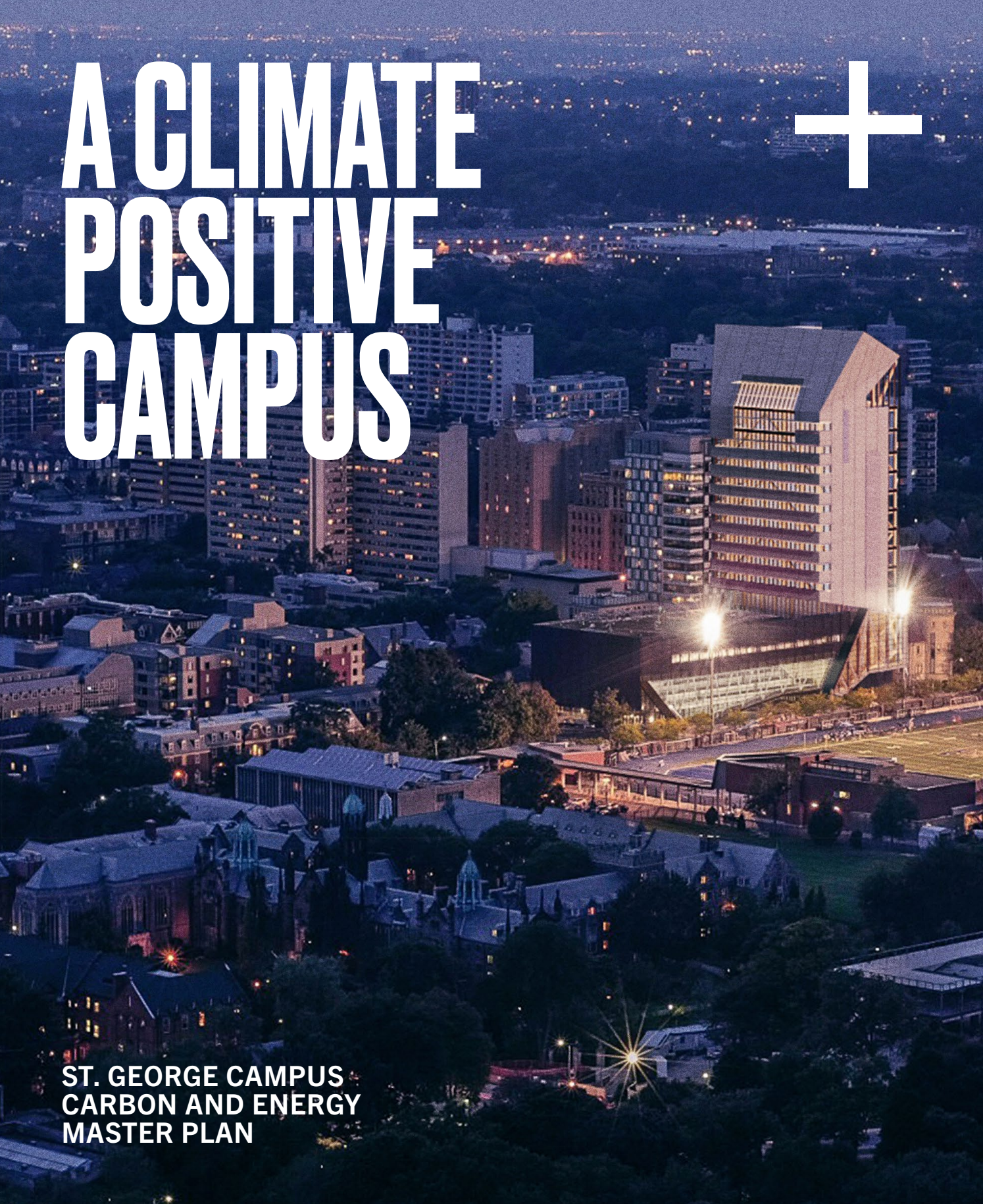
# A CLIMATE POSITIVE CAMPUS



## ST. GEORGE CAMPUS CARBON AND ENERGY MASTER PLAN

# THE UNIVERSITY OF TORONTO ST. GEORGE CAMPUS WILL BECOME CLIMATE POSITIVE BY 2050.

## 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.

We commit to reducing more greenhouse gas emissions than we emit, creating a net benefit in our community.

This plan describes how we will design and build our utility infrastructure to significantly reduce our operating carbon footprint—a critical first step on our path to becoming a climate positive campus.

## The St. George campus is committed to becoming climate positive.

The University of Toronto is committed to taking decisive action against climate change, one of the most pressing challenges of our time.

Our St. George campus—the oldest, largest and most energy-intensive of our three campuses—is pledging to go beyond the goal of carbon neutral to become climate positive by 2050. Climate positive is a regenerative approach to sustainability that is befitting of an institution dedicated to making the world a better place.

The University of Toronto is taking this considerable first step towards climate positive through significant infrastructure transformation. To meet this goal fully, we will need to work together to build an entirely new model of sustainable growth—one that will serve as a learning opportunity across our University.

I am eager to see the benefits of this model—for our campus, for our community, and for the environment. And I look forward to the opportunities it will provide for experiential learning, employment, and sustainable infrastructure for future generations.

**Meric S. Gertler**
President





# ADVANCING OUR LOW-CARBON PLANS

In 2018, the University of Toronto joined the University Climate Change Coalition, a group of leading North American research universities committed to reducing greenhouse gas emissions.

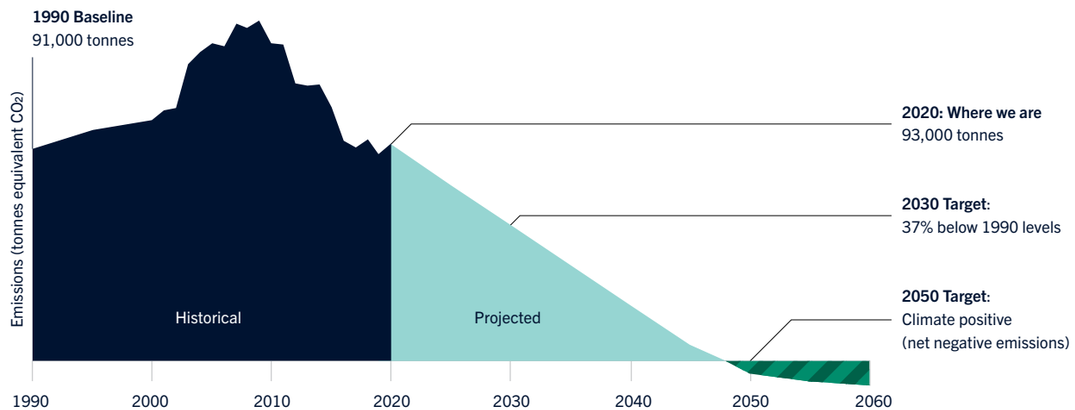
The University of Toronto set a goal to reduce emissions by 37% below 1990 levels by 2030. In 2019, we launched the *Low-Carbon Action Plan (2019–24)* and have already implemented significant projects moving us towards meeting our 2030 goal.

The St. George campus makes up over 80% of the University of Toronto's operational carbon footprint.

Our impact on the institutional footprint and our key role in the urban community calls for going beyond net zero emissions to become climate positive by 2050.

Our first step towards becoming climate positive is to invest in transformational infrastructure renewal as part of our 30-year carbon and energy campus master plan, detailed at uoft.me/sustainability.

**2050 Climate positive target, St. George campus**



This plan will transform our campus and set a new infrastructure standard.

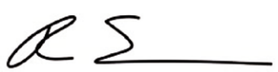
We acknowledge that our carbon footprint is one of the highest among Ontario institutions. As a city within a city—the downtown Toronto St. George campus serves a population of 100,000 on an average day—our carbon footprint reflects the significant amount of energy needed to run a research-intensive campus of our size and age through hot, humid summers and cold winters.

As our campus grows to enable our academic and research mission, our vast and aged utility infrastructure requires significant investment to ensure future performance.

Renewal of this infrastructure—hidden underground and behind walls—presents an opportunity for a major transformation of the entire campus that will embed sustainability into its backbone.

The launch and implementation of our carbon and energy master plan is our first step towards becoming a climate positive campus. To me, this means not only reducing the operating emissions under our control, but also mitigating additional carbon emissions to achieve net negative emissions.

Highlighted are some of Canada's most ambitious low-carbon projects in our historic core of campus. We want to demonstrate these possibilities here to show what can be done with aged infrastructure and old buildings everywhere, now and for future generations.



**Ron Saporta**
Chief Operating Officer
Property Services & Sustainability





# REDUCING ABSOLUTE CARBON EMISSIONS

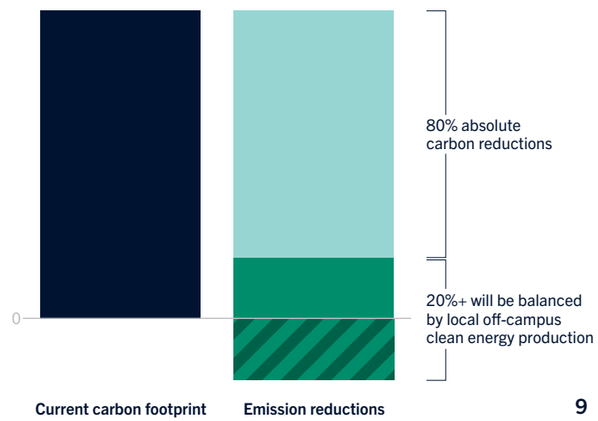
Our 2050 climate positive goal will be achieved through at least 80% absolute carbon reductions on-campus.

Our commitment is to achieve real carbon reductions on our campus in the heart of Canada's largest city. To become a climate positive campus, we cannot simply continue to operate locally at today's emission levels while offsetting carbon elsewhere in the world.

By transforming our utility and energy infrastructure, we will reduce our absolute scope one and scope two greenhouse gas emissions on campus by at least 80%. We will use renewables and other strategies to not only offset the remaining balance of our own carbon emissions, but further reduce other carbon emissions in Ontario—creating a net environmental benefit in our community.

We are tackling the carbon reduction challenge at its source and achieving real and local benefits through sustainable investment, job creation, experiential research, and learning opportunities.

**80% <u>absolute</u> reduction**
Our first step towards becoming climate positive is reducing emissions that our campus operations produce (scope 1) as well as by the energy we purchase (scope 2).



# THREE GOALS TO TRANSFORM OUR INFRASTRUCTURE

**1. Responsibly manage the growth** of our campus to mitigate the environmental impacts of more space and activity.

**2. Renew existing and aged utility infrastructure** to ensure future performance that supports academic and research excellence.

**3. Build resilient systems** to support our carbon reduction targets with reliable infrastructure by changing how our campus produces, distributes and consumes energy.

—

Our aged utility and energy infrastructure relies heavily on natural gas and our current electrical distribution system is not designed for resiliency.

We're moving towards renewed, resilient and, reliable utility infrastructure that will enable our campus to operate and thrive without disruption and mitigate the impacts of growth on our carbon footprint.

"Building utility infrastructure with renewal, responsible growth, and resiliency at the forefront is a major step towards fulfilling the University of Toronto St. George campus's commitment to becoming climate positive by significantly reducing our operating carbon footprint."

**Scott Mabury**
Vice-President
Operations and Real Estate Partnerships

# WE WILL RESPONSIBLY MANAGE THE GROWTH OF OUR CAMPUS

The St. George campus will nearly double in size in the next 30 years—adding a million square metres of world-class research, teaching, and community space. Our buildings contribute considerably to our carbon emissions. To achieve our carbon reduction targets, we need to manage our growth differently.

## KEY INITIATIVES:

**High performance standard and carbon budgets** — We have implemented an aggressive energy modelling and utility performance standard to minimize energy use, carbon emissions, and water consumption while maximizing value for our stakeholders. This includes setting a strict carbon budget for all new construction, including targets for energy, carbon emissions, and water reduction.

**Space optimization** — We will maximize the use of existing building spaces before expanding.

**Expanded district energy** — We will expand our district energy system to efficiently meet new campus demand and reduce carbon emissions.

**Project spotlight:**
**Low-carbon student residence**

The new Spadina-Sussex residence will be one of the first buildings on the St. George campus designed to meet the University's new rigorous carbon intensity target. Using a new geoexchange system beneath Robert Street field, the building will become the lowest-carbon residence on the St. George campus.

# WE WILL RENEW OUR AGING INFRASTRUCTURE

We are approaching our 200-year anniversary as an institution. We have buildings on our St. George campus that are more than 120 years old and underground infrastructure that is just as old.

A crucial component of our plan is to renew this infrastructure to ensure future performance, longevity, and compatibility with sustainable technology. Renewal will help reduce the carbon footprint and energy use intensity of our existing buildings.

## KEY INITIATIVES:

**Eliminate steam generation for heating** — We will eliminate the use of steam as a primary source for heating our buildings by retrofitting them to use efficient low-temperature systems.

**Deep energy retrofits** — We will maximize the efficiency of our existing buildings through extensive energy conservation measures and deep energy retrofits.

**Generation and distribution upgrades** — We will upgrade our energy generation and distribution systems to be compatible with renewables and low-carbon technologies, including modernizing our central power plant and district energy system.

**Renewable energy** — We will increase on-campus and off-campus renewable energy generation, such as solar.

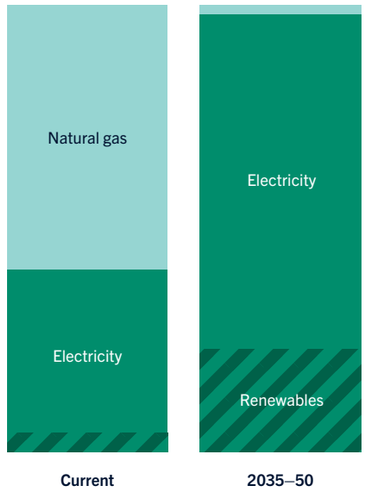
**Project spotlight:**
**One of Canada's oldest central power plants and district energy systems**

Jerry Newton, a shift engineer, is pictured in the district energy distribution tunnels that run under the campus. Plans are underway to electrify our central power plant. In Ontario, using electricity is cleaner than natural gas. The effort is part of a larger suite of upcoming low-carbon initiatives known as Project50 that will reduce up to 50% of our current carbon footprint.

# WE WILL BUILD RESILIENT SYSTEMS

Our plan serves as a model for large urban communities to reduce greenhouse gases and grow sustainably. It is flexible, anticipating that technology will continue to change over the next 30 years. To support cleaner energy production and distribution, our utility and energy infrastructure will need to be resilient.

**Switching to lower-carbon fuel sources**




## KEY INITIATIVES:

**Electrification** — We will transform our aging infrastructure to state-of-the-art, replacing fossil fuels with electricity as the primary source for thermal energy.

**Nodal networks** — We will remove single points of failure and increase redundancy by creating a network of interconnected thermal and electric energy redistribution nodes.

**Interconnected electrical switching stations** — We will diversify our incoming electricity by installing new high-voltage switching stations in areas of dense energy demand to reduce outages and increase flexibility and reliability using automated load sharing and shedding.

**Peak demand management** — We will actively manage our peak electricity demand by leveraging the flexibility of our enhanced energy generation, distribution, and storage systems, also benefiting the Ontario electricity grid.

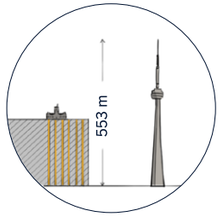
**Low-carbon technology** — We will implement existing low-carbon technologies such as ground source heat pumps while exploring emerging technologies such as carbon capture.



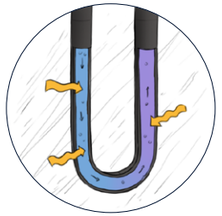
**Project spotlight: Canada's largest urban geoexchange**

Geoexchange technology leverages the natural thermal storage properties of the ground to regulate building temperature. Combined with building retrofits, this system will reduce the carbon footprints of numerous buildings in our downtown historic campus core.

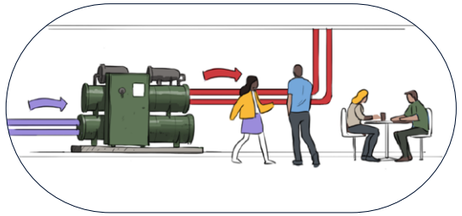
# URBAN CANADA'S LARGEST GEOEXCHANGE SYSTEM BENEATH KING'S COLLEGE CIRCLE



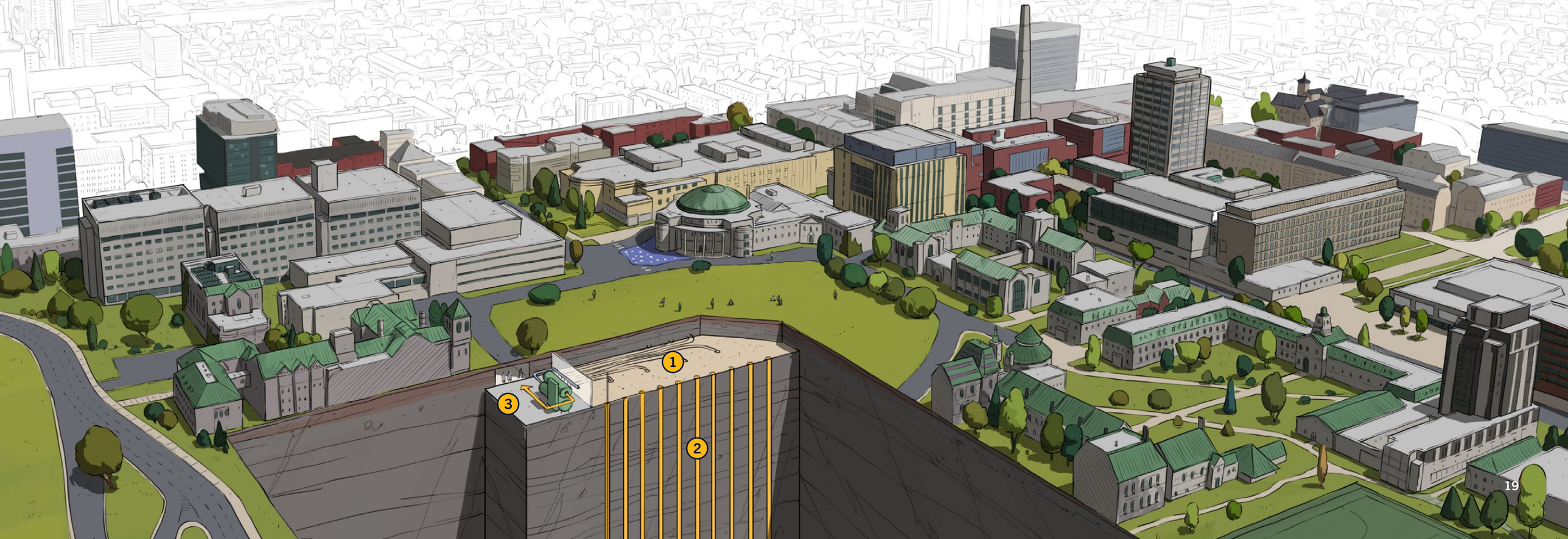

**1** — Over 370 boreholes have been drilled 250 metres deep under front campus, nearly half the height of the CN Tower.



**2** — U-shaped pipes are inserted into each borehole. Water is circulated through this system, taking excess heat from buildings in the summer and storing it underground for use in the winter.

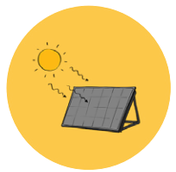


3 — Heat pumps circulate the water, transferring heat to or from the University's building ventilation systems. This installation will feature an underground display and serve as an applied learning classroom to showcase how the system works for visitors and students.



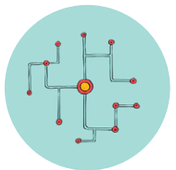
# HIGHLIGHTS FROM OUR CLIMATE POSITIVE CAMPUS STRATEGY

Our climate positive strategy encompasses many interconnected and synergistic initiatives. Together, they will significantly reduce our operating carbon footprint.



**Responsibly manage our growth**

- Implement carbon and energy budgets for new buildings
- Extend our district energy system to all new buildings
- Increase use of renewable energy, including a large off-campus solar farm

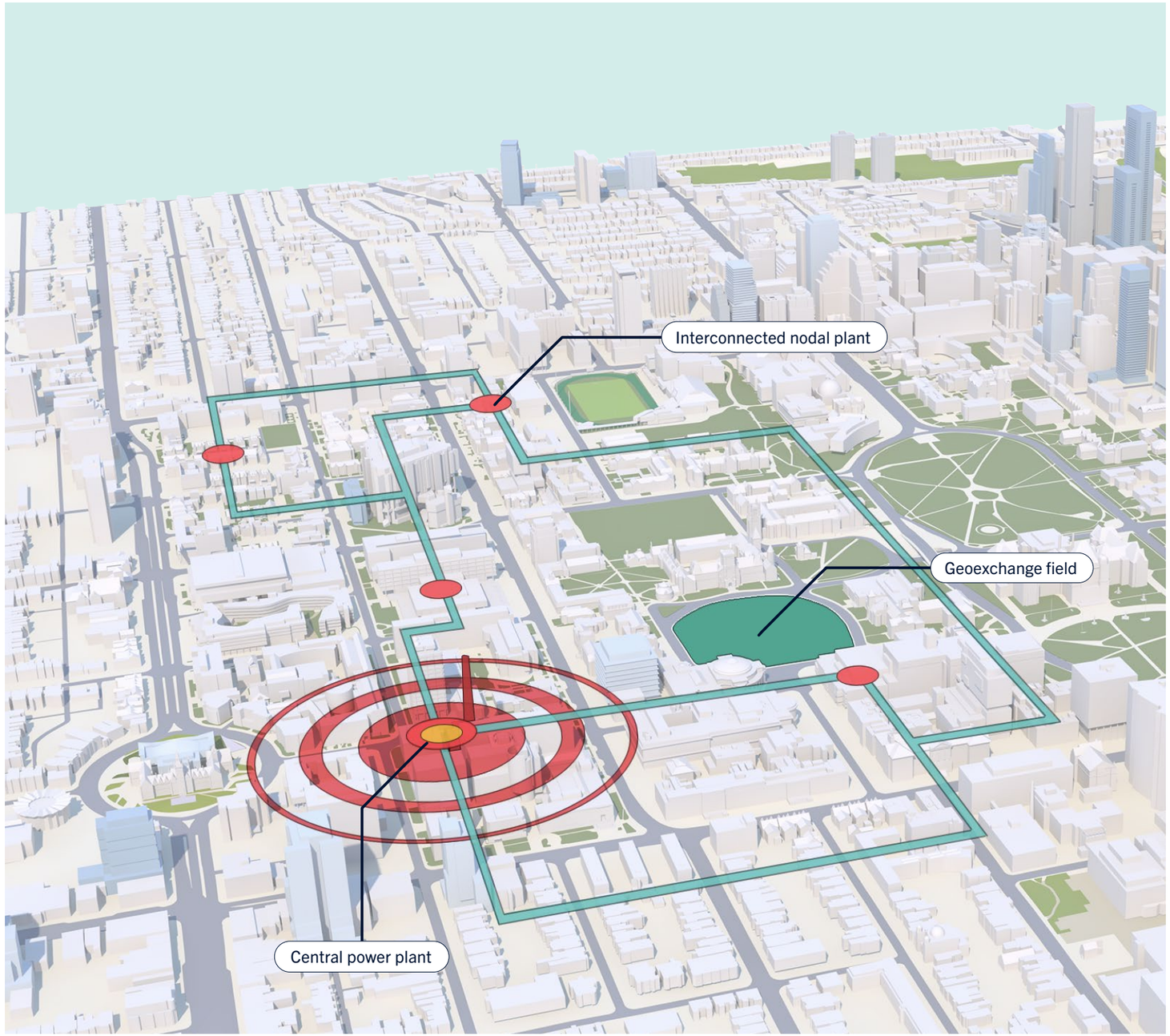


**Build resilient systems**

- Increase use of electricity to heat our campus, using technologies such as geoexchange
- Create inter-connected nodal plants to increase redundancy
- Introduce new inter-connected electricity feeds to increase reliability

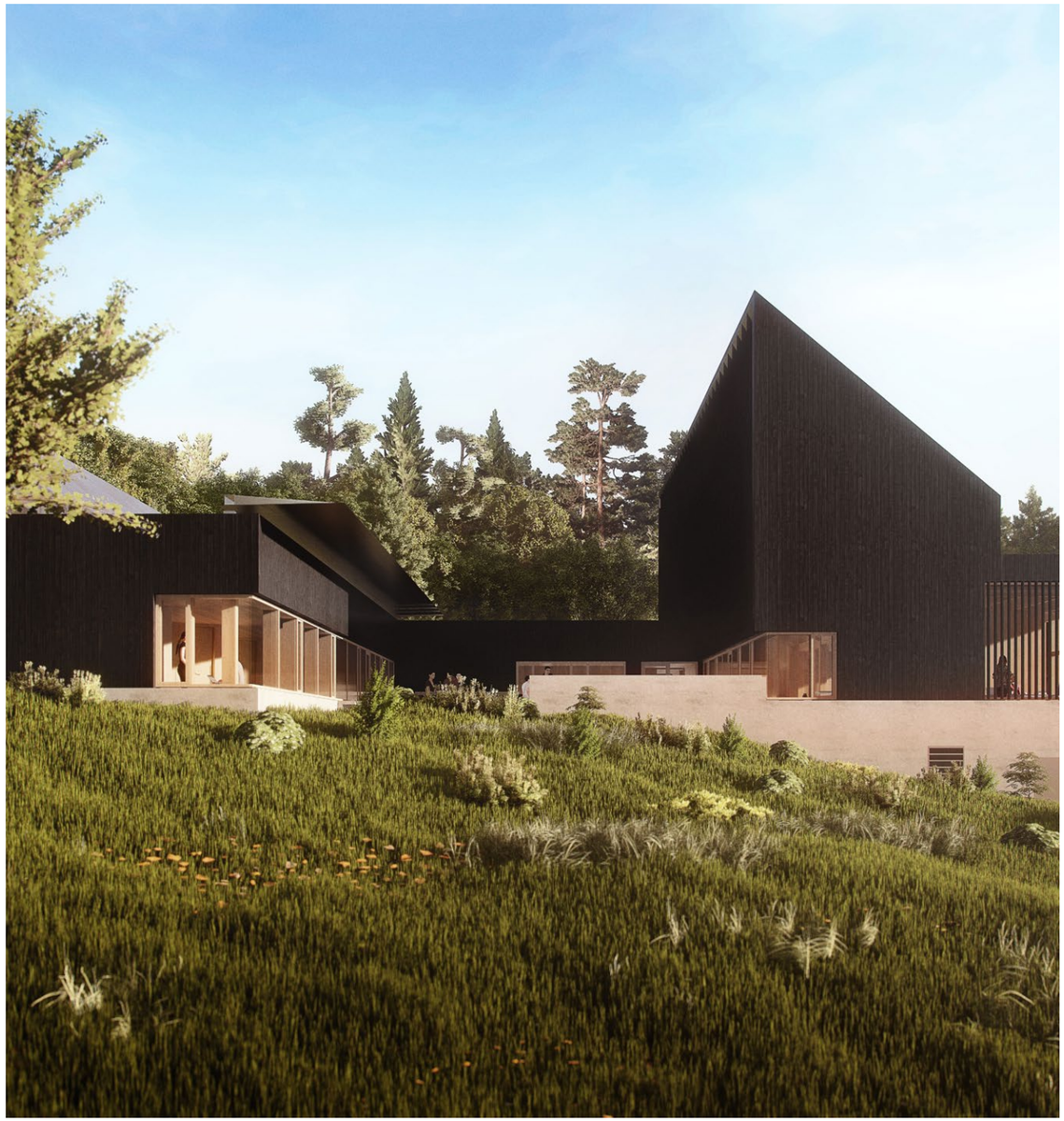
**Renew our infrastructure**

- Eliminate fossil fuels as a primary energy source for heating
- Eliminate steam distribution
- Significantly reduce existing building energy use through deep energy retrofits
- Renew and electrify our central power plant




**Project spotlight: Our interconnected nodal network for added resiliency**

Review further details about this plan at uoft.me/sustainability.



**Project spotlight:**
**Off-campus solar farm**

We will build a large solar farm to generate renewable energy at the University of Toronto's Koffler Scientific Reserve. The solar farm will complement the development of a new purpose-built dining and operations centre to support researchers at the field site, which is targeting net-zero-carbon, net-zero-energy performance, and LEED Gold certification.



"St. George campus is taking a leadership role in its ambitious plans to move beyond net-zero targets to a climate positive campus. This regenerative approach is at the forefront of sustainability thinking and highly consistent with the broader work on regenerative sustainability at the University being led by the President's Advisory Committee on the Environment, Climate Change and Sustainability."

**John Robinson**
Professor, Munk School of Global Affairs and Public Policy
Professor, School of the Environment
Presidential Advisor on the Environment,
Climate Change and Sustainability
Utility Master Plan Steering Committee Member

# WE'RE PASSIONATE ABOUT A CLIMATE POSITIVE CAMPUS

The St. George campus has been a long-standing pioneer in operational sustainability and environmental stewardship. This is the result of the ingenuity and hard work of our incredible staff, faculty, students, and campus partners who are committed to making a positive impact on our climate and community.

**KEY MILESTONES:**

**1912** — One of the first institutions in North America to have a district energy system.

**1964** — Switched from coal to gas boilers, reducing our carbon footprint.

**1977** — One of the first North American universities to hire a full-time energy manager.

**1991** — Retrofitted more than 175,000 lamps on campus to high efficiency.

**2003** — Received energy efficiency award from Natural Resources Canada.

**2012** — Launched one of North America's largest utility reduction revolving funds.

**2018** — Implemented $50 million in carbon reduction projects.

**2019** — Launched the Low-Carbon Action Plan (2019–24).

**2021** — Named among Canada's Greenest Employers for the eighth time.


**Our people: Behind the scenes**

Clockwise (from top right): Christine Tan, area manager, assesses mechanical equipment with her team. A team from CERT Systems Inc., a company spun out of our Faculty of Applied Science & Engineering, works on scaling up $CO_2$ conversion technology developed at the University. Gurmel Multani, Chief Operating Engineer and Manager of the central power plant, monitors activity in the control room.

**Learn more online**
Visit uoft.me/sustainability to keep up to date on our progress and discover how you can support a #GreenerUofT.

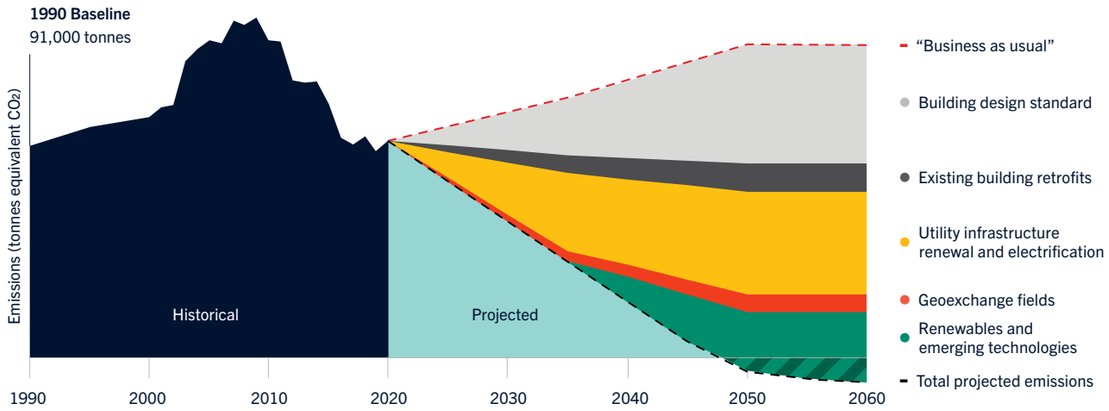
# BECOMING CLIMATE POSITIVE BY 2050

The first chapter of our climate positive future is about transforming our infrastructure and energy systems.

By 2050, we will reduce 80% of our emissions through absolute carbon reductions on-campus. We will offset the remainder and beyond by generating renewable energy on University-owned properties off-campus and by staying flexible to explore and incorporate emerging technologies and approaches into our plan.

The St. George campus is uniquely positioned to demonstrate how institutions with large, complex, and diverse infrastructure can reduce their direct impact on the environment and create a net benefit for their communities.

**St. George campus emissions projections**



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