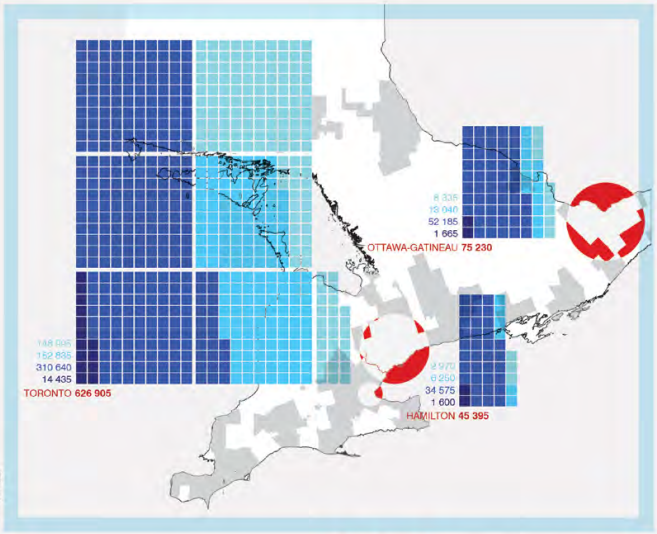
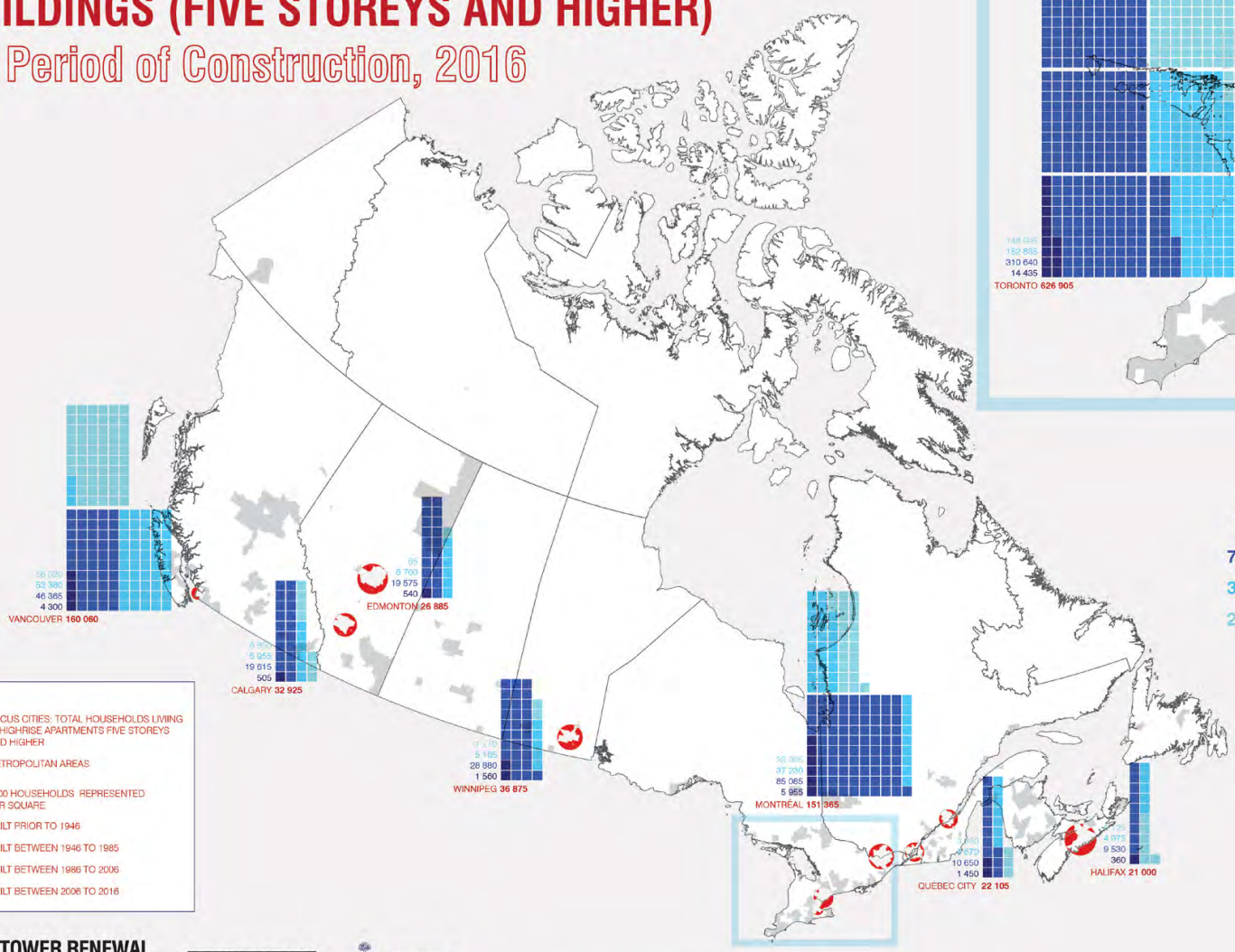

KEN SOBLE TOWER ENERPHIT
E B A
TOWER RENEWAL PARTNERSHIP
ENTUITIVE
REINBOLD engineering group
JMV CONSULTING

TOWER RENEWAL
PARTNERSHIP

CANADIAN HOUSEHOLDS LIVING IN HIGHRISE BUILDINGS (FIVE STOREYS AND HIGHER)

By Period of Construction, 2016





LEGEND

- FOCUS CITIES: TOTAL HOUSEHOLDS LIVING IN HIGHRISE APARTMENTS FIVE STOREYS AND HIGHER
- METROPOLITAN AREAS
- 1000 HOUSEHOLDS REPRESENTED PER SQUARE
- BUILT PRIOR TO 1946
- BUILT BETWEEN 1946 TO 1985
- BUILT BETWEEN 1986 TO 2006
- BUILT BETWEEN 2006 TO 2016

1 391 040 TOTAL HOUSEHOLDS LIVING IN HIGHRISE BUILDINGS IN CANADA

■ 1000 HOUSEHOLDS PER SQUARE

TOTAL HOUSEHOLDS LIVING IN HIGHRISE BUILDINGS BY PERIOD OF CONSTRUCTION

37 610 | (03%) PRE - 1946

739 490 | (53%) 1946 - 1985

335 870 | (24%) 1986 - 2006

278 075 | (20%) 2006 - 2016

ONTARIO

886 705 NUMBER OF HOUSEHOLDS LIVING IN HIGHRISE APARTMENTS IN ONTARIO

55% OF CANADIAN HIGHRISE HOUSEHOLDS LIVE IN APARTMENTS CONSTRUCTED BETWEEN 1946-1985

QUÉBEC

187 800 NUMBER OF HOUSEHOLDS LIVING IN HIGHRISE APARTMENTS IN QUÉBEC

56% OF CANADIAN HIGHRISE HOUSEHOLDS LIVE IN APARTMENTS CONSTRUCTED BETWEEN 1946-1985

BRITISH COLUMBIA

177 830 NUMBER OF HOUSEHOLDS LIVING IN HIGHRISE APARTMENTS IN BRITISH COLUMBIA

31% OF CANADIAN HIGHRISE HOUSEHOLDS LIVE IN APARTMENTS CONSTRUCTED BETWEEN 1946-1985

ALBERTA

62 395 NUMBER OF HOUSEHOLDS LIVING IN HIGHRISE APARTMENTS IN ALBERTA

66% OF CANADIAN HIGHRISE HOUSEHOLDS LIVE IN APARTMENTS CONSTRUCTED BETWEEN 1946-1985

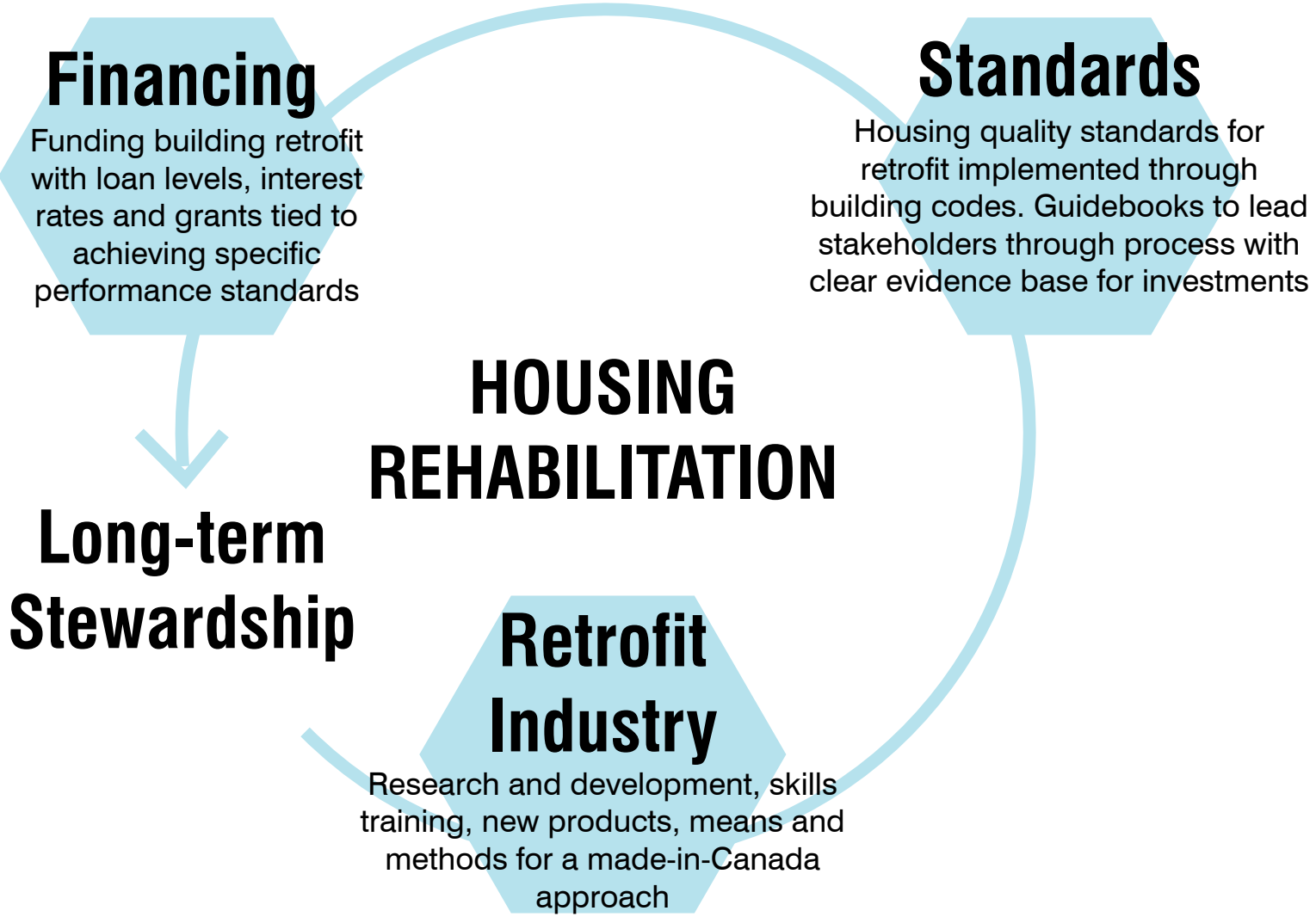
TOWER RENEWAL PARTNERSHIP

NEIGHBOURHOOD CHANGE

UNIVERSITY OF TORONTO

SOURCE: STATISTICS CANADA, CMA DATA, CENSUS 2006/2016

TOWER RENEWAL PARTNERSHIP



Federal Government:

National Housing Strategy Launched with Direction to Retrofit 200,000+ units of Public and Private Sector Housing through $15.8 Billion Co-Investment Fund

NATIONAL HOUSING STRATEGY

A place to call home

TOWER RENEWAL PARTNERSHIP

KEN SOBLE TOWER TRANSFORMATION

FCM GREEN MUNICIPAL FUND INITIAL REVIEW FORM: FEASIBILITY STUDY

FEBRUARY 28 2017

CITYHOUSING HAMILTON · ERA · DKGi Inc. · ENTUITIVE · JOSHUA MONK VANWYCK CONSULTING

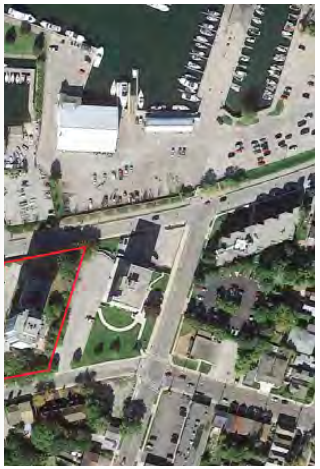
TOWER RENEWAL PARTNERSHIP

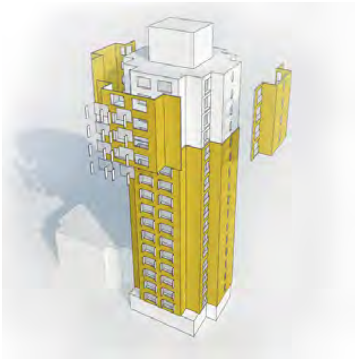
70%

ENERGY INTENSITY REDUCTION

90%

GHG EMISSION REDUCTION





High Performance Building Envelope

New Community Spaces & Partnerships

CityHousing Hamilton is using Passive House to accelerate social housing transformation by improving financial and social sustainability.

Passive House

- 1x high-rise retrofit
- 2x neighbourhood revitalization
- 4x new builds

Social

- Air quality
- Wellness
- Aging in Place
- Resiliency

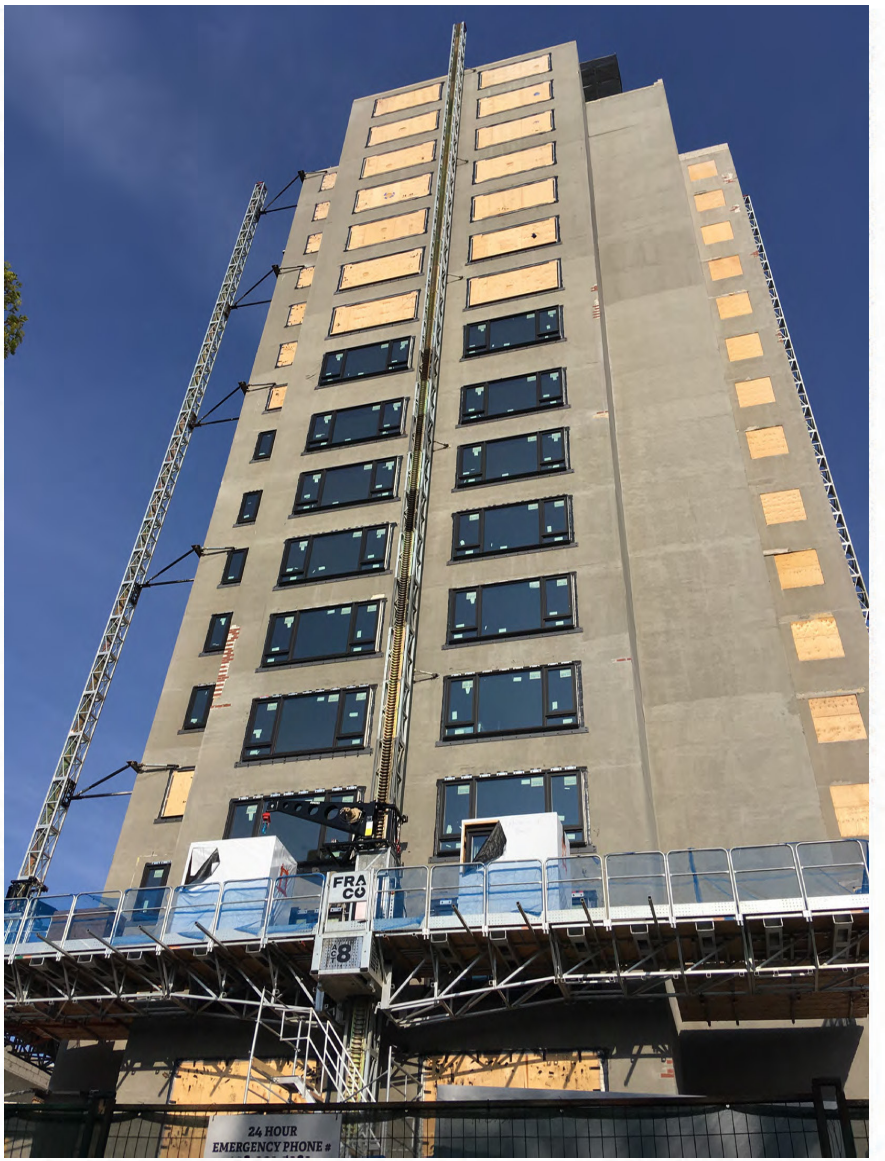
Financial

- Energy
- Maintenance
- Grants

TOWER RENEWAL PARTNERSHIP

500 MACNAB **1967**

500 MACNAB **2020**



TOWER RENEWAL
PARTNERSHIP

KEY CHALLENGES

Deteriorating envelopes

Lack of insulation

Inadequate ventilation

Mould and hazardous materials

Lack of thermal control

End of life systems

OVERVIEW ENERPHIT & ASSET RENEWAL

KEN SOBLE TOWER TRANSFORMATION

SYSTEMS

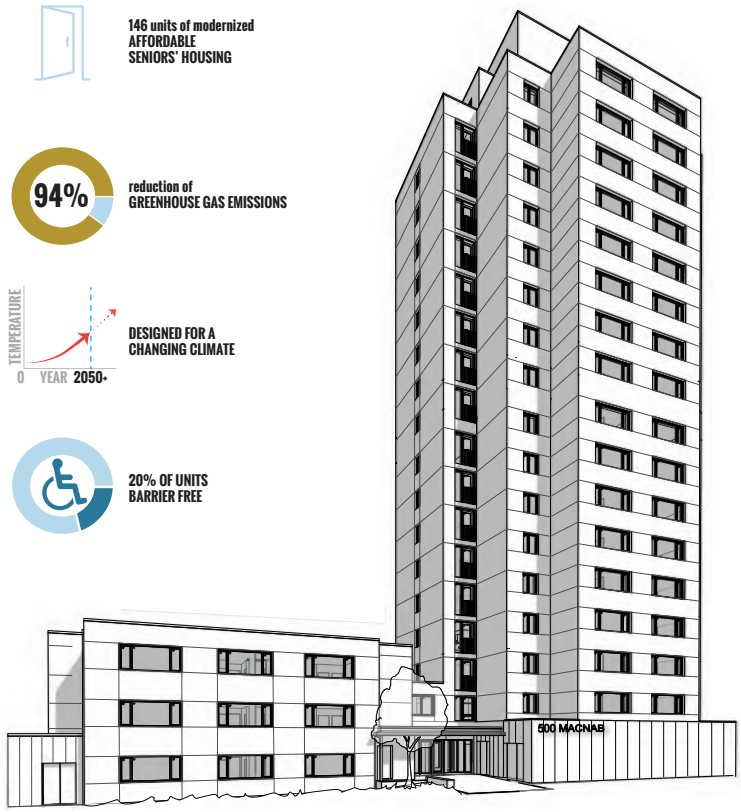
Centralized HVAC with Cooling
Riser Replacements for Most Systems
Full Building Sprinklering

ENVELOPE

R38 Effective Overcladding
Passive House Windows
0.6ACH @ 50Pa Airtightness

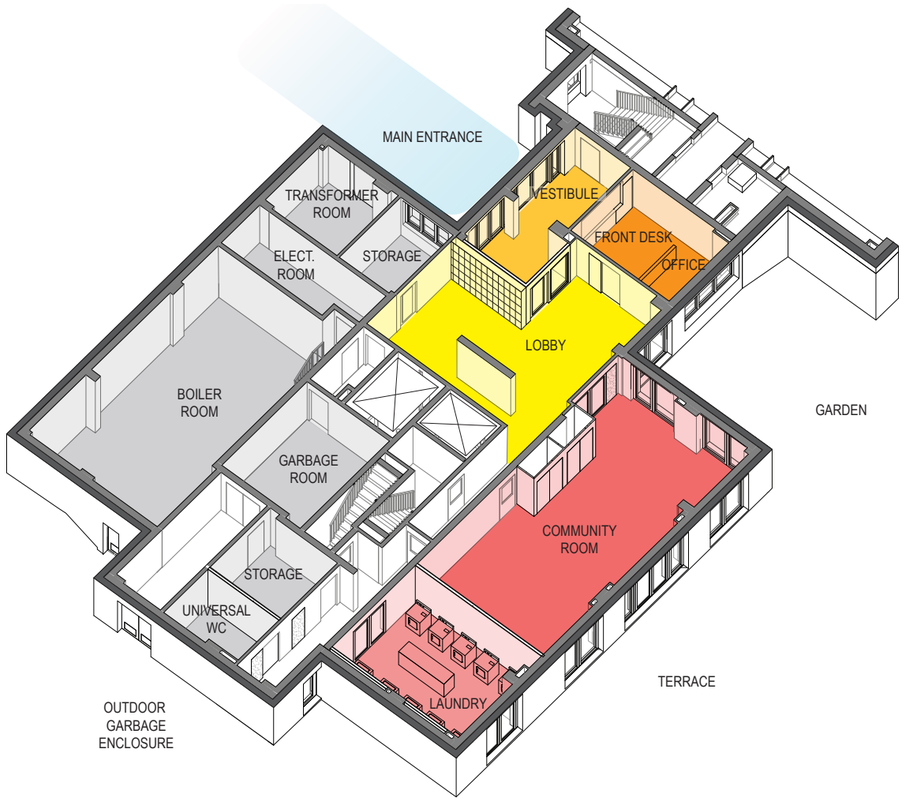
MODERNIZATION

Accessibility Upgrades
New Community Room and Solarium
Interior Upgrades to Support Aging-in-Place
Rain Gardens and Green Gathering Spaces



TOWER RENEWAL PARTNERSHIP

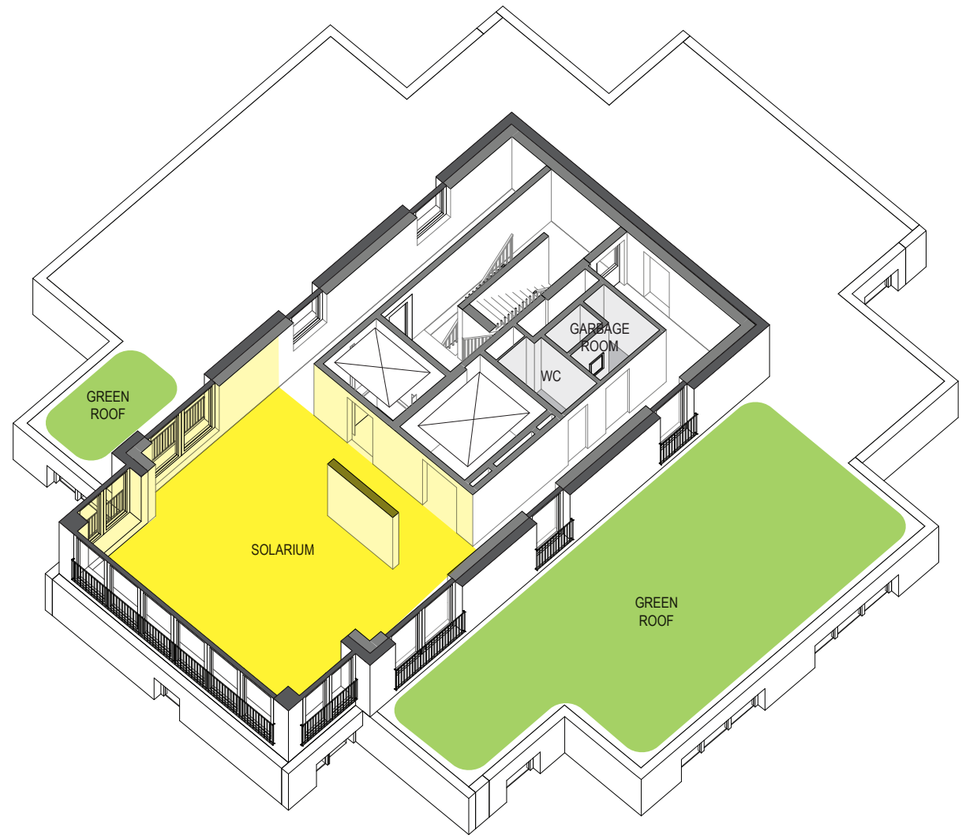
COMMUNITY APPROACH



Investment in **common areas** to strengthen resident community

Partnerships with local nonprofit agencies to bring programming to building residents and neighbourhood

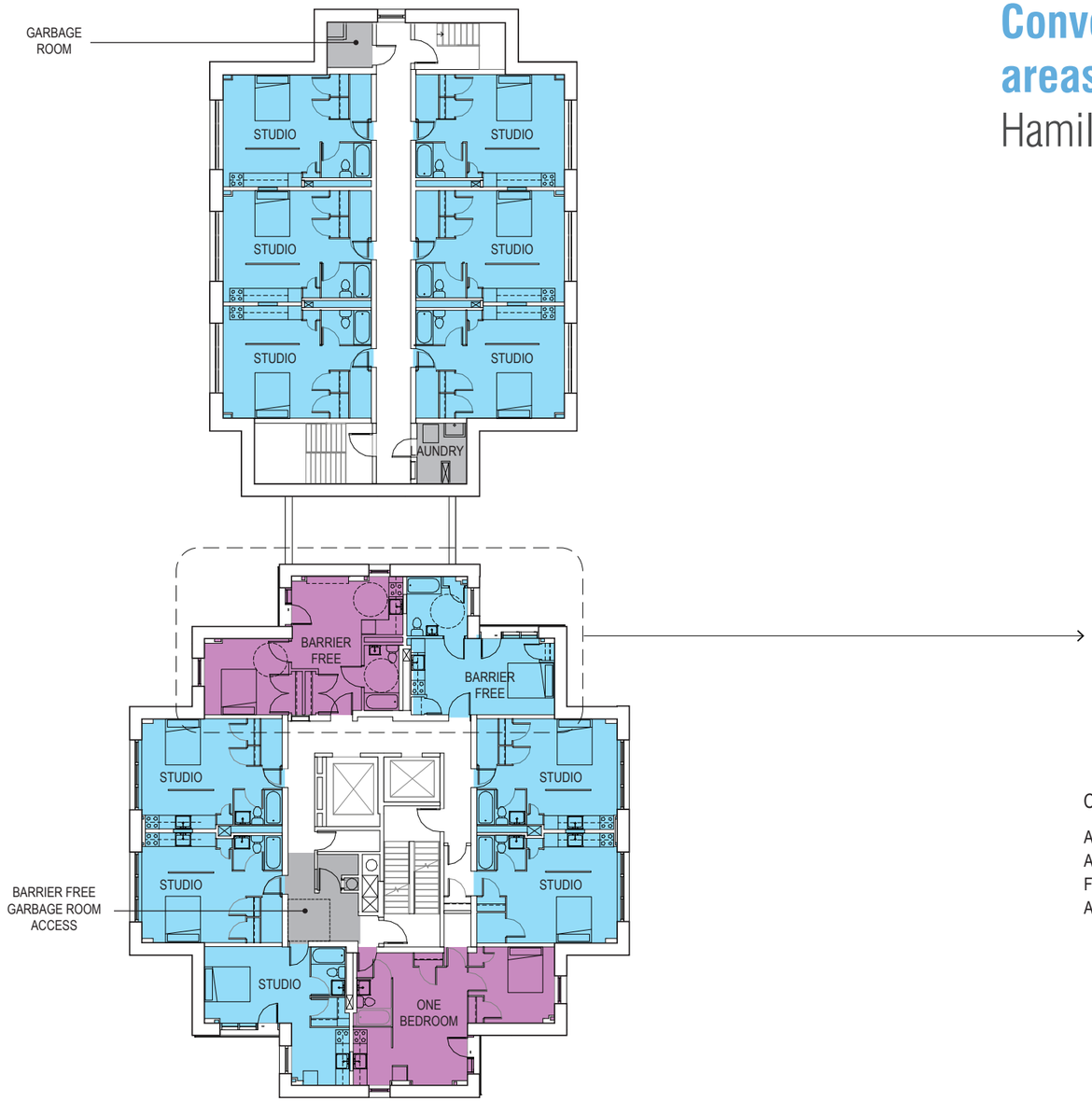
KEN SOBLE TOWER TRANSFORMATION



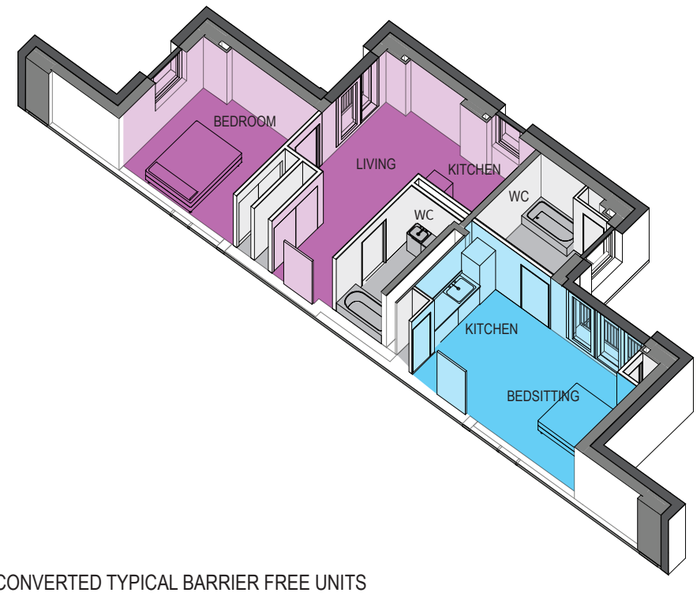
TOWER RENEWAL PARTNERSHIP

EBA

ACCESSIBILITY APPROACH



Conversion of all common areas and 21% of units to City of Hamilton barrier-free standards

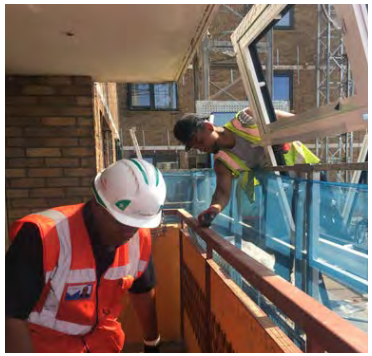


CONVERTED TYPICAL BARRIER FREE UNITS

ACCESSIBLE Bedroom and Closet
ACCESSIBLE WASHROOM with new fixtures
FULL-HEIGHT OPERABLE DOOR to new Juliette Balcony
ACCESSIBLE KITCHEN millwork and appliances

KEN SOBLE TOWER TRANSFORMATION

LINKING HOUSING QUALITY OUTCOMES TO RETROFITS



Tenant comfort

Thermal controls

Adequate ventilation

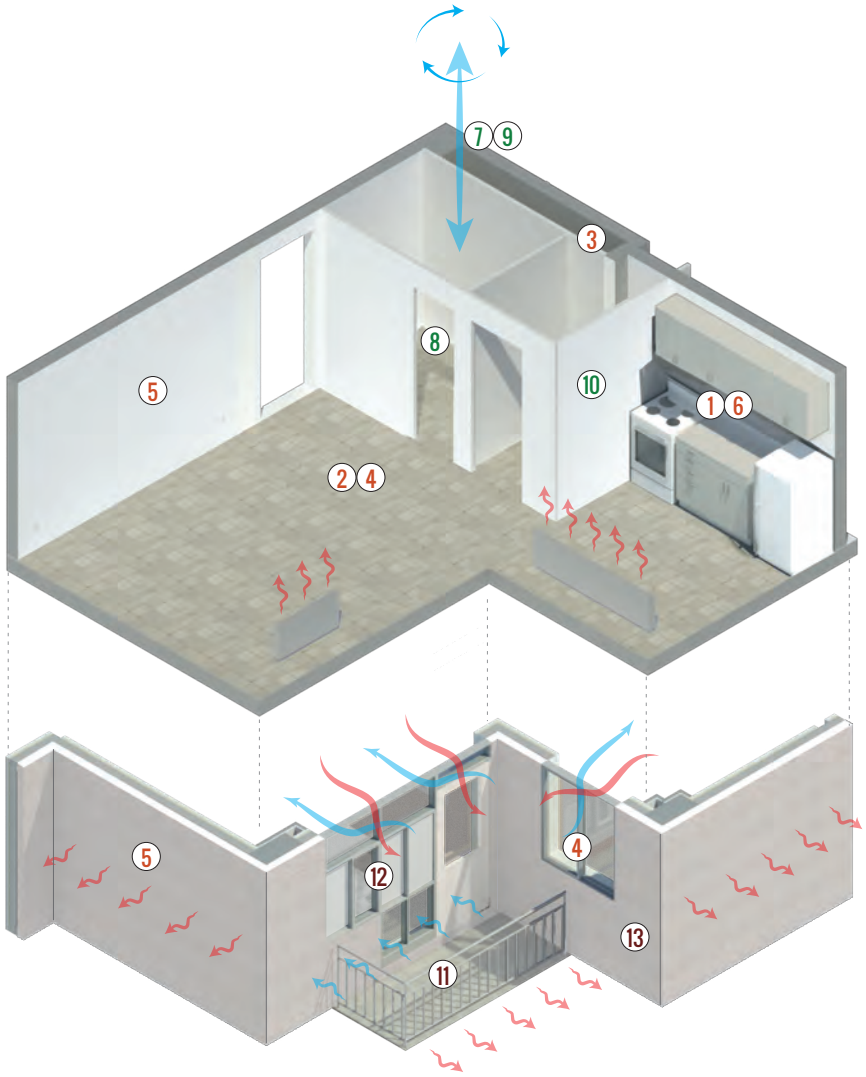
Life safety measures

Community connectivity

Climate resilience

TOWER RENEWAL PARTNERSHIP

500 MACNAB **BASE CONDITIONS**



INTERIORS

1. Deteriorated fixture, millworks and appliances
2. Deteriorated flooring
3. Holes in fire separations between units
4. Asbestos containing materials
5. Mould remediation required in all interior walls
6. Pervasive pests

SYSTEMS

7. Deteriorated central ductwork
8. Deteriorated plumbing
9. Inadequate ventilation
10. Deteriorated electrical system

ENVELOPE

11. Deteriorated balcony slab edge
12. Deteriorated windows
13. Masonry repairs required
14. Deteriorated roof

TOWER RENEWAL PARTNERSHIP

ERA

500 MACNAB **PASSIVE HOUSE RENEWAL**

LIFE SAFETY

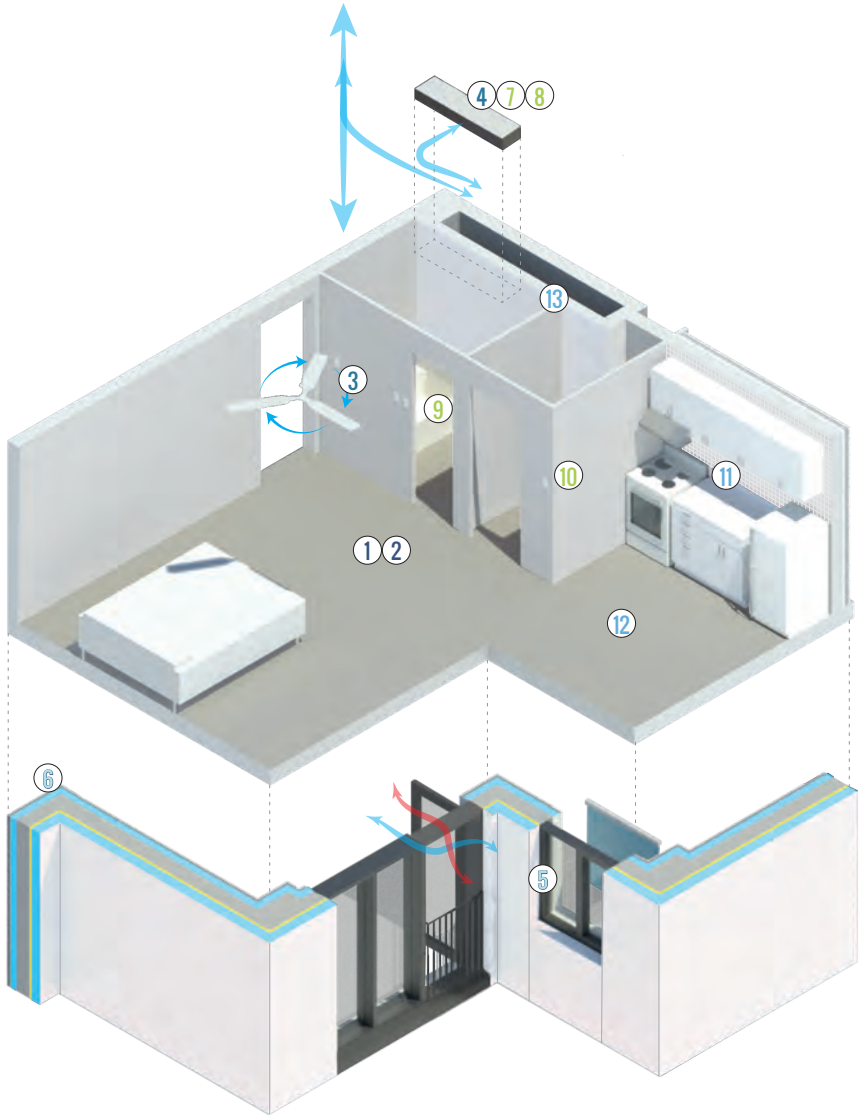
① Sprinklers
② New fire alarm system

COMFORT

③ Ceiling fans
④ Central low energy cooling

ENVELOPE

⑤ Triple glazed windows
⑥ Thermally continuous and airtight envelope with exterior and Interior Insulation



SYSTEMS

⑦ Direct ducting for fresh air supply in units with
⑧ Heat recovery
⑨ New plumping system
⑩ Modernized electrical system

UNITS

⑪ New kitchen
⑫ New flooring
⑬ Repair of walls for continuous fire separations between units

BUILDING AMENITY

⑭ New community space at base and penthouse
⑮ New laundry facility
⑯ Modernized landscape

STATE OF REPAIR

⑰ All state of repair issues addressed to achieve 30 year plus asset renewal

TOWER RENEWAL PARTNERSHIP

ERA

500 MACNAB **PASSIVE HOUSE RENEWAL: ACCESSIBILITY UNITS**

ACCESSIBILITY

Ⓐ 20% of units fully accessible with new washrooms and kitchens meeting CSA standard

LIFE SAFETY

① Sprinklers
② New fire alarm system

COMFORT

③ Ceiling fans
④ Central low energy cooling

ENVELOPE

⑤ Triple glazed windows
⑥ Thermally continuous and airtight envelope with exterior and Interior Insulation

SYSTEMS

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⑰ All state of repair issues addressed to achieve 30 year plus asset renewal

TOWER RENEWAL PARTNERSHIP

ERA

OVERHEATING A PASSIVE HOUSE CHALLENGE

DYNAMIC THERMAL COMFORT MODELLING

EXTREME WEATHER DAYS

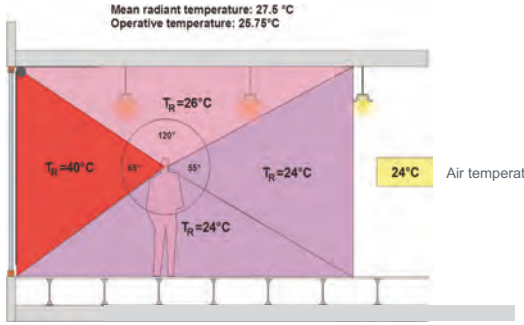
IMG: TRANSSOLAR

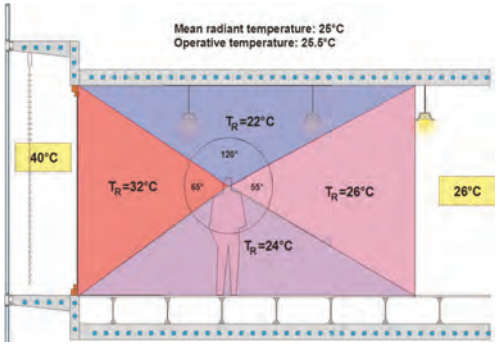
Operative Temperature vs. Air Temperature

Thermal Comfort

What we experience and perceive as thermal comfort in a building is influenced by both the air temperature and the mean radiant temperature. The mean radiant temperature accounts for the temperature of the surfaces to which a person is exposed. Balancing the operative temperature can create more comfortable spaces in a building.

The examples to the right illustrate the importance of balancing the operative temperature and not just the air temperature. People would feel the same level of comfort in both cases. Even though the air temperature in the example in the bottom right is warmer (26°C) than the example in the top right (24 °C), their operative temperature is around the same (25.5 °C). In the first example, since the surfaces are warmer, the air temperature needs to be cooler to provide the same level of comfort as the bottom room.



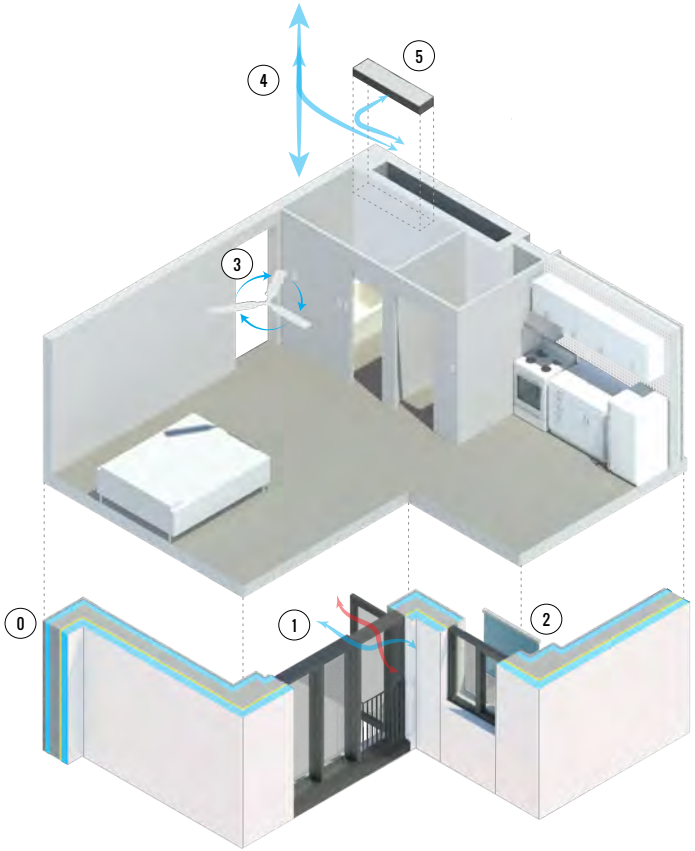


COOLING MULTI-STAGE SYSTEM

0 1 2 3 4 5

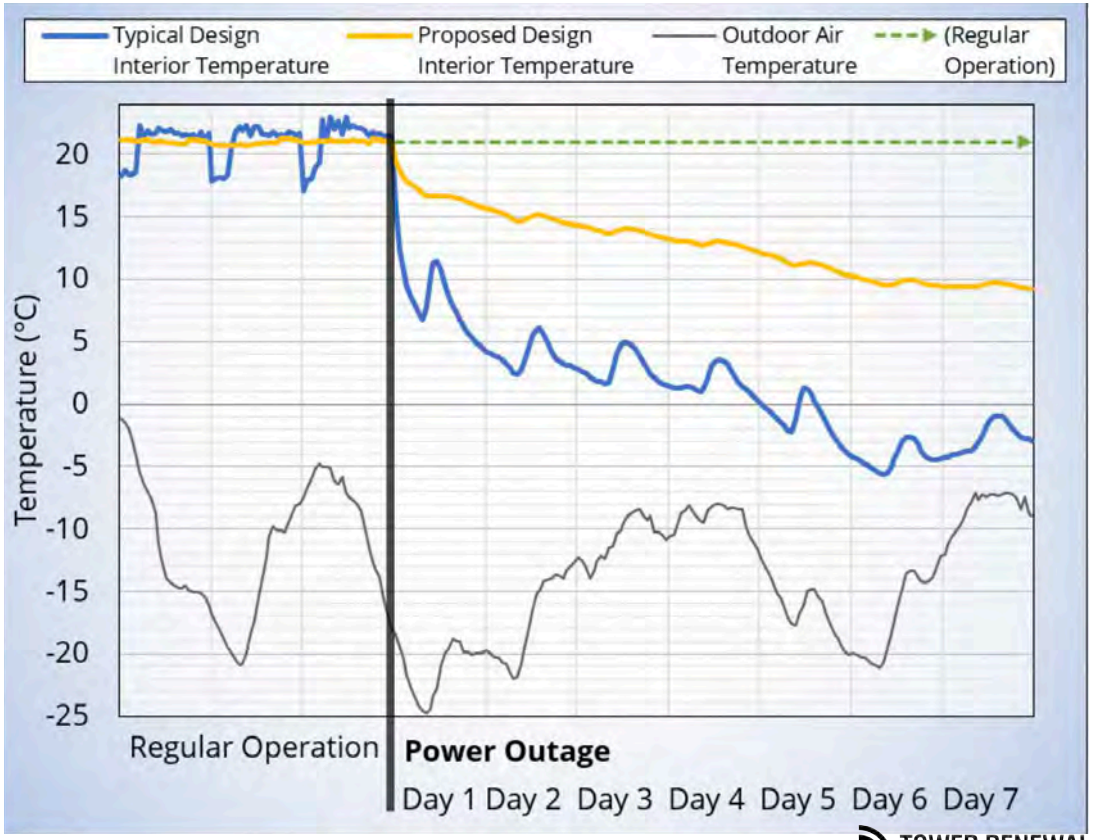
Passive *Active*

0. R38 Effective Envelope
1. Glazing with a low Solar Heat Gain Coefficient
2. Low emissivity interior shades
3. Ceiling fans to circulate air within units
4. Lightly tempered air delivered through a centralized ventilation system
5. Decentralized cooling 'boost' through a Variable Air Volume Unit activated by in-suite controls



RESILIENCE PASSIVE 'SURVIVABILITY'

RESILIENCE TO EXTREME CLIMATE EVENTS



IMG: UNION GAS SAVINGS BY DESIGN

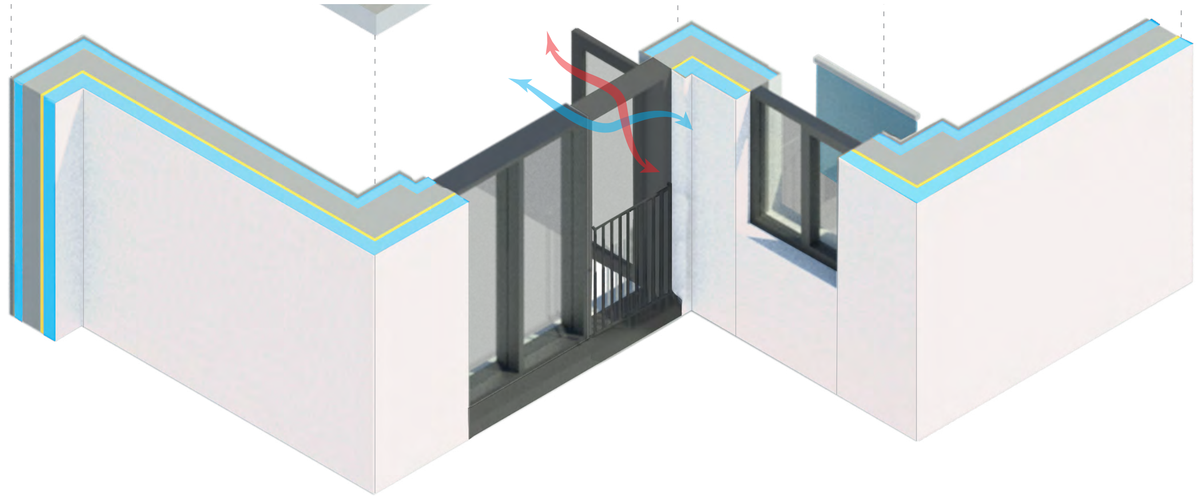
FACADE APPROACH

AIRTIGHT (0.6 ACH @50KPA)

R38-EFFECTIVE

LOW-CARBON

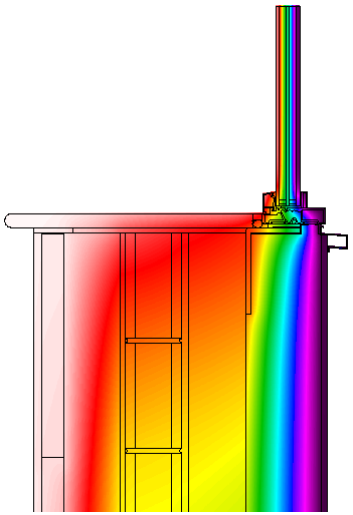
NON-COMBUSTIBLE



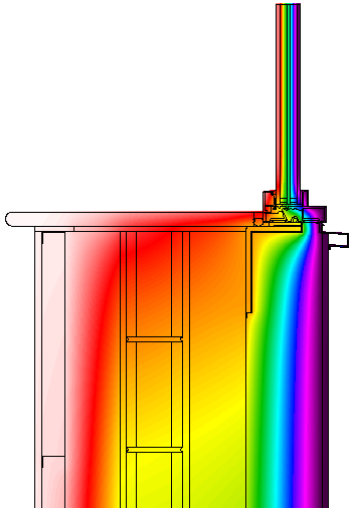
THERMAL BRIDGING WINDOW SILL DETAIL

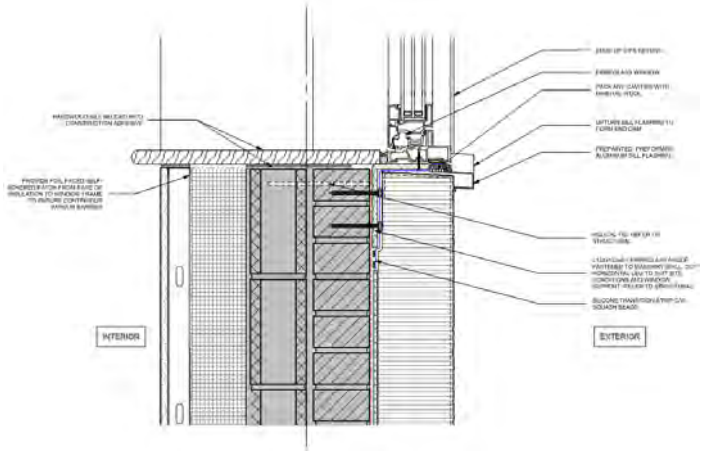
KENSOBLE TOWER TRANSFORMATION

Fiberglass Angle



Steel Angle





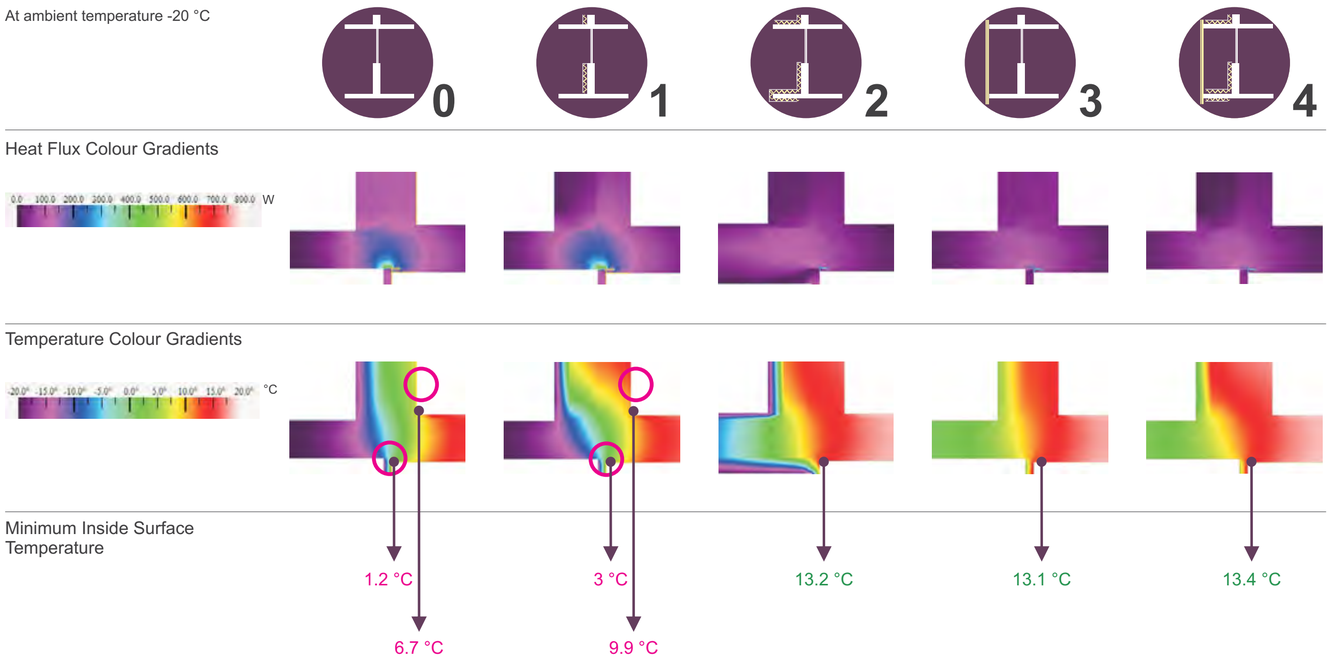
	Psi- Value (W/mK)	Heating Demand (kWh/m²a)
Window Sill Detail - Steel Angle	0.114	
Window Sill Detail - Fiberglass Angle	0.086	-0.16

TOWER RENEWAL PARTNERSHIP


6234-02
CRATE 17


FALCO
8

THERMAL BRIDGING




CAUSCADIA
fiberglass insulation
604 852 4600
CAUTION
CAUTION

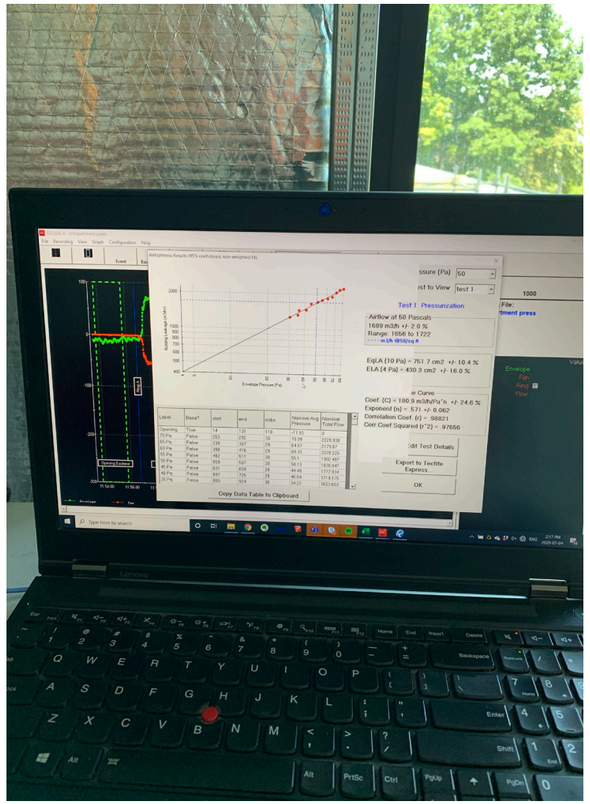
AIR TIGHTNESS PROTOCOLS

DEFINE THE TESTING SCOPE:

- PRE-CONSTRUCTION BASELINE
- MOCK-UP TEST
- SINGLE FLOOR TESTS (x5)
- FINAL CERTIFICATION TEST

Air Tightness Criteria	ACH 50
Passive House Limit	0.6
500 Macnab Baseline Test (Full Building)	5.41
500 Macnab (Existing Envelope Only)	3.86

AIR TIGHTNESS TESTING GUARDED TESTS




FRA
CO
8
24 HOUR
EMERGENCY PHONE #

5/8 in 159 mm

MEASURING IMPACT TO SCALE CHANGE

KEN SOBLE TOWER TRANSFORMATION

HEALTH IMPACTS ER visits / Attendance at Public Health Services / Heat-Related Thermal Stress / Missed Work

SAFETY FACTORS Home Fire Incidents / Accessibility within Common Areas / Police Calls / Break-Ins

HOUSING QUALITY IMPACTS Outdoor Noise Disruptions / Indoor Air Quality / Elevator Breakdowns

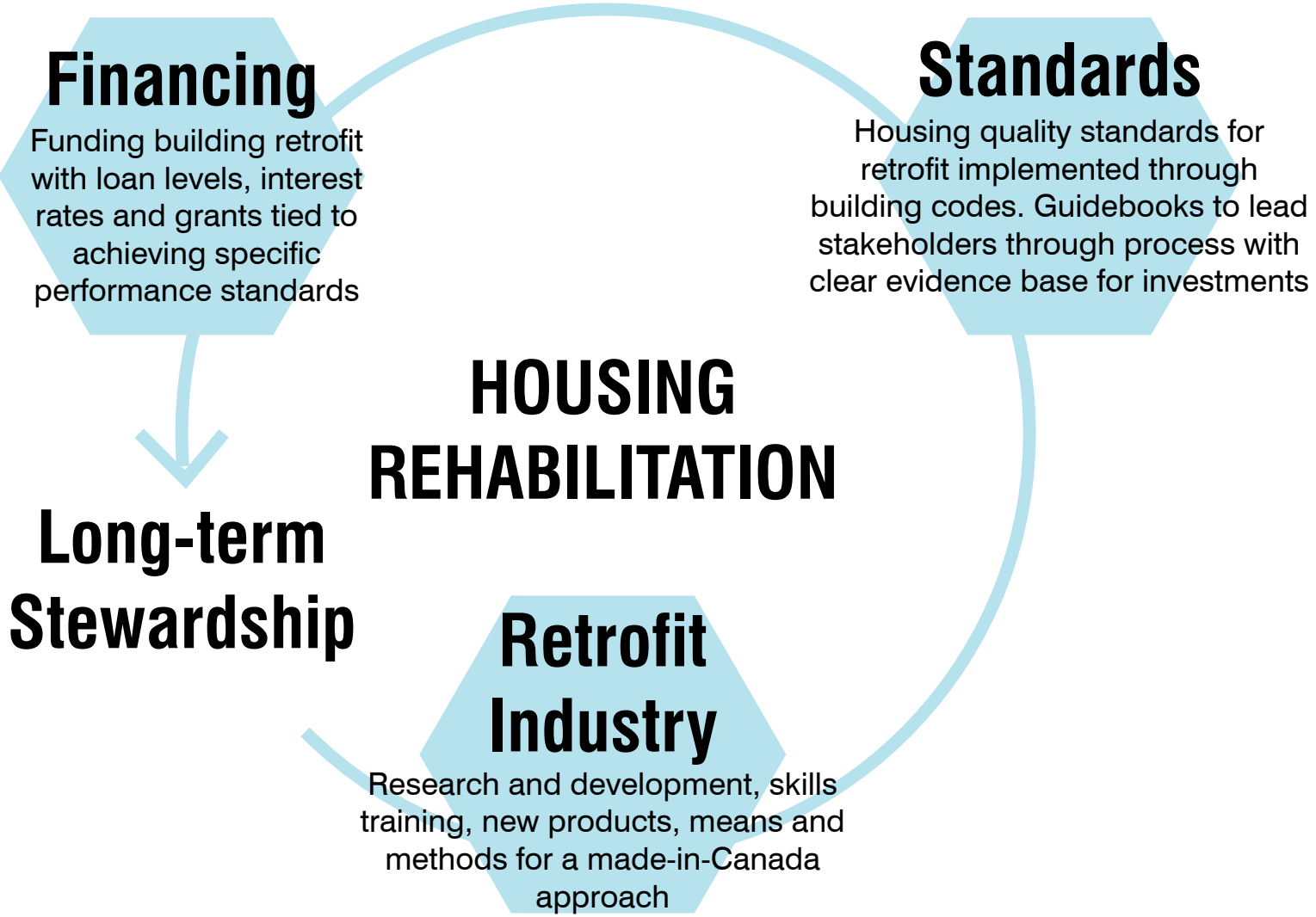
AFFORDABILITY IMPACTS Tenant Turnover / Ability to Pay Utility Bills / Ability to Pay Rent / High-Cost Loans

OPERATIONS Pest Control Incidents / Tenant Complaints / Equipment Maintenance / Repairs and Replacements

ENVIRONMENTAL FACTORS Avoided GHG Emissions / Utility Costs / Avoided Material in Waste Stream

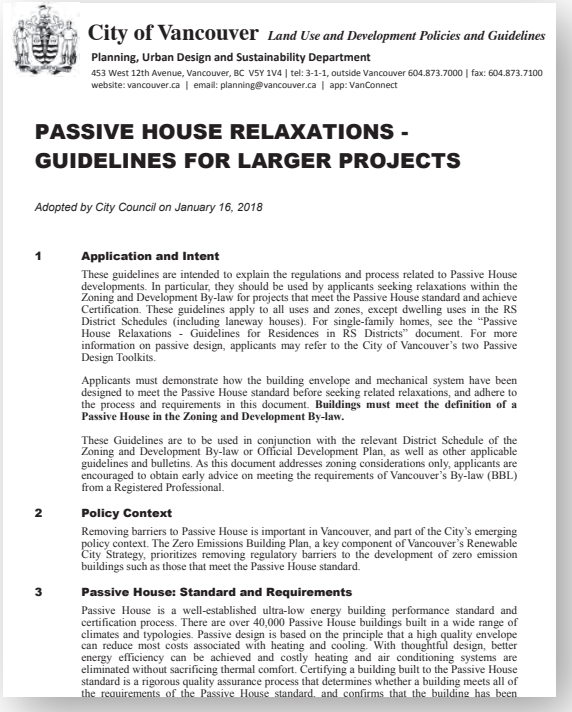
ECONOMIC FACTORS Trades Training / Property Value / Operating Costs / Vacancy Rate / Reserve Fund

TOWER RENEWAL PARTNERSHIP



Regulating High Performance Buildings

Vancouver and Toronto



City of Vancouver *Land Use and Development Policies and Guidelines*

Planning, Urban Design and Sustainability Department

453 West 12th Avenue, Vancouver, BC V5Y 1V4 | tel: 3-1-1, outside Vancouver 604.873.7000 | fax: 604.873.7100
website: vancouver.ca | email: planning@vancouver.ca | app: VanConnect

PASSIVE HOUSE RELAXATIONS - GUIDELINES FOR LARGER PROJECTS

Adopted by City Council on January 16, 2018

1 Application and Intent

These guidelines are intended to explain the regulations and process related to Passive House developments. In particular, they should be used by applicants seeking relaxations within the Zoning and Development By-law for projects that meet the Passive House standard and achieve Certification. These guidelines apply to all uses and zones, except dwelling uses in the RS District Schedules (including laneway houses). For single-family homes, see the "Passive House Relaxations - Guidelines for Residences in RS Districts" document. For more information on passive design, applicants may refer to the City of Vancouver's two Passive Design Toolkits.

Applicants must demonstrate how the building envelope and mechanical system have been designed to meet the Passive House standard before seeking related relaxations, and adhere to the process and requirements in this document. **Buildings must meet the definition of a Passive House in the Zoning and Development By-law.**

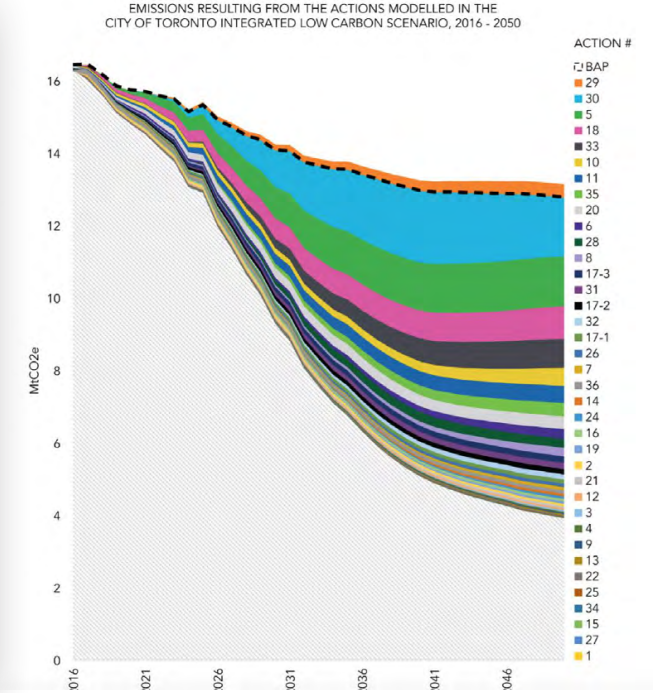
These Guidelines are to be used in conjunction with the relevant District Schedule of the Zoning and Development By-law or Official Development Plan, as well as other applicable guidelines and bulletins. As this document addresses zoning considerations only, applicants are encouraged to obtain early advice on meeting the requirements of Vancouver's By-law (BBL) from a Registered Professional.

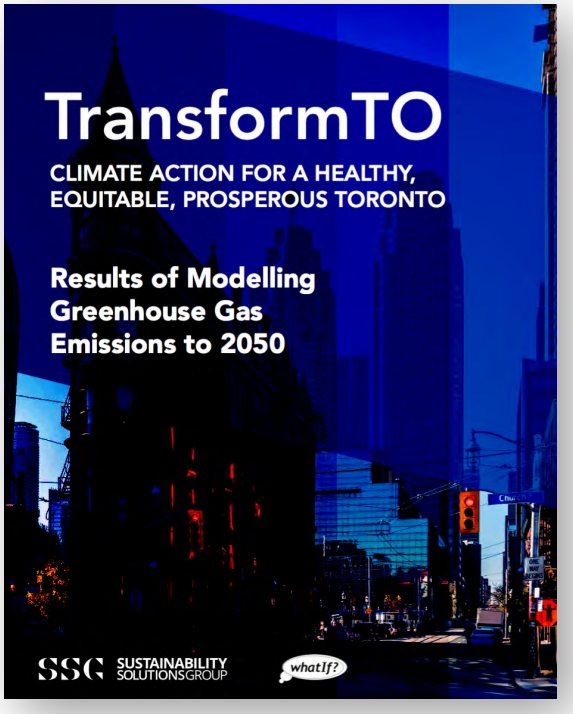
2 Policy Context

Removing barriers to Passive House is important in Vancouver, and part of the City's emerging policy context. The Zero Emissions Building Plan, a key component of Vancouver's Renewable City Strategy, prioritizes removing regulatory barriers to the development of zero emission buildings such as those that meet the Passive House standard.

3 Passive House: Standard and Requirements

Passive House is a well-established ultra-low energy building performance standard and certification process. There are over 40,000 Passive House buildings built in a wide range of climates and typologies. Passive design is based on the principle that a high quality envelope can reduce most costs associated with heating and cooling. With thoughtful design, better energy efficiency can be achieved and costly heating and air conditioning systems are eliminated without sacrificing thermal comfort. Certifying a building built to the Passive House standard is a rigorous quality assurance process that determines whether a building meets all of the requirements of the Passive House standard, and confirms that the building has been





TOWER RENEWAL PARTNERSHIP

LINKING HOUSING QUALITY TO RETROFITS

STANDARDS* (FOR LARGE BUILDINGS)	CANADA new	CANADA retrofit	GERMANY new	GERMANY retrofit
HEALTHY SPACE				
Condensation / Mould mitigated through min. interior surface temperature (12.6oC)	Not Enforced	Not Enforced	Enforced	Enforced
Healthy Ventilation Systems by mechanical and natural means	Not Enforced	Proposed Change	Enforced	Enforced
Controlled 'Infiltration' by operable windows or trickle vents	Not Enforced	Not Enforced	Enforced	Enforced
THERMAL COMFORT				
Interior Temperatures based on dynamic metrics (i.e. operative temperature and adaptive comfort modelling)	Not Enforced	Not Enforced	Enforced	Enforced
Thermostat Control individual control of thermostats / heaters in each room	Under Consultation	Not Enforced	Enforced	Enforced
Eliminating Thermal Bridging by implementing continuous insulation and other strategies	Proposed Change	Not Enforced	Enforced	Enforced
Air Tightness in-situ testing required	Proposed Change	Not Enforced	Enforced	Enforced
Triple-pane Windows / Doors max U-Value 0.85 W/m2K (installed) (current PH standard for comfort reasons)	Not Enforced	Not Enforced	Enforced	Enforced
Shading Control for summer cooling	Not Enforced	Not Enforced	Enforced	Enforced
FIRE SAFETY				
Overcladding** avoiding flammable insulation materials at all building heights	Not Enforced	Not Enforced	Enforced	Enforced
Sprinklers	Enforced	Not Enforced	?	?
ENERGY PERFORMANCE				
Energy Requirements low energy performance standards	Proposed Change	Proposed Change	Enforced	Enforced
TRACKING AND MONITORING				
Commissioning	Under Consultation	Not Enforced	Enforced	Enforced
Sub-Metering / Energy Tracking / Energy Modelling	Under Consultation	Not Enforced	Enforced	Enforced

LEGEND

Enforced · Proposed Change · Not Enforced · Under Consultation

* Deep energy currently considered for non-extensive renovations.

** Non-flammable insulation required for six storeys and above in Ontario.

TOWER RENEWAL PARTNERSHIP

TOWER RENEWAL PARTNERSHIP

CANADIAN COMMISSION ON BUILDING AND FIRE CODES

FINAL REPORT
Alterations to Existing Buildings

Joint CCBFC/PTPACC Task Group on Alterations to Existing Buildings

August 2019

This document is a working paper dealing with the national model codes. Work on these codes is carried out under the authority of the Canadian Commission on Building and Fire Codes of the National Research Council of Canada

National Research Council Canada
Conseil national de recherches Canada

Canada

CODES AND STANDARDS:

HEALTH / COVID:

- ACCESS TO FRESH AIR

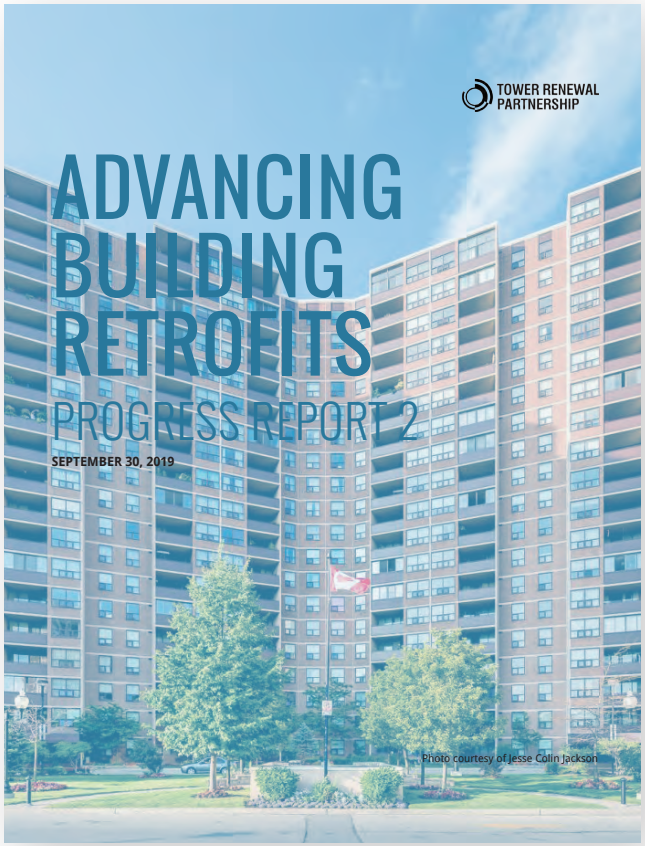
GHG REDUCTION:

- LOW CARBON / M2;
- LOW EMBEDDED CARBON

CLIMATE RESILIENCE & LIFE SAFETY:

- MIN OPERATIVE TEMPERATURE RANGES TO AVOID OVERHEATING DEATHS;
- BACK-UP SYSTEMS FOR OUTAGES
- MANDATORY SPRINKLERS;
- NON-FLAMMABLE INSULATION

ADVANCING RETROFITS IN THE CANADIAN MARKET



TOWER RENEWAL PARTNERSHIP

CMHC SCHL

ACCELERATING RETROFIT INDUSTRY

TOWER RENEWAL PARTNERSHIP

INTERIM CASE STUDY / GAP ANALYSIS SUMMARY

DECEMBER 13, 2019

Case Study	Market Transformation Phase		Envelope	
BC Housing Grandview Terrace	**Phase**	**Notes**	**Component**	**Strategy**
Canada	Early Adopter (Demonstration of comprehensive retrofit in an unfamiliar market)	Mid-Performance Range	Windows	**Double glazed**
			Shading	N/A
			Cladding	**New exterior over-cladding: rockwool with hardyboard sheathing**
Oxford City Council Towers	**Phase**	**Notes**	**Component**	**Strategy**
United Kingdom	Early Majority (Higher performance in an emerging retrofit market)	High-Performance Range	Windows	**Double glazed, higher performance and retrofit ready**
			Shading	N/A
			Cladding	**New exterior over-cladding: rockwool and metal panel cladding**
Pforzeim Bau und Grund Tower	**Phase**	**Notes**	**Component**	**Strategy**
Germany	Late Majority (Best in Class in a mature retrofit market)	Peak-Performance	Windows	**Triple glazed, designed for retrofit exterior face application**
			Shading	**Exterior operables shades**
			Cladding	**New exterior over-cladding: rockwool and precast concrete cladding**
BC Housing Grandview Terrace	**Component**	**Notes**	**Component**	**Notes**
Canada	Heating	**Hydronic, existing system**	Balconies	N/A
	Fresh Air	**Central system replacement with air condition and dehumidification**	Typ. Details	**Commitment to air tightness, mid performance mandate**
	Natural Ventilation	N/A	Other Penetrations	**Commitment to air tightness, mid performance mandate**
	Heat Recovery	N/A		
Oxford City Council Towers	Component	Notes	Component	Notes
United Kingdom	Heating	**Hydronic, Updated Low-Energy System**	Balconies	**Enclosed with wintergarden glazed assembly**
	Fresh Air	**Retrofit specific unitized HERV systems with 'snap' ductwork for easy install**	Typ. Details	**Commitment to air tightness, high performance mandate**
	Natural Ventilation	**Operable Windows**	Other Penetrations	**Commitment to air tightness, high performance mandate**
	Heat Recovery	**Contained in in-suite units**		
Pforzeim Bau und Grund Tower	Component	Notes	Component	Notes
Germany	Heating	**Hydronic, Updated Low-Energy System**	Balconies	**Replaced, thermally broken new assembly**
	Fresh Air	**In-suite HERVs, minimal ductwork, Passive House Certified**	Typ. Details	**PH House Certified**
	Natural Ventilation	**Operable Windows / trickle vents**	Other Penetrations	**PH House Certified**
	Heat Recovery	**Contained in in-suite units, Passive House Certified**		
BC Housing Grandview Terrace	**Occupancy During Construction**	**Notes**	**Context**	**Notes**
Canada	**Residents in Place**	**Sophisticated staging, scheduling and communication plan lead by constructor superintendent in consultation with BC Housing. Model scaling to other complex renovation projects.**	Code	**BC Step Code**
			Funding	**Provincial Low-Carbon Funds / BC Housing**
Oxford City Council Towers	**Occupancy During Construction**	**Notes**	**Context**	**Notes**
United Kingdom	**Residents in Place**	**Council mandated and resident endorsed 'customer care' directive for selected contractor, ensuring minimal tenant disruption and inclusion in key decision making through contractor 'tenant liaison' and weekly meetings between council, tenants and contractor.**	Code	Code for Sustainable Homes / Decent Homes Standard
			Funding	Oxford Council (Supported by Government Carbon Reduction Funds)
Pforzeim Bau und Grund Tower	**Occupancy During Construction**	**Notes**	**Context**	**Notes**
Germany	**Residents in Place**	**Interior works minimized and per-fabrication used to minimize construction duration and disruption. Housing company highly involved in day to day construction to minimize tenant disruption.**	Code	EnEv 2019
			Funding	KfW

Availability in Canadian Marke of Product / Approach:

Commonly Available

Challenging to Implement

Unavailable

TOWER RENEWAL PARTNERSHIP

BEST PRACTICE PARTNERS

TOWER RENEWAL PARTNERSHIP

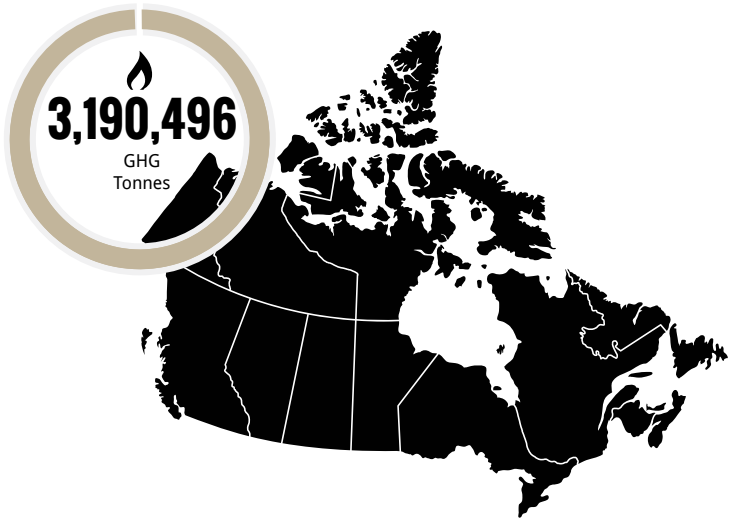
SCALE OF ECONOMIC IMPACT

GLOBAL COST OF ACHIEVING COMPREHENSIVE RETROFIT

Scale	Cost
1 tower (200 units)	**~$16 Million**
10 towers (2,000 units)	**~$160 Million**
50 towers (10,000 units)	**~$850 Million**
All tower in Toronto	**~$23 Billion**
All towers in Ontario	**~$41 Billion**
Nationwide	**~$62 Billion**

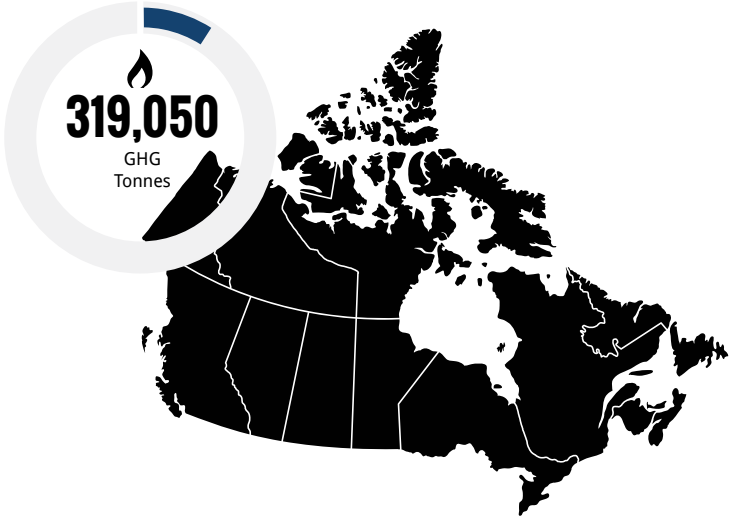
TOWER RENEWAL PARTNERSHIP

NATIONAL IMPACT



4.11 GHG/Unit

IN CANADA THERE ARE 777,100 HOUSEHOLDS LIVING IN AGING POST-WAR HIGHRISES.
EACH HOUSEDHOLD EMITS 4.11 TONNES GHG/YR*.



0.41 GHG/Unit

FOLLOWING RETROFIT GHG REDUCTION OF 90%

EACH HOUSEHOLD*

** The average based on typical building condition per city of Toronto 2016*

TOWER RENEWAL PARTNERSHIP


KEN SOBLE TOWER ENERPHIT
E B A
TOWER RENEWAL PARTNERSHIP
ENTUITIVE
REINBOLD engineering group
JMV CONSULTING