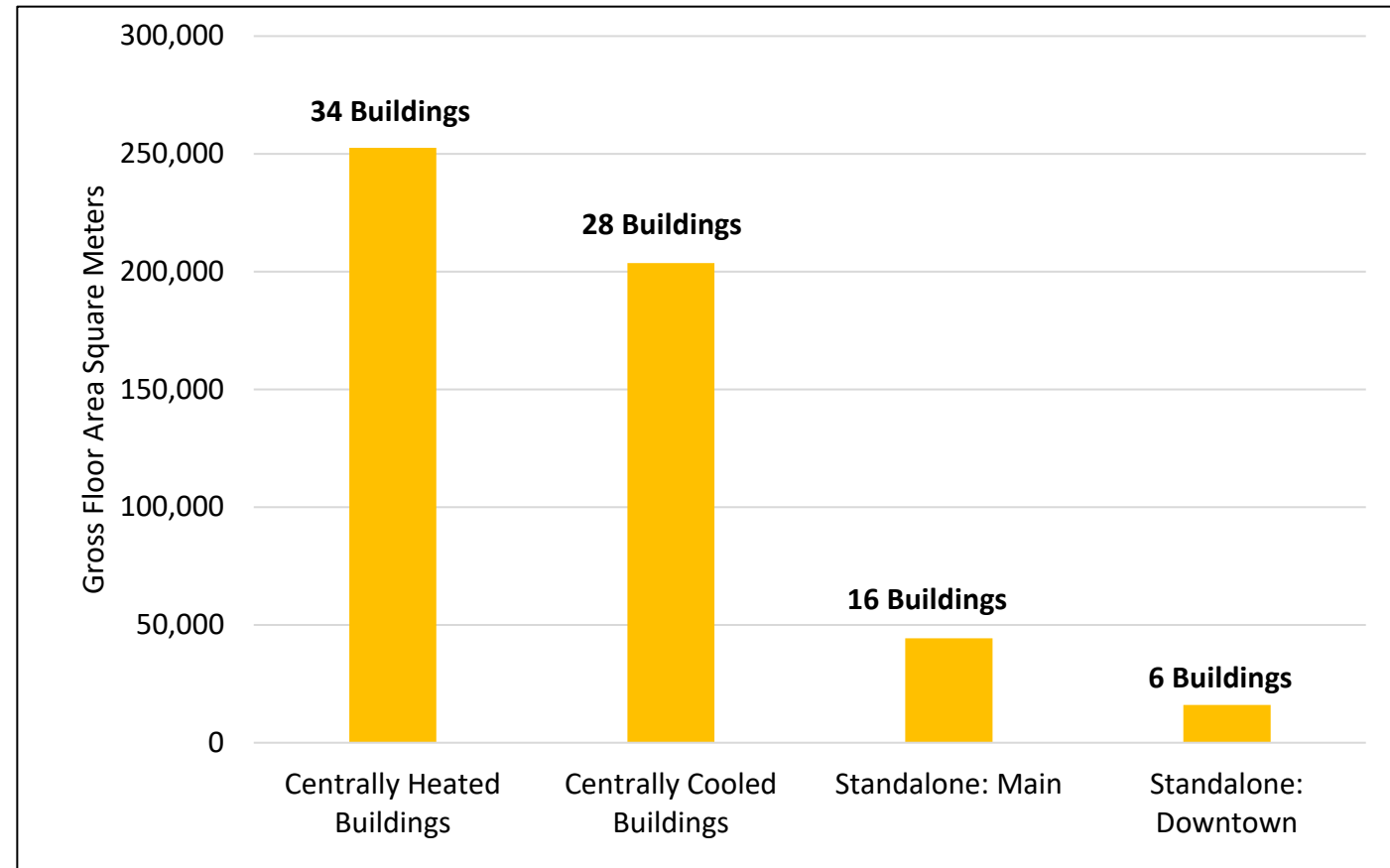
# Campus Buildings, by Plant Connection – Central vs Standalone

The Energy Conversion Centre (ECC) is the heart of the University's heating and cooling systems. Significant investments in this facility are especially powerful in terms of value for money, as efficiencies impact a significant volume of campus buildings.

As part of the implementation plan, the University will closely review the buildings on the main campus that are not connected to the ECC (16) at all or are connected only for heating (6). These buildings may be targeted either for decommissioning, tie-in to the central system, or onsite renewable energy projects.

The implementation plan will also consider the electrification of the standalone buildings which cannot be connected to the ECC (through use of heat pumps as an example).

**Summary of gross floor area square meters by plant connections**



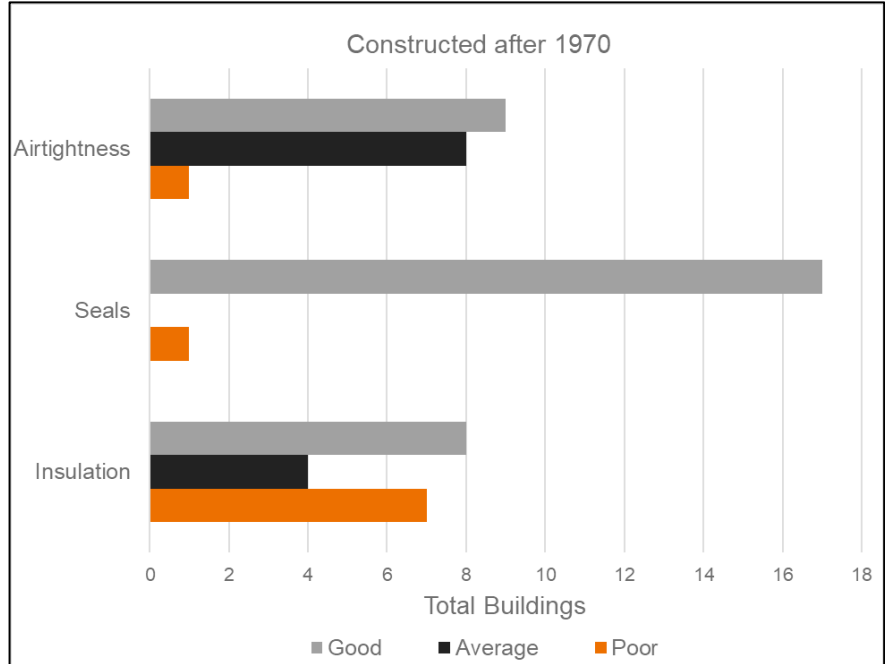
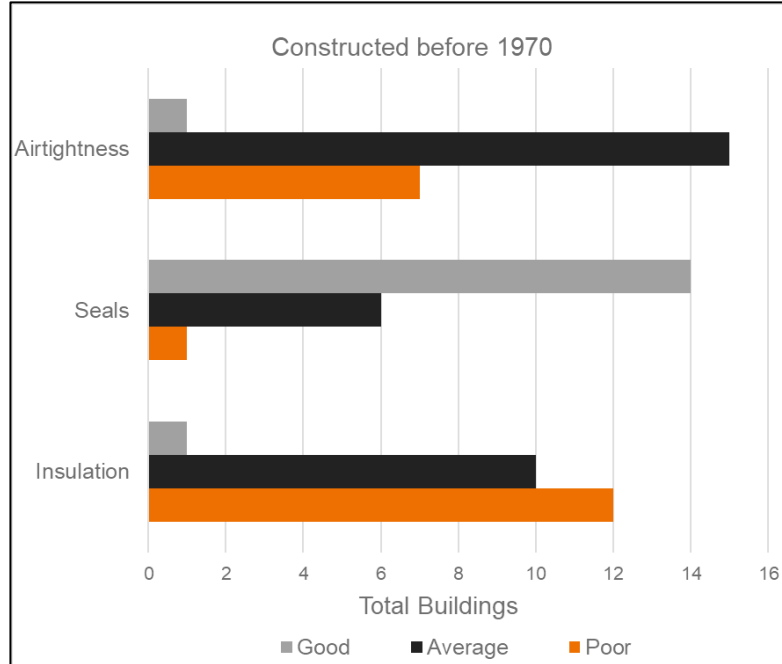
# Building Envelope Condition: Pre & Post 1970

The efficiency of the building envelope (including its airtightness, seals, and insulation) drives energy conservation.

The campus has buildings of various vintages, but it is particularly notable that even some of the more modern construction (after 1970) do not have efficient envelopes.

In case of older buildings, it is the CAW Student Centre with 'good' airtightness and insulation, likely upgraded as part of renovations in the 1990's.

**Building Envelope Condition (Good, Average or Poor)**



*Note: not all buildings are included as some could not be assessed by Stantec.*

**Newer construction buildings rated "poor" in insulation envelope category: Odette School of Business & Alumni Hall**



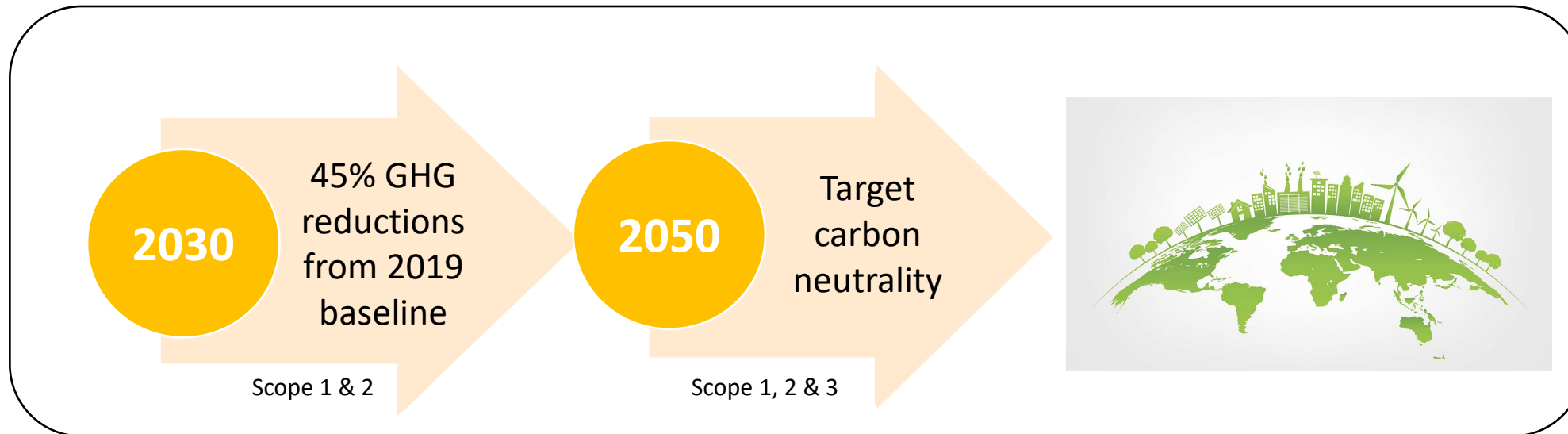


3 Setting targets and establishing the campus roadmap



# Roadmap to Carbon Neutrality

Based on the report, administration is recommending to the Board of Governors that the University establish its net zero emissions targets as follows:



*Note: The University has scoped in all owned and operated properties of the University as well as its related parties, including those properties where the University of Windsor is the lessor. Buildings and spaces within properties leased to an arms length third party, or operated by an arms length third party are out of scope.*



# Carbon Neutrality - A Phased Approach

Given project scale, a phased approach to achieve 2030 and 2050 targets is planned

Project plan will involve three primary activities including:

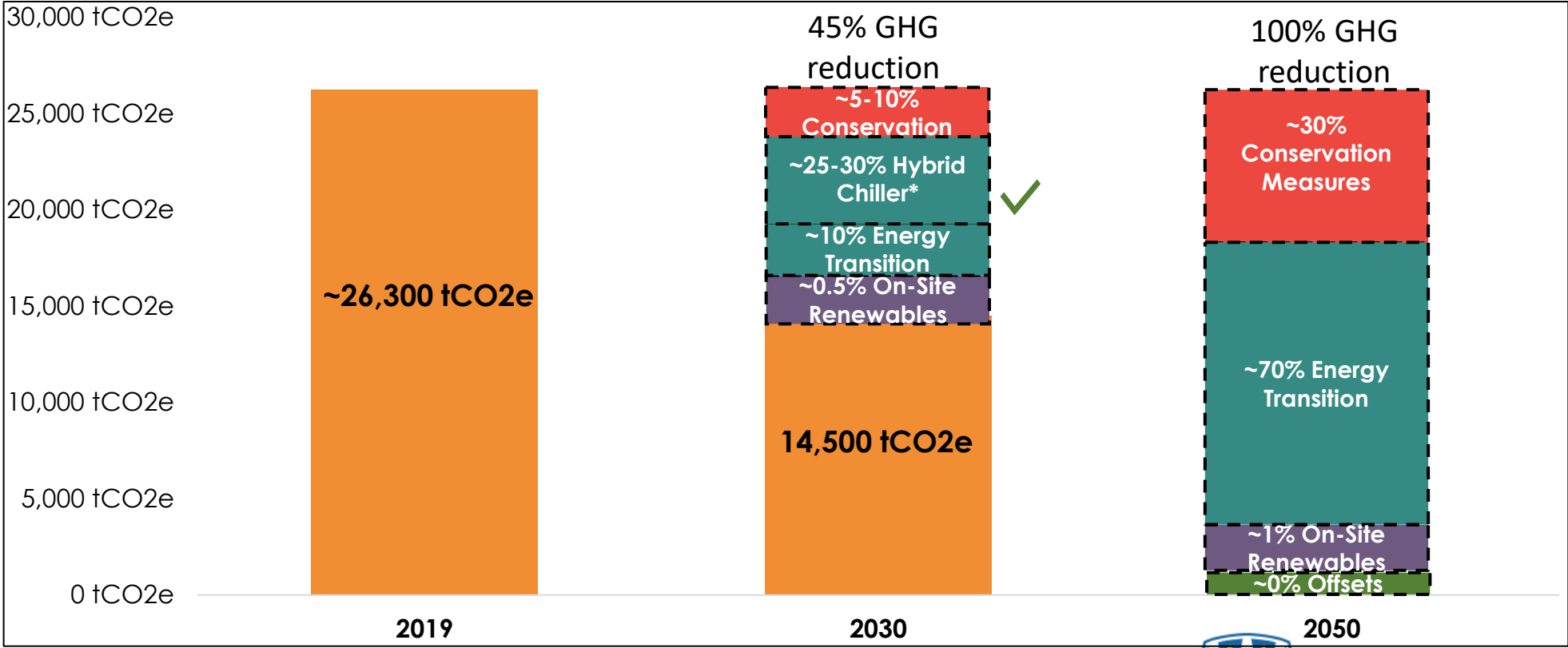
- Conservation
  - Renewal of infrastructure through recommissioning, upgrades to envelopes / HVAC
- Energy Transition
  - Transition to low carbon DES with renewable energy sources
- Renewable Generation
  - On-site renewable energy sources including solar PV/thermal and other means



# Recommended Pathway to Achieve Carbon Neutrality

Administration has recommended the following mix of strategies (conservation; energy transition and renewables) as the framework for reduction in emissions to achieve targets:

**UWindsor Pathway to Neutrality**



*Note: Sustainable Hybrid Chiller installed Fall 2023 ✓*





# Strategies to Achieve 2030 Target

While significant progress has been made towards the 2030 target, significant work is still required in the years ahead. Within the 2023/24 capital budget, the University has made commitments to some early priorities identified in partnership with Stantec (highlighted in bold below).

## *Emission reduction strategies, categorized with examples*

### Conservation

- Renew and improve aging infrastructure by **expanding building automation systems and metering**
- **Recommissioning**
- Improve building envelopes
- Upgrade HVAC and **optimize controls**



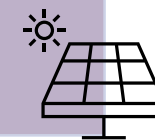
### Low Carbon Energy Transition

- **Optimize co-generation operations with recently installed hybrid chiller**
- Transitioning to a low carbon district energy system with a renewable energy supply such as ground source heat pumps



### Renewable Energy

- On site renewables can include:
  - **Solar PV**
  - Solar Thermal
  - Biodigesters



*Note: 2030 target includes Scope 1 and 2 emissions only*



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# Initiatives to Achieve 2030 Target

Specific initiatives within the 2023/24 facilities project plan include:

- Conservation

- Upgrades to HVAC (Leddy, Alumni Hall), controls (Essex), lighting (Memorial, Education & Leddy parking lots)
- Space review and optimization (including demolition)

- Energy Transition

- Hybrid chiller optimization
- ECC operational updates (Cogeneration equipment), review of boilers

- Renewable Generation

- Solar PV (CEI) and solar thermal studies



*Note: 2030 target includes Scope 1 and 2 emissions only*

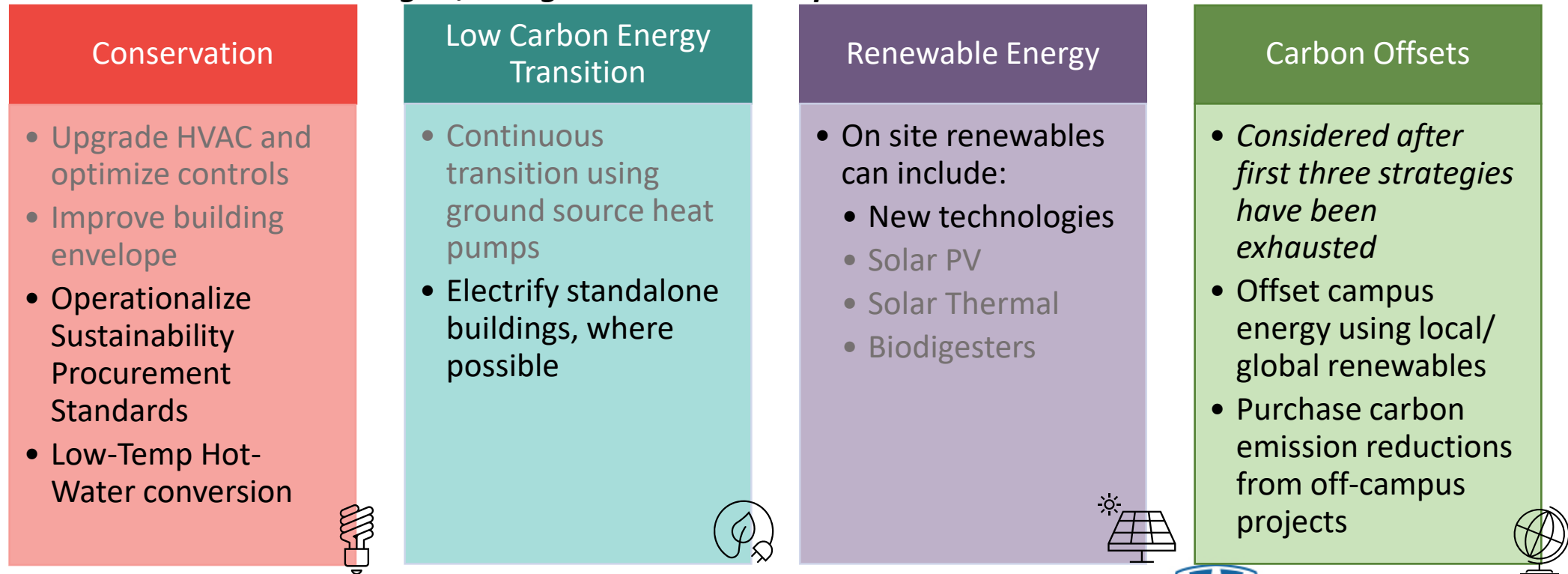


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# Strategies to Achieve 2050 Target

Through completion of the study, several other potential projects, initiatives and technologies have been identified for possible consideration including those highlighted below. The most significant challenge to achieve the 2050 target will likely come with inclusion of Scope 3 emissions that come from commuting, business travel, waste, etc.

## *Emission reduction strategies, categorized with examples*



Note: 2050 target includes Scope 1, 2 and 3 emissions.



4 Financial planning and possible future project spotlights



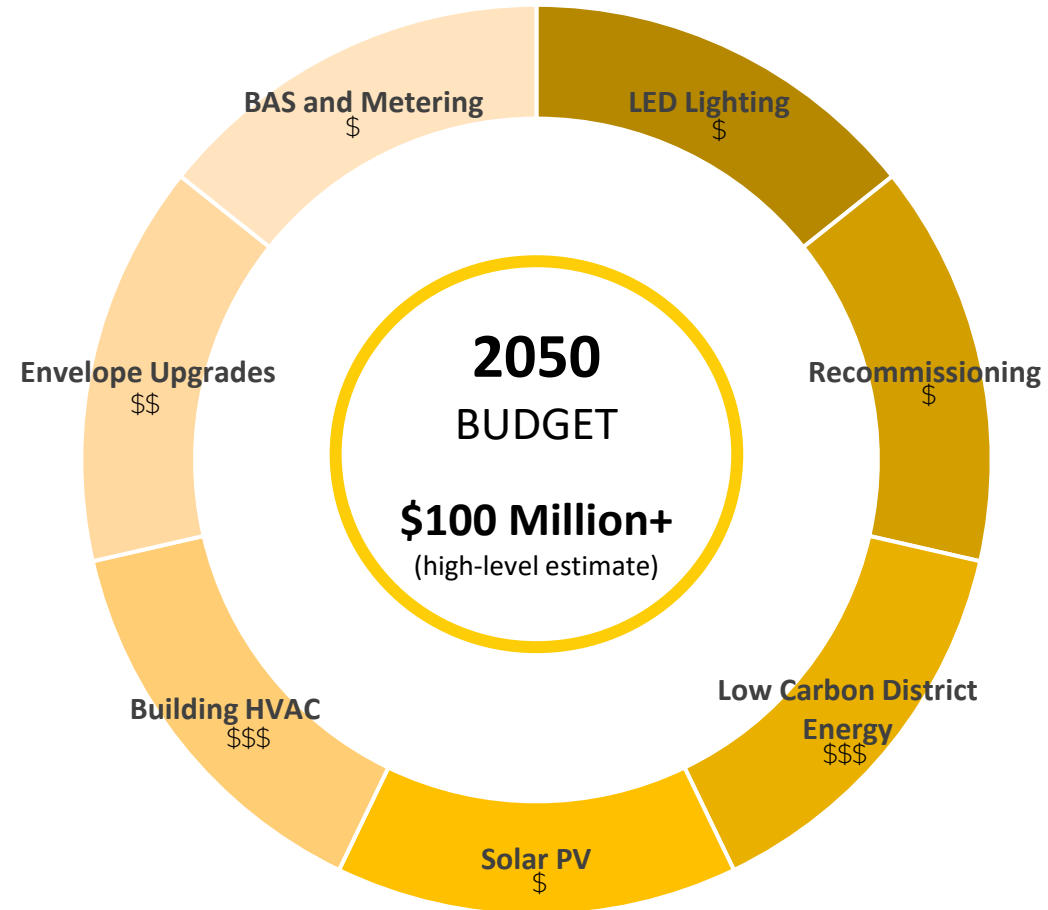
# Expected Level of Investment

Estimating the necessary investment needed for a goal beyond 25 years is challenging due to uncertainties in energy prices, emerging technology, and the broader campus plan.

It is evident that the investment required will be substantial and beyond the reach of current funding sources and operating budgets.

Strategic partnerships, government grant-based funding, external investments and programs, renewables, offsets, space optimization, and innovative approaches will be explored.

*Innovative investment strategies will be required for plan execution*



Note: \$ depicts estimated level of investments (\$ - low, \$\$- medium, \$\$\$ high)





# Financial Planning: Financial ROI & Emission Reduction ROI

Key to determining which projects should proceed in which order is evaluating both the financial ROI (typically, the capital cost divided by either costs avoided, or revenues generated) and the environmental ROI of the capital project. One way to assess the environmental ROI is to calculate capital costs divided by the annual savings in emissions expected.

We would expect in some cases that the ROI's would conflict (solar PV and lighting being key examples).

**Financial and Emission Based ROI Calculations: Sample**

	Operating Budget Efficiency		Environmental Efficiency	Return on Investment	
	Electricity	Gas		Financial*	Emission Reduction**
Solar PV	Green	NA	Yellow	Green	Orange
Building Envelope retrofits	Orange	Yellow	Green	Orange	Orange
Standalone building electrification	Orange	Green	Green	Green	Green

Green – High impact or quick payback  
 Yellow – moderately efficient  
 Orange – low/negative impact or slow payback

\*calculated as capital cost divided by per year savings in electricity or gas purchases  
 \*\*calculated as capital cost divided by per year savings in GHG emissions (tCO2e)

As part of the implementation plan, administration will develop key financial and non-financial indicators to measure the 'return on investment' of significant net zero aligned projects for regular review by the Board.



# Longer Term Capital Planning

For the University to be successful in achieving its neutrality goal, projects will need to be proposed that address capital programming needs, deferred maintenance as well as carbon neutrality. UWindsor can no longer run its master capital plan and its long-range capital plan in isolation from the neutrality plan. This will also allow us to leverage funding to achieve maximum impact. As an example, a significant donation to the Library could be mobilized to refurbish a student study area, and could include lights, window replacement and a controls upgrade along with new furniture for students.

Maximizing the impact of dollars spent outside of the ECC will come from projects targeting buildings with high emissions. A few high-profile examples are provided below:

Building	% of campus square meters	% of campus emissions*	Poor Insulation	Poor Airtightness	Poor Seals	No or few LED lights
Essex Hall	7%	11%	X	X	X	X
Leddy Library	4%	4%	X	X	X	
Assumption Hall	1%	1%	X	X		X
Leddy Library West	2%	1%	X	X		

\*based on 2019 data; in some cases, this may be a 'best estimate' depending on metering infrastructure at the time of the study



# Building Profile “Case Study”: Essex Hall

Essex Hall remains a heavy utilized UWindsor facility and home to the Faculty of Science, University Players (School of Dramatic Art), Chemical Control Centre and other departments. Essex was originally built in the 1960's, but has been extended a number of times, most recently in 2018 through the Essex CORE facility.

Essex Hall is the single largest carbon emitter on campus, largely because of the building's condition and the mechanical equipment, but also because of the labs (and related equipment such as hood vents).

Several challenges currently are faced within this building impacting both emissions and the student experience including:

- Poor envelope conditions
- No / Minimal LEDs
- Past end of useful life air handling equipment (60 years) and controls

These challenges create an unstable environment for building occupants, students and visitors. A space study is currently underway to determine the utilization of the building and the pathway forward.



## 5 Accountability



# Accountability Framework

As part of project, the UWindsor team is developing an accountability framework that will help to govern Plan activities including:

## Governance

- Establishment of a framework that includes a Sustainability Committee and Working Groups (Academic, Financial, Environmental)

## Aspire Strategic Plan

- Development of an Environmental Sustainability Cascading Framework to support Aspire

## Sustainability Annual Report

- Updates on performance metrics and key actions undertaken in pursuit of objectives

## Capital Planning

- Integration of Carbon Neutrality Plan with Facility Services Long Range Capital Plan

## Reporting

- Preparation of systems to support compliance for required reporting





# Acknowledgements

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