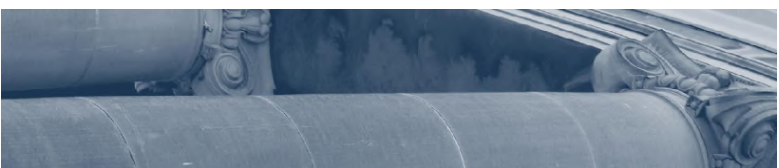
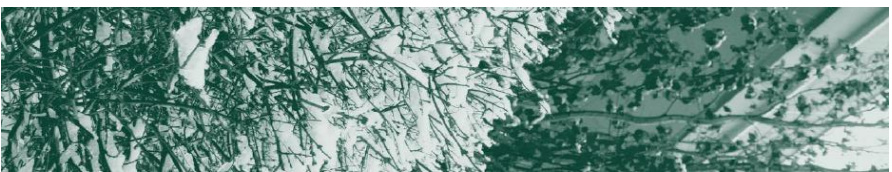


# Getting to Carbon Neutral at St. George Campus



# Towards a Low-Carbon Future

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## Panelists:



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



**Adriana Dossena**  
Project Coordinator  
Sustainability Office



**Marc Couture**  
Director  
Sustainability Operations & Services  
Property Services & Sustainability

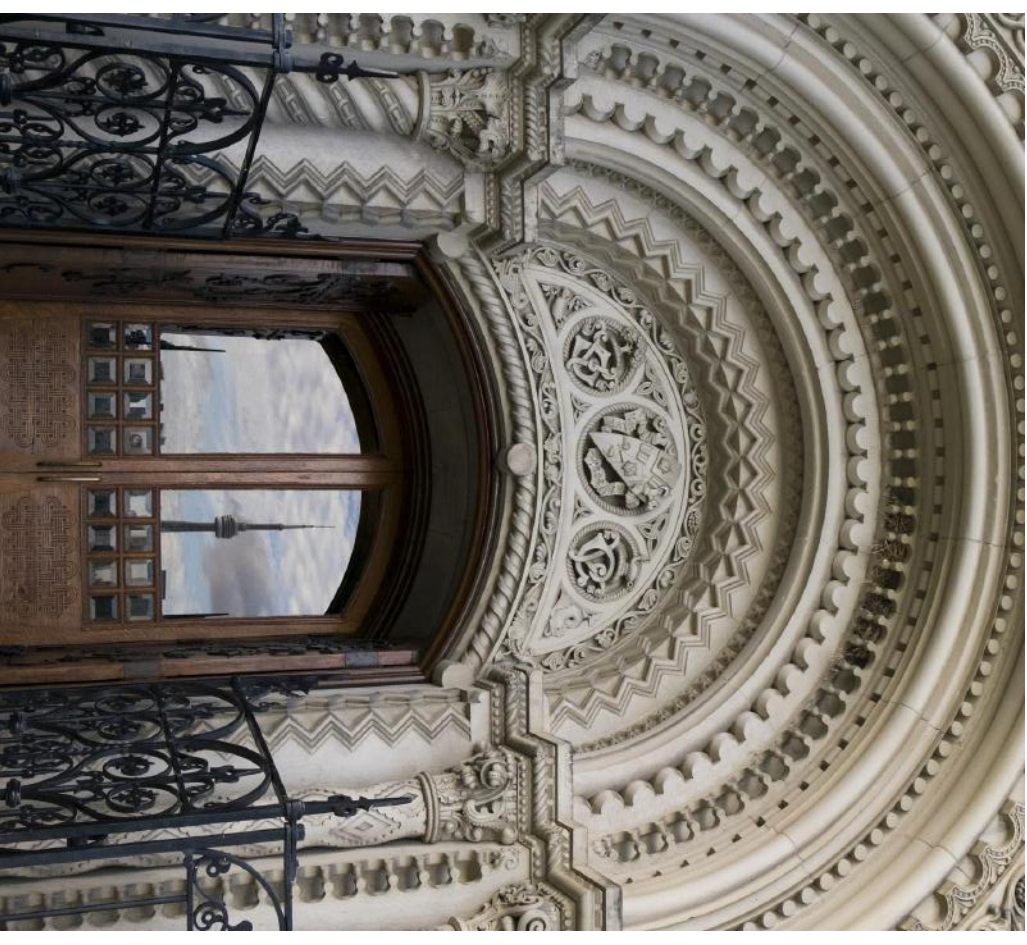
## Moderator:



**Jennifer Puskar**  
Project Coordinator  
Sustainability Office

# Agenda

1. U of T's commitment for action on Climate Change
2. Review Low-Carbon Action Plan (next 5 years) and Net Zero Campus Master Plan (to 2050)
3. Project Highlights
4. Partnerships and Engagement through the Sustainability Office



## Context: U of T – A City Within a City

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- Across the 3 campuses, we educate more than 88,000 students. That makes us **the largest university in North America**
- We employ more than 20,000 faculty and staff members

**91,286** Total Enrolment

**14,434** Faculty Members

**156** Librarians

**7,198** Staff Members

**266** Buildings

**1,790,704** Gross Square Meters

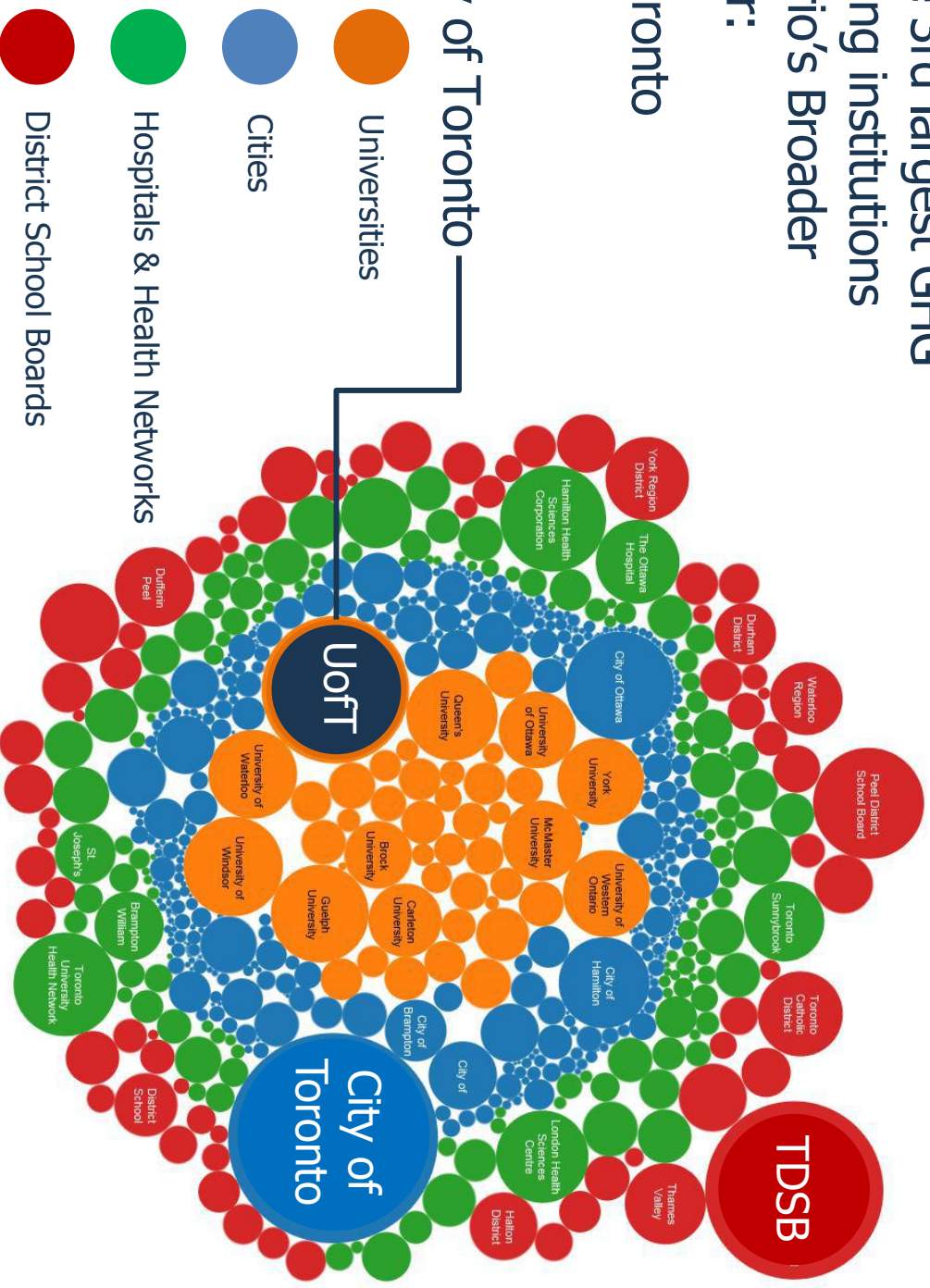
**100,000+**  
Population



# How U of T's Greenhouse Gas Footprint Compares

- U of T is the 3rd largest GHG emitter among institutions within Ontario's Broader Public Sector:

1. City of Toronto
2. TDSB
3. University of Toronto

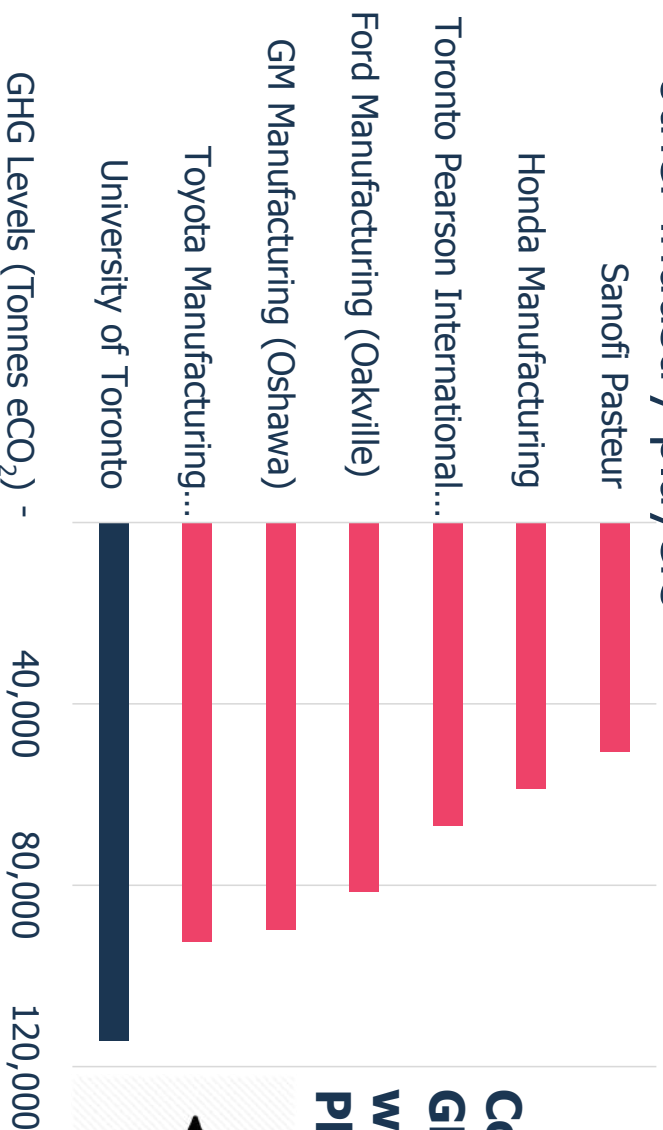


## How U of T's Greenhouse Gas Footprint Compares

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- U of T produces more GHG emissions than other universities and colleges in Ontario; U of T's reduction target of 59,000 tonnes alone is larger than the total annual emissions of any other Ontario university

- While we are efficient, we still have a significant footprint—emitting more than many local auto manufacturing plants and other industry players



**Comparing U of T's  
GHG Emission Levels  
with Local Industry  
Players**



# Building on Leadership in Operational Sustainability

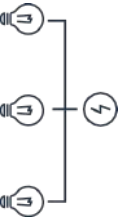
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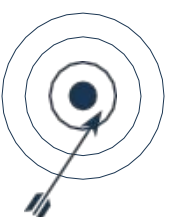
- **Awarded Canada's Greenest Employer 7 times**



- **\$8.5M green revolving fund** — one of the largest in North America, providing funding for significant energy reduction projects and building retrofits.



- **100+ years of district energy.** We currently produce more than 80 per cent of our heating and 20 per cent of our electricity needs for our downtown Toronto campus.



**Since 2011, we have:**

**Achieved** a reduction of more than 55 thousand tonnes of GHG emissions



**Saved** over 1.25 billion litres of water (equivalent to 500 Olympic-size pools).



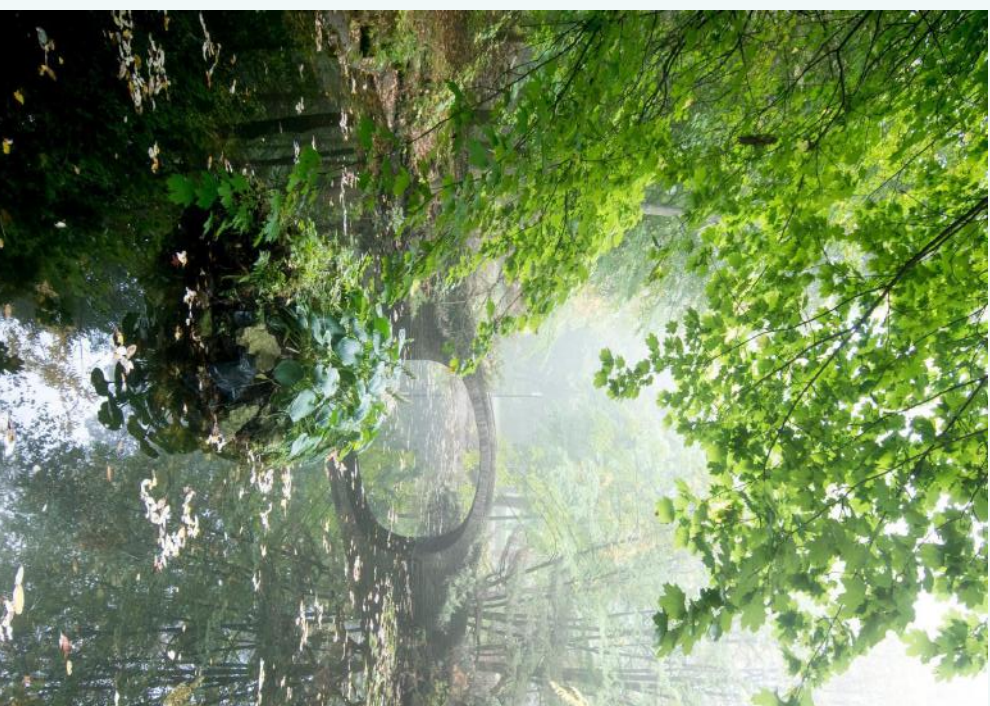
**Avoided** over \$30 million in utilities costs.

## Our Commitment

**The University of Toronto has set a goal to advance towards a 37% reduction in greenhouse gas emissions by 2030, from a 1990 level baseline.**

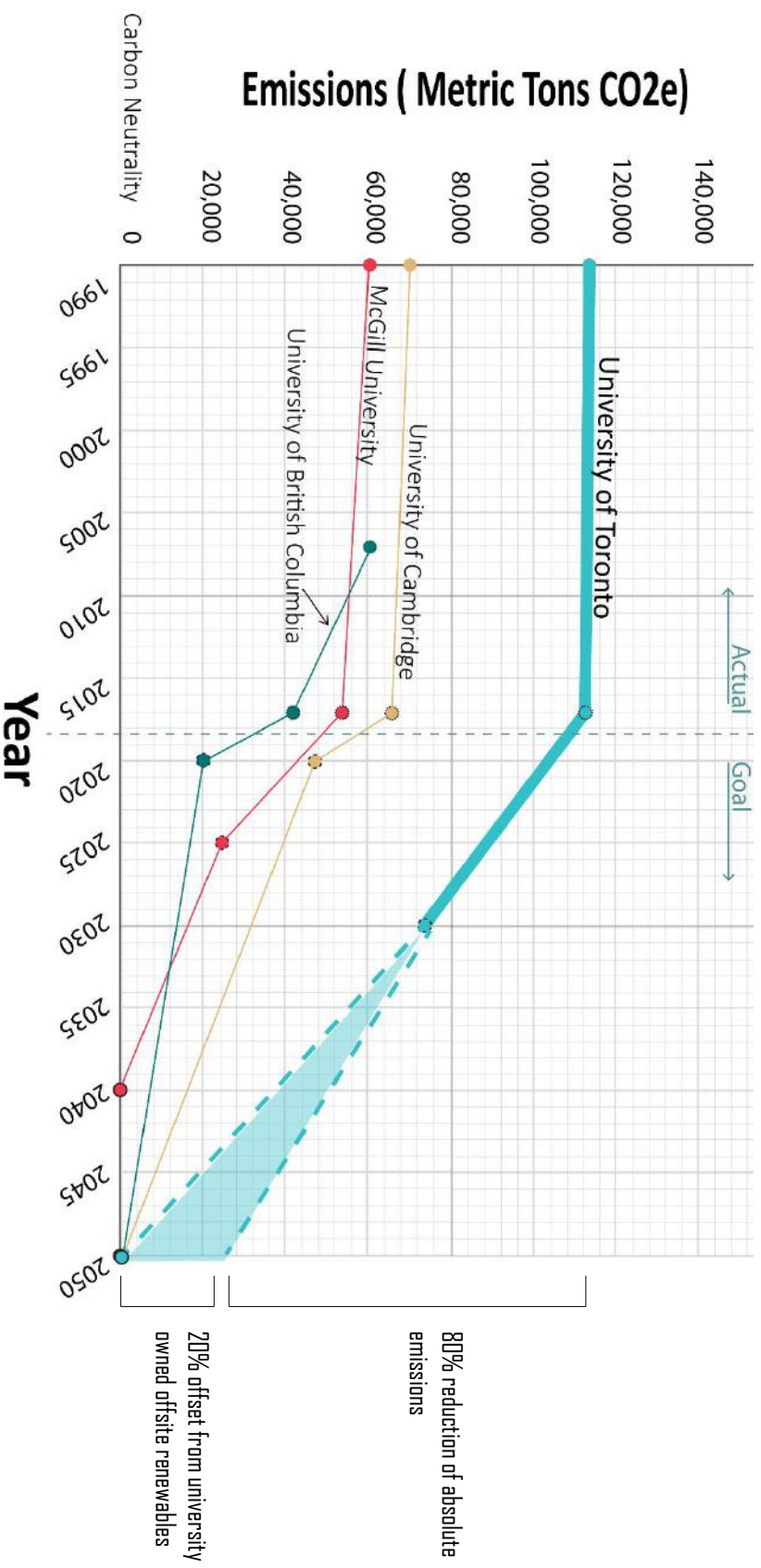
“Climate change remains one of the world’s greatest challenges, and the University of Toronto community—our brilliant students and alumni, faculty and staff—are working hard to meet that challenge.”

**- President Meric Gertler**





# Pathway to 2050: Carbon Neutral



# What Our Peers Are Doing: University Benchmarking

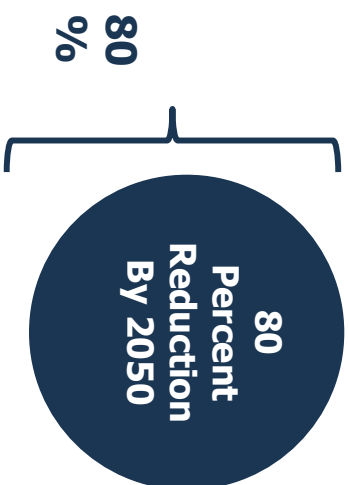
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- Each university has adopted it's own definition of Carbon Neutrality

<b>Scope 1</b>	• GHG emission reduction	●	●	●	●	●	●	
<b>Scope 2</b>	• Offsite renewable energy	●	●	●	●	●	●	
<b>Scope 3</b>	• Reducing indirect emissions				●		●	
<b>Carbon Neutrality includes:</b>	• Carbon sequestration • Carbon offsets	●	●	●	●	●	●	
		Harvard	Cornell	Dartmouth	McGill	U of British Columbia	U of Cambridge	UCLA

# Pathway to 2050: Carbon Neutral

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Target carbon neutrality by 2050, with:

- 80% reduction in absolute emissions
- 20% offsite renewable energy or offsets owned by the University

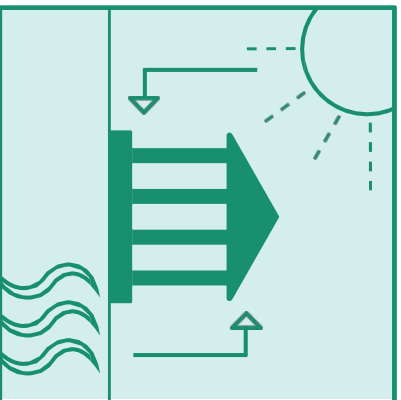
Target is in line with peer institutions, City of Toronto, and Federal Government



# Our Plan: How we plan to achieve our goal

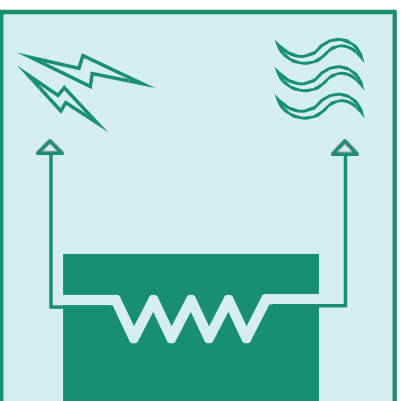
We will optimize how we produce, distribute, and consume electricity and natural gas on our campuses.

## PRODUCE



Clean Energy &  
Carbon Capture

## DISTRIBUTE



Efficient  
Distribution

## CONSUME



Reduced  
Consumption

## Carbon Reduction Framework: Principle 1

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### **Principle 1: Focus on Reduction**

Our strategy's primary focus should be reduction of the energy we consume.

**The cleanest and cheapest energy is the energy we do not consume**

## Carbon Reduction Framework: Principle 2

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### Principle 2: Balance Carbon with Cost

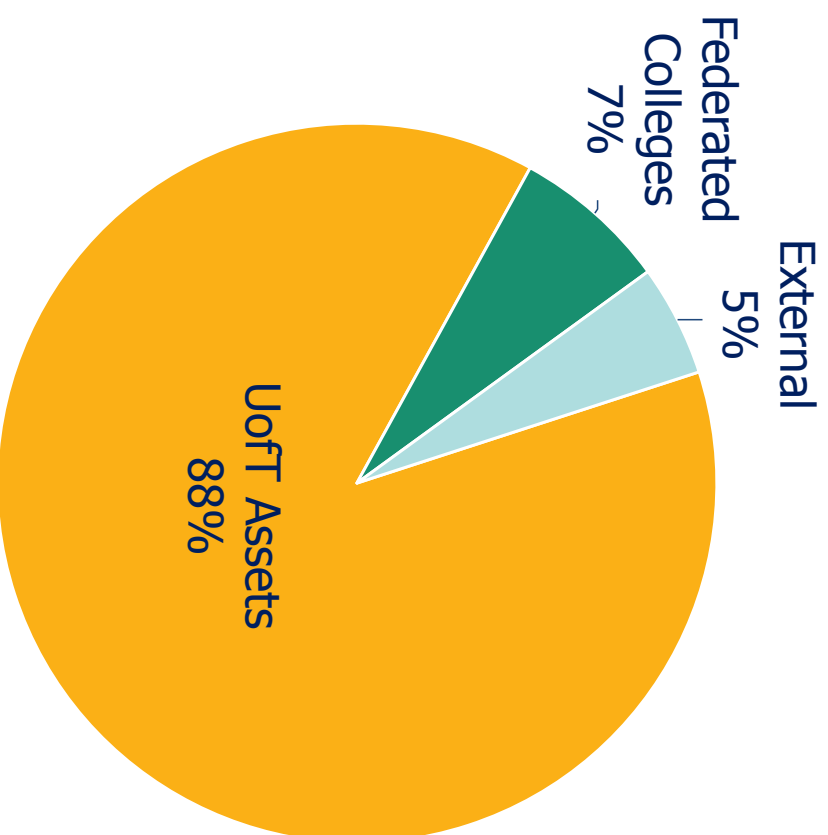
- We could address our carbon issue by switching to electricity because **electricity is 4.5 times cleaner than gas**, however electricity costs are approximately **11 times more expensive** on an equivalent energy basis.

	Commodity Rate \$ / ekWh	GHG Emissions kg / ekWh
<b>Natural Gas</b>	\$0.0148	0.1776 kg
<b>Electricity</b>	\$0.1615	0.0400 kg

## Carbon Reduction Framework: Principle 3

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### St. George GHG Emissions



### Principle 3: Reach Beyond Our Own Assets

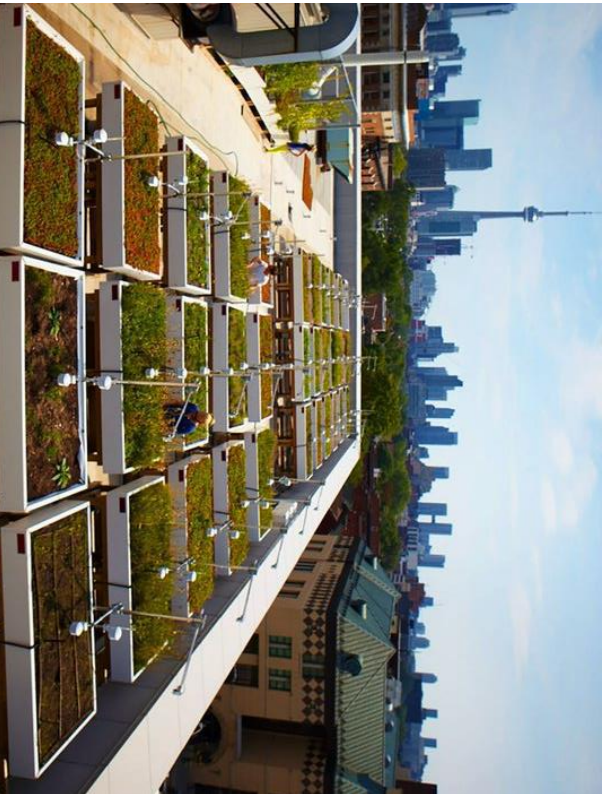
- On the St George Campus, approximately **12%** of our emissions come from assets we do not directly own or influence.
- Our carbon plan must incorporate reductions of these emissions.
- Partner with these organizations to reduce emissions

## Carbon Reduction Framework: Principle 4

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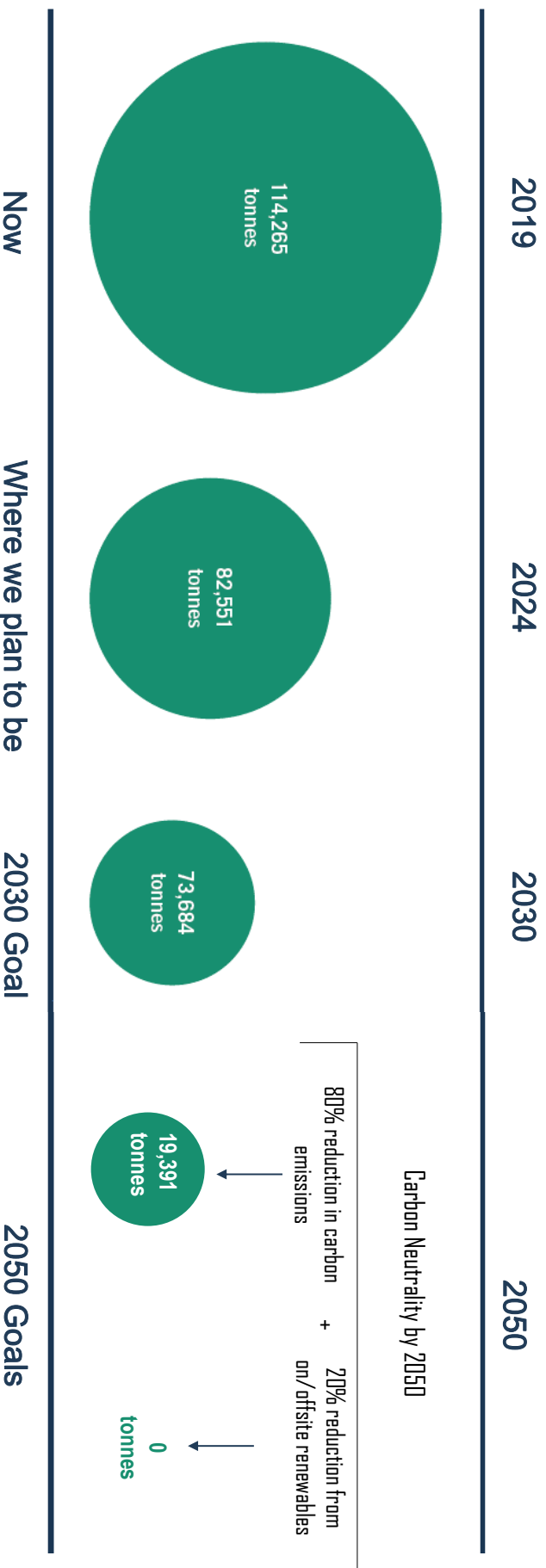
### Principle 4: Fostering Innovative Solutions

- Leverage the **Campus as a Living Lab** model to foster partnerships with our academic community to achieve carbon reductions
- Develop external partnerships to **implement innovative solutions** to our carbon challenges





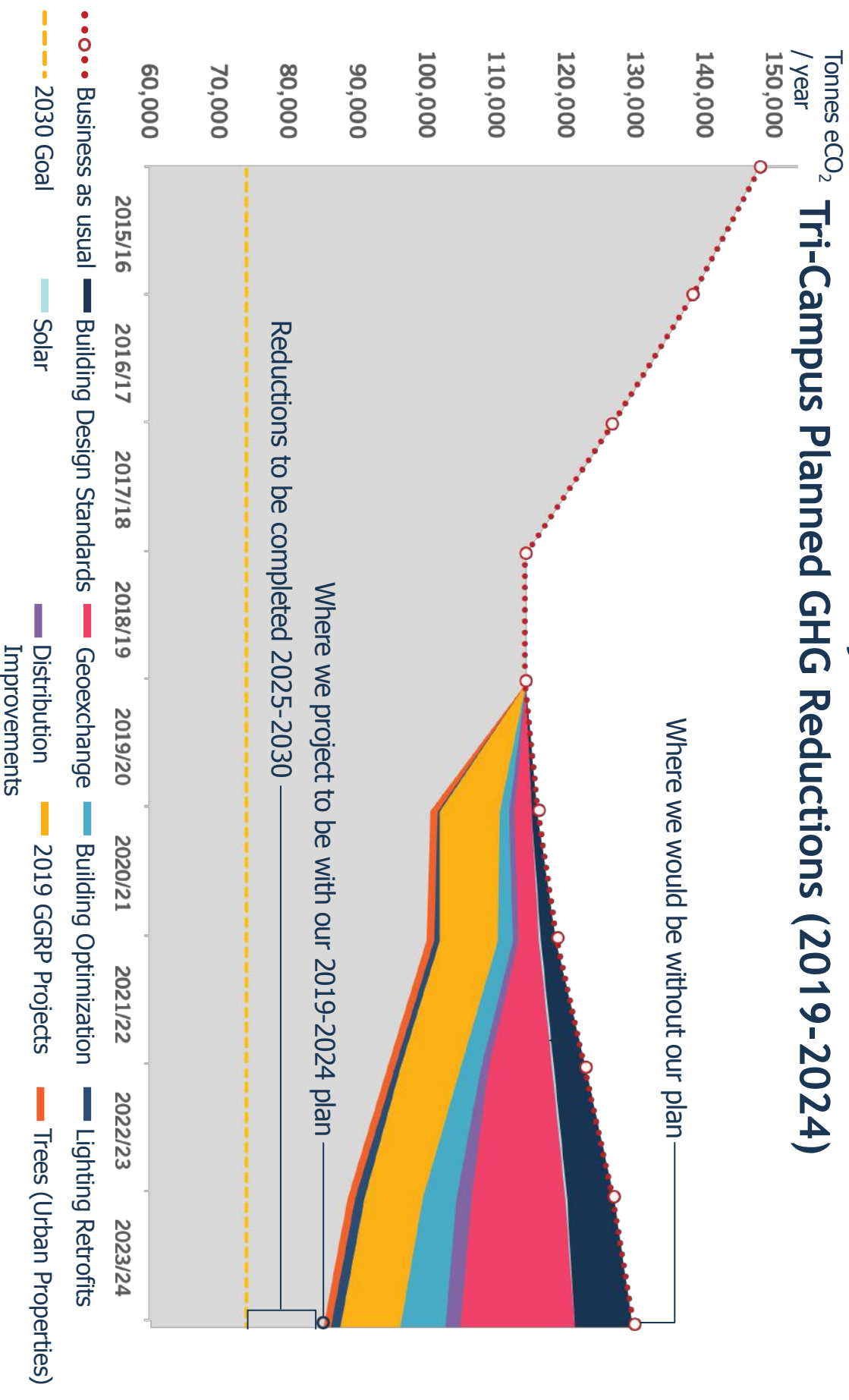
# Campus Emissions - Now and Future Targets



# Pathway to 2030

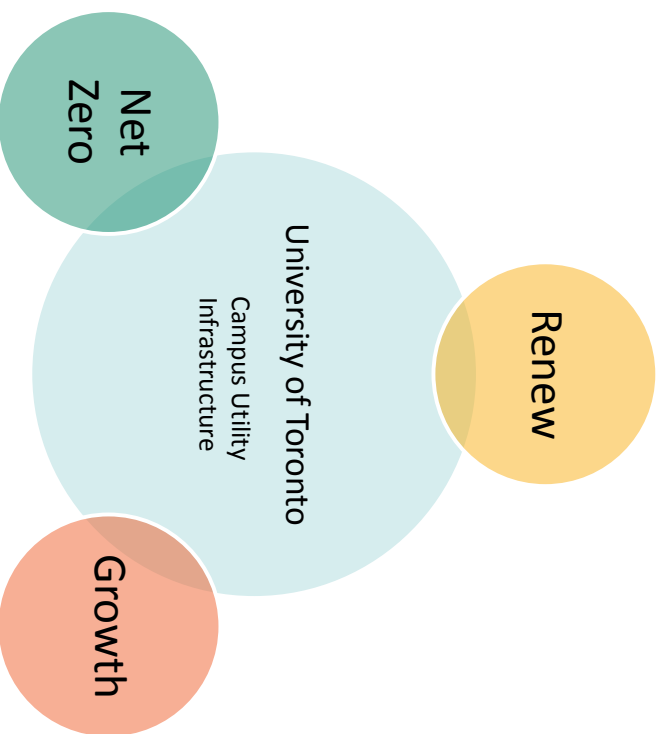
University of Toronto:

Tri-Campus Planned GHG Reductions (2019-2024)



# Net Zero Campus Master Plan Objectives

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Existing campus utility infrastructure is aged and requires renewal to support the university campus in its pursuit of academic and research excellence

Significant new campus growth will require expansion of the campus utility infrastructure in terms of:

- reliability
- redundancy
- resiliency

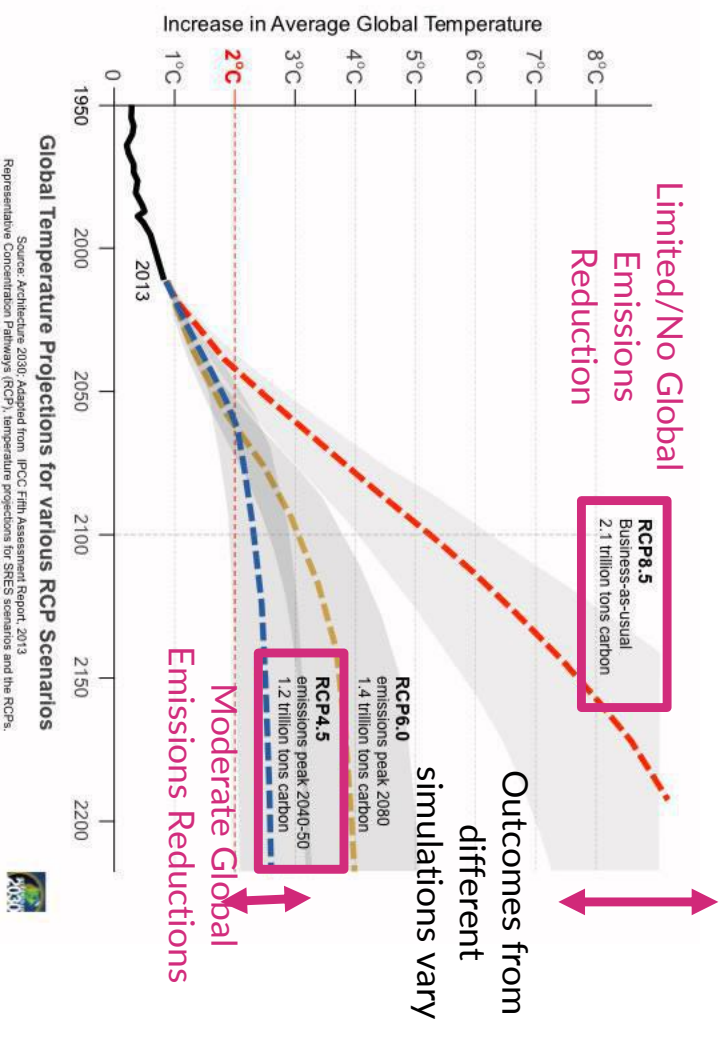
Commitment to reduce Green House Gas emission (by 37% below 1990's emission by the year 2030) will require transformational changes of the campus utility infrastructure

# Future Climate Projections and Impacts

Future climate data from computer models of atmospheric carbon dioxide under different reduction scenarios

Temperature, humidity, wind speed and rainfall changes are localized through shift factors on CWEC Toronto weather file

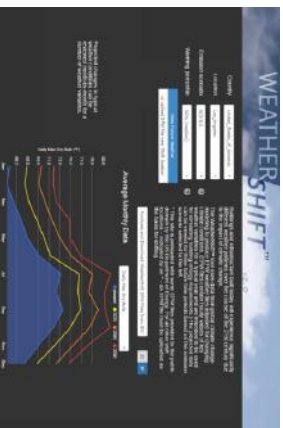
RCP 8.5 is used as the emission scenario  
Timeframe is 2050 (2046 to 2065)  
Warming percentile at 50%



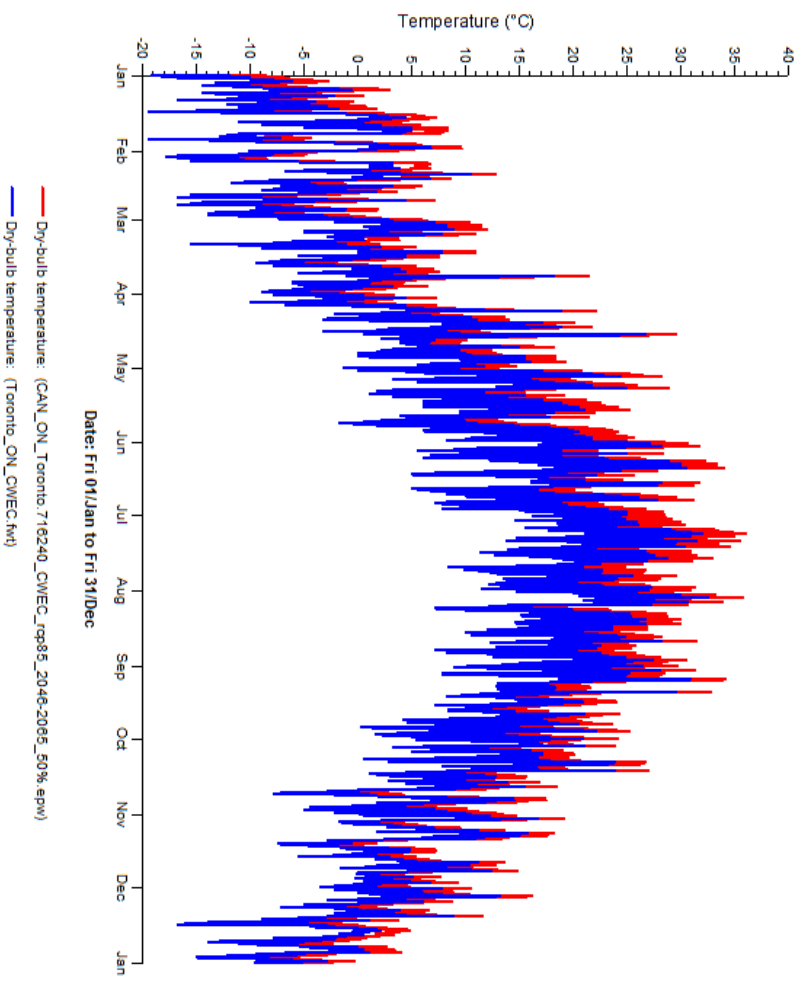
# Future Climate Change Impact

Energy Modelling Results between TMY and morphed weather files

- Annual Heating Consumption [MWh]: -0.6%
- Peak Heating Demand [MW]: -7%
- Annual Cooling Consumption [MWh]: +23%
- Peak Cooling Demand [MW]: +10%

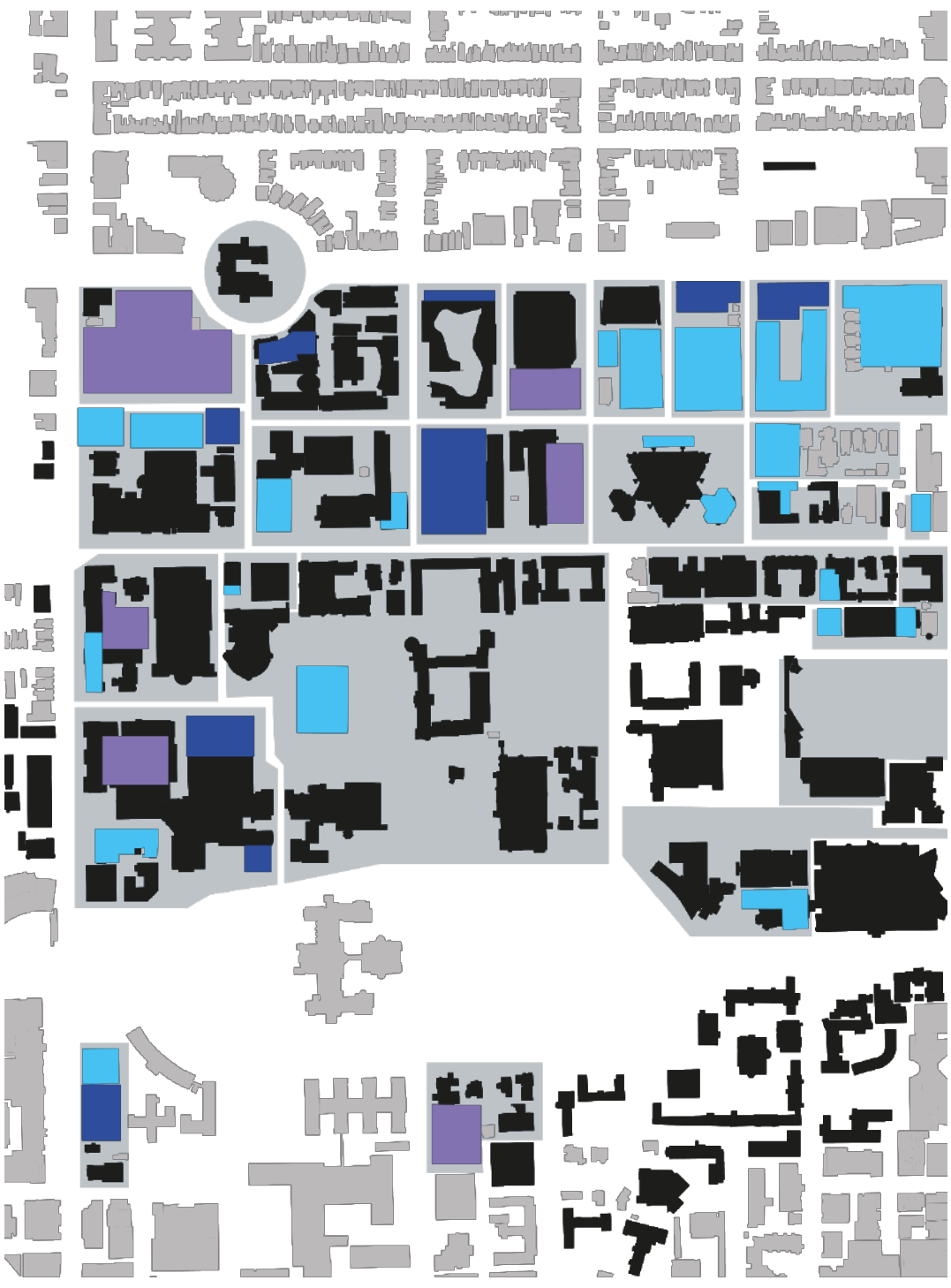


# Outdoor dry bulb temp



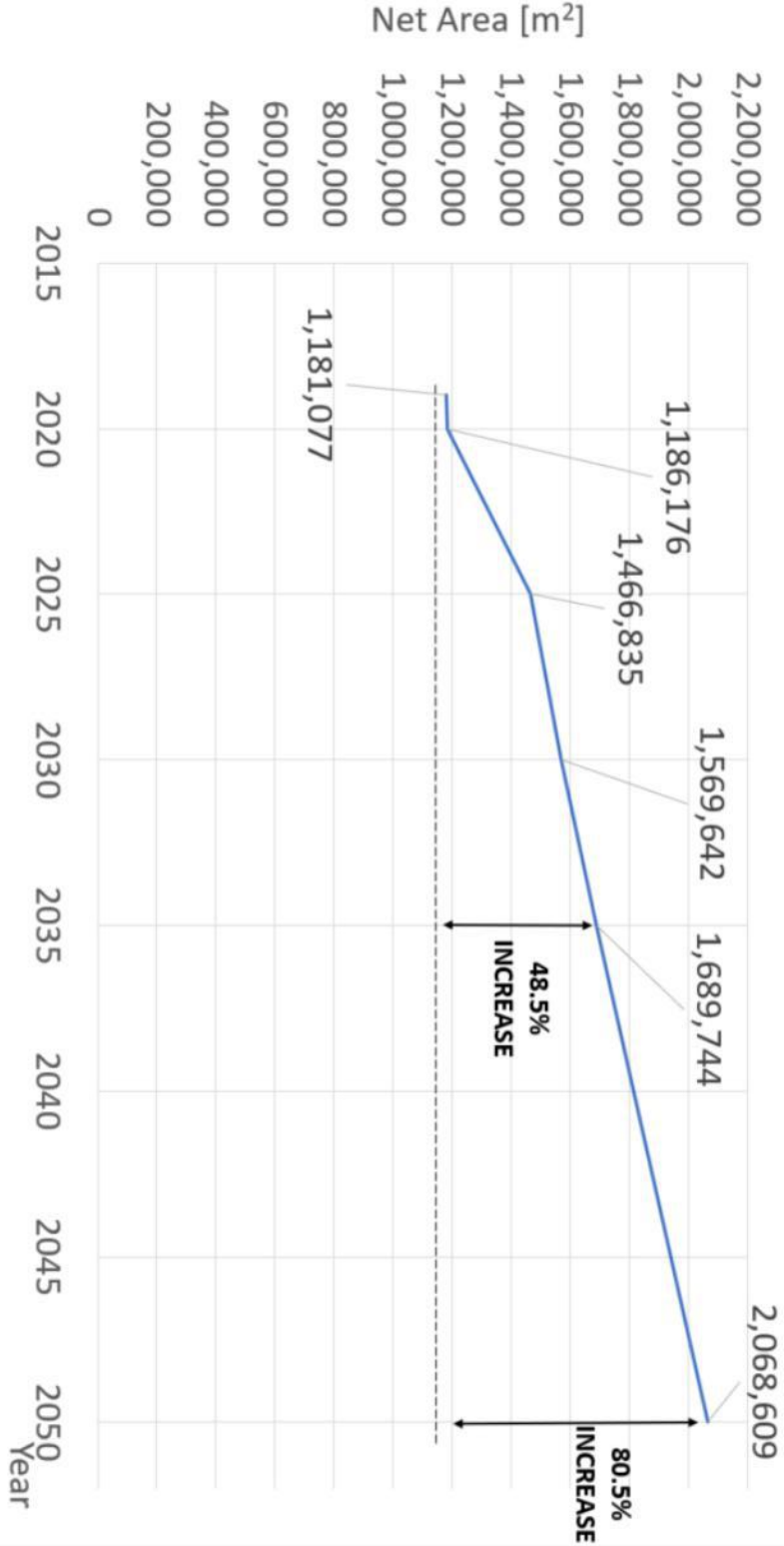
# CURRENT + PLANNED DEVELOPMENTS

- EXISTING
- 2020-2025
- 2025-2030
- 2030-2035
- 2035-2050



# CONSIDERATION 3: FUTURE GROWTH

## CURRENT + PLANNED DEVELOPMENTS



# What does a Net Zero Carbon Campus Look Like?

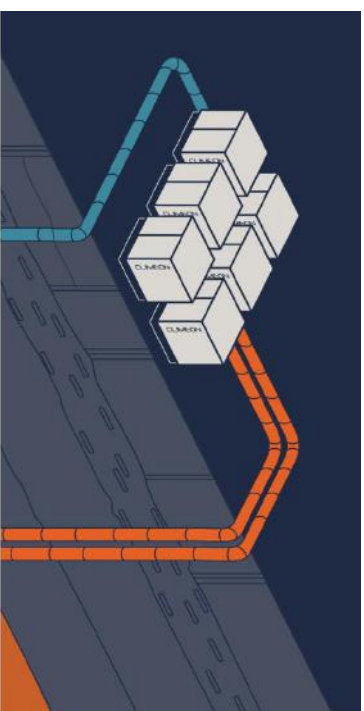


# TECHNOLOGIES REVIEWED

Biomass



Deep Geothermal



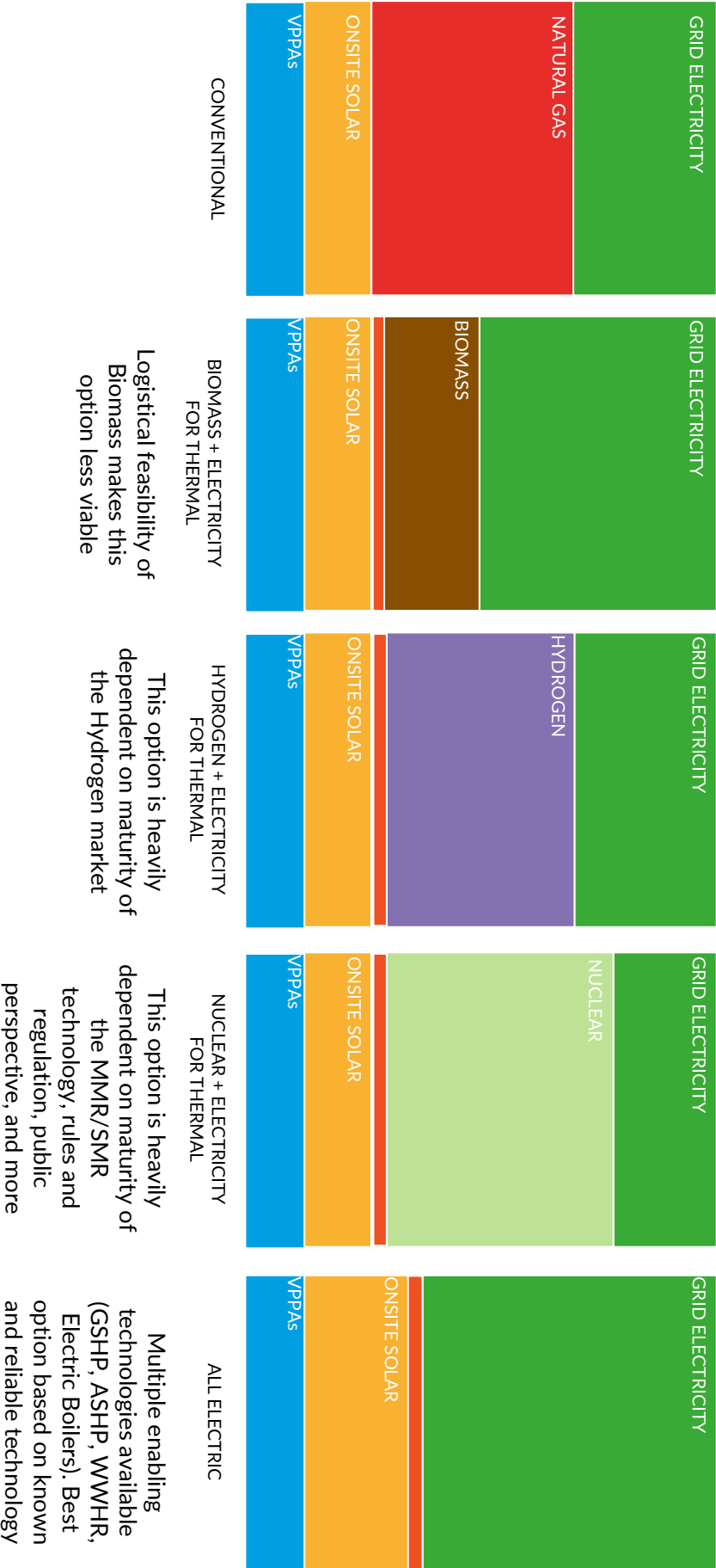
Hydrogen Fuel Cells



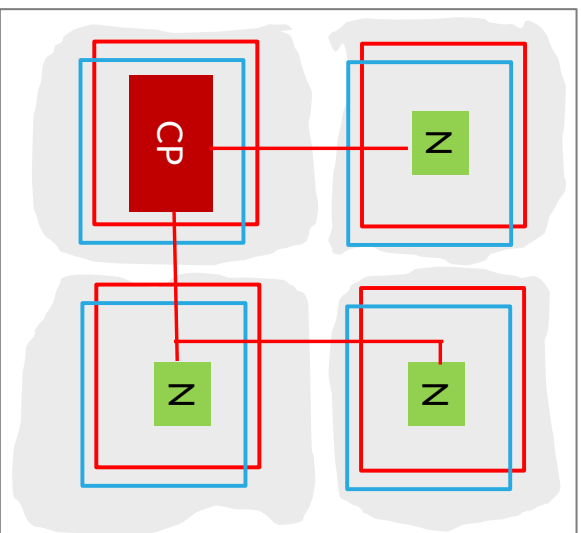
Micro (modular)-Nuclear



# FUTURE ENERGY SUPPLY MIX POTENTIAL SCENARIOS



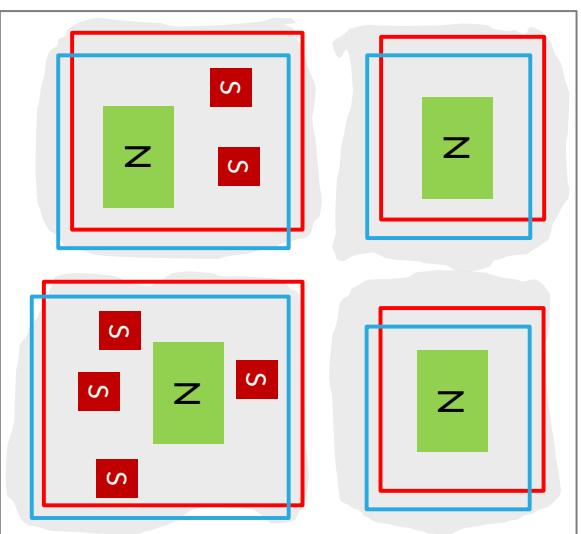
# SHORTLISTED STRATEGIES OVERVIEW



Alt. 1

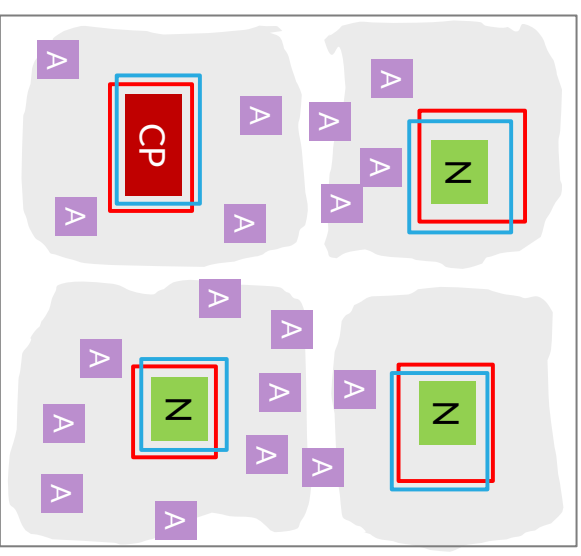
## Inter-Nodal Central Plant

- CP** - Central Steam/HW Plant
- N** - Nodal Plant
- S** - Local Steam Boiler
- A** - Local Air-Source Heat Pump



Alt. 2

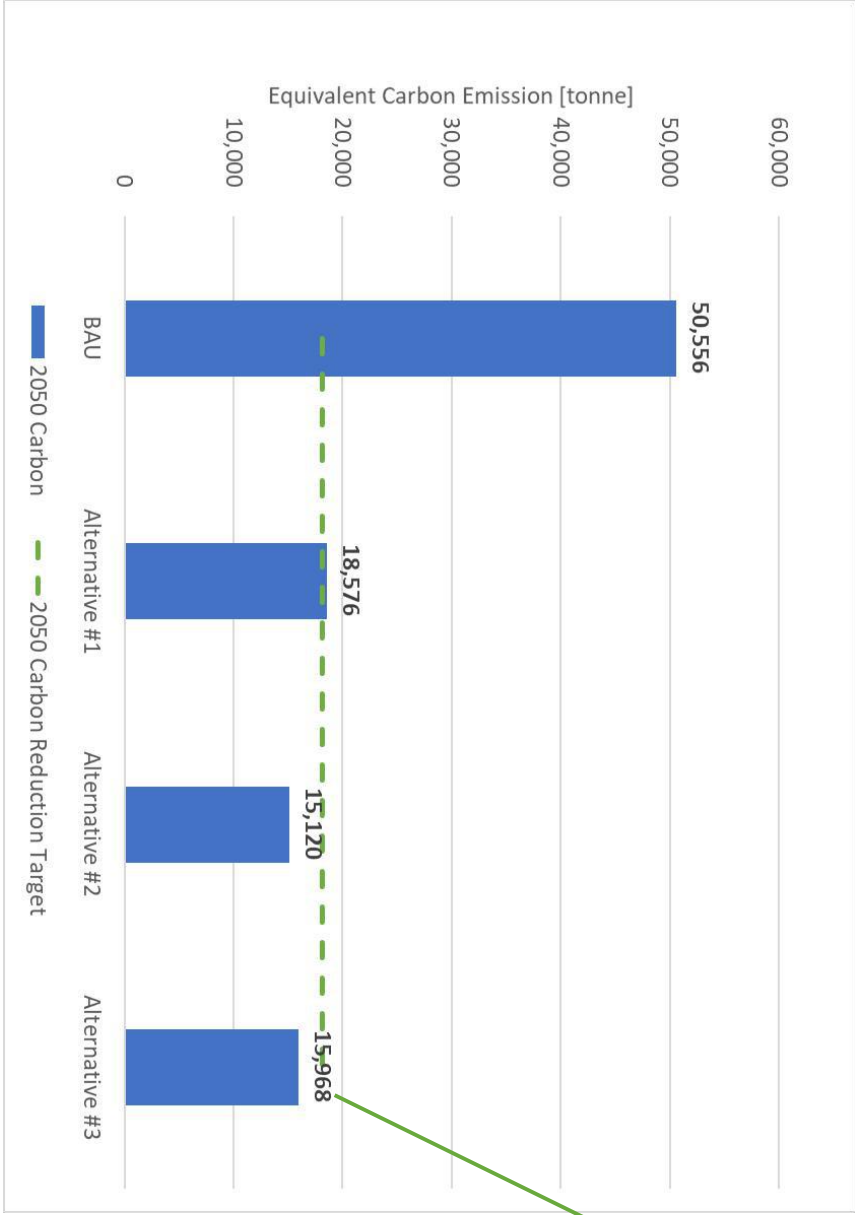
## Nodal Focused



Alt. 3

## Local Generation Focused

# EQUIVALENT CARBON EMISSION - YEAR 2050



Emissions offset associated with Large Scale University Owned off site solar farm