IDEA Annual Conference June 13, 2018

The Role of Thermal Networks for Low-Carbon Resilient Communities

Fernando Carou

Toronto is Changing

Toronto's population is growing & densifying at one of the fastest rates in North America, placing demands on services & infrastructure, energy systems & the environment.

About 50% of households now live in multi-residential housing.


NATIONAL POST

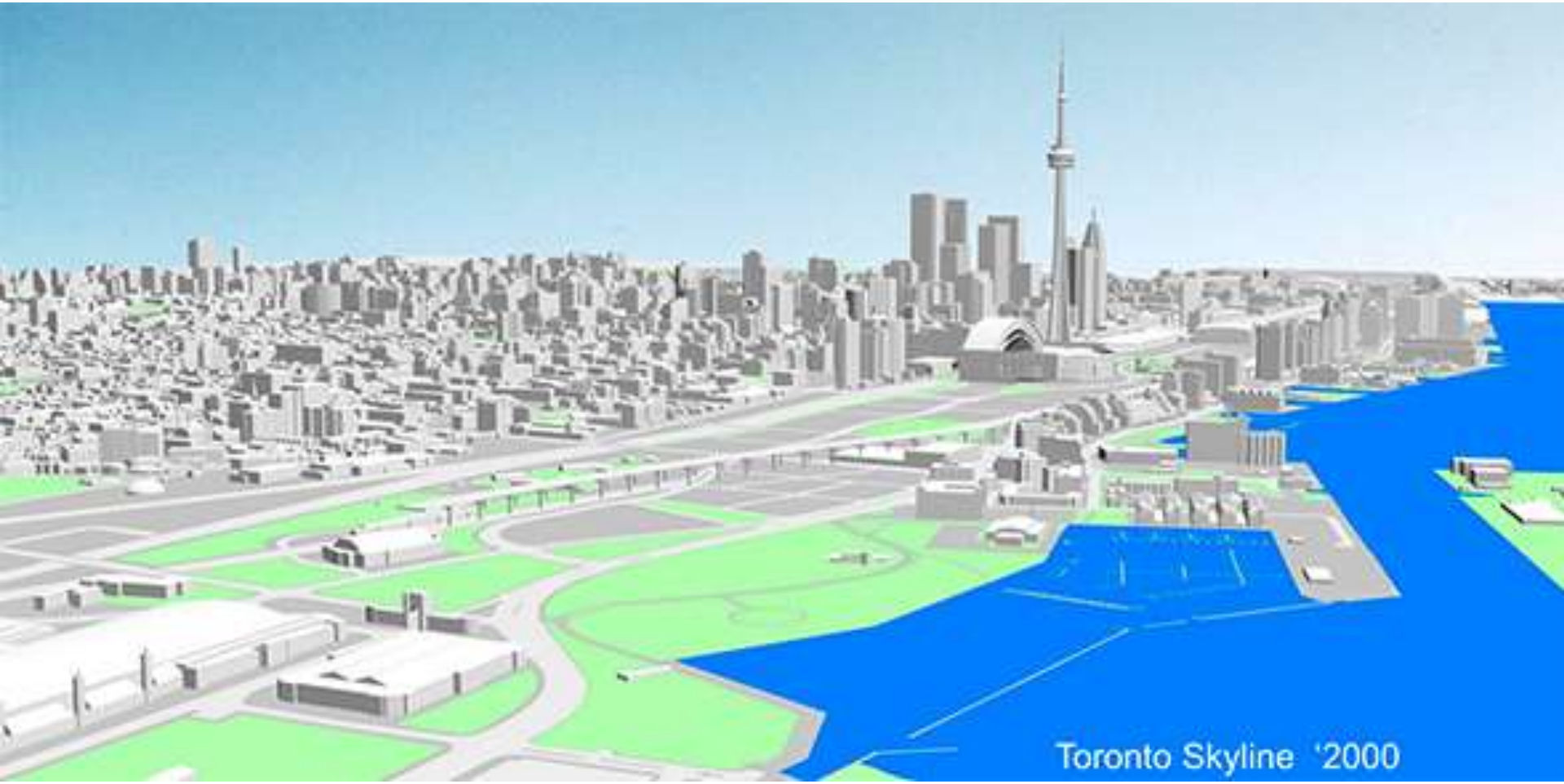
Downtown Toronto s pace of population growth triples, outpacing suburbs as Echo Boomers floc towards urban centre report

THE GLOBE AND MAIL

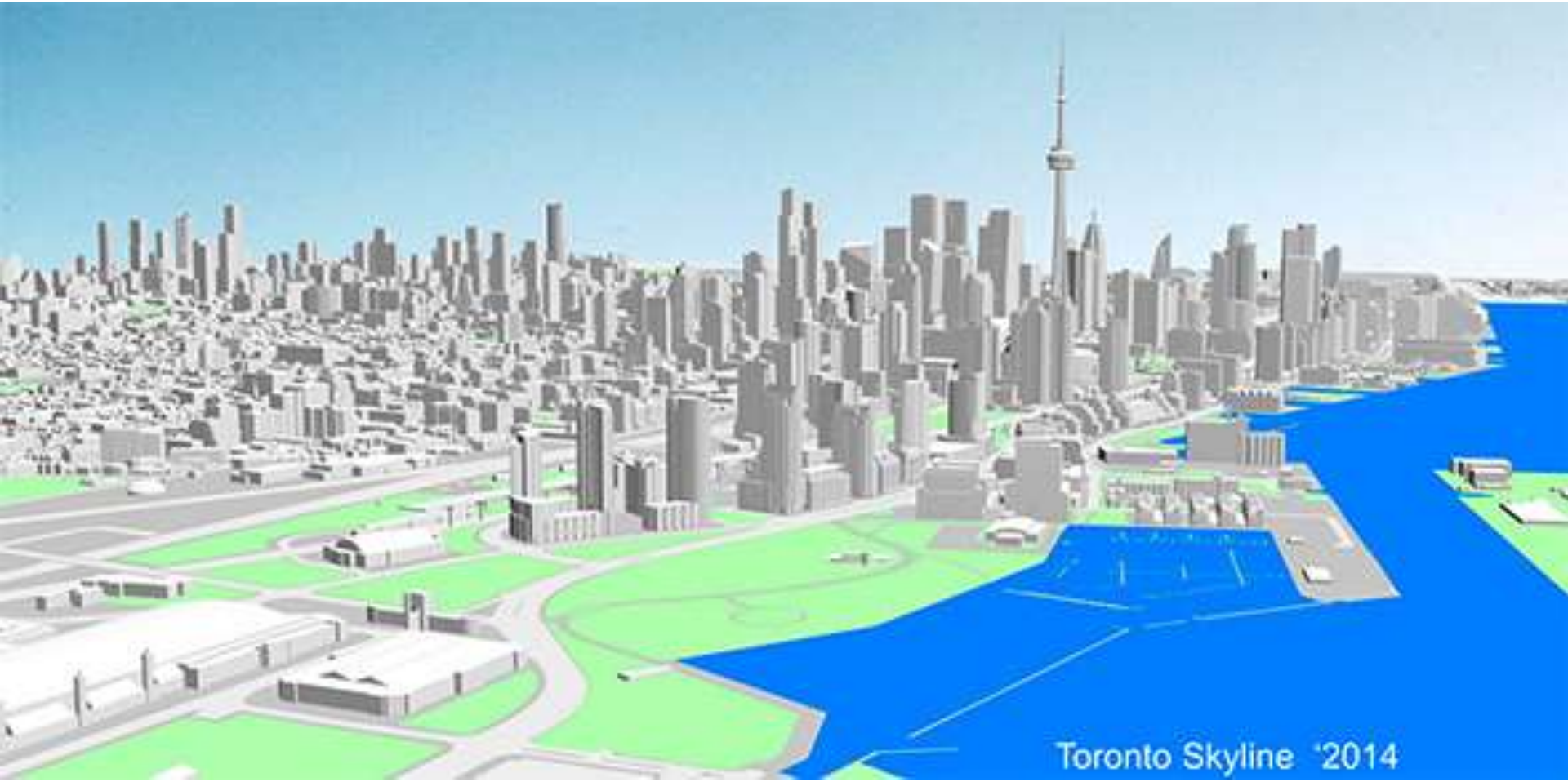
REAL ESTATE

Toronto leads North American high-rise construction

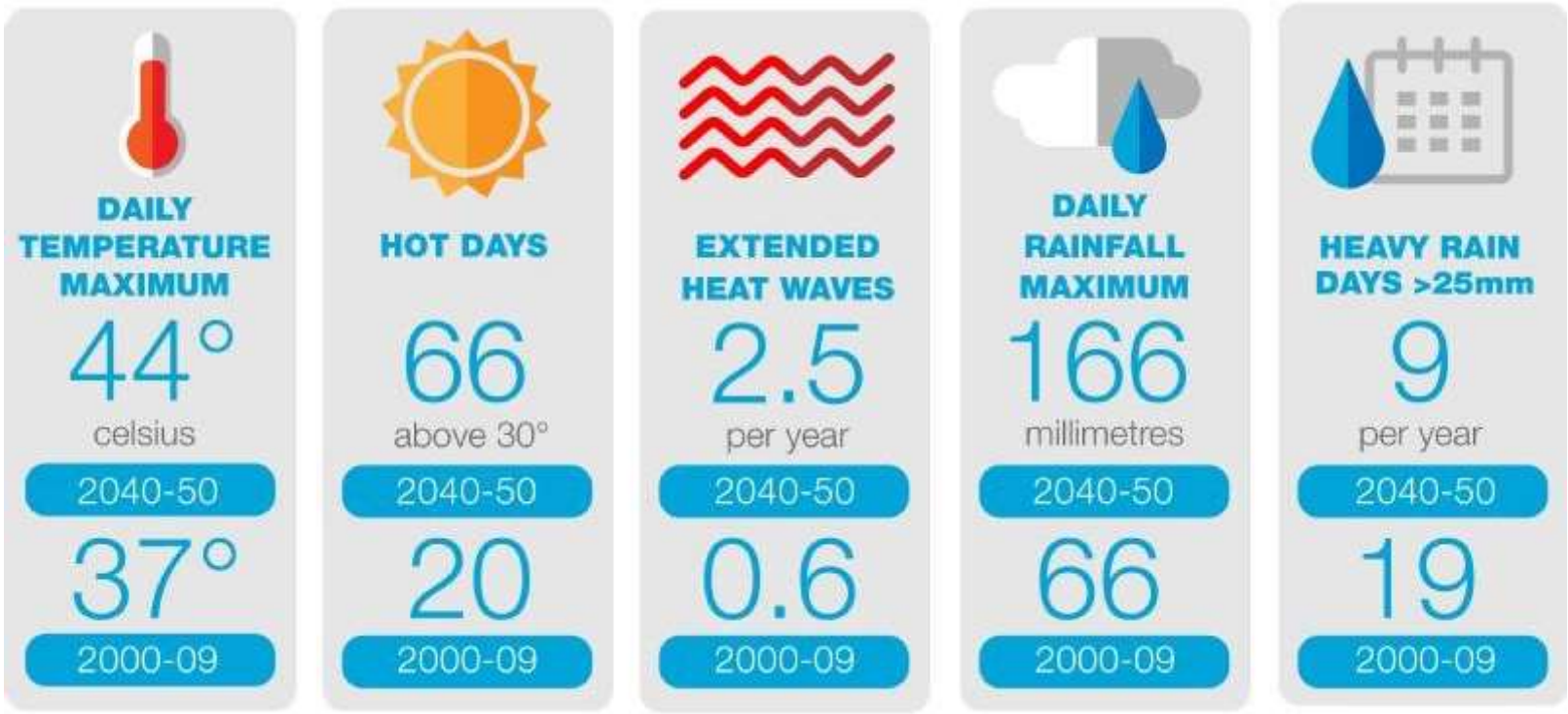
Toronto's Growth: 2000 vs 2014 Skyline



Toronto's Growth: 2000 vs 2014 Skyline



Toronto's Future Weather: Wetter, Warmer & Wilder.



*Source: Toronto's Climate Driver Study, 2011

TransformTO

www.toronto.ca/transformTO

What is Transform TO?

Toronto's new and ambitious climate action plan, identifies how we'll reduce our greenhouse gas emissions and improve our health, grow our economy, and improve social equity.

In July 2017 City Council unanimously approved a set of long-term, low-carbon goals, and strategies to reach them.

Toronto's greenhouse gas reduction targets,

based on 1990 levels: 30% by 2020, 65% by 2030, and 80% by 2050

Achieving these targets **will require transformational changes in how we live, work, commute, and build**.

What will low-carbon Toronto look like in the future?

TransformTO

Homes and buildings generate about half of the greenhouse gas emissions in Toronto today.

- By 2030, **new buildings** will be built to produce **near-zero greenhouse gas (GHG) emissions**
- By 2050, all **existing buildings** will have been retrofitted to **improve energy performance an average of 40%.**

Energy:

- By 2050, **75% of the energy** we use will be **renewable or low-carbon**;
- By 2050, **30% of total floor space** across Toronto will be **connected to low-carbon heating and cooling energy**.

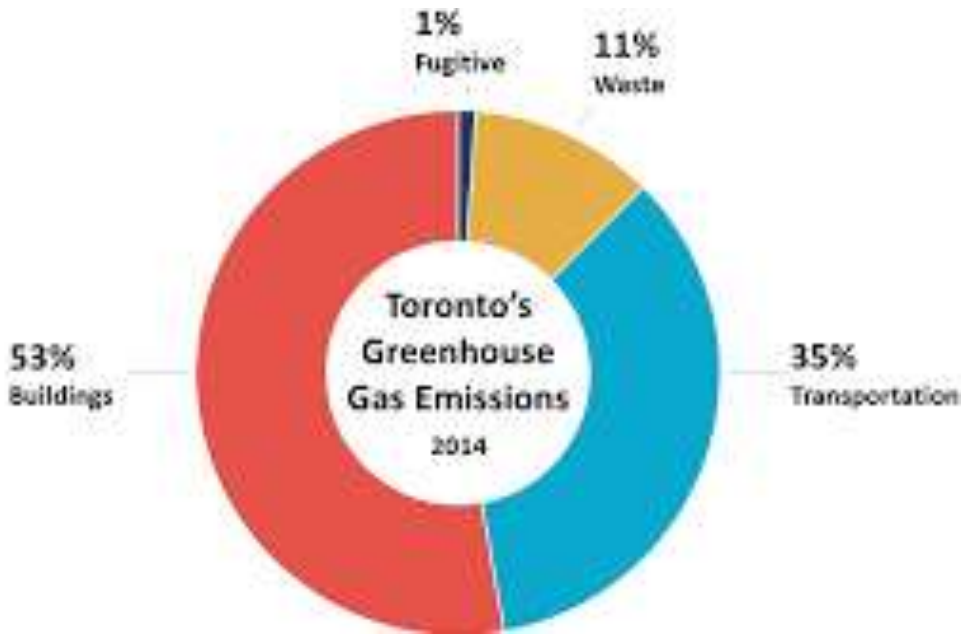
Transportation: vehicles generate about one-third of the greenhouse gas emissions in Toronto today.

- By 2050, **100% of vehicles** in Toronto will **use low-carbon energy**;
- By 2050, **75% of trips under 5 km will be walked or cycled**.

Waste Diversion:

- By 2050, 95% of waste will be diverted from landfills. Waste generates more than 10% of the greenhouse gas emissions in Toronto.

Toronto's GHG Emissions by Sector 2014 data



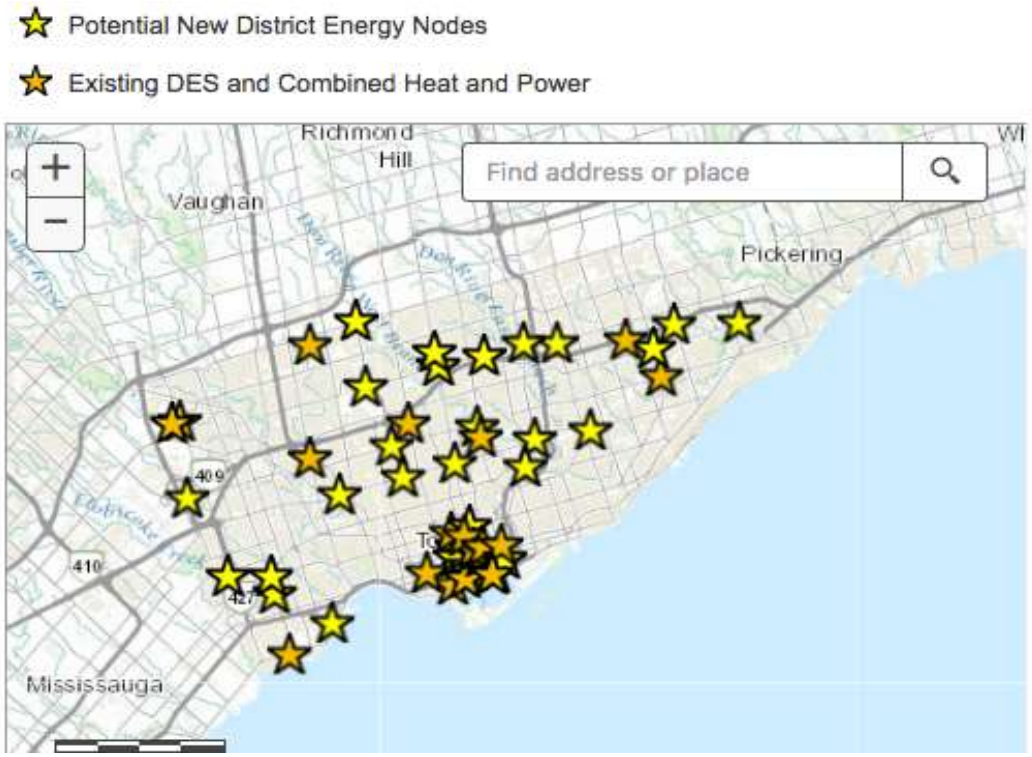
Two key strategies for large magnitude emissions reductions:

Efficient Buildings + Low-carbon Thermal Energy Networks to reduce/displace natural gas use in buildings.

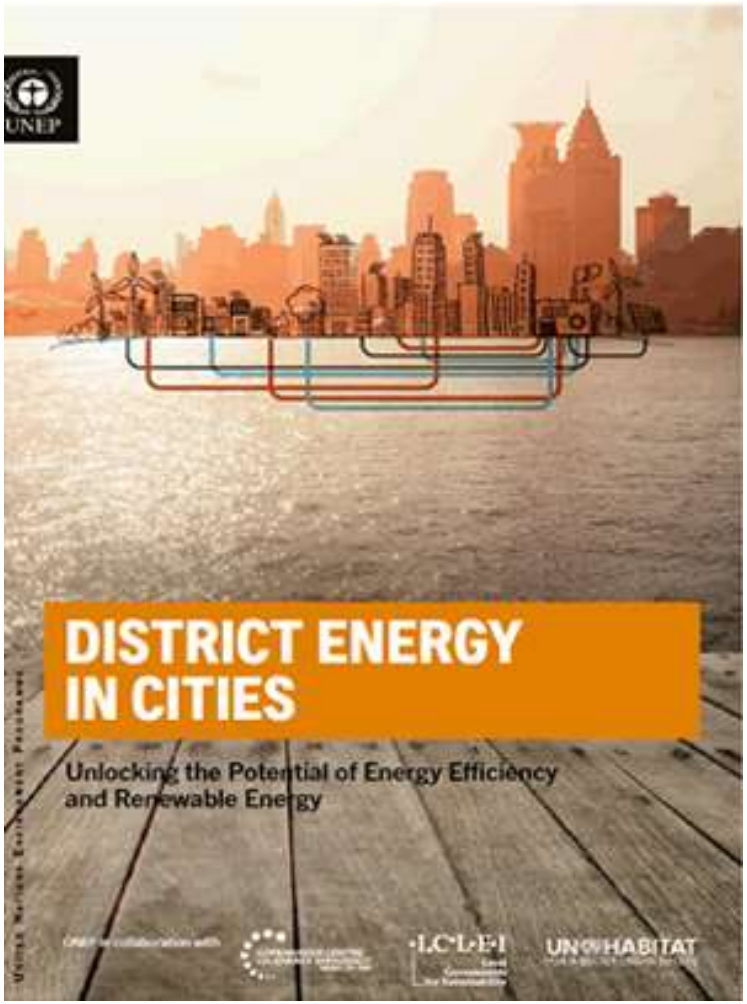
Transit + **Electric Vehicles** to reduce/displace mobile fossil fuels.

Developing Toronto's Thermal Energy Networks

District Energy w/ Large Renewables



Opportunity for 30+ new
District Energy systems in Toronto



2015 UNEP Report

Leading by Example: Ex Place (2016)

New District Energy System completed in 2016.

Hotel X signed a **20 yr energy supply agreement** with Ex Place as the anchor client – hotel opens in 2017.

Converted **existing underutilized assets into revenue generation for Ex Place of $500K per year**.

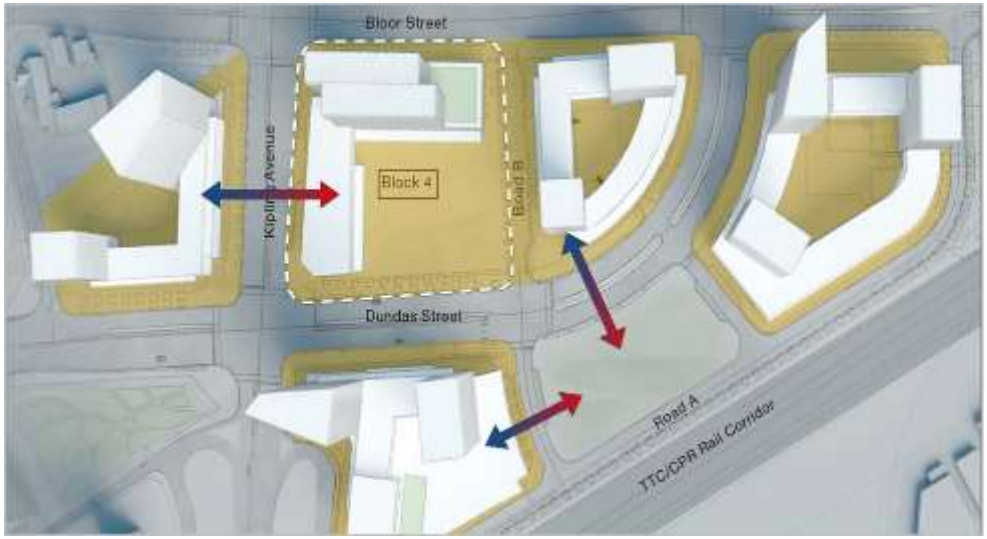
Greater than 10% IRR on $4.5 Million investment.

Figure shows new low-carbon thermal energy network (district energy) interconnecting 3 existing energy plants and supplying energy to new Hotel.

Leading by Example: Etobicoke (under development)

New Etobicoke Civic Centre Precinct (six points intersection)

City owned brownfield. Three million sqft of mixed-use development. New Civic Centre. Unique opportunity for net-zero community**: low-carbon thermal energy network + efficient buildings**



Low-Carbon Thermal Energy Network

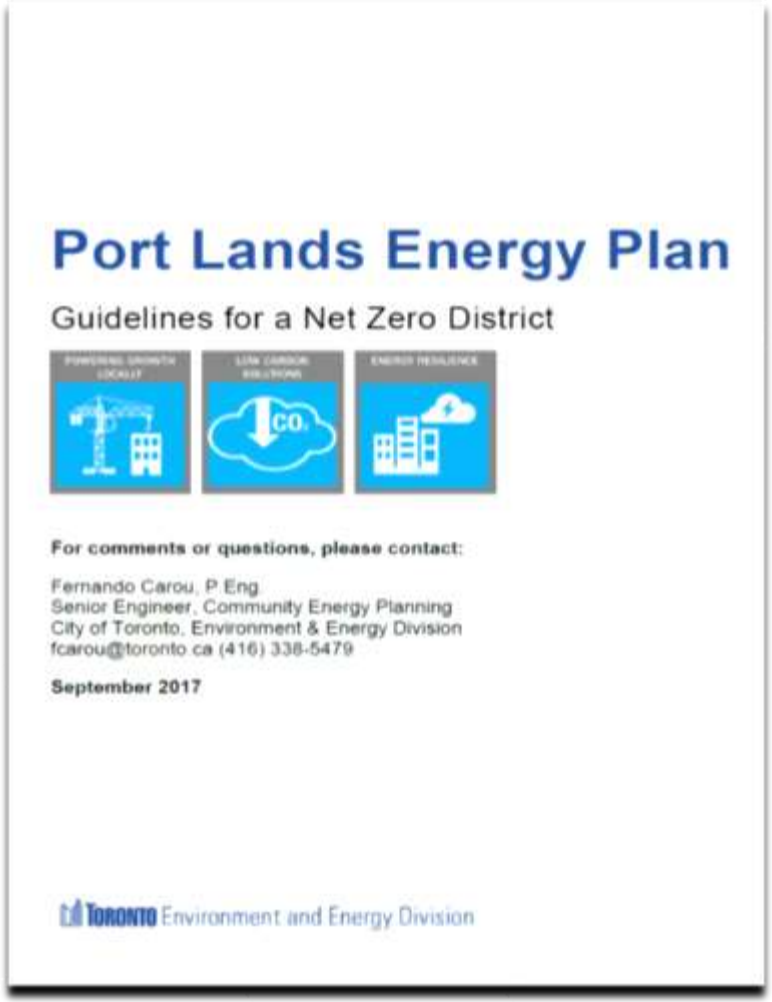
Installation of the energy distribution pipes underway as part of new road network construction.

Leverage large-scale renewable energy sources (e.g. geo-exchange systems) can cost-effectively provide the majority of low-carbon energy use.

Super Efficient Buildings

Passive design + high performance systems for significant reduction in energy use, to be supplied by a low-carbon/renewable thermal energy network.

Leading by Example: Port Lands Net-zero Energy Plan



Potential for new development in the order of 20 Million sqft (gross floor area) of residential and commercial buildings (mixed-use).

18,000 to 25,000 residents

25,000 to 30,000 employees.

Adopted by City Council in 2017

Guidelines for a Net Zero District, include:

- Super efficient buildings
- Low-carbon/renewable thermal energy networks

Roles for the City

- Facilitator / Enabler
- Policy / Master planner
- Supplier of renewable energy from municipal operations/assets (i.e. sewer heat, bio gas, heat recovery, urban wood, underutilized land for geothermal)

Note: role(s) may change with specific opportunity/project.

Policy: Integration with land-use

Toronto has now **integrated energy, emissions, and resilience** considerations **into the land-use process**, at every stage.

Land-use	Energy, Emissions & Resilience
Official Plan (city-wide) OPA 262	**Energy, emissions, and resilience policies**
Area Plans	**Community Energy Plans**
Rezoning development applications	**Energy strategy requirement**
Site plan development applications	**Toronto Green development Standard** (TGS). TGS Version 3 has carbon targets effective May 1, 2018

The Network Effect : $/CO2t reduced

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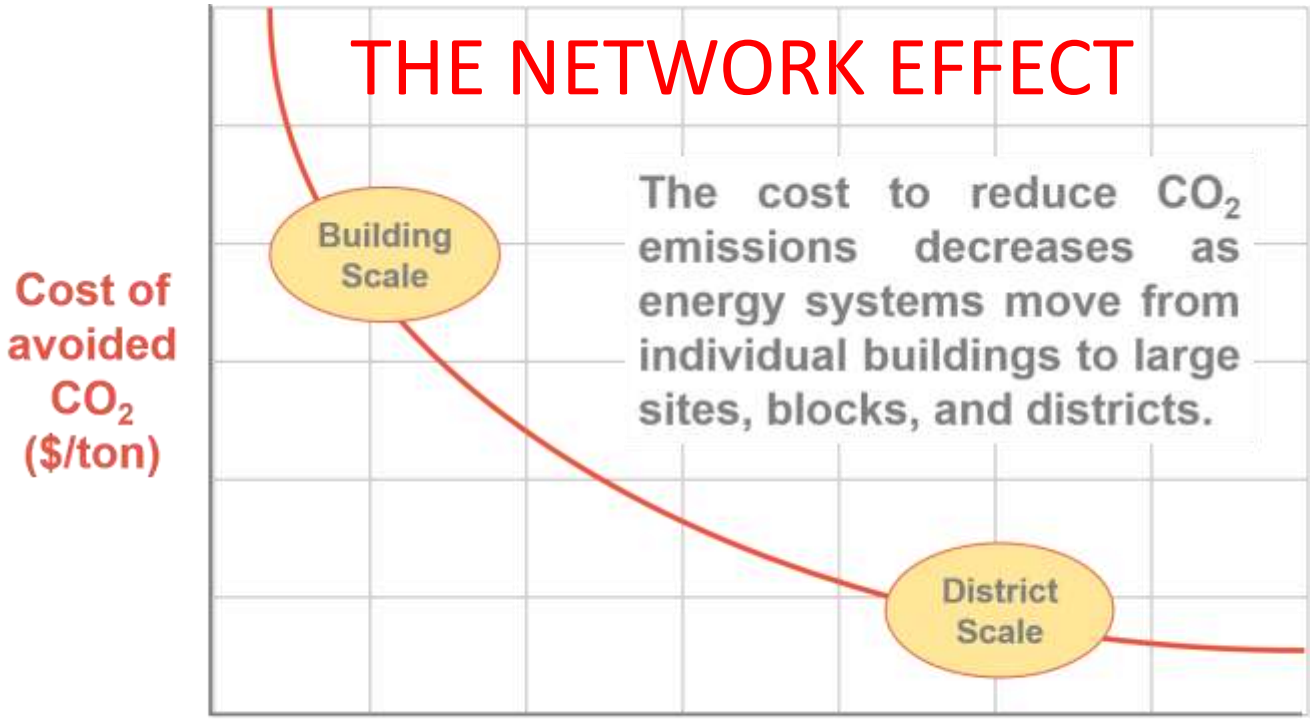


Climate change
will be fought in
cities. Toronto is
ready to do its part, but
we can't do it alone –
John Tory #ParisAgreement
#COP21
TORONTO

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TransformTO

TORONTO GREEN STANDARD v3

Community Energy Planning

Low Carbon Thermal Energy Networks (District Energy)