Clean Air Partnership

RESHAPE STRATEGIES

URBAN EQUATION

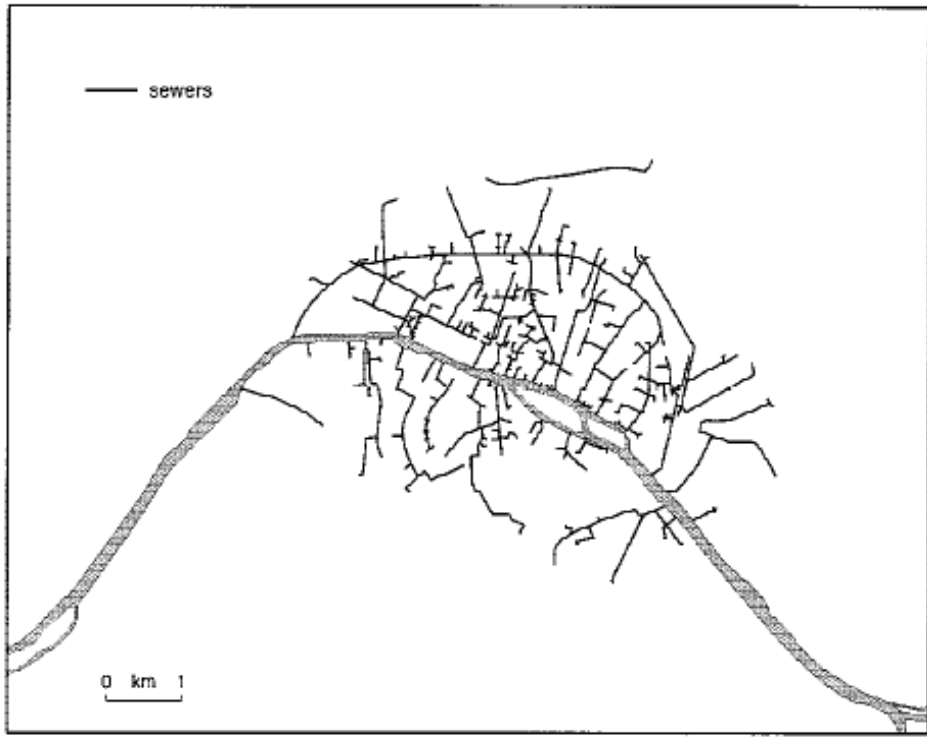
DISTRICT ENERGY WORKSHOP: BUSINESS MODELS AND POLICY OPTIONS FOR MUNICIPALITIES

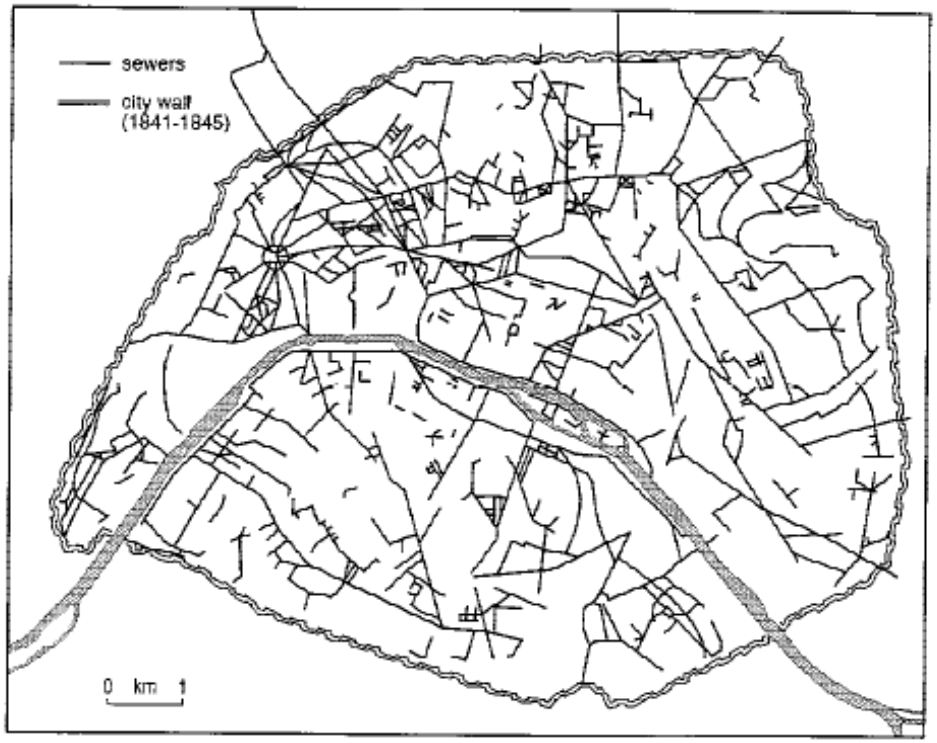
October 19, 2018

Regent Park, ON


RESHAPE
STRATEGIES

Paris sewers 1837 to 1878





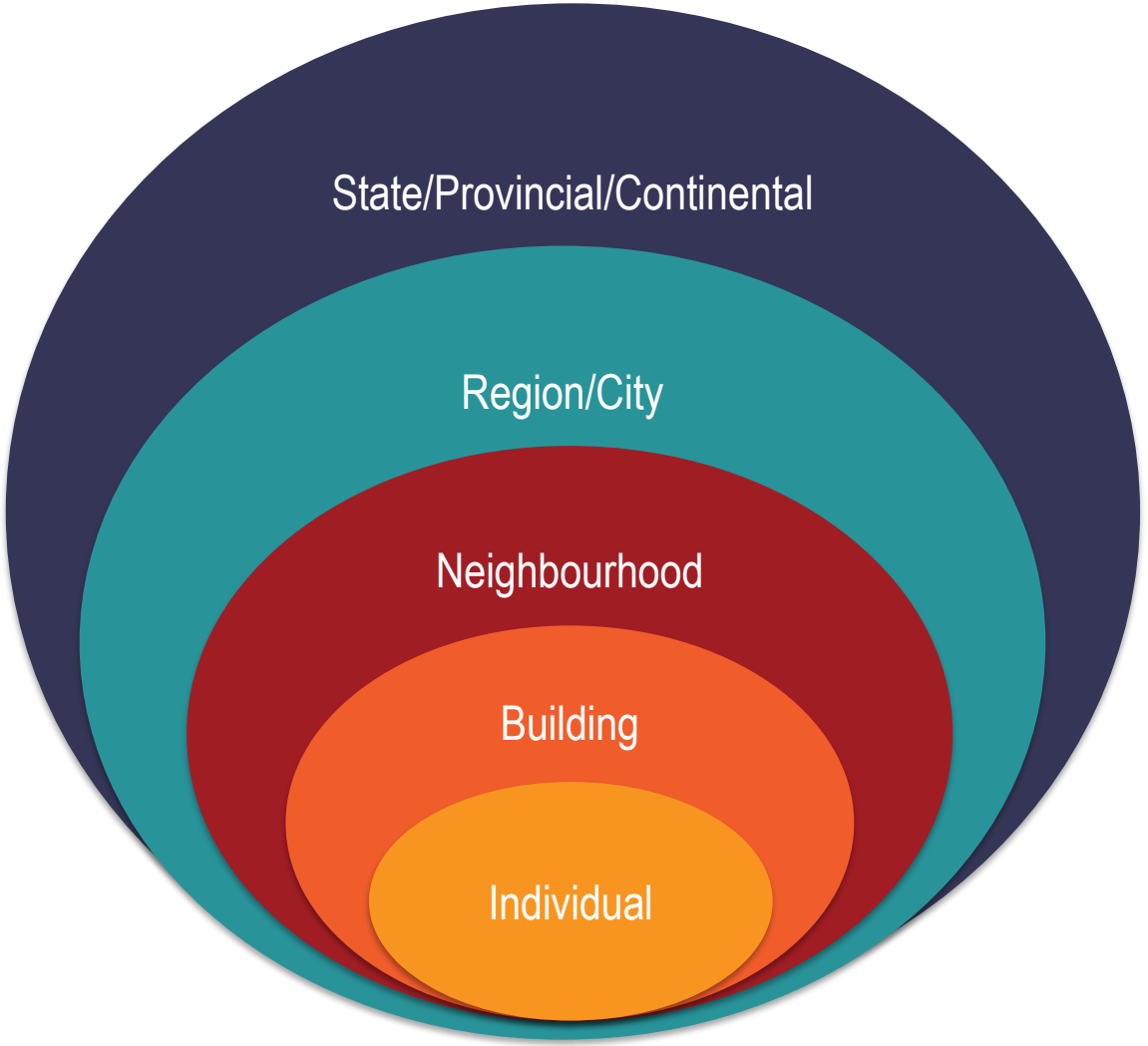
We are capable of thinking like city builders, of taking the long view…

RESHAPE STRATEGIES

WHAT SCALE IS MOST EFFICIENT AND EFFECTIVE?

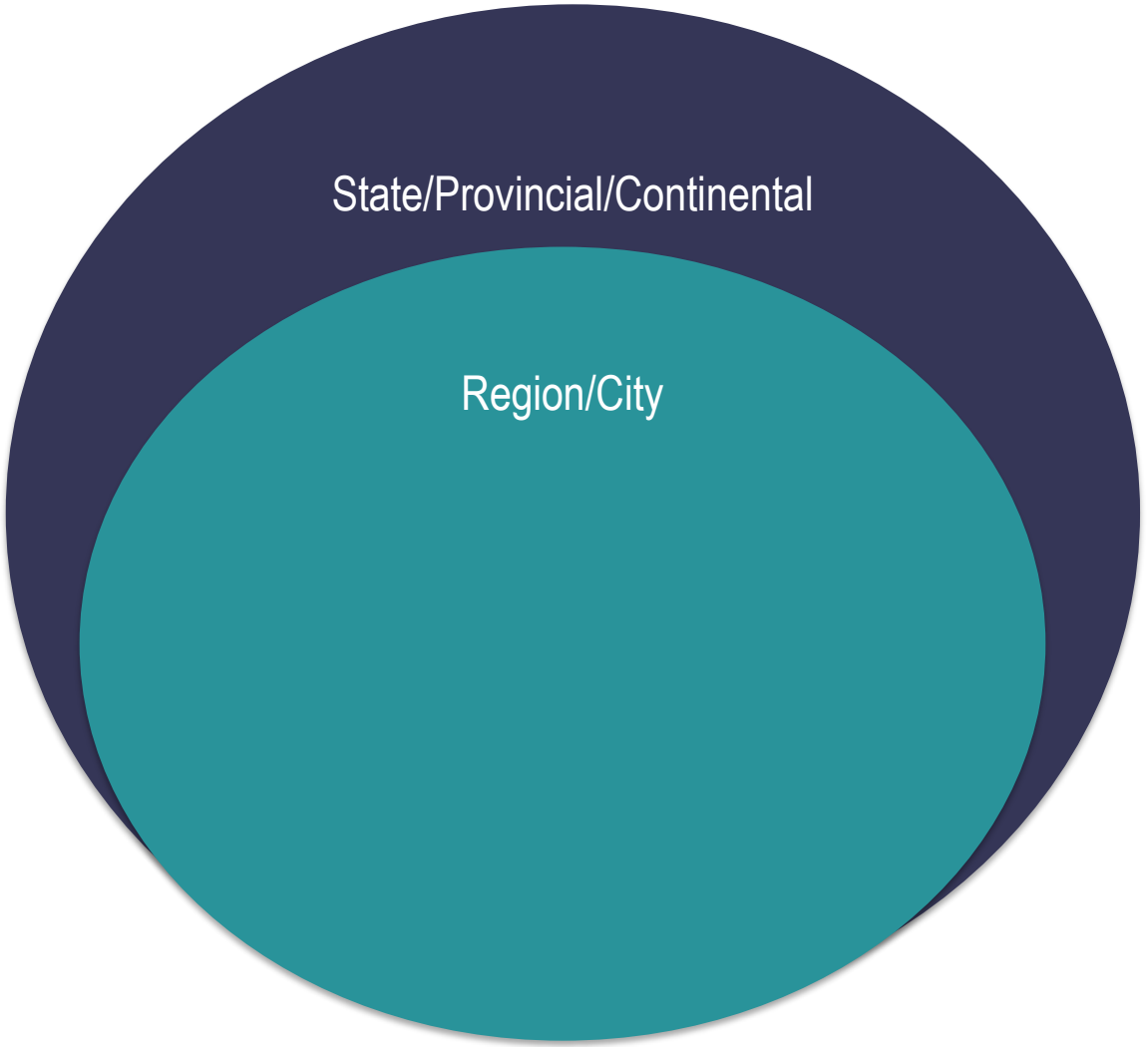
For building energy services and

for sustainability outcomes



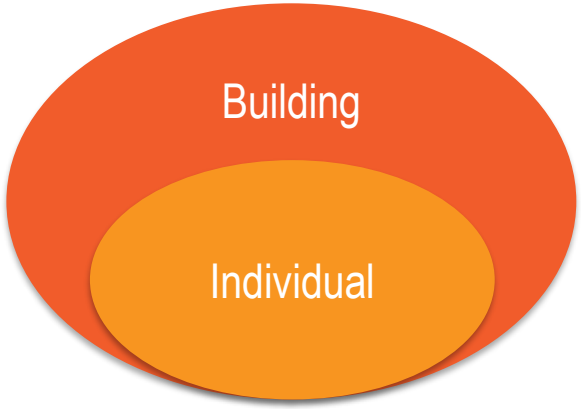
LARGE IS COST EFFICIENT

- Capital Intensive
- Phasing and integration challenges



‘SMALL IS BEAUTIFUL’

- Limited flexibility
- Lacks future option value
- Often lacks economy of scale required to make renewables cost effective



NEIGHBOURHOOD SCALE - THE MISSING LINK?

- Better staging of capital
- Diversity of technologies
- Place making

- Lower risk

- Better flexibility
- Has economy of scale
- Professional management

NEIGHBOURHOOD ENERGY SYSTEMS (NES)

RESHAPE STRATEGIES

Distributed Energy

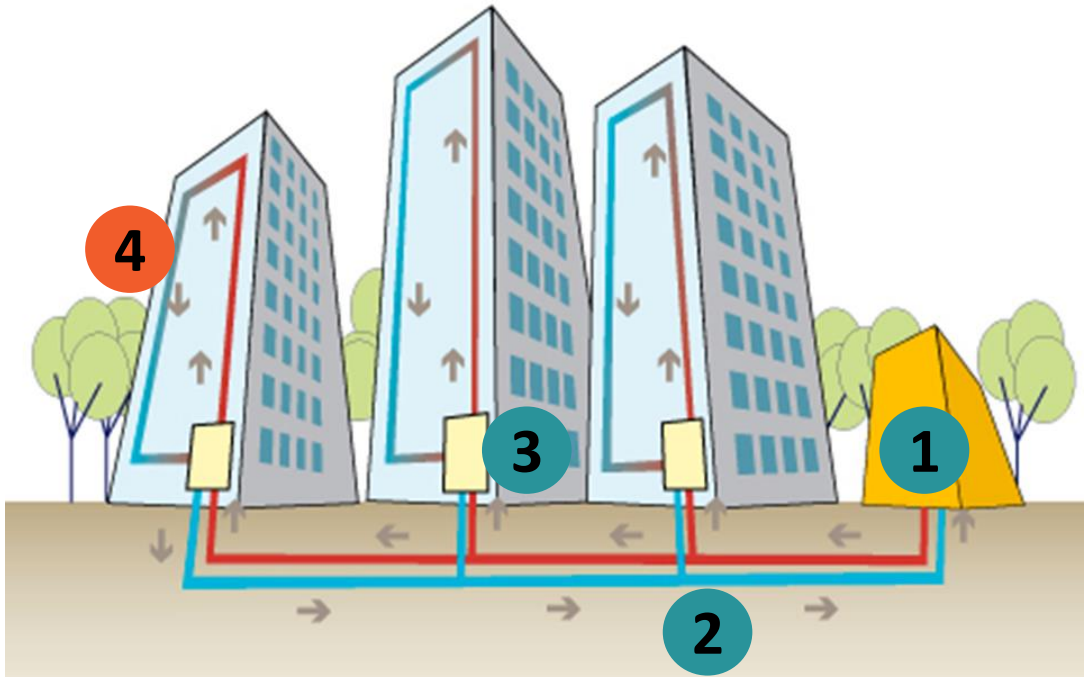
Community Energy

District Energy Systems

Thermal Energy Networks

Low-Carbon Thermal Energy Networks (LCTEN)

COMPONENTS OF A NES



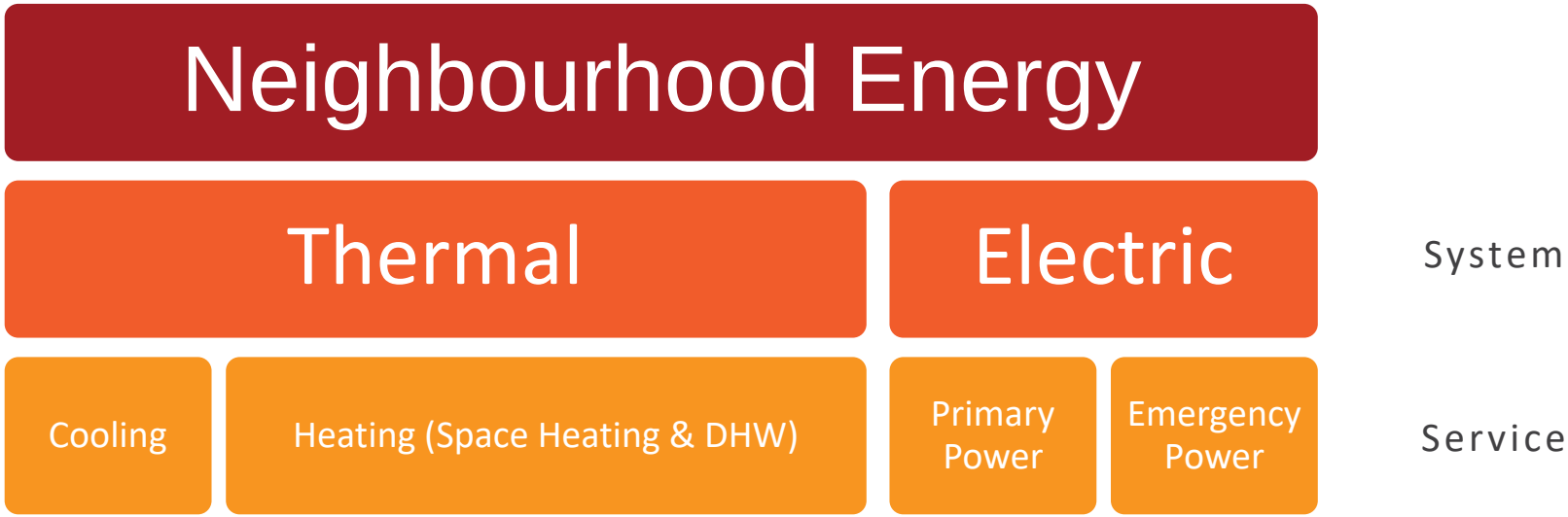
Utility Assets:

1. Energy Centre
2. Energy Transfer Station
3. Distribution Pipes

Building Equipment:

4. HVAC Systems (hydronic)

NEIGHBOURHOOD ENERGY



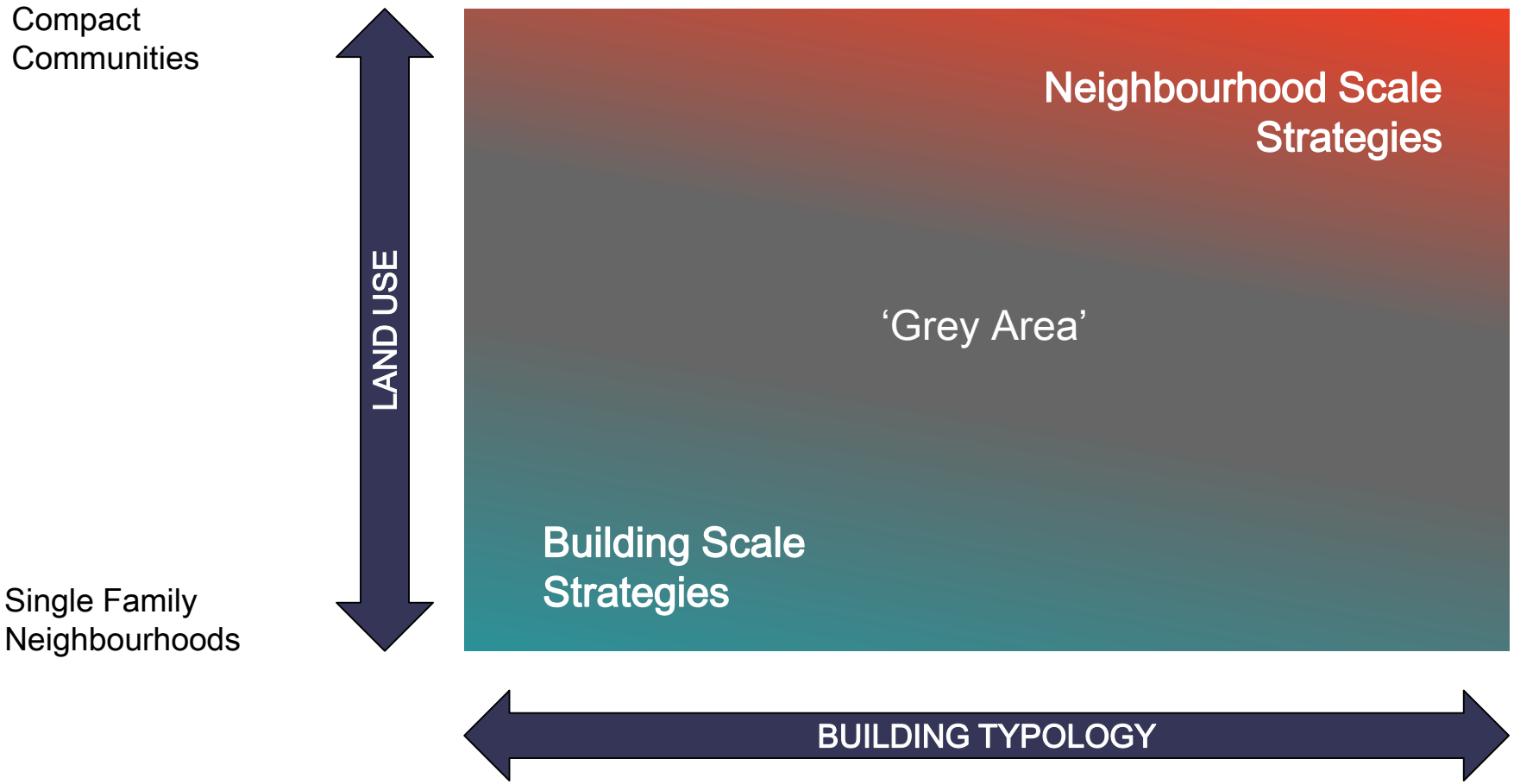
THREE TRUTHS ABOUT NES

1. **NES is not a panacea** (it does not make sense everywhere)

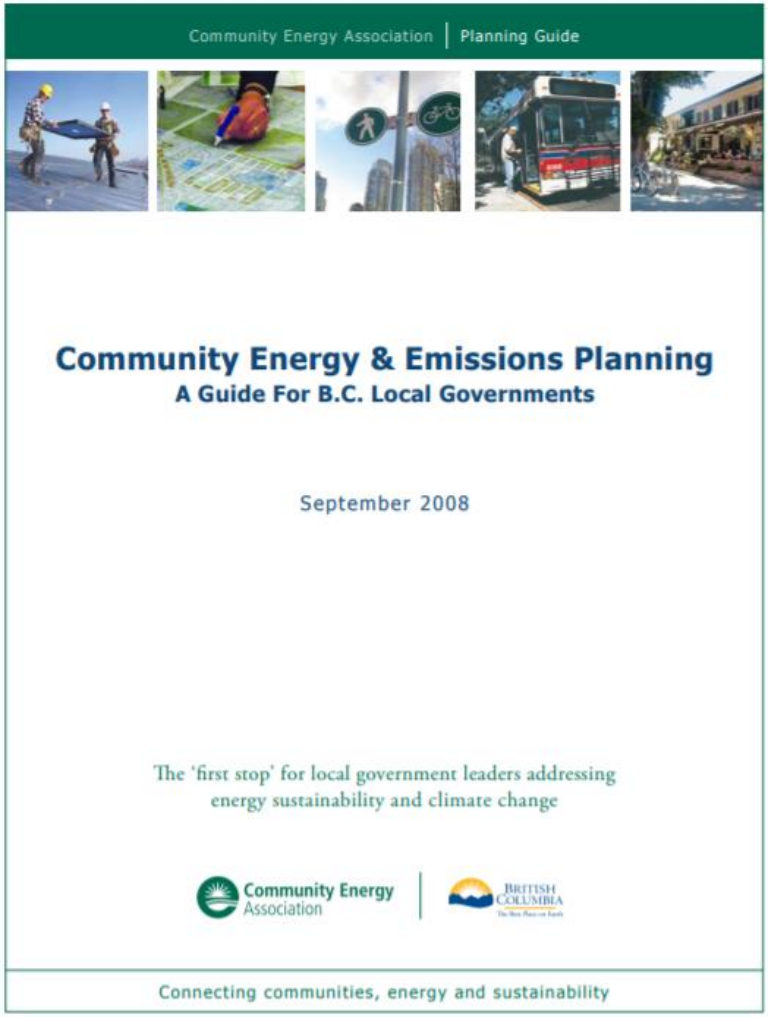
2. **NES is a means to an end** (low carbon outcomes for buildings is the end – NES is just one way to get there)

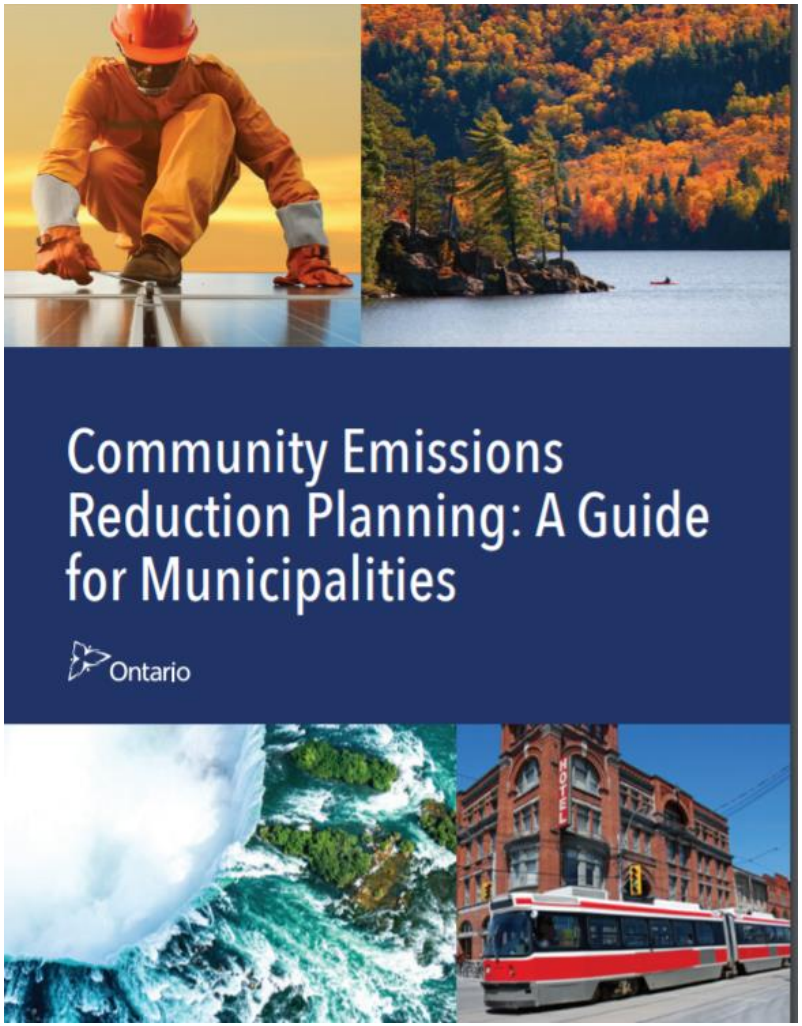
3. **NES are platforms to enable renewable energy technologies** (because the offer the opportunity to access economies of scale)

MOST APPROPRIATE STRATEGY VARIES BY COMBINATION OF LAND USE & BUILDING TYPOLOGY



CEEP INTO ACTION





EXISTING METRO VANCOUVER NETWORKS

1. Lions Gate Hospital System, North Vancouver
2. North Vancouver System (Lonsdale Energy Corporation)
3. University of British Columbia Academic System
4. University of British Columbia Neighbourhood System (Corix)
5. Downtown Vancouver System (Creative Energy)
6. Southeast False Creek (City of Vancouver)
7. Vancouver General Hospital System
8. BC Children and Women's Hospital System
9. Shannon Estates (Shannon Wall Centre)
10. River District System (River District Energy)
11. Burnaby Mountain (Corix)
12. Simon Fraser University Academic System
13. British Columbia Institute of Technology Burnaby Campus
14. Oval Village (Lulu Island Energy Company)
15. Alexandra (Lulu Island Energy Company)
16. Royal Columbian Hospital System
17. Surrey City Centre (City of Surrey)
18. Surrey Memorial Hospital System

SYSTEM OWNERSHIP
- public
- private

SYSTEM TYPE
- heating
- heating & cooling

10 km
10 mi

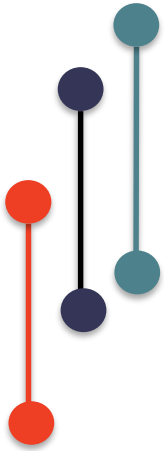
N

RESHAPE STRATEGIES

OWNERSHIP CONTINUUM

Ownership/ Governance		Examples
100% Public	Government Department	Southeast False Creek (Vancouver)
	Government Subsidiary	Lonsdale Energy Cooperation (North Van, BC) Markham District Energy
Hybrids (Shared Ownership and/or Governance)	Concession	Richmond, BC London Olympic Park, UK
	Strategic Partnership	South Hampton, UK
	Cooperative	Rochester District Heating Cooperative, NY Town of Toblach, Italy
	Non-Profit (No Share Capital Corporation)	District Energy St. Paul, MN
100% Private	Private For-Profit	Many examples in CAN and ON

CONSIDERATIONS OF TYPICAL MODELS

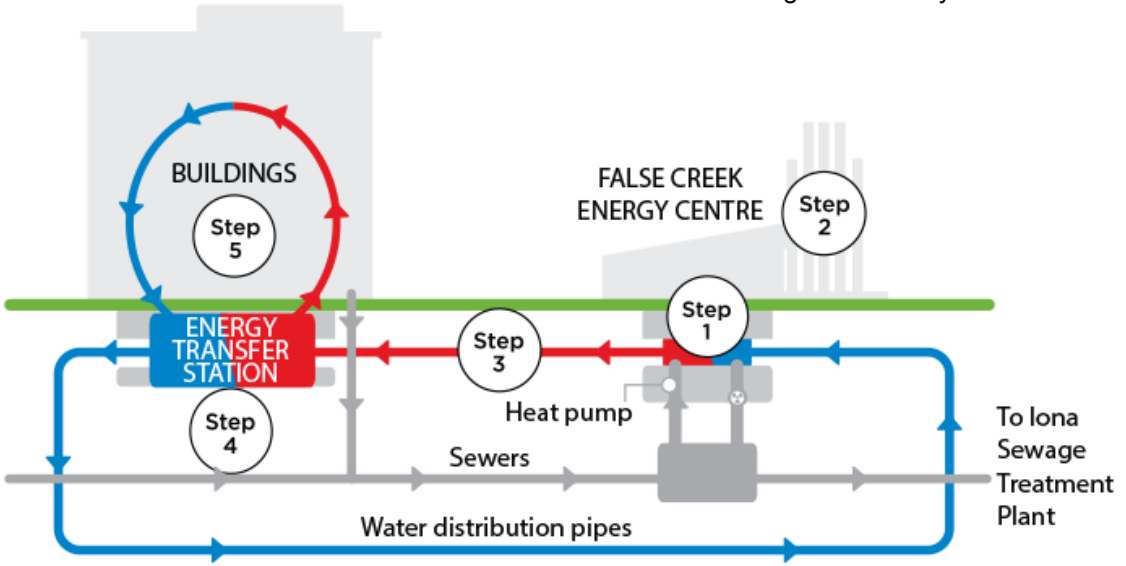
		CAPITAL	(Municipal Contribution)
		RISK	(Financial)
		CONTROL	(Of outcome via NES)
Most			
			
Least			
	100% Municipal	Concession	100% Private

QUESTIONS TO INFORM MOST APPROPRIATE OWNERSHIP MODEL

- Do I have access to capital?
- Do I have the internal resources required?
- Am I comfortable with the risk profile of NES projects?
- Are there alternatives to achieving the same outcomes via other means?
- Are there political champions that will help drive policy and create the necessary programs?

CASE STUDY #1 - SOUTH EAST FALSE CREEK
(100% MUNICIPALLY OWNED BY CITY OF VANCOUVER)

Image Credit: City of Vancouver



CASE STUDY #1 - SOUTH EAST FALSE CREEK
(100% MUNICIPALLY OWNED BY CITY OF VANCOUVER)

RESHAPE STRATEGIES

- Began operating in 2010 serving ~10 buildings with >2M sf
- Initial Capital Cost of ~ $33M funded via:
  - Grants ~ $10M
  - Low interest loan $5M
  - City financing ~ $18M
- Currently serves ~30 buildings with >5M sf
  - Incremental financing required for expansion efforts
- Utility fully recovers costs through NEU customer rates.
- The rates are set based on the dual mandate to provide:
  - Return on investment to the owner (CoV)
  - Provide competitive energy rates to NEU customers

CASE STUDY #2 – RICHMOND, BC
(CONCESSION MODEL – CORIX AND CITY OF RICHMOND)

Image Credit: Lulu Island Energy Company

LuluIsland ENERGY COMPANY

CASE STUDY #2 – RICHMOND, BC
(CONCESSION MODEL – CORIX AND CITY OF RICHMOND)

- Lulu Island Energy Company (LIEC) is a municipal corporation wholly owned by the City of Richmond and regulated by Richmond City Council.
- Oval Village DEU (OVDEU) is being developed under a 30-year concession agreement with Corix Utilities.
- During the concession period Corix designs, builds, finances and operates the OVDEU and supplies energy services to LIEC.
- Oval Village DEU began operating in 2014 as of 2017 eight buildings have been connected.
- At build-out the system will serve ~5.5M sf of floor area.

CASE STUDY #3 – RIVER DISTRICT ENERGY
(100% PRIVATE)

RESHAPE STRATEGIES


Image Credit: kennymatic


Image Credit: CANNEPP

Image Credit: River District

CASE STUDY #3 – RIVER DISTRICT ENERGY
(100% PRIVATE)

- Owned by the River District Energy Utility, a 100% private utility regulated by the BC Utilities Commission (BCUC)

- BCUC sets limits on capital structure and return on equity
  - Capital structure of 60% debt and 40% equity
  - Cap on ROE of 9.5%
  - WACC close to 6.5%

- First phase connected 6 buildings to two temporary gas boiler plants at a cost of $10.8 million, completed in 2016.

- At build-out the system will serve 7.7M sf of floor area.

NATIONAL PRECEDENT: ZIBI, OTTAWA/GATINEAU, ON/QC

ALTERNATIVE FUEL SOURCES

Biomass

Waste Heat

Hydro

SYSTEM TYPE

Central Energy Plants

END USERS

Residential, Retail, and Commercial

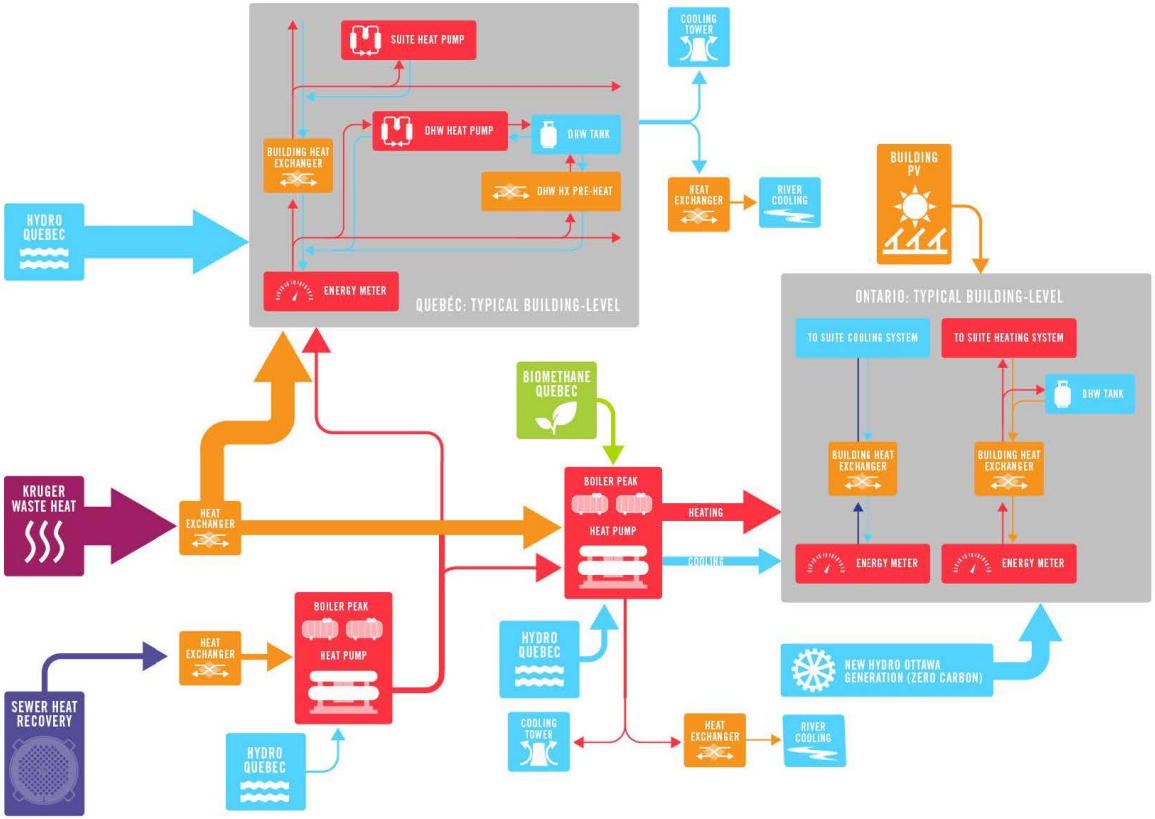
OWNERSHIP

Utility Company

Private Developer

URBAN EQUATION

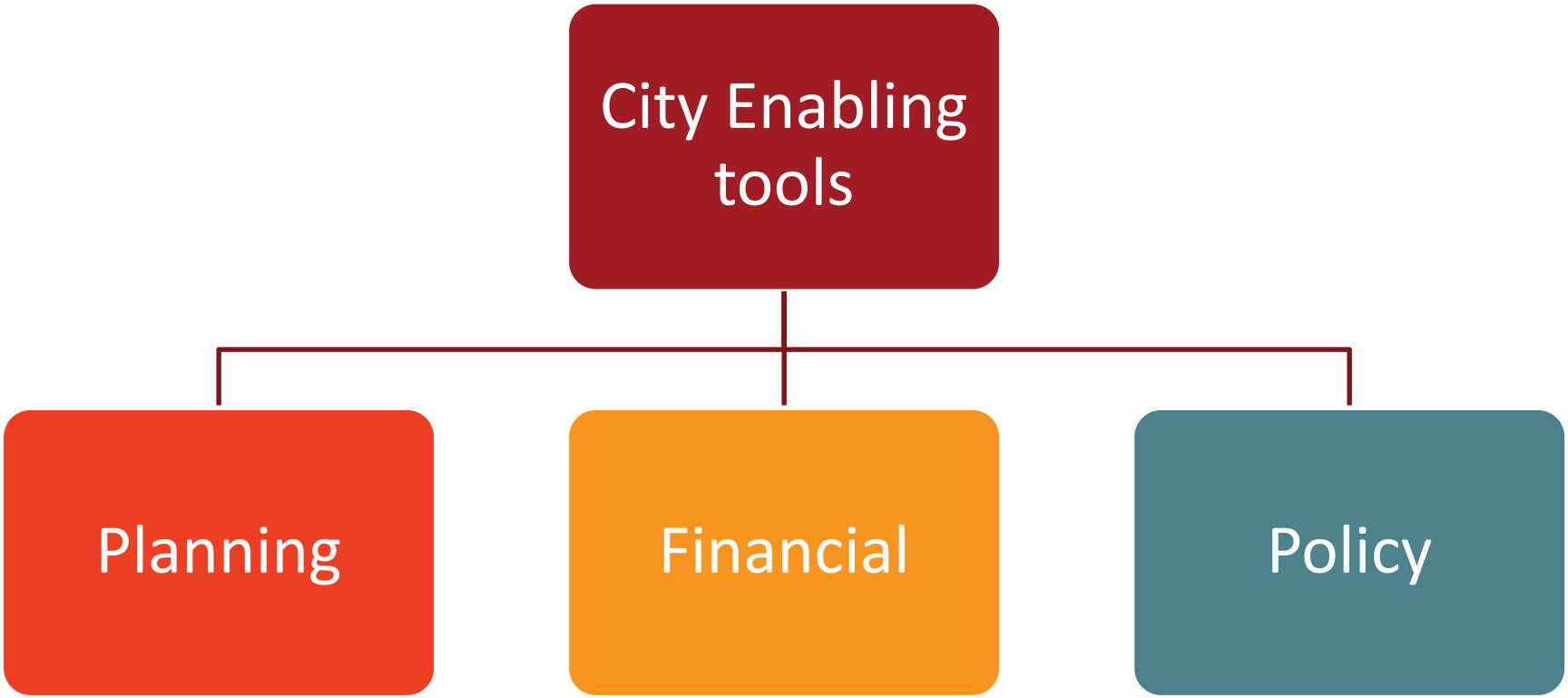
NATIONAL PRECEDENT: ZIBI, OTTAWA/GATINEAU, ON/QC



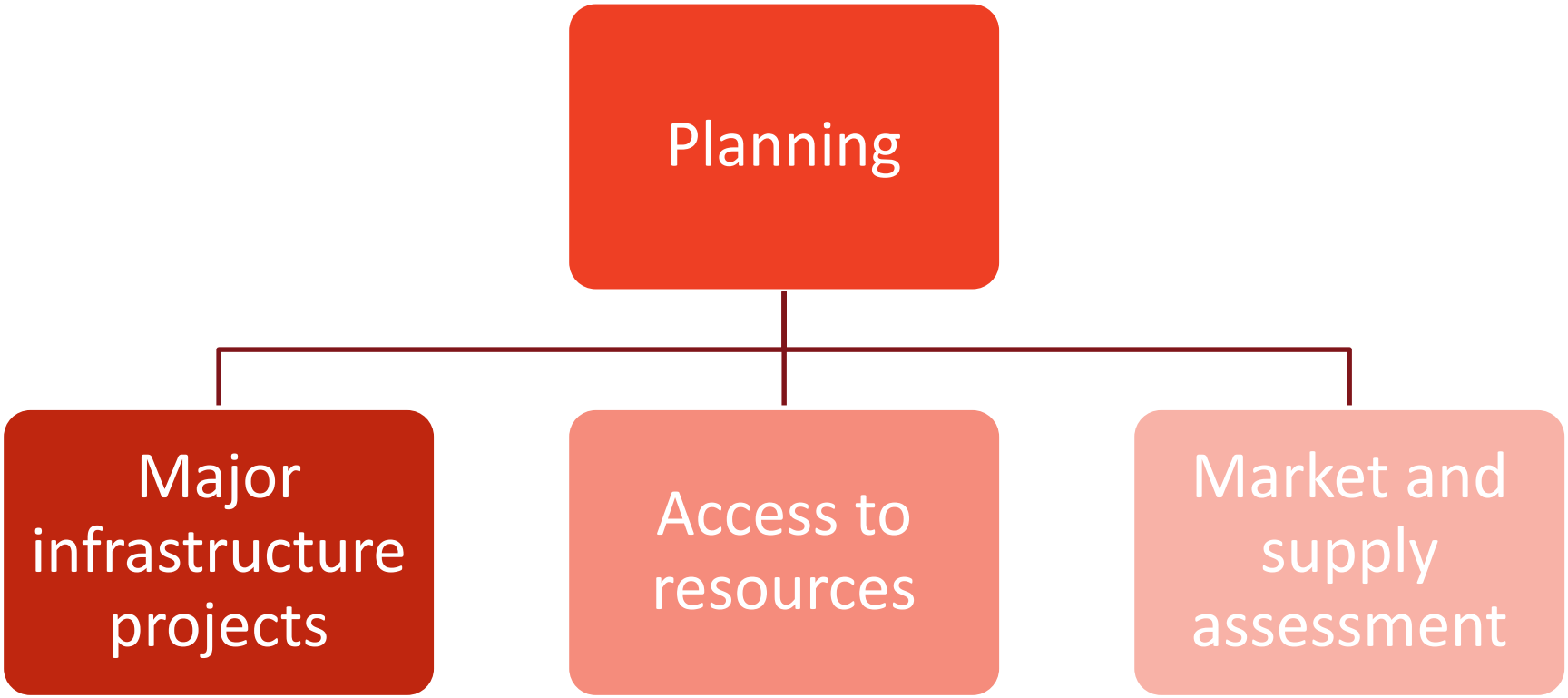
URBAN EQUATION

Municipal NES Enabling Tools

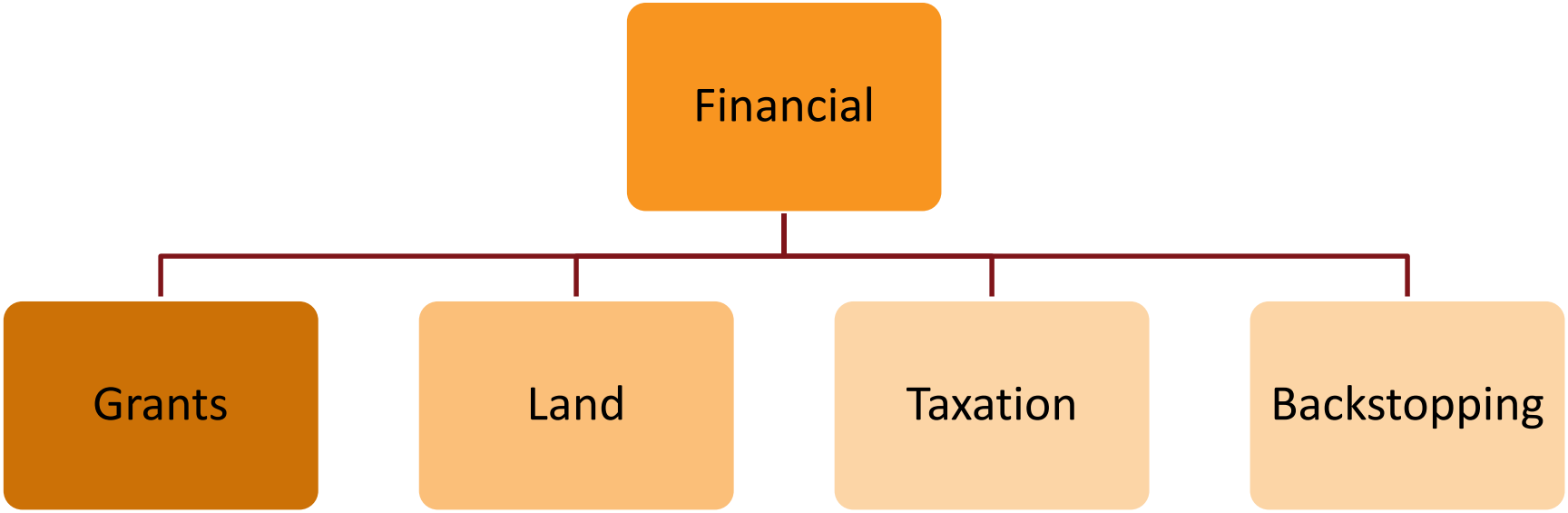
CITY ENABLING TOOLS



CITY ENABLING TOOLS



CITY ENABLING TOOLS



FUNDING PROGRAMS – FCM GREEN MUNICIPAL FUND

Provides funding for: feasibility studies, pilot projects and capital projects related to initiatives that reduce energy consumption and greenhouse gas emissions.

Including:

Energy recovery or district energy
Your project must incorporate thermal energy from residual or renewable sources, and reduce energy consumption by at least 40 per cent for one or more existing facilities, compared to baseline data, within three years of implementation.

Examples:
district energy systems
utilization of residual biomass
process heat capture

URBAN EQUATION

FUNDING PROGRAMS – FCM GREEN MUNICIPAL FUND

Excluded projects

Stand-alone renewable energy production projects are not eligible for funding, unless they are implemented on brownfield sites, with or without remediation, and are approved by the provincial or territorial regulator. If this is the case, your initiative is considered a brownfield capital project.

Who can apply

- All Canadian municipal governments.
- Municipally owned corporations working in partnership with a municipal government.

URBAN EQUATION

FUNDING PROGRAMS – FCM GREEN MUNICIPAL FUND

Pilot projects

- Grants: Up to 50 per cent of eligible costs to a maximum of $350,000.

Capital projects

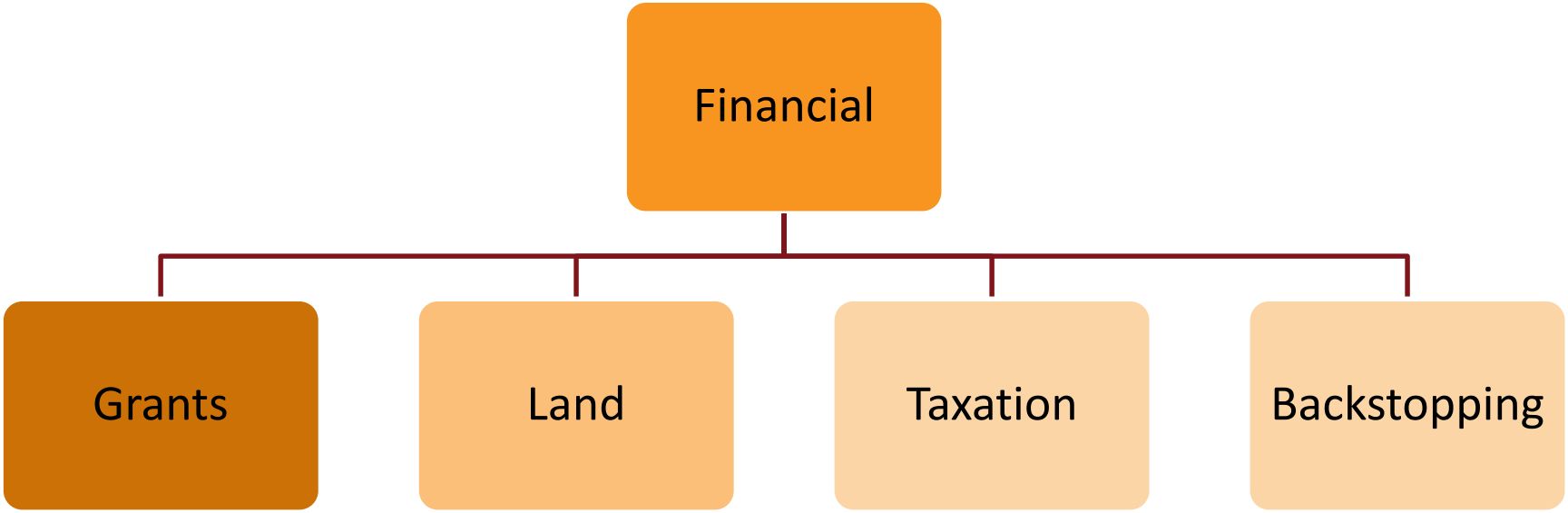
- We offer low-interest loans, with competitive lending rates, usually in combination with grants.
- Funding is provided for up to 80 per cent of eligible project costs.
- The loan maximum is $5 million, and the grant amount is 15 per cent of the loan.

Applicants with high-ranking projects may be eligible for a loan of up to $10 million, combined with a grant for 15 per cent of the loan amount, to a maximum of $1.5 million.

about financing for capital projects.

URBAN EQUATION

CITY ENABLING TOOLS



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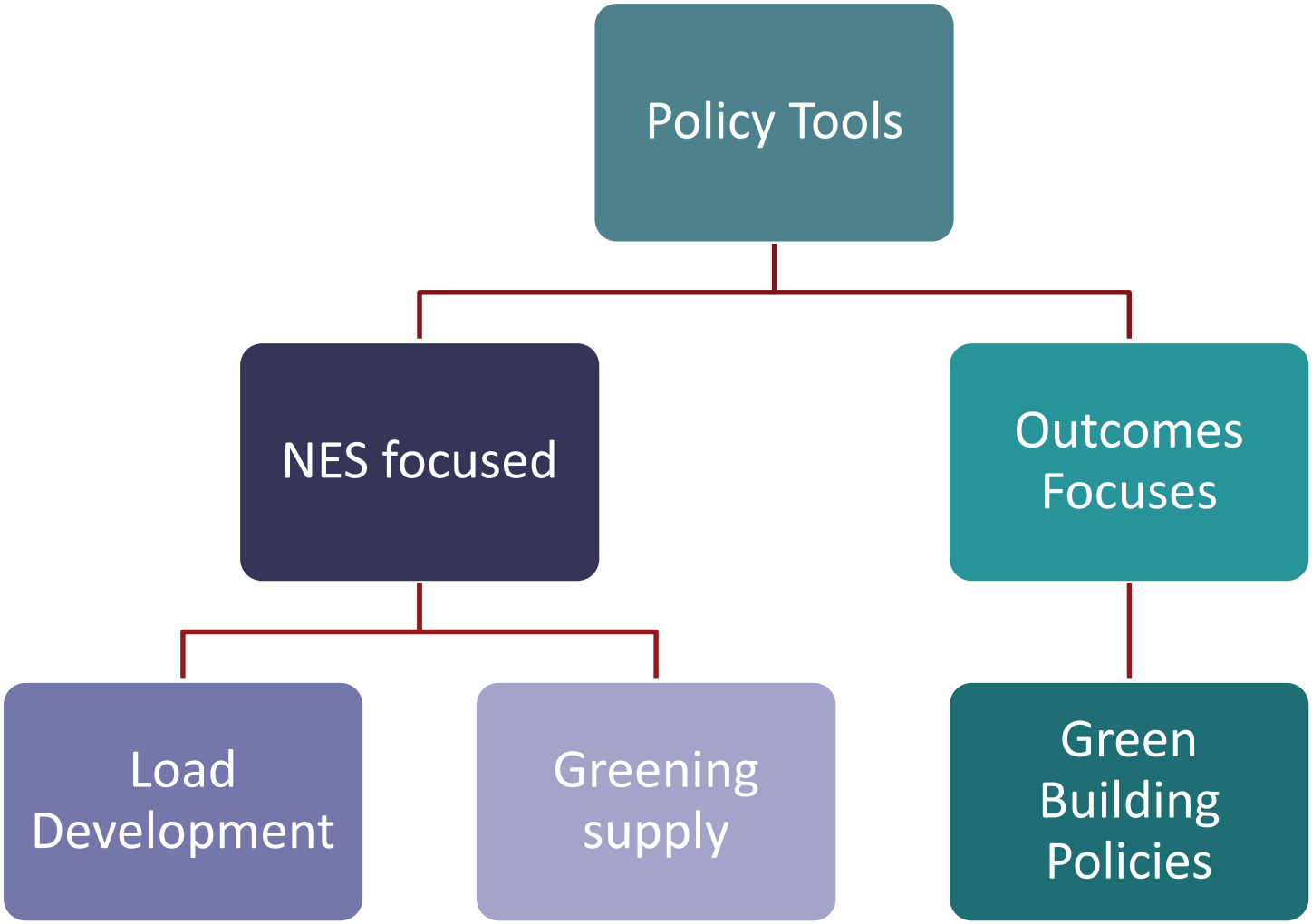
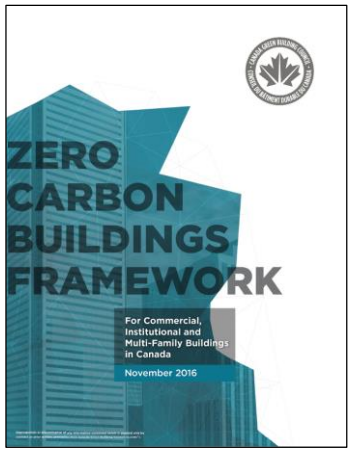
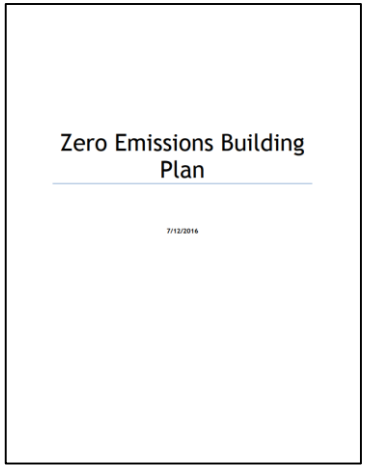


A NEW WAVE OF CARBON BASED GREEN BUILDING POLICIES

RESHAPE STRATEGIES



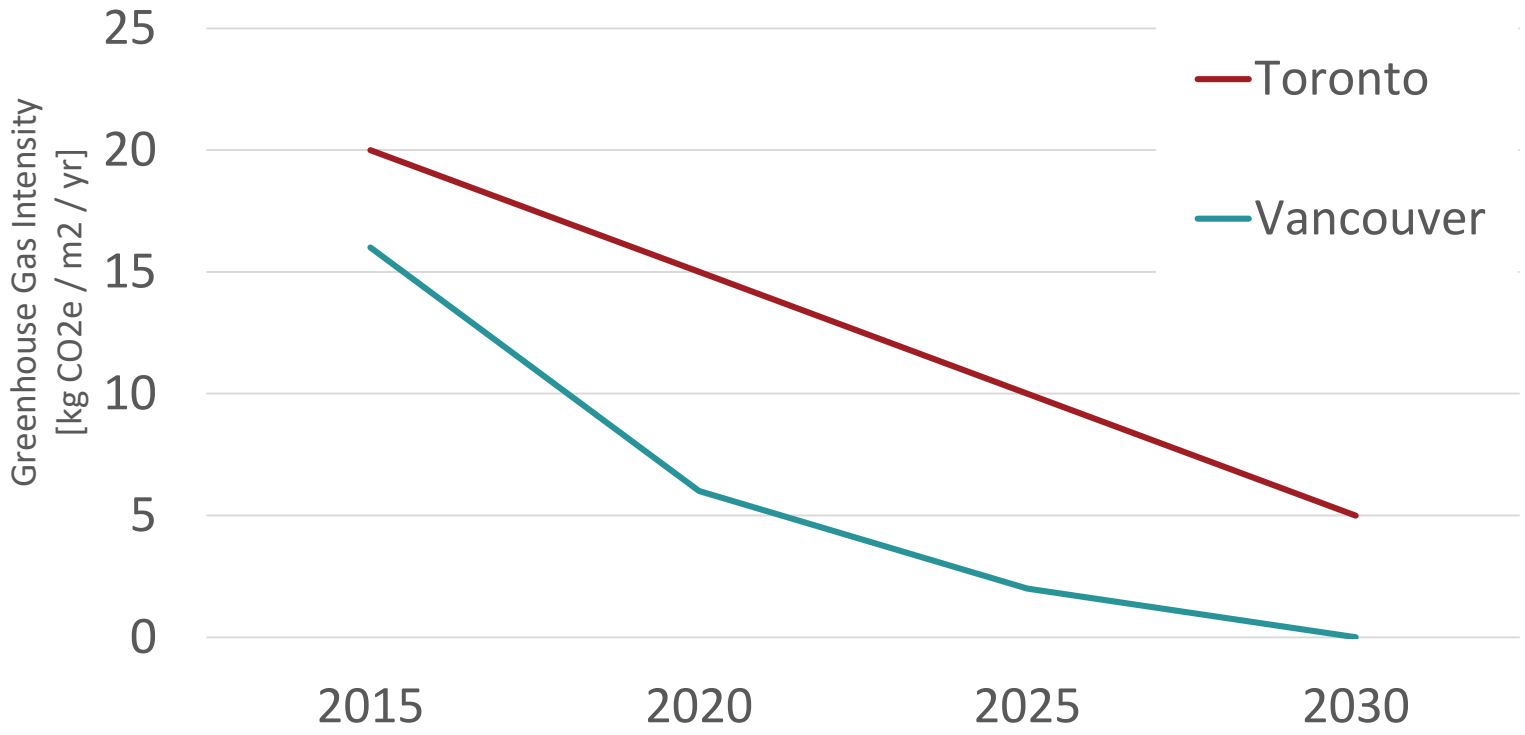


CANADA GREEN BUILDING COUNCIL · CONSEIL DU BÂTIMENT DURABLE DU CANADA ·

TORONTO

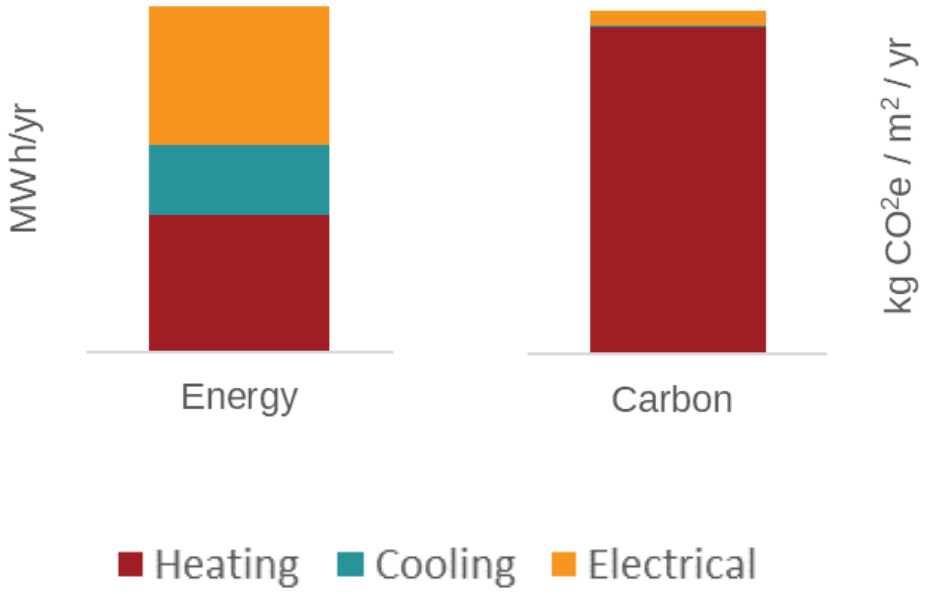
CITY OF VANCOUVER

VANCOUVER (ZEB) & TORONTO (TGS) GHGI LIMITS BY PERMIT YEAR



TYPICAL BUILDING ENERGY SYSTEM (PRE-ZEB)

Power	electricity grid
Cooling	electric chillers
Heating	gas boiler



CASE STUDY - TORONTO ZERO EMISSION BUILDING FRAMEWORK

URBAN EQUATION

A PATHWAY TO ZERO

2018	2022	2026	2030
V3 Tier 1	--	--	--
V3 Tier 2	V4 Tier 1	--	--
V3 Tier 3	V4 Tier 2	V5 Tier 1	--
V3 Tier 4	V4 Tier 3	V5 Tier 2	V6 Tier 1

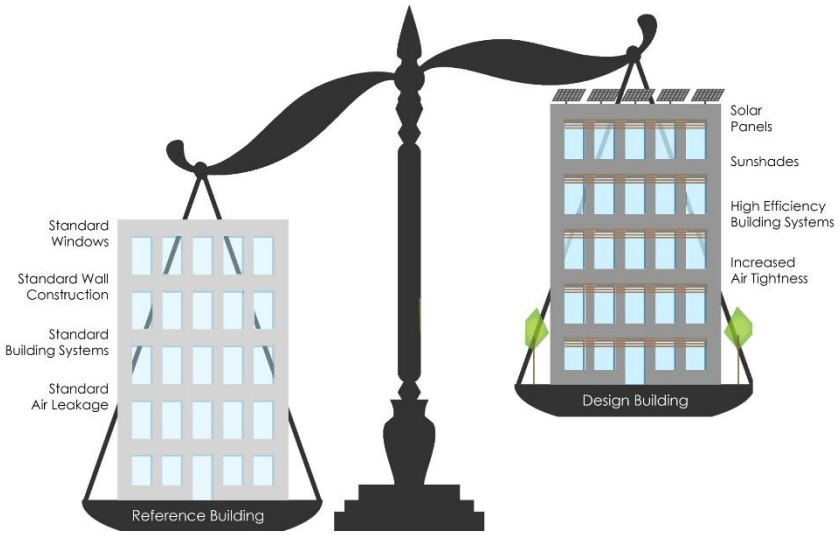
PPA with renewable energy required
= Zero Emission Buildings

URBAN EQUATION

MAJOR CHANGES TO ENERGY MODELS

- Move to ***absolute*** metrics (instead of reference building):
  - Energy Use Intensity (EUI)
  - Carbon Intensity (GHGI)
  - Thermal Demand Intensity (TEDI)

- Detailed accounting of thermal bridge effects



URBAN EQUATION

REVISED TARGETS

BUILDING TYPE	TIER	EUI (kWh/m^2)	TEDI (kWh/m^2)	GHG (kg/m^2)
HIGH RISE MURB	T1	170	70	20
	T2	135	50	15
	T3	100	30	10
	T4	75	15	5
4-6 STOREY WOOD FRAME MURB	T1	165	65	20
	T2	130	40	15
	T3	100	25	10
	T4	70	15	5
OFFICE BUILDING	T1	175	70	20
	T2	130	30	15
	T3	100	22	8
	T4	65	15	4
RETAIL	T1	170	60	20
	T2	120	40	10
	T3	90	25	5
	T4	70	15	3

URBAN EQUATION

TGS TIER 3 – OTHER ENERGY ITEMS

Strategy:	Tier 1	Tier 2
Renewable & District Energy (update)	- Solar Readiness - District Energy Readiness	- Onsite Renewable Energy - District Energy Connection
EV Charging	20% of spaces, 80% Rough in	25% of spaces, 75% Rough in
Air Tightness Testing (new)	None	Whole-Bldg Air-tightness Testing
Building Commissioning (update)	None	Best Practices Cx
Sub-metering (update)	None	Additional Energy & Thermal Metering
Energy Benchmarking and Reporting (new)	Basic preparation for EWRB	N/A
Resilience Checklist (new)	Checklist Required	N/A

URBAN EQUATION

GREEN BUILDING POLICIES

RESHAPE STRATEGIES

Codes

BC Energy Step Code
A Best Practices Guide for Local Governments

Ontario BUILDING CODE

Standards

ASHRAE 90.1

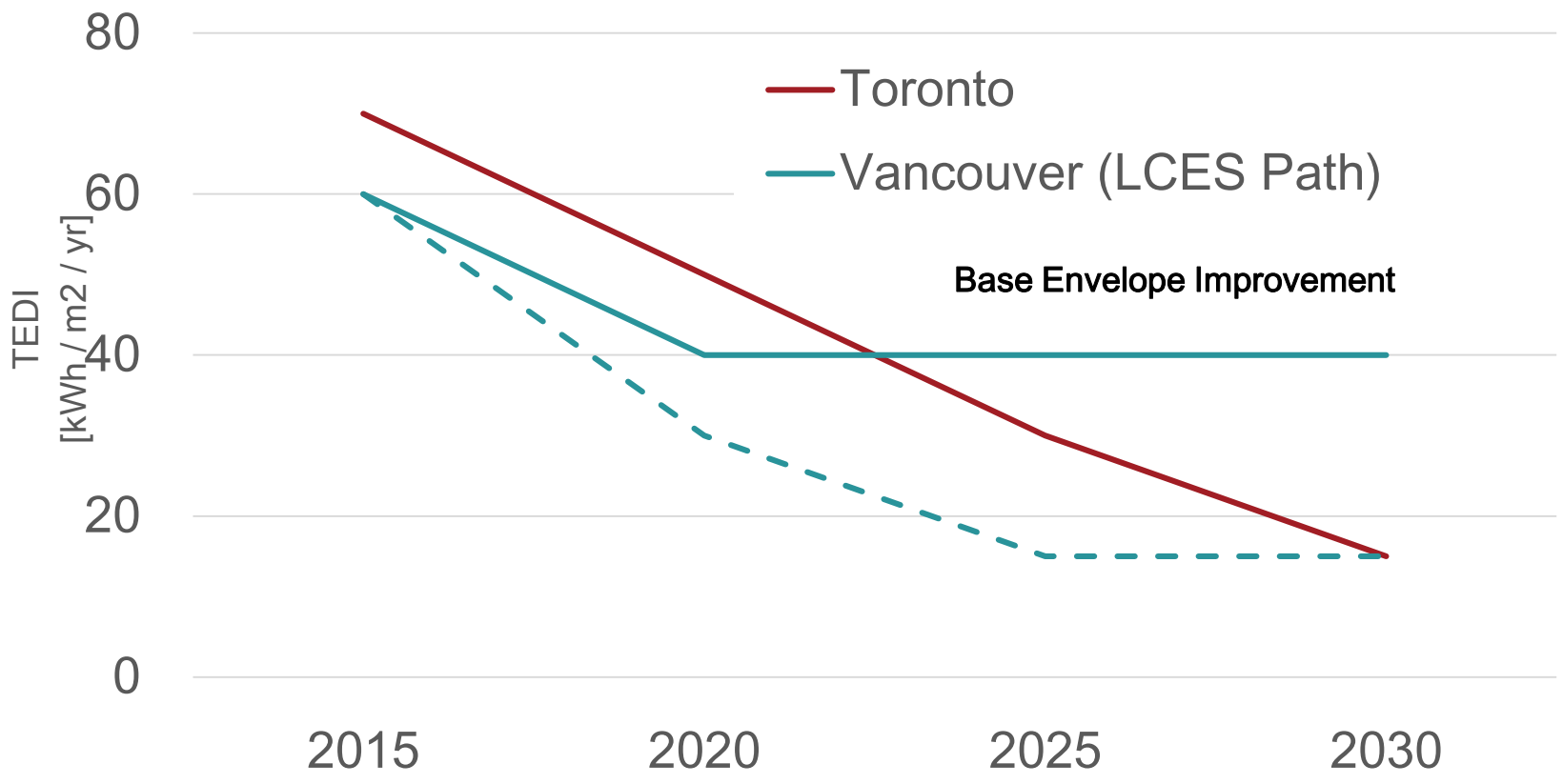
CANADA GREEN BUILDING COUNCIL · CONSEIL DU BÂTIMENT DURABLE DU CANADA · LEED® CANADA GOLD · OR 2012

Certified Passive House
Passive House Institute

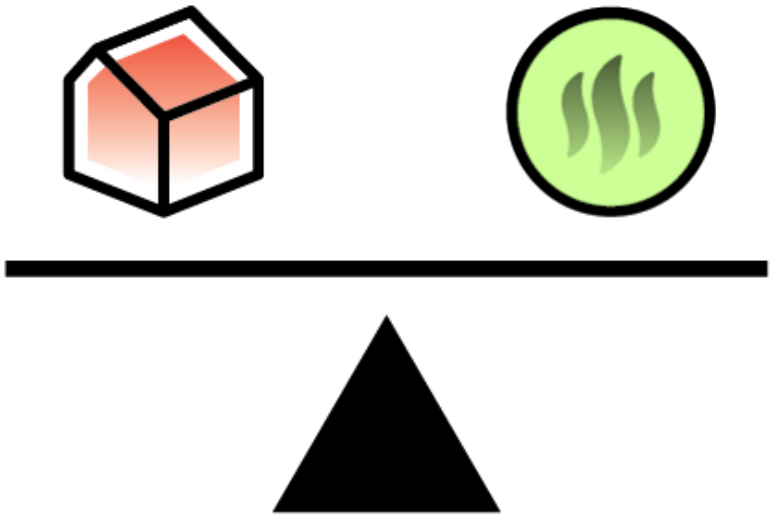
NETZERO ENERGY BUILDING CERTIFICATION

Policies

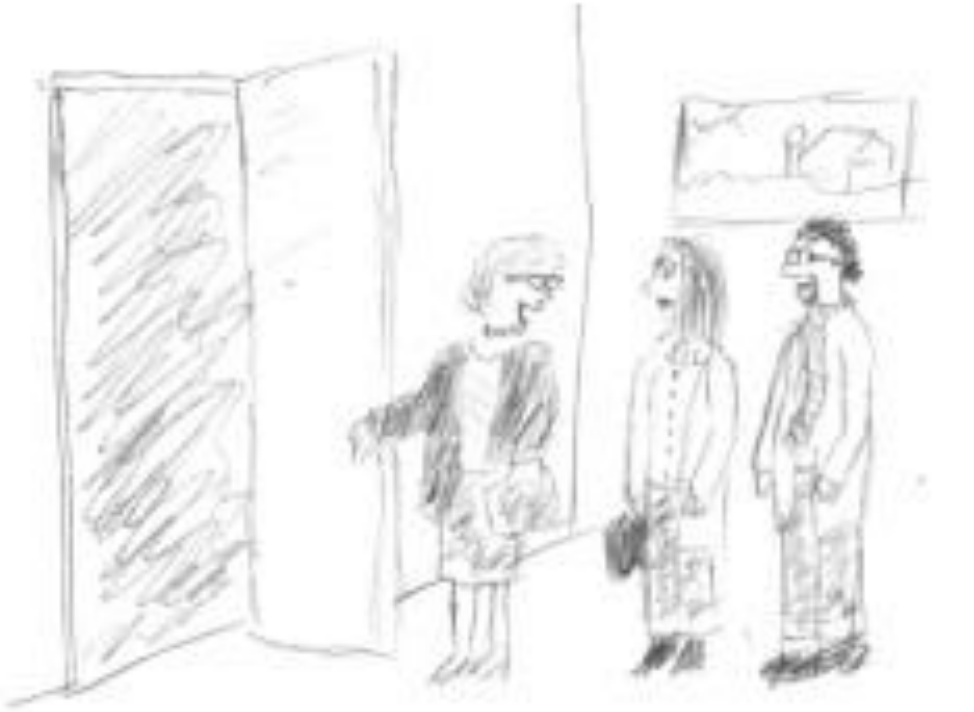
ZEB AND TGS TEDI LIMITS BY PERMIT YEAR



A BALANCED APPROACH

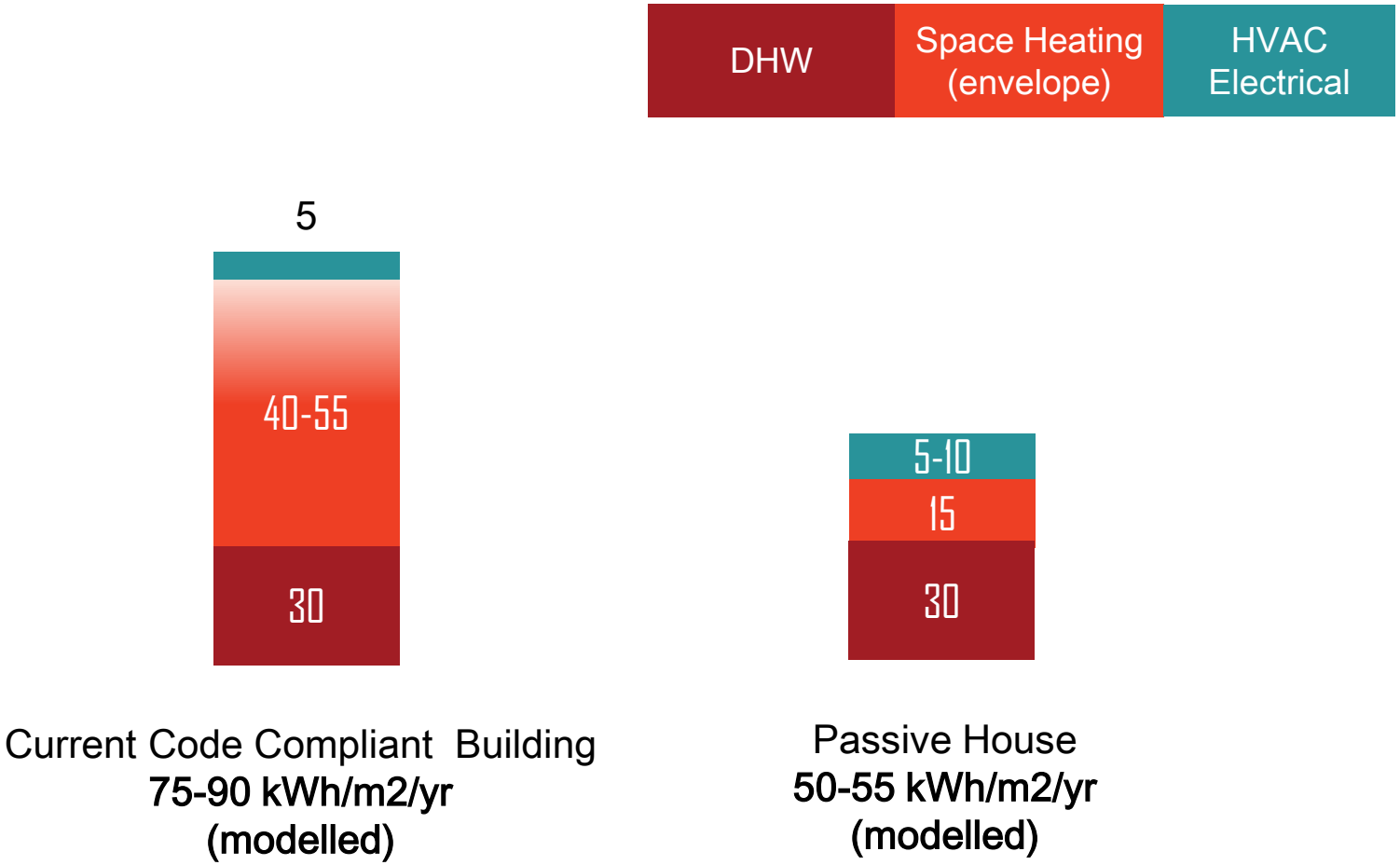


Finding the balance between
Saving heat and **'greening' heat**


"And *this* is the zero-carbon room"

PASSIVHAUS - GWW EXPERIMENT

APPLES TO APPLES



Current Code Compliant Building
75-90 kWh/m2/yr
(modelled)

Passive House
50-55 kWh/m2/yr
(modelled)

DESIGN MATTERS

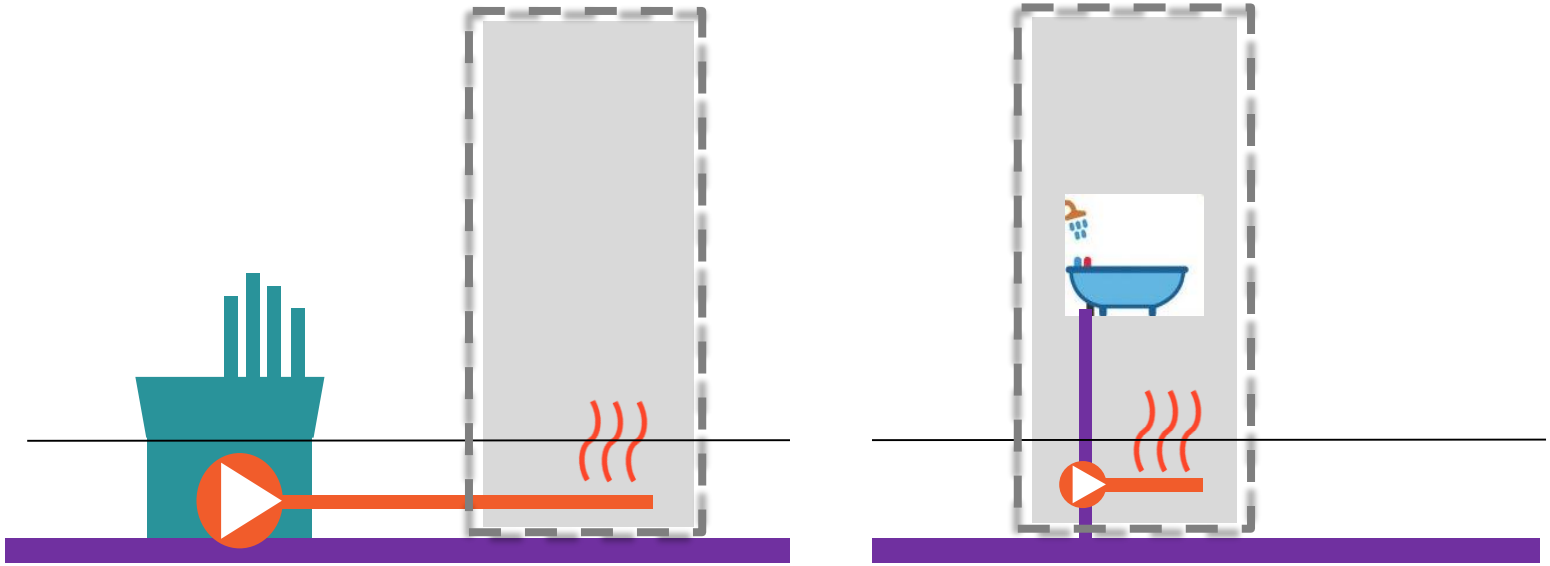
DESIGN MATTERS

BOUNDARY ISSUES

RESHAPE STRATEGIES

Building A

Building B



SWHR
Off-site

SWHR
On-site

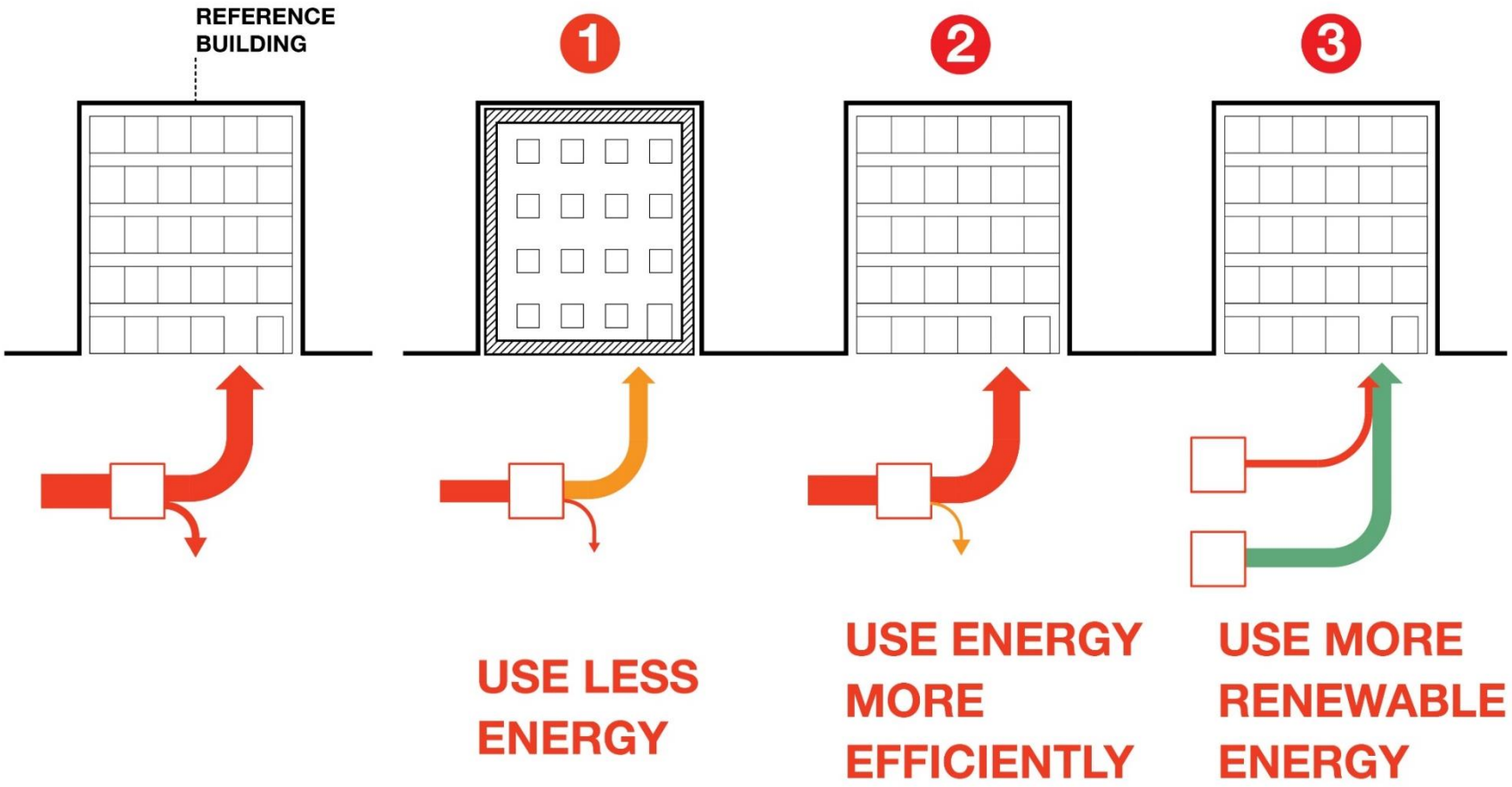
METRIC ISSUES

$ **kWh** **GHG**

Image Credit: GHG Protocol, Data Energy

HIERARCHY ISSUES

RESHAPE STRATEGIES



‘ELECTRIFICATION OF HEAT’

Energy system for building scale heat pump:

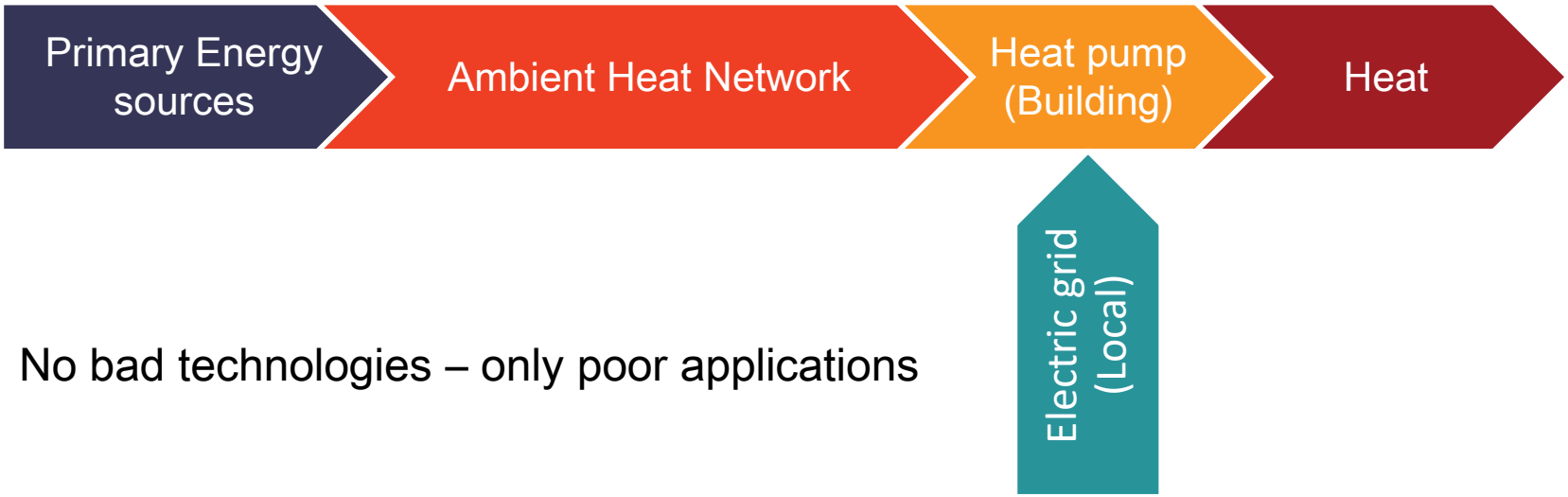
Energy system for neighbourhood scale heat pump:

Both are forms of ‘electrification of heat’ – the difference is in the ‘last mile’

AMBIENT SYSTEMS

Energy System for ‘Conventional NES’:

Energy system for ‘Ambient networks’:



No bad technologies – only poor applications