Corporate Energy Managers COP Meeting

Update on Toronto's low carbon buildings – new and retrofits

June 29, 2021

Dejan Skoric
City of Toronto

TORONTO

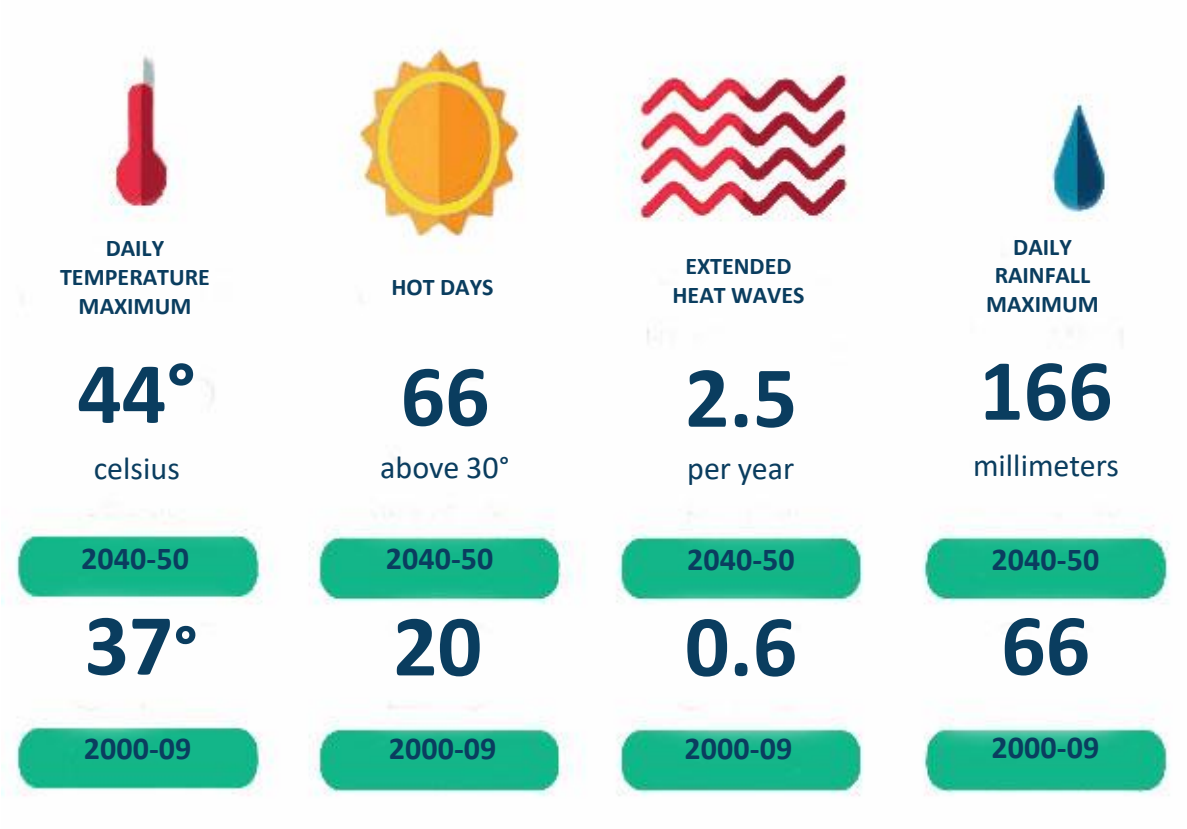
Overview

1. Climate Crisis (TransformTO)
2. New Construction updates
    - Policy/Process
    - Project updates
    - Lessons Learned
3. Deep retrofits
    - Examples
    - Lessons Learned
4. Upcoming Council reports

What does climate crisis look like in Toronto?

Toronto Islands Flooding
May 2017 - Photo by Daniel Williams

Hotter, Wetter, Wilder – Toronto's Future Weather



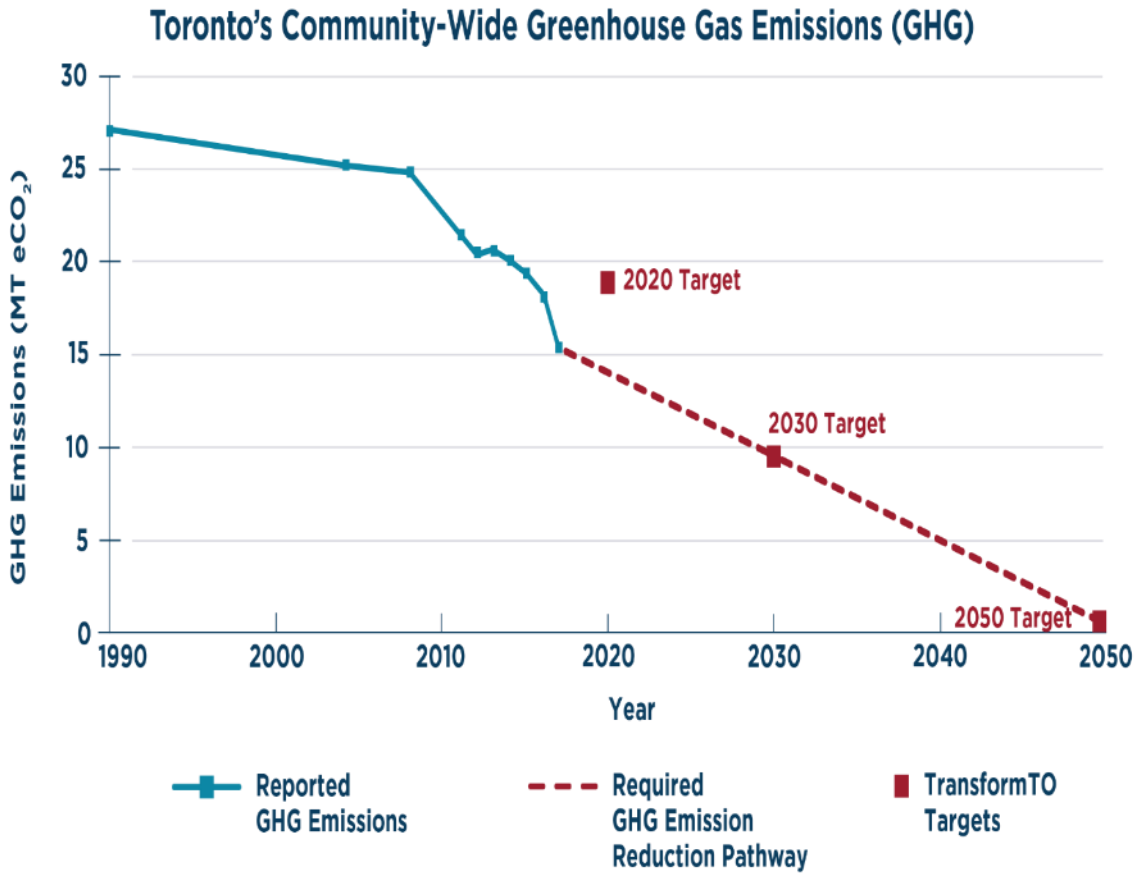
Global Forces Have Local Implications

Toronto Declares a Climate Emergency

On October 2nd 2019, Toronto City Council unanimously voted to declare a climate emergency and accelerate its efforts to mitigate and adapt to climate change.

TransformTO will now aim to achieve net zero emissions by 2050, or sooner.

A Path to Net Zero



Toronto GHG reduction targets, based on 1990 levels:
- 30% by 2020,
- 65% by 2030,
- 100% by 2050(2040)

Low carbon buildings account for about 47% of the future projected reductions

TransformTO 2017 City of Toronto Leadership Goals

100% of new City-owned buildings will be built to be near-zero GHG emissions by 2026

100% of existing City-owned buildings will be retrofitted by 2040

24 MEGAWATTS of renewable energy capacity will be installed on City-owned facilities and lands by 2020

45% of City-owned vehicles will be low-carbon by 2030

1.5 MILLION gigajoules of energy will be generated from biogas by 2030

100% of City-owned facilities will achieve zero waste status by 2030

Earn **'CANADA'S TOP 100 GREEN EMPLOYERS'** designation by 2020

Net Zero Update at the City of Toronto

New construction Policy/Process:

- Since 2018 all City buildings must
  - At minimum meet TGS Tier 2 (25% better than Ontario building code),
  - investigate feasibility of achieving net zero emissions,
  - and report back to Council on additional funds required to achieve it
- Net Zero Feasibility Study Terms of Reference (https://www.toronto.ca/wp-content/uploads/2021/04/8dce-CityPlanningNZETOR20210301.pdf)
- Updated internal RFP Guide for PMs with sections specific to RFP for design of new Net Zero buildings

How to Deal with Climate Crisis:

Options for New Construction:

1. ~~**Business as Usual**~~

2. **Delay Implementation**
   - require major re-investments by 2040 in order to meet City Net Zero targets
   - all the emissions released in meantime

3. **Design for Net Zero Today**
   CaGBC study estimates an ~8% cost premium for Net Zero Buildings compared to buildings that meet minimum code

Mount Dennis Childcare:

The City of Toronto's first Net Zero Facility: Update

Mount Dennis Childcare – Final Design Numbers

TGS Tier 2 >25% above SB-10 2017

✓ ***46.1% Above***

Net Zero Energy Balance

✓ ***Consumption 101,830kWh/a vs. Production 119,320kWh/a***

TEUI	TEDI	GHGI
53.56	30.97	0

✓ ***First City of Toronto building certified to Canadian Green Building Council's Zero Carbon Building Standard***

Mount Dennis Child Care Design Process

Establish Goals: Net Zero Carbon

SCHEMATIC DESIGN

- 100% electric building
- Estimate potential PV production to set **Solar Budget**
- Calculate the EUI that Can be Supported – **20% Contingency**
- Check Standards
- Find Benchmark Buildings & Use their R Values
- Add 20% contingency to each element for thermal bridging
- Build Energy model and check that required energy is below the budget

DESIGN DEVELOPMENT

- Detail all envelope elements – thermal bridge free with 20% allowance for thermal bridges
- Coordinate with programing and structural design team
- Update Energy Model and check that required energy is below the budget

CONSTRUCTION DOCUMENTS

- Source all products and equipment and adjust U values based on selected products
- Update Energy Model and check that required energy is below the budget

THIRD PARTY COMMISSIONING AND M&V AGENT

- Air Tightness testing requirements
- Develop Commissioning and M&V Plan

Mount Dennis Childcare – Construction Update

- Q2 2022 occupancy date

NE Scarborough CRC

- **Status: Tender documents**
- 8-10% cost increase
- The proposed facility is approximately 84,000SF and will include 25m indoor lap pool and leisure pool, gymnasium, child care centre, teaching kitchen, and multipurpose spaces.
- Targeting Zero Carbon Building design certification (possible first for community centre with indoor pool)

Technologies & Measures	Energy Savings**	TEUI (kWh/m²)	GHGI*** (kg/m²)
TGS Compliant Base Design	-	306	37
A2.1: Envelope Improvement – Walls R25	0.3%	305	36.9
A2.2: Envelope Improvement – Roofs R55	0.3%	305	36.9
A2.3 : Envelope Improvement – Triple Glazing (U-0.2)	2.6%	298	35.8
A2.4: Fins Shading			
A3: Airtightness Improvement by 50%	3.6%	295	35.8
M1.1: Geothermal Heat Pump*	30.4%	213	10.7
M1.2: Geothermal Heat Pump with backup Electric Boiler	27%	223	11.2
M2: Air Source Heat Pump	30.4%	213	10.7
M3: Hybrid Air Source & Geothermal Heat Pump			Expl
M4: Push and Pull System	-18%	361	53.3
M5: Pool Covers	5%	291	36.8
M6: Earth Tubes	3%	293	36
M7: Bio Mass Boilers	-7%	340	7
M9: Improve Heat Recovery Efficiency to 85% (except pool)	1.6%	301	36.9
M10: Drain Heat Recovery	8.2%	281	32.8
E1.1: Photovoltaic and Thermal (PVT) (Roof Area)	23%	245	28.5
E1.2a: Bifacial PV Panels (Roof Area)	6.2%	287	36.3
E1.2b: Bifacial PV Panels (Parking Area)	14.3%	262	34.9
E1.3 BIPV on South Façade Glazing	2%	300	36.9

Progress Avenue Multi-Function Paramedic Station

Detailed Design (post-NZE feasibility study)

- 5-7% cost premium
- 90,000SF and will accommodate up to 250 Paramedic Services personnel
- Targeting Zero Carbon Building certification from the CaGBC
- Proposes to use the following elements to achieve Net Zero:

✓ Passive design elements (highly efficient envelope, air tightness requirements, thermal bridge free),

✓ mass timber structure for lowered embodied carbon;

✓ energy recovery

✓ ground source heat pump

✓ solar energy (BIPV cladding, rooftop PV, a solar wall, and solar PV carport)

✓ EV charging stations

✓ energy storage for facility resiliency, etc.

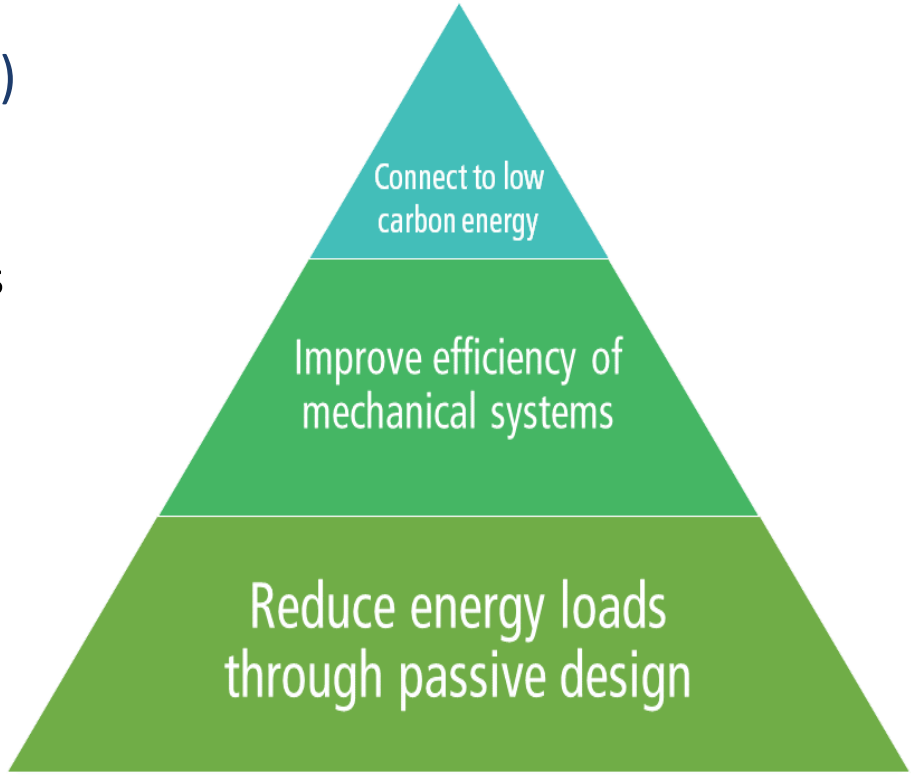
Net Zero Update at the City of Toronto

Incomplete list of other projects targeting NZE:

- Schematic design and Net Zero feasibility study:
  - Wabash Community Recreation Centre
  - Davisville Aquatic CRC
  - Dawes Rd Library branch
  - George Street Revitalisation
- Detailed design/tender documents:
  - Centennial Library branch
  - Western North York Community Centre
  - Dufferin Solid Waste Services office building

Lessons learned – new buildings

- RFP for Architect must clearly specify this is a Net Zero Building (emissions or energy or both)
- Incorporate passive design principles in the RFP scope of work
- Specify Net Zero Emissions (GHGI = 0) and/or Net Zero Energy goal:
  - The site generates as much ON-SITE renewable energy as it uses
- Require air tightness testing
- Recommended:
  - Require third party CxA & M&V
  - Require that design meets the CaGBC's Zero Carbon Standards



Existing Buildings Retrofits

Deep Retrofit Pilots:

- Three underway
- More in development / RFP stages
- Holistic approach addressing both planned SOGR upgrades and energy / GHG reduction measures
- Financed by a combination of:
  - recoverable debt financing (energy savings repay the loan),
  - SOGR budget, and
  - grants (if available)
- ESCO contracts (design-built)

Deep Retrofits

Emergency Services HQ

- Construction began in June 2021
- COVID-related cost increases about 10%

- Measures:
  - Ground source and air source heat pump systems
  - Modular chiller, cooling tower, and boiler replacements
  - 500 kW Solar PV carport over parking garage
  - Controls optimization
  - Heat recovery
  - Rooftop unit replacements
  - Exterior lighting retrofit
  - EV charging stations

Quick stats	
Total Estimated Budget	$5.60 million
Total % energy saving	59%
Total % Cost savings	42%
Total % GHG reduction	79%

Deep Retrofits

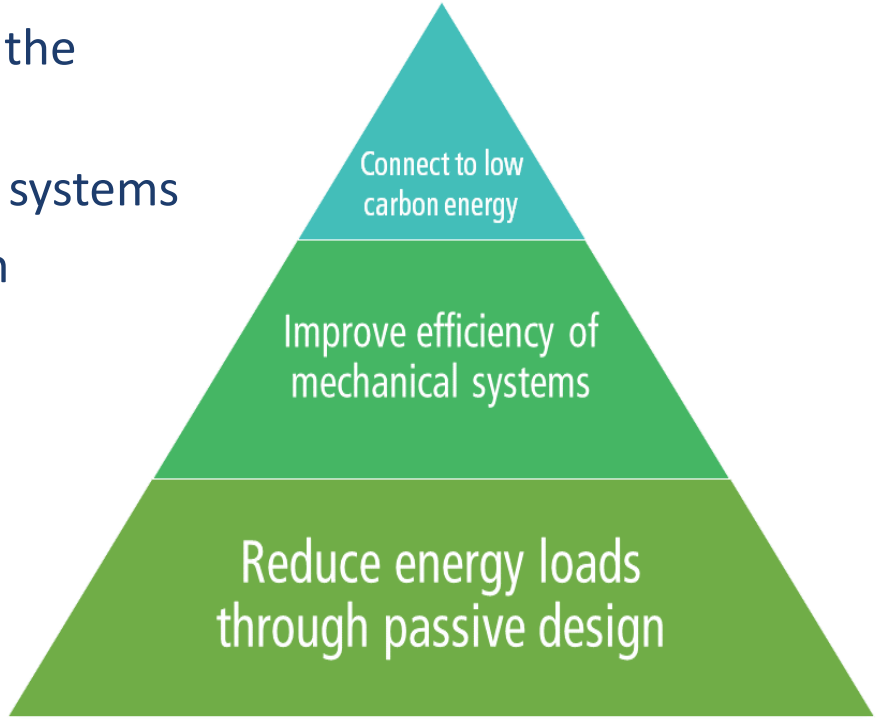
Waterfront Neighbourhood Centre

- Holistic approach for a path to Net Zero
- Phase 1: LED lighting retrofit
- Phase 2: 100 kW Solar PV + 200 kWh energy storage
- Phase 3: Lake-based geoexchange system, replacement of boiler, chiller, and cooling tower, heat recovery, energy conservation, and BAS upgrades
- Phase 3: 100% design

Quick stats (3rd Phase)	
Total Estimated Budget	$3.230 million
GRANTS approved	$850,000
Total % energy saving	60%
Total Cost savings	30%
Total % GHG reduction	79%

Deep Retrofit Experience at the City of Toronto

- Fuel switching is key to meet Net Zero emission targets
- Best results achieved with integrated approach (deep retrofits)
- Crucial to address the overall 'health' of existing HVAC system
- Schedule deep retrofits to coincide with the replacement of major equipment
- Integrate new components with existing systems
- Retrofits tend to be like peeling an onion
  - A large contingency is always a good idea
- Establish the pre-retrofit baseline
- Procurement: design-built or ESCO



Net Zero Update – 2021 future outlook

2021 Council reports affecting climate action on municipal properties:

July

- Toronto Green Standard v4
  (2022 Zero Carbon building mandate for City owned buildings)
- Corporate Real Estate Management's Zero Carbon Plan
  http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2021.IE23.2
  (goal: Zero carbon by 2040 across whole portfolio of City owned real estate)

November

- TransformTO: Net Zero Strategy and Action Plan
  (updated Leading By Example actions to achieve Zero Carbon across all City operations)

Toronto Green Standard v4 – City Buildings

June 28th Planning and Housing Committee
(http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2021.PH25.17)
July 14th City Council

Recommendations for City Buildings:

- TGS v4 in effect on May 1st 2022
- **Greenhouse Gas Intensity (GHGI) of 0**
  (Zero Carbon Building)
- Energy targets - meet one of the following:
  - Minimum TEUI of 100 ekWh/m²/yr and TEDI of 30 ekWh/m²/yr;
  - A minimum 50% better than Ontario Building Code compliant building
  - Passive House certification
  - CaGBC Zero Carbon Building Standard v2 design certification.
- Embedded carbon study and a minimum of 20% embodied carbon reduction, compared with a baseline building
- Air Leakage Test with target equal to or less than 2 L/s/m² (at 75 Pa)
- At least 25% of the parking spaces equipped with EV chargers

Discussions/Q&A

Thank You

Dejan Skoric, PMP, LEED AP O+M
Senior Project Manager
Environment & Energy Division
Dejan.Skoric@toronto.ca

energy conservation and demand management

reduce emissions to the environment

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