

CLIMATE POSITIVE

**UNIVERSITY OF TORONTO
MISSISSAUGA**

**CLIMATE CHANGE
MITIGATION STRATEGY
2023**



LAND ACKNOWLEDGEMENT

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years it has been the traditional land of the Huron-Wendat, the Seneca, and the Mississaugas of the Credit. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.



“Climate change remains one of the world’s greatest challenges, and the University of Toronto community—our brilliant students and alumni, faculty and staff—are working hard to meet that challenge.”



Meric Gertler
President, University of Toronto

VISION

As a world class institution, the University of Toronto Mississauga has a responsibility to take decisive, bold action against climate change as it is one of the most pressing challenges of this generation. We are committed to reducing greenhouse gases beyond net zero, creating a net positive benefit to the environment.

This plan describes how we will achieve this goal by 2050, focusing on how we produce, distribute, and consume energy on campus. By transitioning key infrastructure, we will build sustainably, while managing campus growth.



MESSAGE FROM THE PRINCIPAL

Rising oceans and biodiversity loss. Spiking temperatures and more frequent droughts. Increasingly severe wildfires, floods, and storms. The evidence is overwhelming: climate change is one of the grand challenges of our lifetime; and time isn't on our side. But we have the power to act now.

So, I am delighted to introduce the next bold step in the University of Toronto Mississauga's (UTM's) work towards a sustainable future: our Climate Positive Plan. It outlines our strategy to reduce campus carbon emissions to net zero—and beyond. It shows our path over the next three decades to capture more carbon than we emit and to model the kind of environmental leadership our world needs to flourish.

UTM is on the right path already. We have met—and are on track to exceed—standards set in 2019 by the University of Toronto (U of T) tri-campus Low Carbon Action Plan (LCAP). Our community has done it by developing efficient LEED-certified buildings, accelerating our transition to renewable energy, and realizing our sustainability goals. We have strengthened this work through outstanding programs in research and teaching, which continue to extend the power of sustainability learning from our campus into the wider world.

This work matters deeply, especially since UTM has the privilege to welcome more young people to campus every year. UTM has a responsibility to these and all future generations: to help create a world better than we found it. I look forward to achieving this goal together and to opening a path to go beyond net zero. It's the right and good thing to do—for our lifetime and for lives to come.

Sincere thanks to the teams that led this Plan's development and to the entire community that will put its work in practice.

Alexandra Gillespie
Vice-President and Principal
University of Toronto Mississauga

ACHIEVING CLIMATE POSITIVE

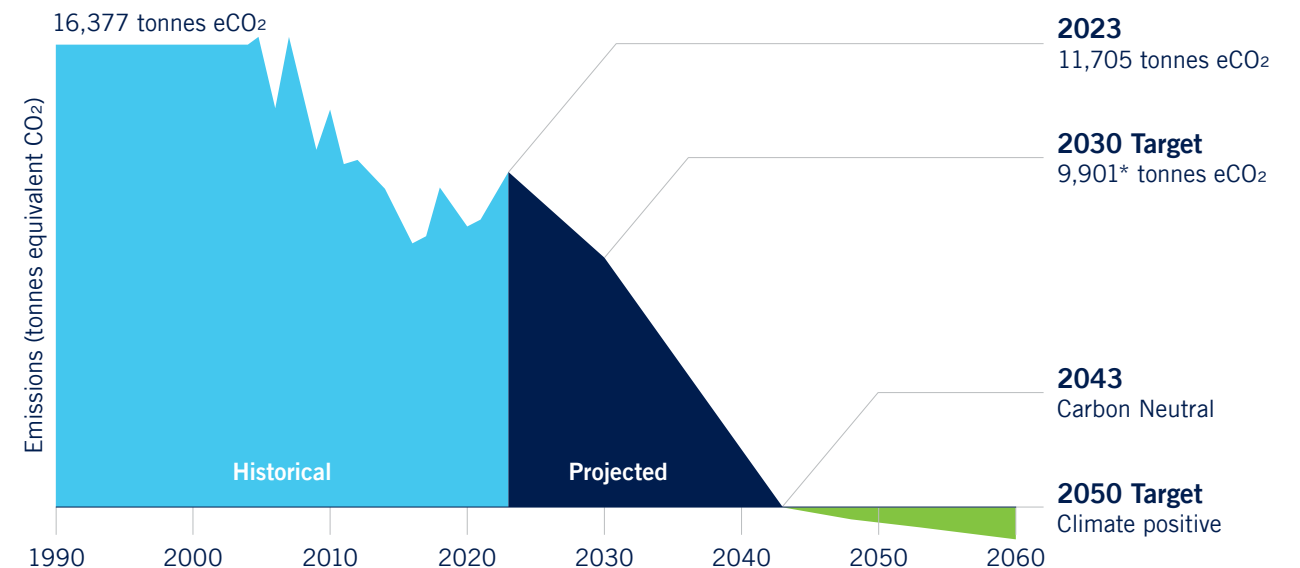
In 2018, U of T joined the University Climate Change Coalition (UC3), a group of leading North American research institutions dedicated to accelerating the reduction of greenhouse gas (GHG) emissions. As part of the coalition, and under a 2015 agreement with the Province of Ontario, the tri-campus LCAP (2019-2024) was created, with a goal to reduce GHG emissions by 37 per cent from 1990 levels by the year 2030.

In 2021, U of T's St. George campus released a Climate Positive Campus Plan which commits to

reducing more greenhouse gas emissions than it emits, creating a net emissions benefit.

Similarly, this Plan supersedes the LCAP, reducing emissions by 39 per cent by 2030, and achieving climate positive by 2050. We worked diligently to develop strategies that holistically considers and responds to our campus growth and sustainability ambitions. On that basis, UTM's Strategy outlines the transformational infrastructure change in the way we consume, distribute, and produce electricity.

Figure 1
2050 Climate Positive Target, Mississauga Campus



*Please note that the 9,901 value has been updated from a previous version to precisely represent the 39% reduction target.

MESSAGE FROM THE MANAGING DIRECTOR



UTM, and U of T as a whole, has a long-standing commitment to operational sustainability, and reducing greenhouse gas (GHG) emissions. Founded in 1967, UTM has significantly expanded to accommodate for the increase in students, resulting in more buildings, energy use, and GHG emissions.

During that time, UTM created its first ever Sustainability Strategic Plan, Central Utilities Master Plan, and completed a series of robust campus energy audits. From this strategic planning, and critical analysis of the campus, UTM has a clear path forward to reduce emissions and achieve our ambitious climate goals.

From a local context, one of the most significant milestones in Ontario was the phasing out of coal plants in 2014, which made Ontario's electricity grid much cleaner, helping all organizations consume electricity more sustainably.

Additionally, the City of Mississauga declared a climate emergency in 2019, and subsequently released the Climate Change Action Plan, committing to reduce GHG emissions by 80 per cent by 2050.

I'm proud of UTM for the many key milestones that have been achieved over the last decade. However, as the climate crisis continues to devastate communities and the planet, as a world-renowned university, we had to reflect and evolve our targets to step up and meet the challenge ahead. I'm confident that with continued leadership support, this Plan will be a great success, and will provide leadership to other higher education institutions as well.

Ahmed Azhari
Managing Director
Operations, Sustainability and Asset Management

**UTM'S
KEY
MILESTONES**



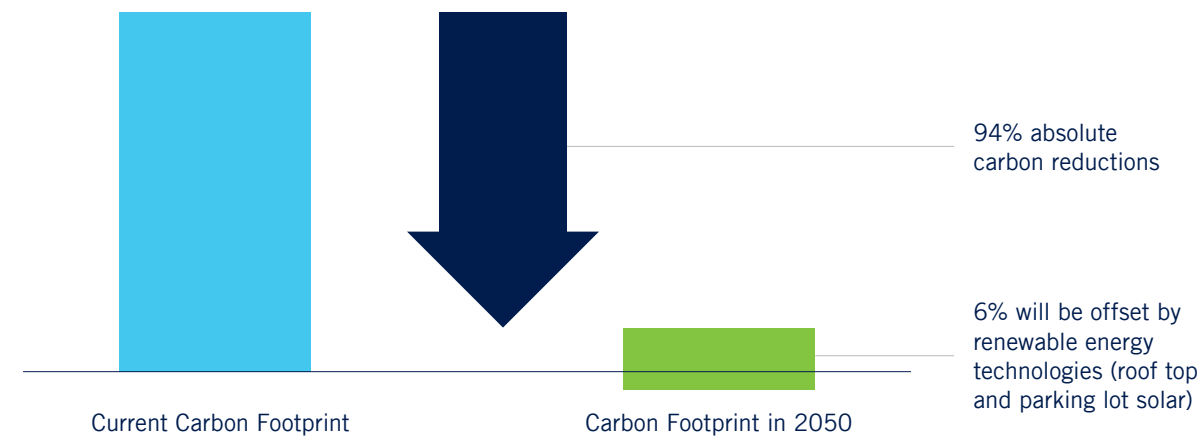
REDUCING ABSOLUTE CARBON EMISSIONS

Our 2050 climate positive goal will be achieved through at least 94% absolute carbon reductions on-campus.

The Utilities Master Plan is estimated to reduce the campus equivalent carbon emissions by 70% (relative to 1990 baseline emission levels). This is a considerably deeper reduction when compared to a business-as-usual scenario where the existing central utilities plant (CUP) continues to rely on fossil fuels in the form of natural gas.

Our campus-wide energy audits provided recommendations for the implementation of 240 energy conservation measures. The implementation of these measures will ensure we meet our goal: carbon neutral by 2043 and climate positive by 2050.

Figure 2
Carbon Reduction Strategy 2050



FRAMEWORK

Currently, natural gas and electricity are the two main energy sources on campus. Natural gas is used in our CUP to generate steam and hot water, which is used for heating, research processes and domestic hot water. It is also used directly in some buildings for heating and humidification. Electricity is used to power our equipment and our buildings.

UTM's framework for achieving a climate positive campus by 2050 builds on the strategy identified in the 2019 tri-campus LCAP plan. Much of the strategy rests on transitioning from natural gas as a main energy source, to electricity, which will significantly reduce our campus GHG emissions. As noted in Figure 3, through electrification projects and the implementation of the energy conservation measures, 94 per cent of our reduction in GHG emissions will be attributed to building envelope and HVAC upgrades alone.

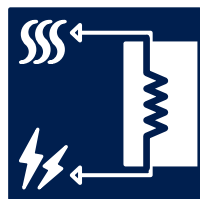
Consistent with the LCAP strategy, UTM's plan is further described below:



Reduced Consumption

1 CONSUME

Energy conservation measures such as heating, ventilation and air conditioning (HVAC), building envelope (doors, windows, walls and roofs) lighting, building controls, water and renewables will be implemented. These measures will result in savings at the point of use resulting in decreased need for production and distribution.



Efficient Distribution

2 DISTRIBUTE

Efficient distribution of energy throughout campus will be an integral part of our electrification efforts. Converting all steam boilers to electric domestic hot water, and converting steam distribution to hot water will result in energy efficiencies.



Clean Energy & Carbon Capture

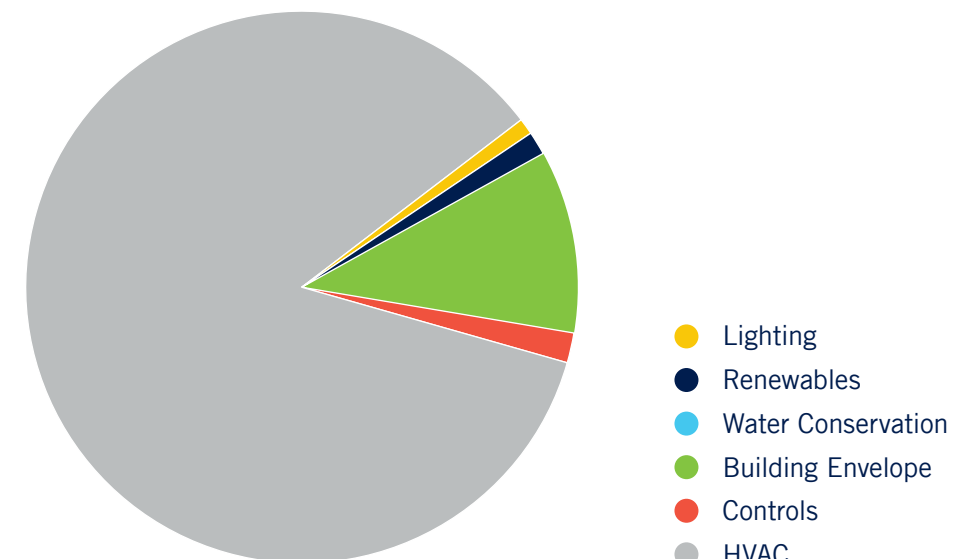
3 PRODUCE

By 2043 we will be a net-zero campus; continuing our strategy of investing in renewable energy. By including, solar, wind and grey water heat recovery, our campus will be producing net positive energy by 2050.



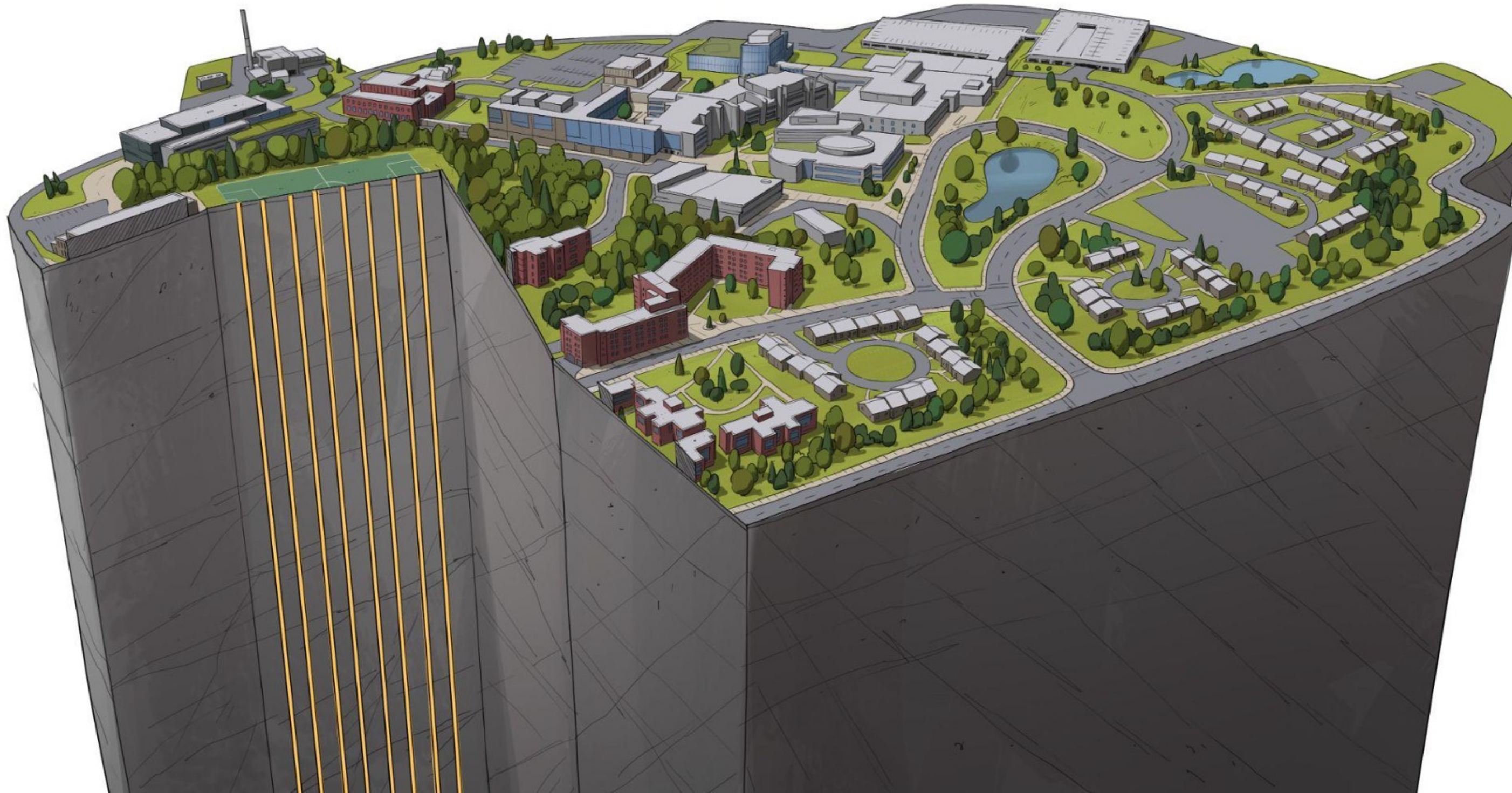
UTM's New Science Building

Figure 3
GHG Reductions by Category



UTM'S FIRST GEOTHERMAL SYSTEM

When the Instructional Centre was built, 117 boreholes, each 168 meters deep, were drilled in the field adjacent to the building. In the summer, heat is removed from the building and stored in the ground for use in the winter. Since the energy use is less than a conventional system, the heat pump system uses 18 per cent less energy compared to a similar building.



1

CONSUME



Reduced Consumption

We have an extensive portfolio of existing buildings, many of which are aged and require significant retrofits to reduce energy use and GHG footprints. With UTM's future campus growth, we have new buildings coming online over the next several years. Our strategy is to address the campus growth in a responsible and sustainable manner.

EXISTING BUILDINGS

This year, we wrapped up campus-wide energy audits on all UTM buildings. The audits took a comprehensive look at the systems in our buildings (such as lighting, heating and air-conditioning, building envelope) to assess each building's energy consumption. It was the first step in identifying opportunities to reduce energy as well as GHG emissions.

The audits revealed opportunities to implement 240 energy conservation measures across campus to help us achieve our 2030 and 2050 commitments.

The energy conservation measures have been broken down to short, medium and long term projects that will be implemented over the next several years.

NEW BUILDINGS

UTM's Campus Master Plan supports the design of sustainable, high quality buildings and spaces that embrace natural ecological settings; that promote community health, connection, and flourishing; and that enable aspirations in research, teaching and reciprocal civic engagement. The recommendations of the Plan are informed by a rigorous consultation program, as well as expert recommendations related to urban planning and design, architecture and landscape architecture, sustainability, ecology, transportation, cultural heritage, and stormwater management and servicing. Building design will contribute to reduced GHGs through clean energy, efficient energy distribution, and reduced energy consumption.

KEY INITIATIVES

Controls Optimization – optimizing building HVAC systems, and lighting based on occupancy and class schedules.

Peak Demand Management – actively manage our peak electricity demand by leveraging the flexibility of our enhanced energy generation (solar and wind), distribution, and storage system (future battery and thermal), also benefiting the Ontario electricity grid.

Future Energy Storage – recharging chilled and hot water systems during off-peak hours using thermal energy storage systems.

CAMPUS WIDE ENERGY AUDITS

240

OF ECMs
(ENERGY CONSERVATION MEASURES)



1 YEAR
TO COMPLETE



2.5 MILLION
SQUARE FEET OF
BUILDINGS



30 BUILDINGS AUDITED



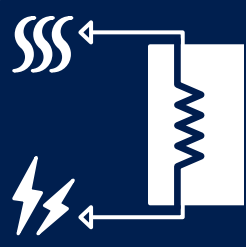
27 ASHRAE
LEVEL II AUDITS



3 ASHRAE
LEVEL III AUDITS

2

DISTRIBUTE



Efficient Distribution

ELECTRIFICATION & STEAM TO HOT WATER CONVERSION

UTM has over a half century of innovation with district energy systems. The current CUP distributes electricity, steam, hot and chilled water to buildings on campus. This is a more efficient way to distribute energy than placing stand-alone systems in buildings directly.

Dubbed Project SHIFT, UTM plans to complete deep energy retrofits in the CUP – such as electrification, steam to hot water conversion, controls optimization, and energy storage. The retrofits will reduce GHG emissions by more than 6,000 tonnes of CO2 equivalent. Project SHIFT will allow UTM to modernize the plant and begin to SHIFT away from fossil fuels as the primary heating source. We can then upgrade connected energy-intensive buildings to reduce the amount of carbon they emit.

KEY INITIATIVES

Nodal Networks – removing single points of failure and increasing redundancy by creating a network of interconnected thermal and electric energy redistribution nodes.

Electrification – transforming our infrastructure to state-of-the-art, replacing fossil fuels with electricity as the primary source for thermal energy.

Steam to Hot Water Conversion – eliminating the use of steam as a primary source for heating our buildings by retrofitting them to use efficient low-temperature hot water (LTHW) systems.



3

PRODUCE



Clean Energy & Carbon Capture

In 2020, UTM completed a Utilities Master Plan to enhance our utilities infrastructure operating efficiency, redundancy and resiliency to meet anticipated future campus growth.

The Utilities Master Plan recommended a nodal-plant approach, where two new nodal utilities plants are to be constructed with optional future interconnections with the existing Central Utilities Plant (CUP1). The first new nodal plant (CUP2) will be integrated within the new F2 Building (currently in design) located on the west side of the campus and to be constructed in the next five years. The second new nodal plant (CUP3) will be integrated within the new Athletics & Parking Expansion Building on the east side of the campus to be constructed in the next 10-15 years (CUP3). Please view Figure 4 for a design depiction of the nodal plants.

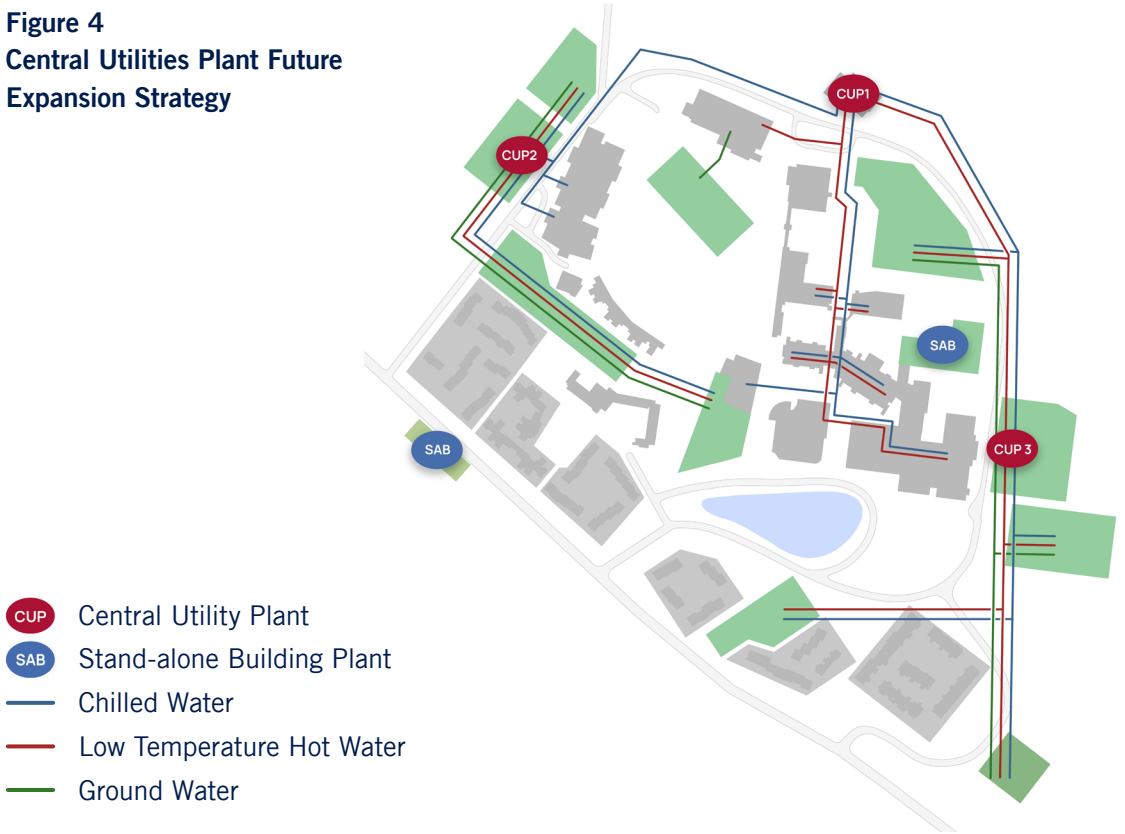
Our new buildings will utilize nodal plants, with centralized electrical infrastructure, and a district ground-source heat pump system with geo-exchange borefields to meet connected buildings' thermal and electrical needs.

As an innovative institution, UTM is continually looking at renewable technology to support its ambitious long-term goals. To date, the university has investigated renewable natural gas, wind generation, wastewater heat recovery systems and solar power. Detailed feasibility studies have been performed on these technologies to determine viability, cost, and associated GHG reduction potential. A graphic representation highlighting our anticipated solar installations can be found on page 22-23. In the next several years, as these technologies become more financially feasible, we will implement these projects to realize our climate positive goals.

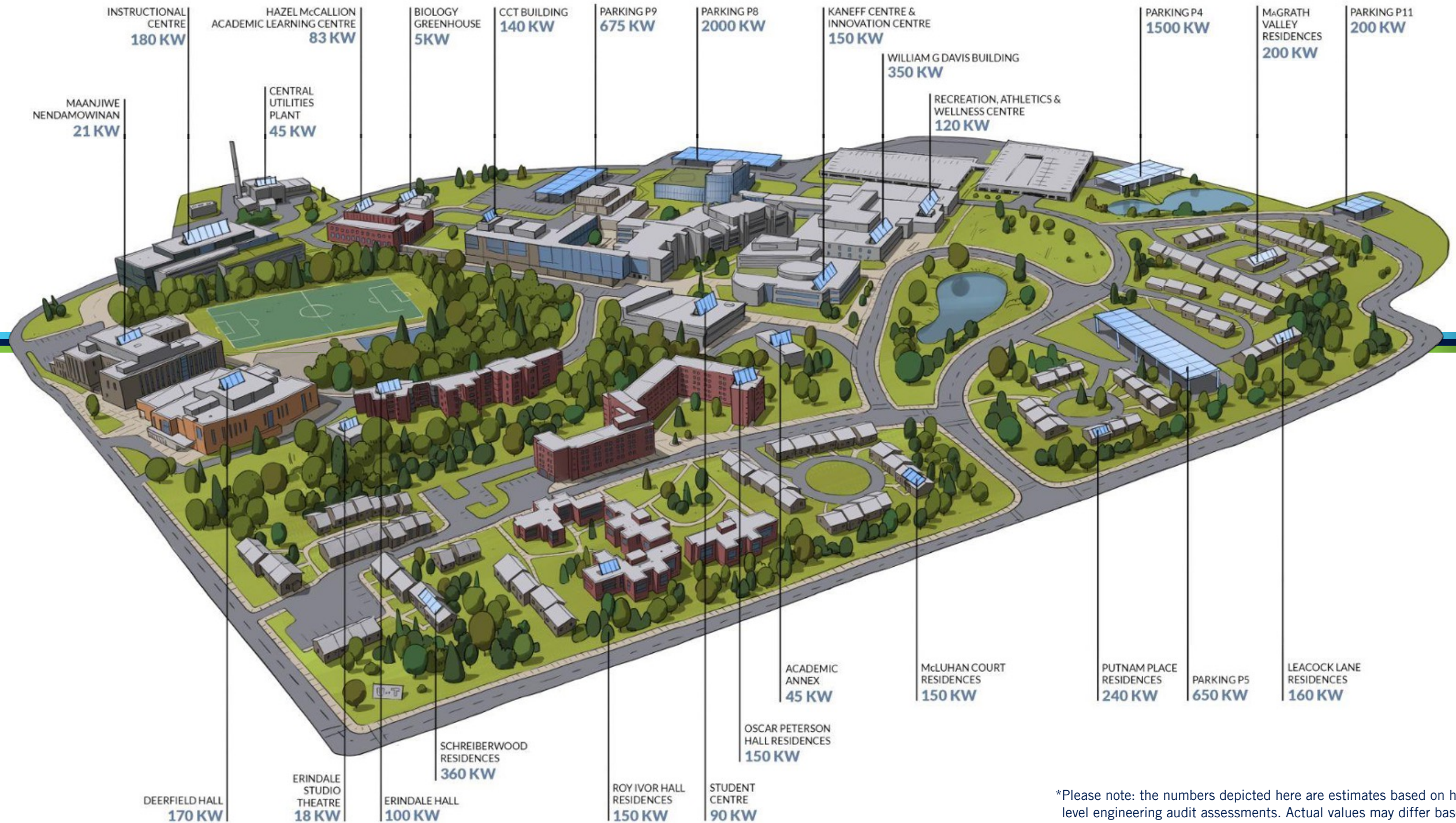


Geothermal distribution pipes in the mechanical room of the Instructional Centre

Figure 4
Central Utilities Plant Future Expansion Strategy



EXPANDING SOLAR POWER ON CAMPUS



*Please note: the numbers depicted here are estimates based on high level engineering audit assessments. Actual values may differ based on installed system capacity and performance.

UTM'S PATH FORWARD



In fewer than thirty years, UTM will become climate positive. We'll do it through an ambitious energy strategy that, as figure 5 shows, focuses on areas that produce most of our GHG emissions.

That means we will transform UTM's system for heating, ventilation, and air conditioning (HVAC) and revitalize all aspects of building design: from doors, windows, and roofs to lighting, controls, and water. These steps will decrease our carbon footprint significantly and help us model the future—a climate positive campus for our students, faculty and staff.

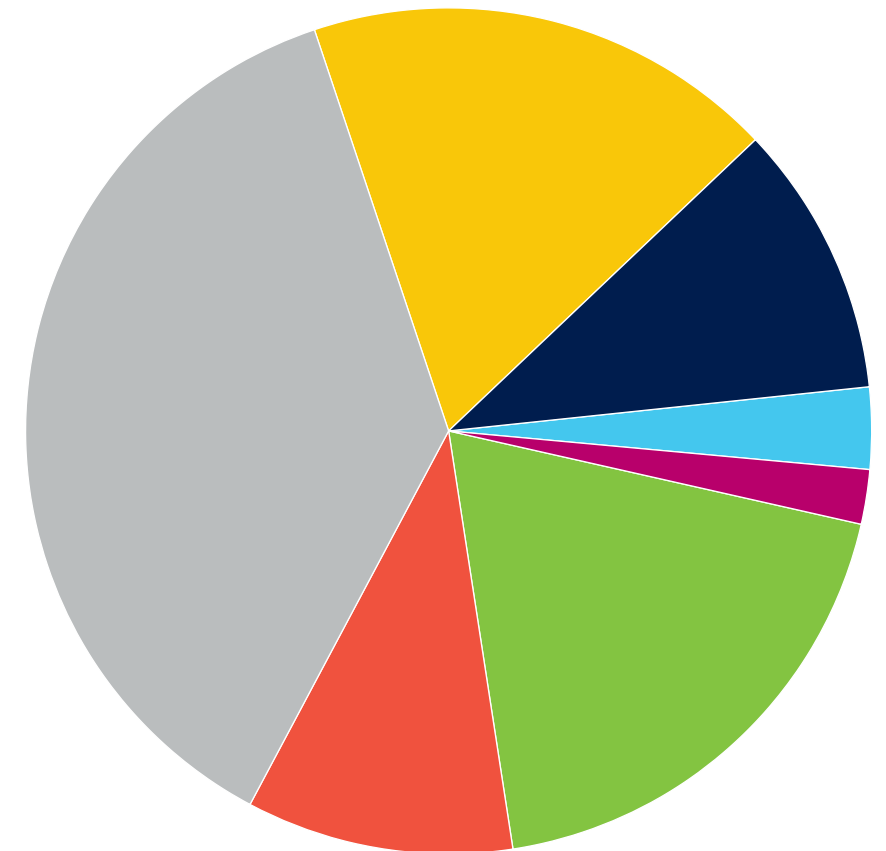
To realize this positive change, we need a big investment—of resources, time, and expertise. UTM is ready to do it, alongside our research, community, government, and public partners. We have an amazing opportunity to extend U of T's leadership as one of the world's most sustainable universities and to achieve our climate positive goals together.

Deborah Brown
Chief Administrative Officer

PLANNING AND REPORTING

Although approved in principle, this plan will function as a living document: many factors will shape our ability to realize the goals set out in this Strategy. For this reason, UTM will re-evaluate the Strategy annually to ensure its continued validity and viability. This process will enable UTM to adapt to new best practices in sustainability, to changes in the financial landscape, and to the emergence of innovative technologies.

Figure 5
Energy Conservation Measures by Category



**2050 CLIMATE POSITIVE TARGET,
MISSISSAUGA CAMPUS**

- Lighting
- Building Envelope
- Renewables
- Controls
- Water Conservation
- HVAC
- Parking Lot PV



REFERENCES

Utilities Master Plan

Campus-wide Energy Audits

Campus Master Plan

Low Carbon Action Plan (LCAP)

Detailed engineering documents that went in to this plan are available upon request.

All photos provided by the University of Toronto unless otherwise stated, with acknowledgement to:

- Kieran Timberlake (13)
- Nicolas Demers (14-15, 21, 22-23)
- Arash Ghorayshi (17, 21)
- Kranti Sharma (19)



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