Funded by: Natural Resources Canada

Wednesday May 28 | Calgary, AB

CODES WORKSHOP FOR COMMERCIAL BUILDERS

free event

Building Better: Practical Applications of National Energy Codes for Alberta's Future

Calgary

SAIT

enbix

ALBERTA ecotrust

NECB 2020

Learning Outcomes

1

Apply
Building energy flow mechanics to buildings.

2

Identify
Relevant NBC and NECB sections that drive energy efficiency measures.

3

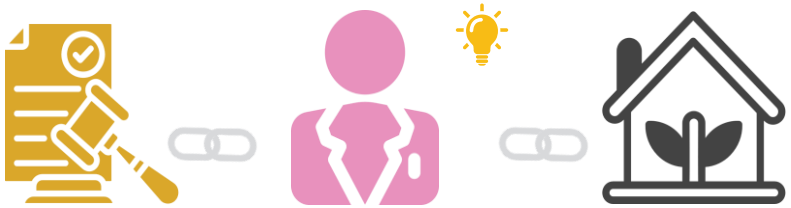
Understand
The new tiered energy code requirements.

Outline

- ❑ Introduction
- ❑ Legislative Framework and Building Energy Consumption
- ❑ Code Update (What's new?)
- ❑ Compliance and Tiered Energy Performance

Introduction – CAF Project Overview

Goal – create a **holistic program** where **higher performance tiers** of the energy codes are **encouraged & implemented** effectively and confidently by **The City** and **industry partners** to meet the **GHG emissions reduction targets**



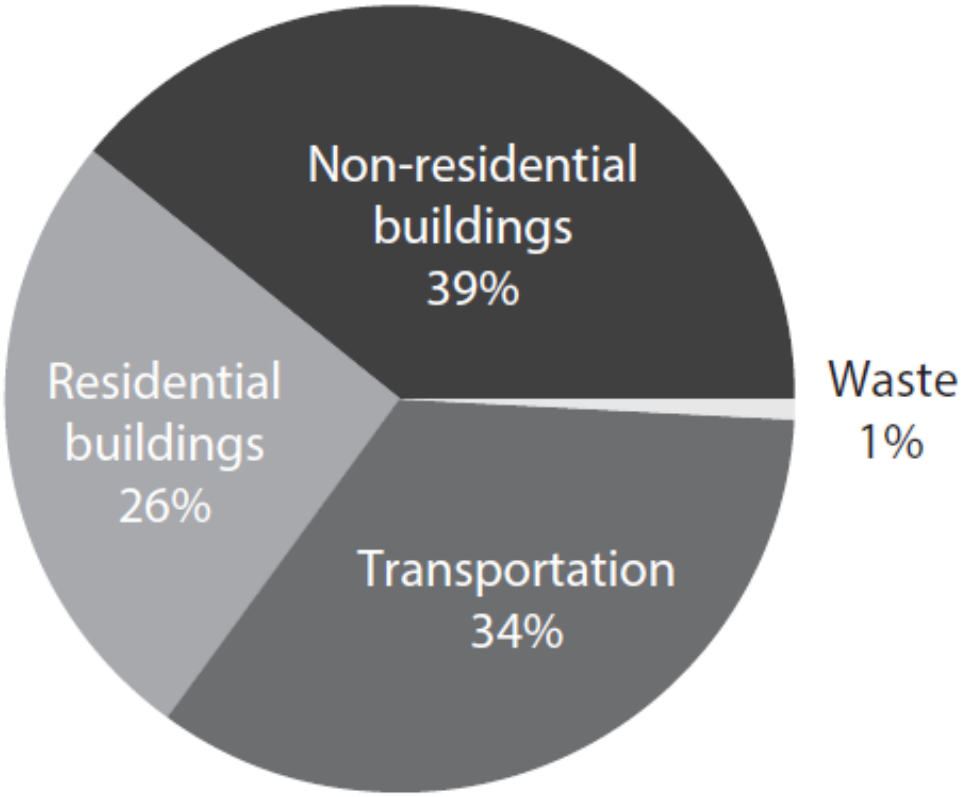
Calgary's Climate Commitments

On November 15, 2021, Calgary City Council declared a Climate Emergency, committing to:

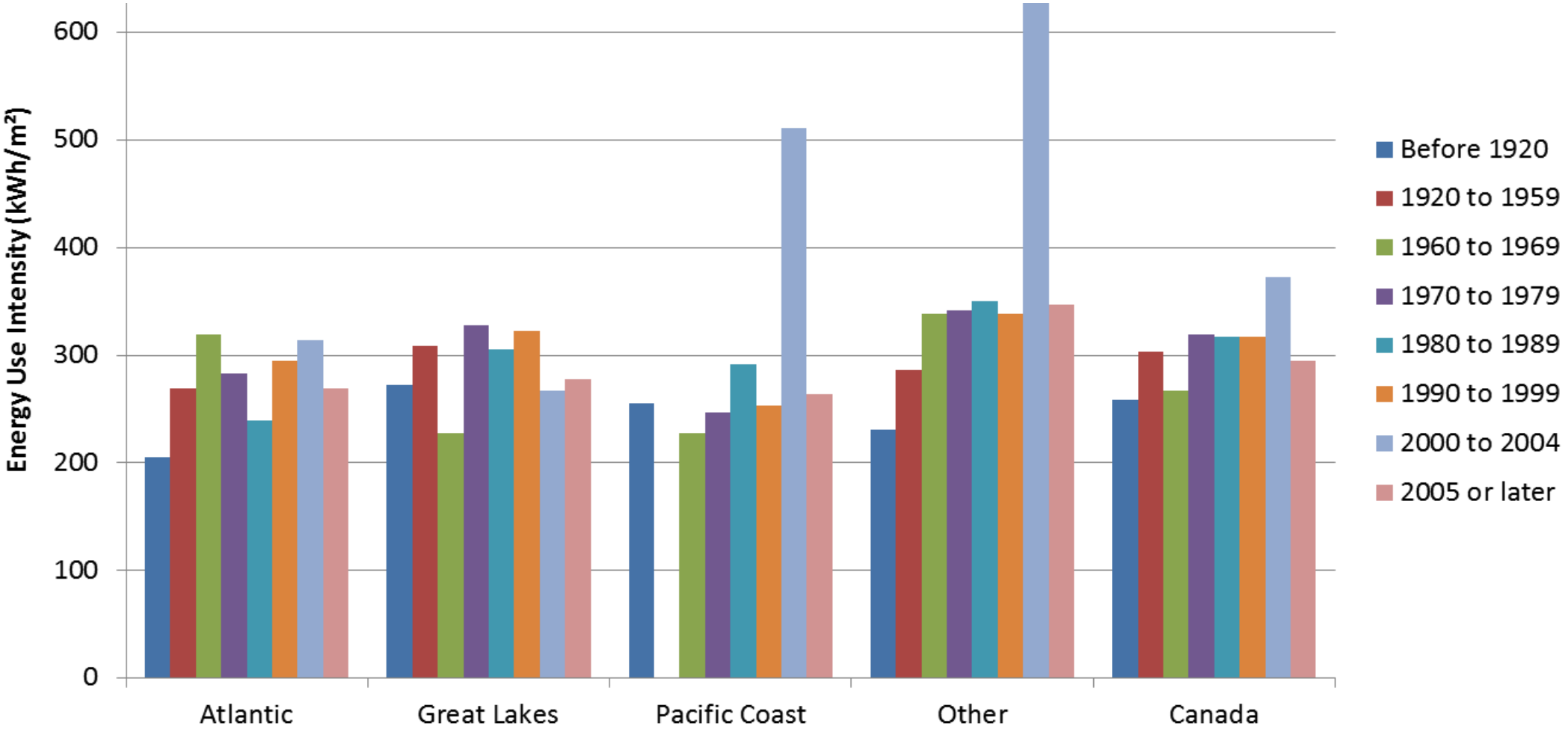
- Reducing GHG emissions significantly, reaching net-zero by 2050
- Invest and accelerate high-priority emissions reduction and climate risk opportunities

what are our challenges?

FIGURE 1 – CALGARY COMMUNITY-WIDE GHG EMISSIONS BY SECTOR (2017)



what is the real challenge?



problem in a nutshell?

we currently have a large number of underperforming buildings, a GHG and image problem, and no comprehensive set of tools or guidelines to fix this…

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or do we?

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City Charter

problem in a nutshell?

we currently have a large number of underperforming buildings, a GHG and image problem, and no comprehensive set of tools or guidelines to fix this…

or do we?

Incentive Opportunity City Charter

problem in a nutshell?

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or do we?

Tiered Energy Codes

Incentive Opportunity

City Charter

problem in a nutshell?

we currently have a large number of underperforming buildings, a GHG and image problem, and no comprehensive set of tools or guidelines to fix this…

or do we?

Economic Pressure
Tiered Energy Codes
Incentive Opportunity
City Charter

problem in a nutshell?

we currently have a large number of underperforming buildings, a GHG and image problem, and no comprehensive set of tools or guidelines to fix this…

or do we?

Let's look at the parts...

Sections 615.4(1) and 615.5(2)

Province of Alberta

MUNICIPAL GOVERNMENT ACT

CITY OF CALGARY CHARTER, 2018 REGULATION

615.4(1) The City must, in accordance with this section, establish a plan for the purpose of addressing and mitigating the effects of climate change.

615.5(2) The City must, in accordance with this section, establish a plan for adapting to effects of climate change.

The City must have both climate adaptation and mitigation plans…

Sections 615.4(5) and 615.7(7)

Province of Alberta

MUNICIPAL GOVERNMENT ACT

CITY OF CALGARY CHARTER, 2018 REGULATION

(5) A climate change mitigation plan must be reviewed no later than 5 years after it is established and at least once every 5 years thereafter.

(7) A climate change adaptation plan must be reviewed no later than 5 years after it is established and at least once every 5 years thereafter.

… and update and report on them

Section 617(b) and 640

Province of Alberta

MUNICIPAL GOVERNMENT ACT

CITY OF CALGARY CHARTER, 2018 REGULATION

Section 617(b) of the Act is to be read as follows:

(b) to maintain and improve the quality of the physical environment within which patterns of human settlement are situated within the boundaries of the City, including the promotion of environmental sustainability and stewardship,

Section 640 of the Act is to be read as follows:

(vii) any other matters necessary to regulate and control the issue of development permits that to the council appear necessary.

You (The City) have the discretion to consider environmental criteria in approving development

Province of Alberta

MUNICIPAL GOVERNMENT ACT

CITY OF CALGARY CHARTER, 2018 REGULATION

In the *Safety Codes Act*, in section 66, the following is added;

(4) Notwithstanding subsection (1), the City may make bylaws

relating to environmental matters, including, without limitation,

matters relating to energy conservation and heat retention, but

only to the extent those bylaws are consistent with all regulations made under this section and section 65.01 and all

codes declared in force by those regulations.

NOT ANY MORE...

This is the first time The City – within the limits highlighted – may pass bylaws in those areas controlled by the Building Code

In summary

Province of Alberta

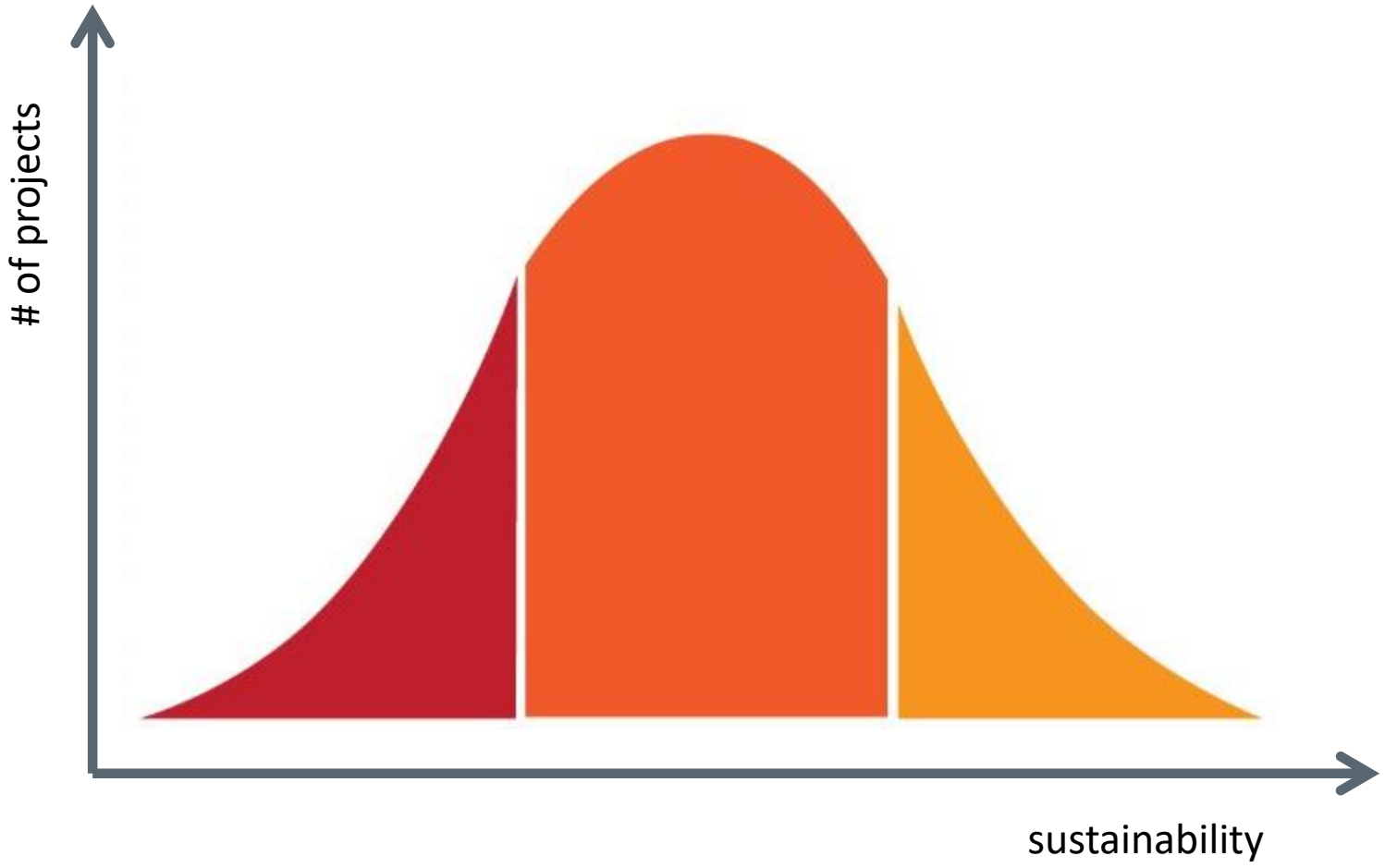
MUNICIPAL GOVERNMENT ACT

CITY OF CALGARY CHARTER, 2018 REGULATION

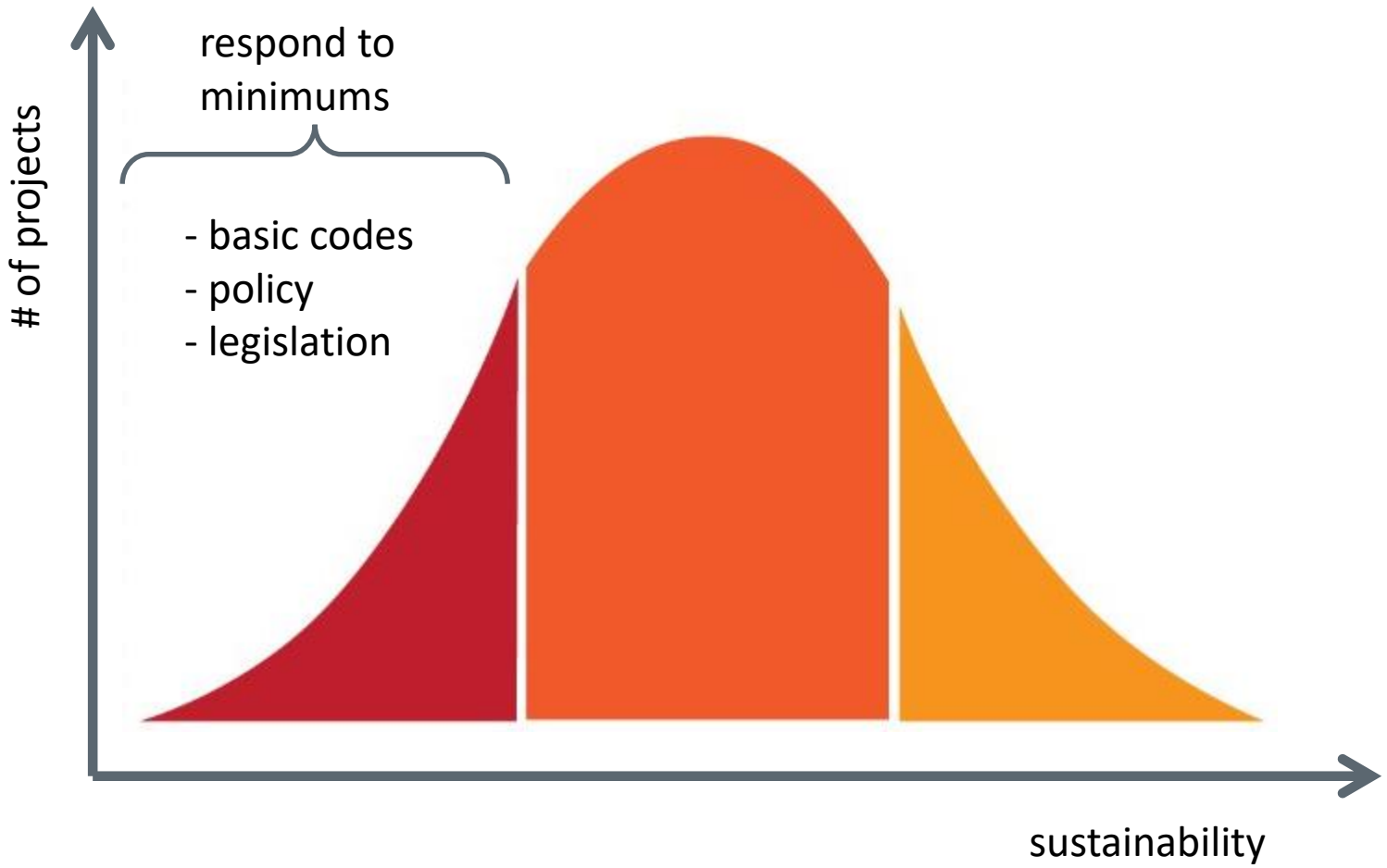
Since 2018, the City of Calgary;

- has an obligation to create and update climate change mitigation and climate change adaptation plans
- can use environmental considerations in approving development and development permits
- may put in place incentives to encourage higher tiers of energy performance

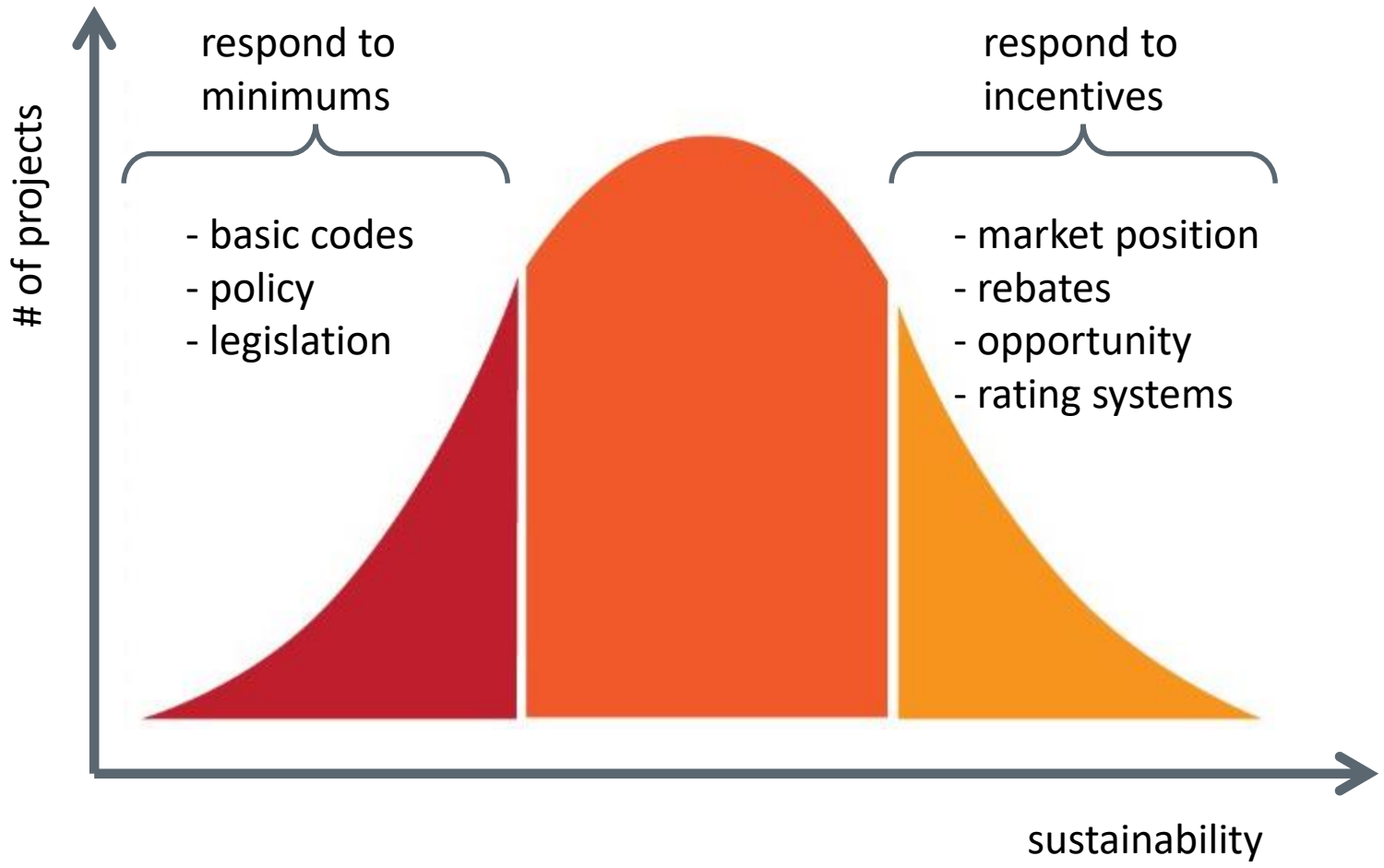
how to motivate? for sustainability?



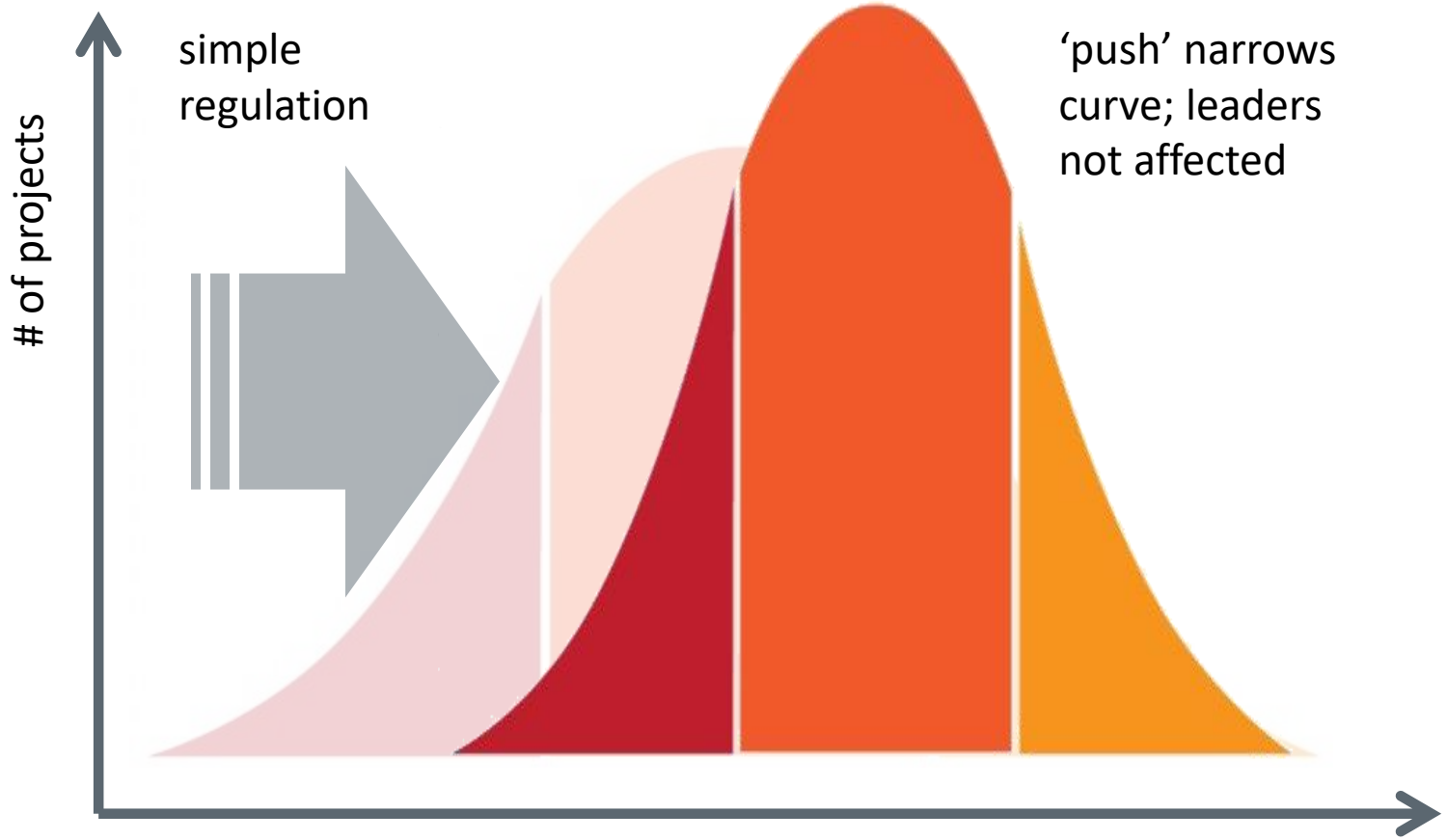
how to motivate?



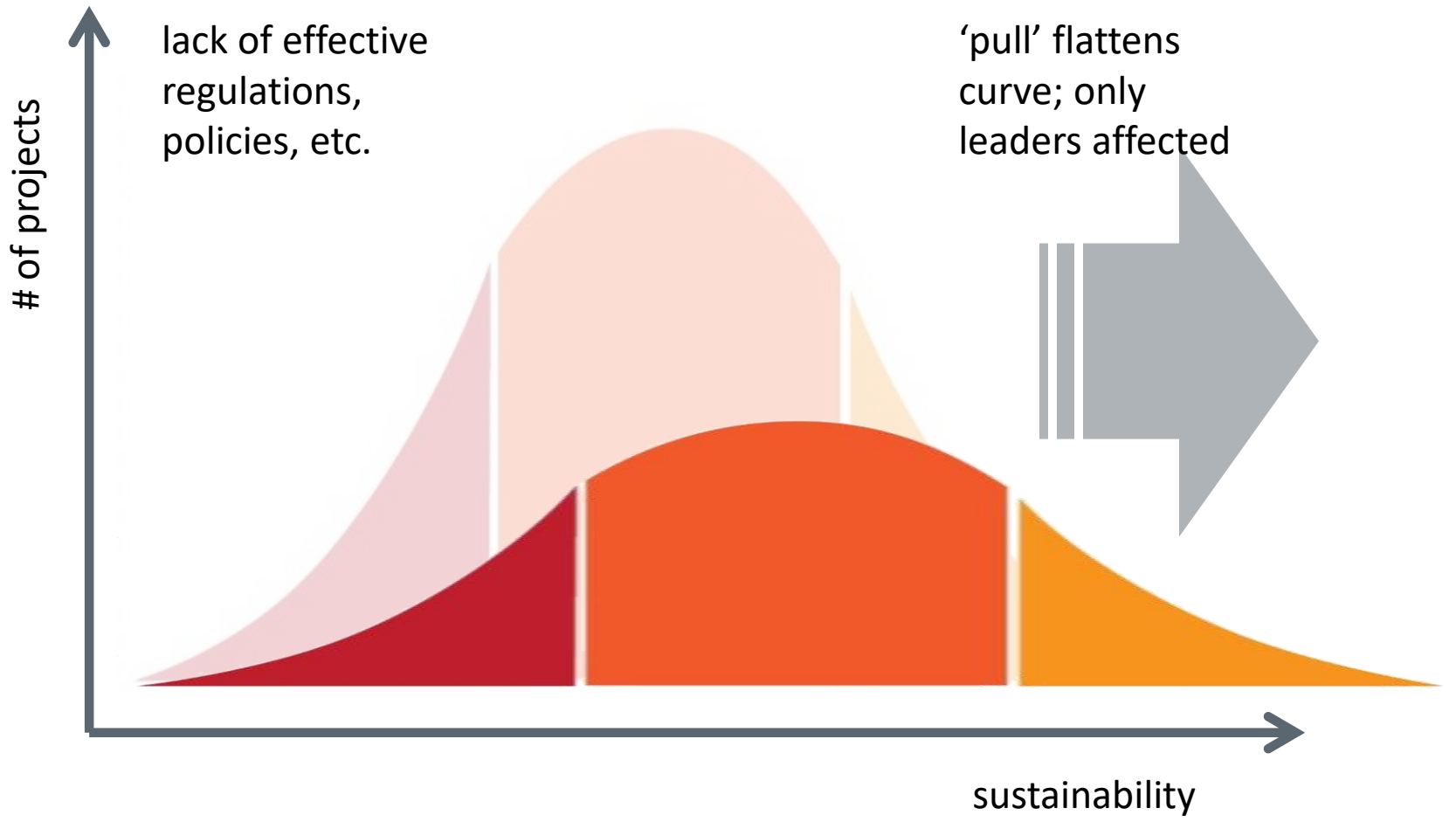
how to motivate?



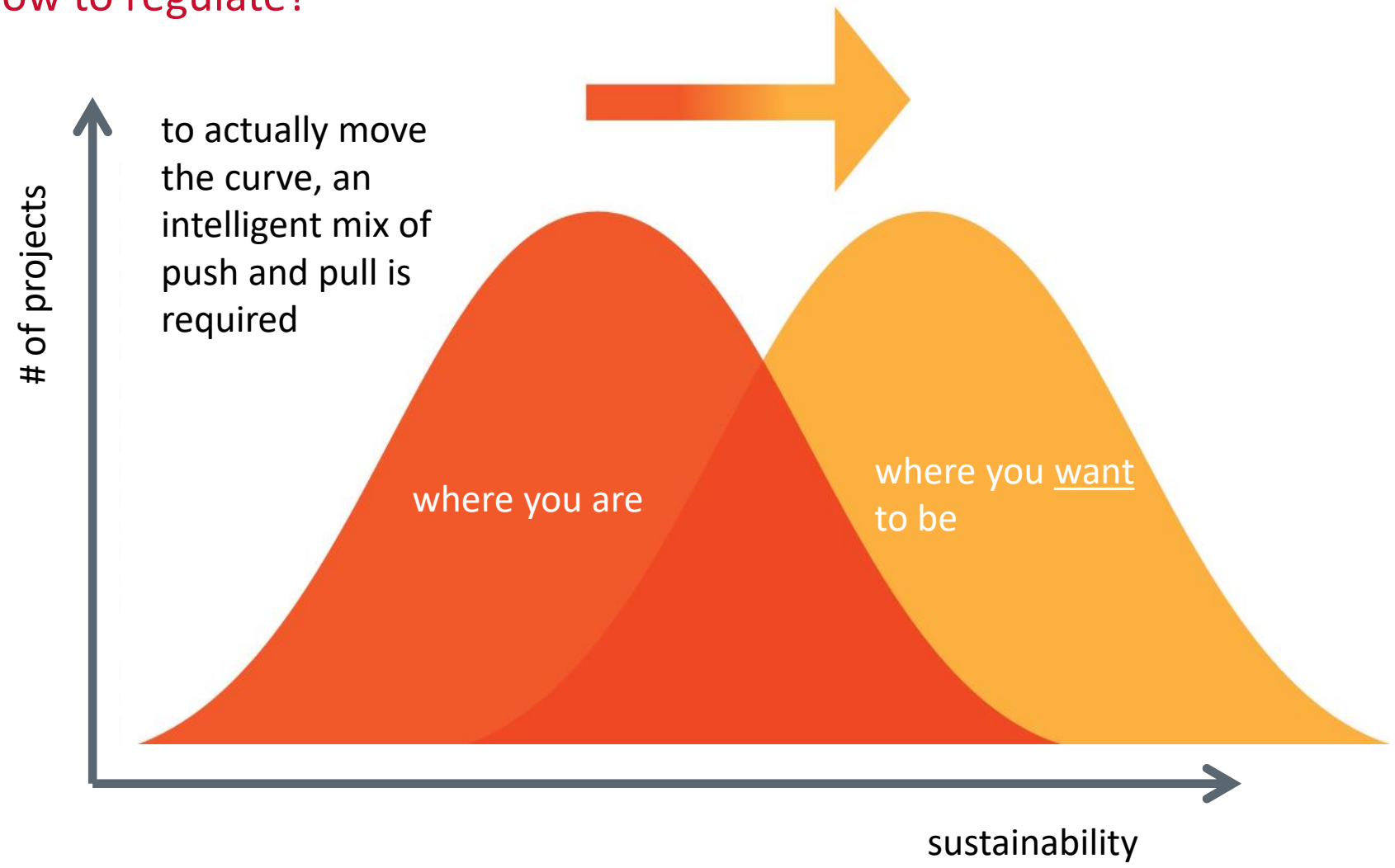
do you regulate?

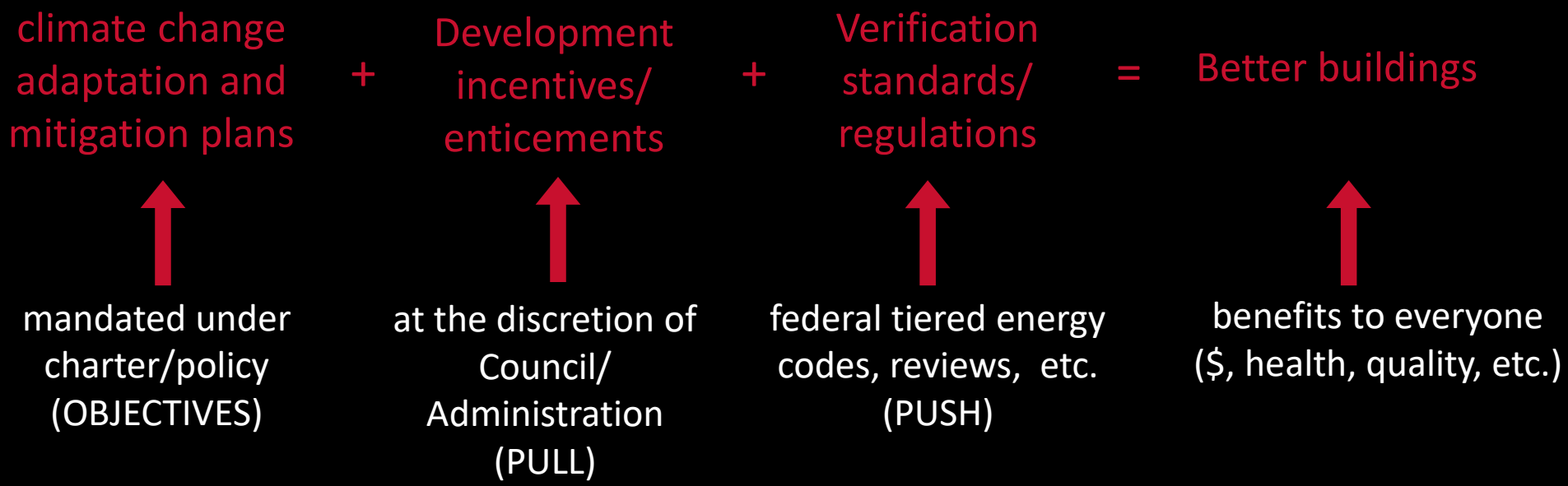


what about incentives?



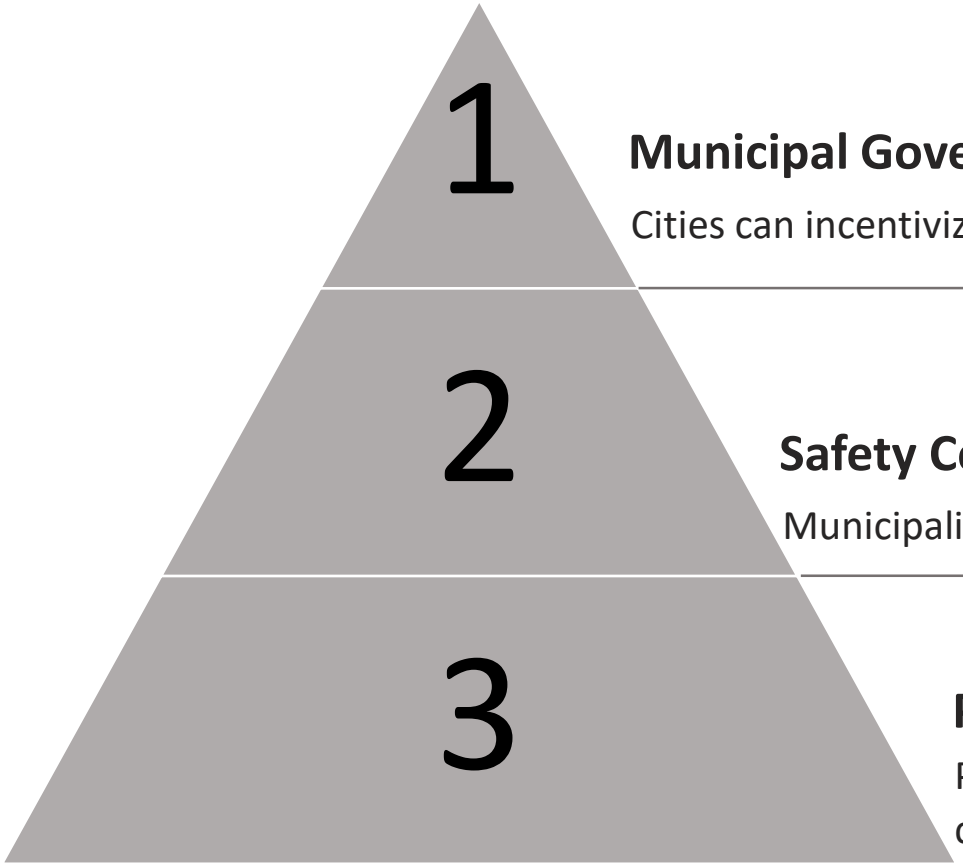
how to regulate?




climate change adaptation and mitigation plans
+
Development incentives/ enticements
+
Verification standards/ regulations
=
Better buildings
mandated under charter/policy (OBJECTIVES)
at the discretion of Council/ Administration (PULL)
federal tiered energy codes, reviews, etc. (PUSH)
benefits to everyone ($, health, quality, etc.)

Let’s look at some legislative constraints….

Legislative Constraints



Municipal Government Act

Cities can incentivize but not mandate higher tiers

Safety Codes Act

Municipalities cannot exceed provincial standards

Provincial Authority

Province of Alberta has sole authority over building codes

Process

OWNER
- Project Initiation

DP
- What (Goals)

BP
- How (Verification)

Process

OWNER
- Project Initiation

DP
- What (Goals)

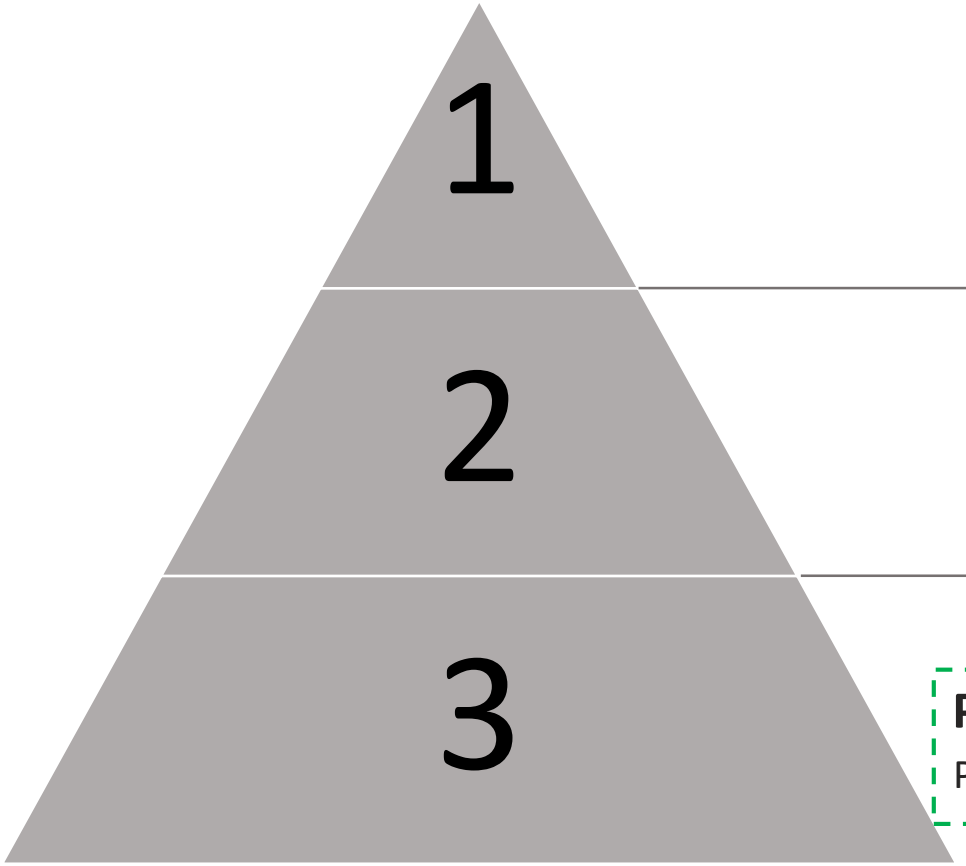
BP
- How (Verification)

Sets goals (kind of…)

Sets broad energy goals

energy efficiency metrics & tools

Legislative Constraints

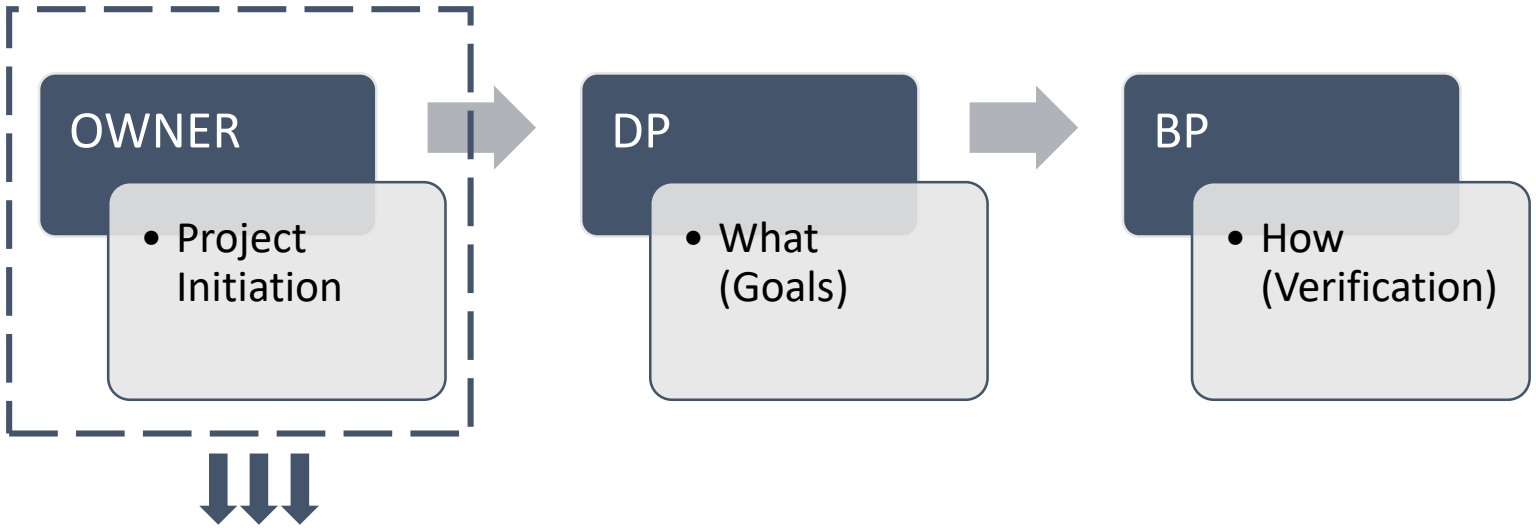


Provincial Authority

Province of Alberta has sole authority over building codes

The province sets the MINIMUM standard. The **OWNER** is ultimately responsible for compliance with codes

Process

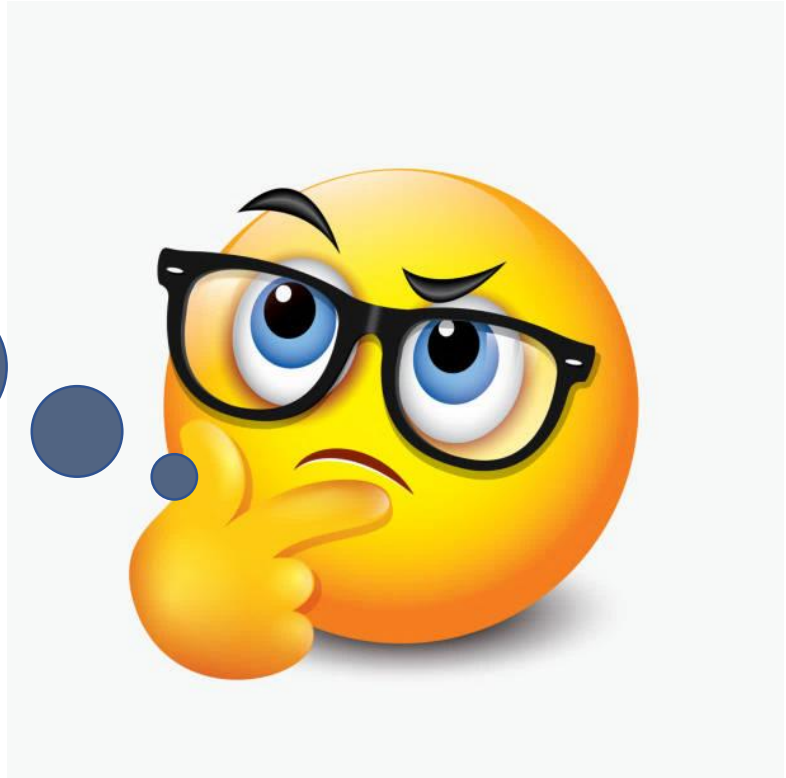


- Can build to a superior standard, so long code minimum requirements are met.

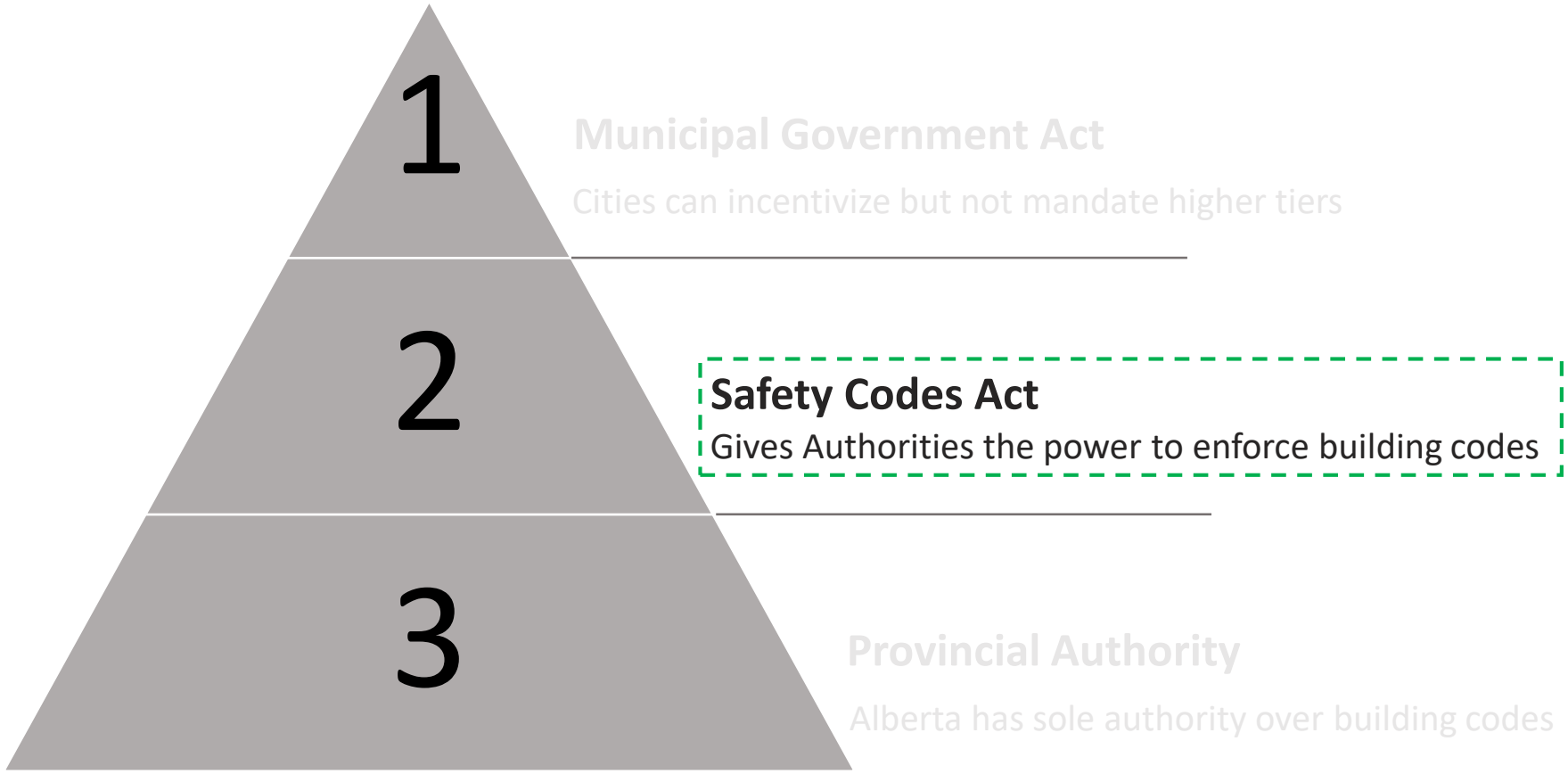
VOLUNTARY!!!

How can you encourage owners to voluntarily build to a higher standard?

Keep this in mind for later...

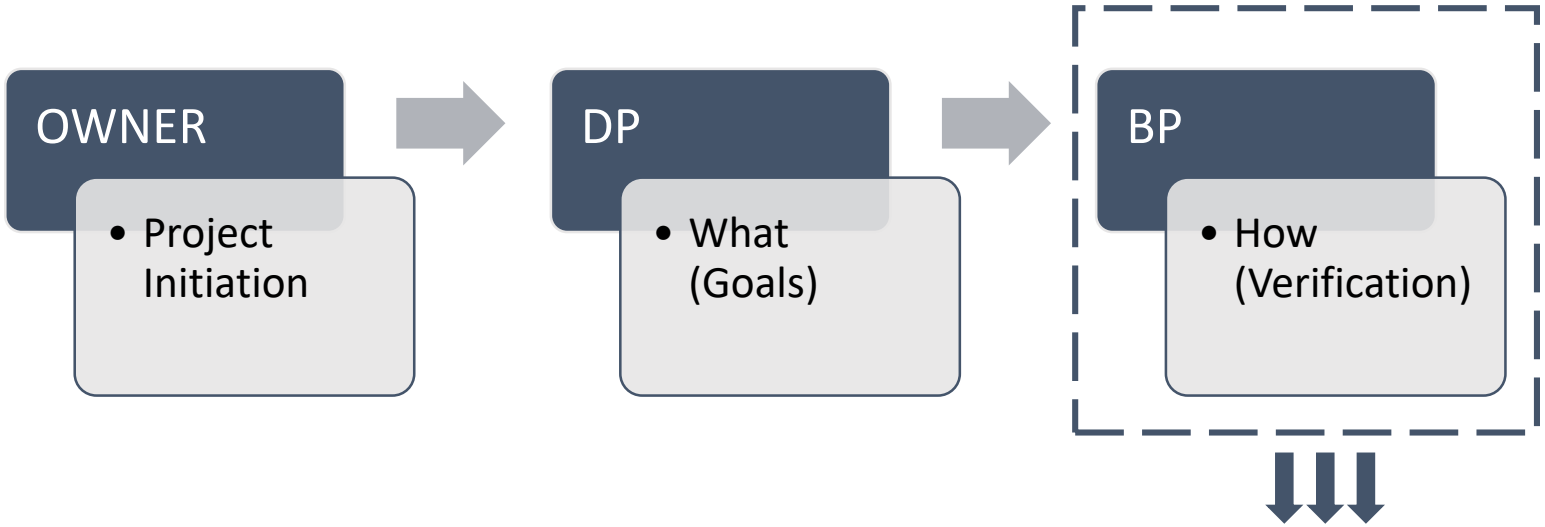


Legislative Constraints



Under Alberta's Safety Codes Act and Municipal Government Act, cities cannot impose higher building standards than provincial minimums. However, they can promote voluntary adoption through incentives.

Process



- There are a number of ways to measure and verify building performance

TIERED CODES ARE SIMPLY THE EASIEST! (prepare for soapbox diatribe)

Safety Codes Act (SCA)

Purpose

- Establishes REQUIREMENTS AND PROCEDURES for life safety, property protection, and energy efficiency (among other things…)

Focus

- **Minimum standards** for design and construction (Building Code, Fire Code etc.)
- **Permitting and Inspection** for building safety, fire protection, electrical, plumbing, gas etc.
- **Procedural and legislative** frameworks for codes and standards

Safety Codes Act Regulates Energy Efficiency

Safety Codes Act has Established:

- ❑ 9.36 Energy Efficiency Standard for Houses and Small Buildings
- ❑ NECB is the Energy Efficiency Standard for Larger and Commercial Buildings
- ❑ Energy Codes and the Building Codes are Complementary Documents
  - They are equivalent in authority but different in scope and application.
- ❑ Tier 1 as the minimum energy code compliance

National Building Code — 2023 Alberta Edition

1 The *National Building Code — 2023 Alberta Edition*, published by the National Research Council of Canada and as amended or replaced from time to time, is declared in force with respect to buildings.

National Energy Code of Canada for Buildings 2020

2(1) The *National Energy Code of Canada for Buildings 2020*, published by the National Research Council of Canada and as amended or replaced from time to time, is declared in force with respect to buildings with the variations set out in this section.

(2) Clause 1.1.2.1.(1)(c) is repealed and the following is substituted:

c) at least the tiered performance requirements specified as Energy Performance Tier 1 in Table 10.1.2.1. in Part 10.

(3) Sentence 10.1.2.1.(1) is amended by striking out "one of Energy Performance Tiers 1 to 4 specified in Table 10.1.2.1., each of" **and substituting** "at least Energy Performance Tier 1 specified in Table 10.1.2.1.,".

Building Type	Compliance Options		
	Part 9 - Prescriptive	Part 9 - Performance	NECB
- Houses, houses with secondary suites, - Buildings containing only dwelling units with common spaces ≤ 20% floor area	✔	✔	✔
- Purely residential buildings - Any building, where all non-residential portions (not F2) have a floor area ≤ 300 m²	✔		✔
- Any building where non-residential occupancies have a floor area > 300m² - Buildings containing F2 occupancies (any size)			✔

Inspections

34(1) For the purpose of ensuring that this Act and any thing issued under this Act are complied with, a safety codes officer may, without a warrant, at any reasonable time, enter any premises or place, except a private dwelling place that is in use as a dwelling, in which the officer has reason to believe there is something to which this Act applies and may, using reasonable care, carry out an inspection, review designs and examine and evaluate quality management systems and manufacturing and construction processes.

Permission To Inspect

(2) The Lieutenant Governor in Council may, by regulation,

(a) declare in force a code, standard or body of rules relating to the matters set out in subsection (1) and require compliance;

(b) amend or repeal a code, standard or body of rules declared in force before or after the coming into force of this subsection.

(3) A code, standard or body of rules may be declared in force under subsection (2)

65

Province Adopts Specific Codes

Bylaws

66(1) Except as provided in this section, a bylaw of a municipality that purports to regulate a matter that is regulated by this Act is inoperative.

Legislative hierarchy

Permits required

43(1) If this Act requires a person to have a permit to sell, construct, control or operate any thing or supervise, operate or undertake any process or activity, no person shall do so unless the person has the appropriate permit.

Need For Permits

Permit issues

44(1) On receipt of an application, a safety codes officer or other person designated by an Administrator may issue a permit to a person who complies with the requirements of this Act or issue a permit with respect to a thing, process or activity if it complies with the requirements of this Act.

City Can Issue Permits

Officer's powers and duties

32 A safety codes officer designated in accordance with section 31(1)(a) may exercise the powers and perform the duties of a safety codes officer only in accordance with

(a) a designation of powers under section 31(1)(b) and the safety codes officer's terms of employment, or

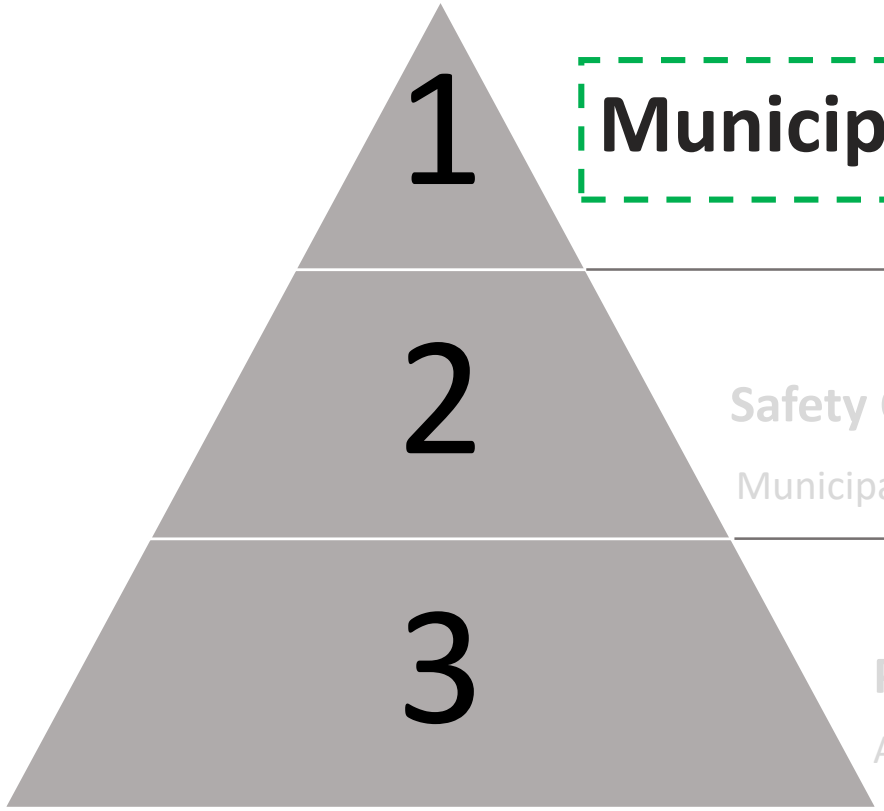
(b) an appointment referred to in section 33(1) and the safety codes officer's terms of employment.

RSA 2000 cS-1 s32;2015 c10 s15

Safety Codes Officers Represents City

Policy & Legislative Framework

Legislative Constraints



Municipal Government Act (MGA)

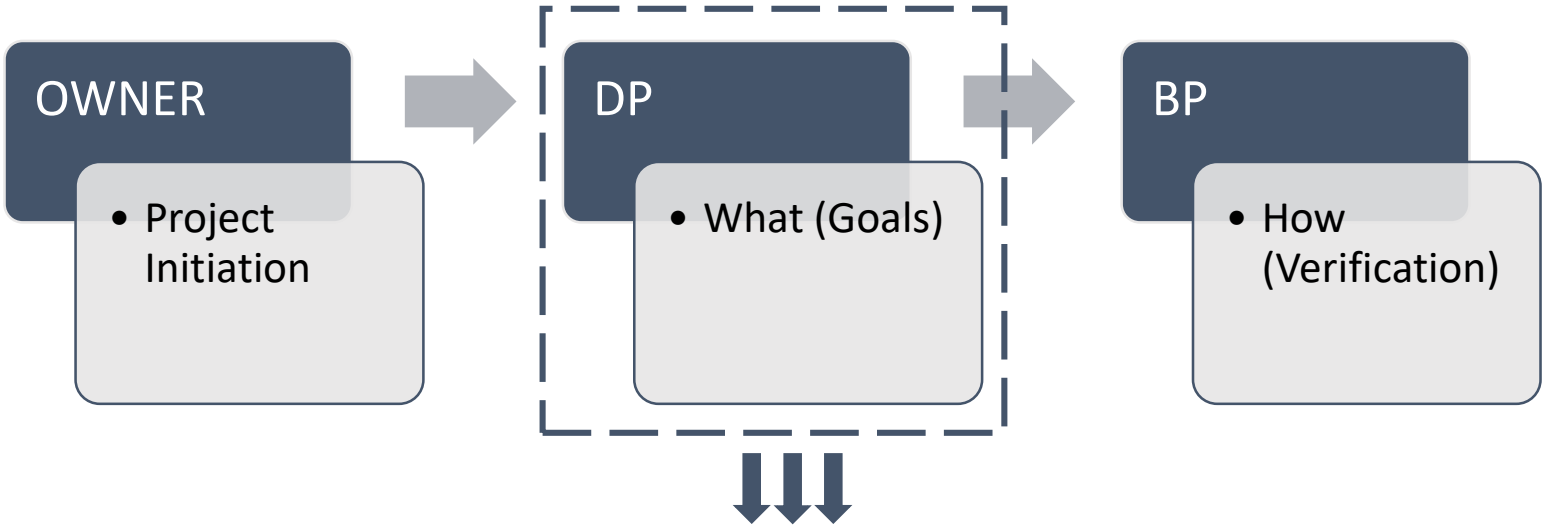
Safety Codes Act

Municipalities cannot exceed provincial standards

Provincial Authority

Alberta has sole authority over building codes

Process



- Development Permits set the shape, use, and development requirements for the project – this has an enormous impact on the energy consumption!

Development Permits can set project specific goals!

(simplified) Municipal Government Act (MGA)

Purpose

- ❑ Provides the legal framework for how municipalities operate and make decisions regarding land use, development planning, governance, and local bylaws

Focus

- ❑ Land use and zoning
- ❑ Development approvals
- ❑ Subdivision processes
- ❑ Municipal bylaws
- ❑ Infrastructure and services
- ❑ Property tax and assessment

Limits on the city to override code

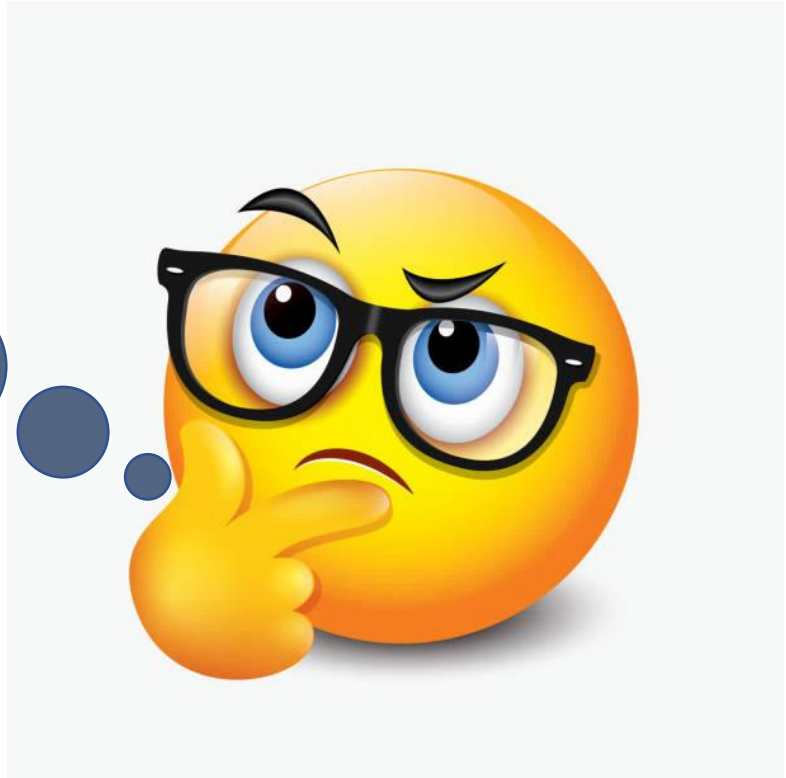
According to MGA Section 7, municipalities are allowed to pass bylaws.

> **General jurisdiction to pass bylaws**
>
> **7** Subject to section 7.1, a council may pass bylaws for municipal purposes respecting the following matters:

However, municipalities cannot pass bylaws about matters **already regulated** by the building code. SCA Section 66

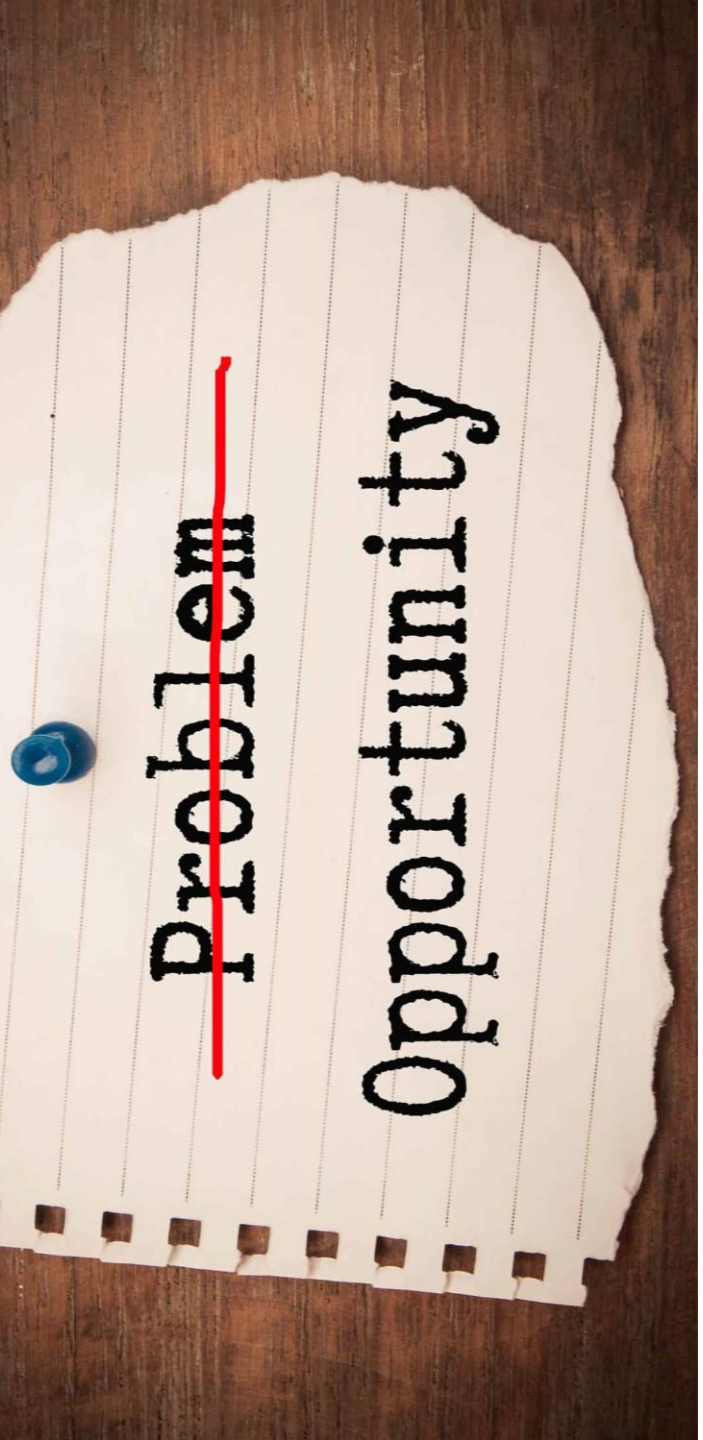
> **Bylaws**
>
> **66(1)** Except as provided in this section, a bylaw of a municipality that purports to regulate a matter that is regulated by this Act is inoperative.

So What Bylaws Are Not Regulated Under The SCA ?



Among the Bylaws/Areas **Not** Regulated By The SCA

- ❑ Zoning
- ❑ Setbacks
- ❑ Building Heights or FAR
- ❑ Site Coverage
- ❑ Incentives



What can we do ?

Process

OWNER

- Project Initiation

DP

- (

P

- How (Verification)

- n build to a superior standard, so long code minimum requirements are met.

VOLUNTARY!!!

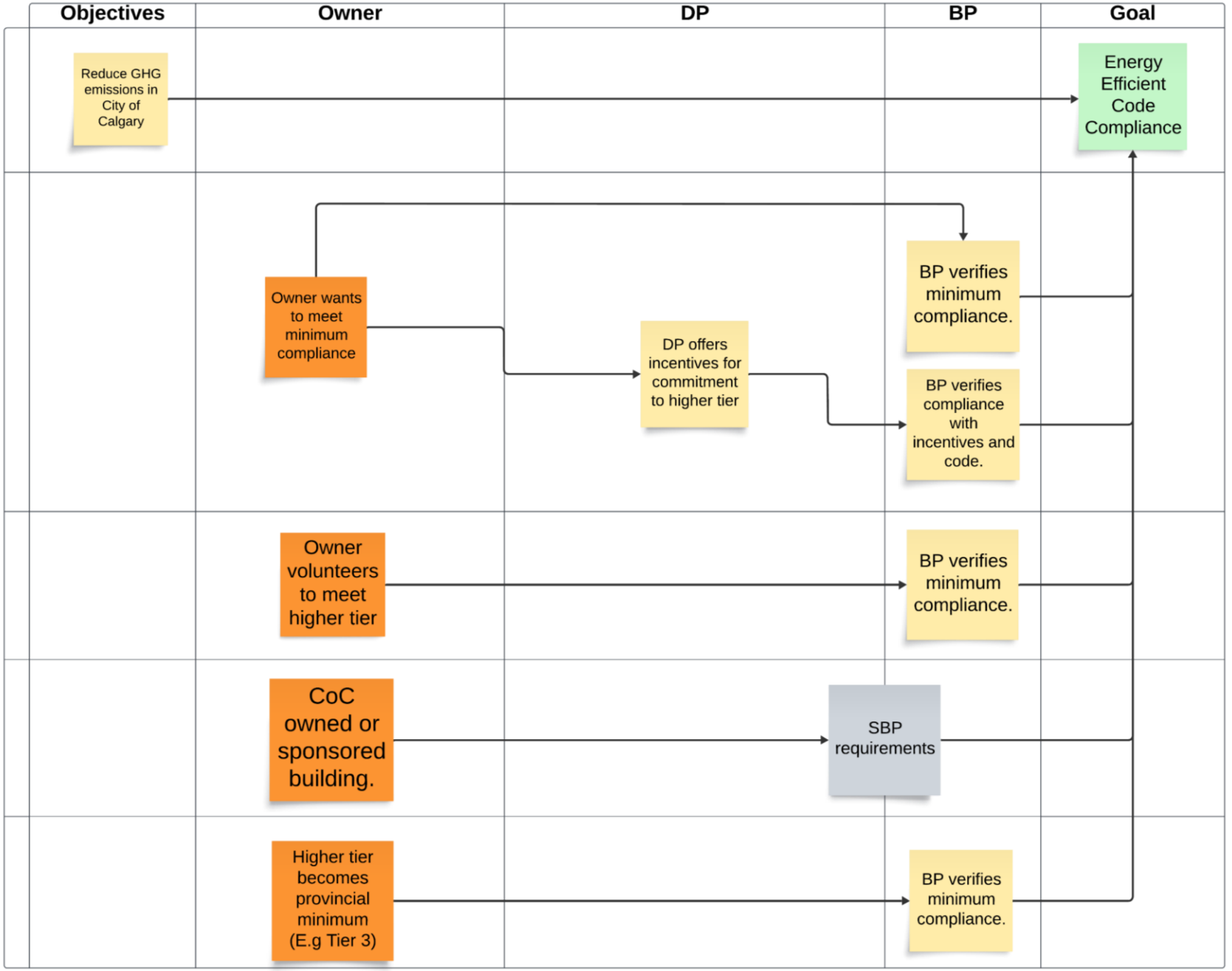
INCENTIVES

Opportunities Under The (MGA)

	Land Use Bylaws **(Sec. 640)**	**Bonus Density | Zoning Relaxations**
★	Municipal Development Plans **(Sec. 632)**	**City can set policies requiring new developments to meet higher-tier performance.**
★	Fast-Tracking Permits **(Sec. 683.1)**	**Expedite permit approvals and reduce fees for energy-efficient projects**
	Community Revitalization Levy **(Sec. 381.2)**	**City can provide levy rebates or allocate funds for projects committing to higher tiers**
	Tax Incentives for Non-Residential Property **(Sec. 364.2)**	**City can offer temporary property tax reductions for high-performance commercial buildings.**
★	Clean Energy Improvement Tax **(Sec. 390.3)**	**City has the Clean Energy Improvement Program (CEIP) program that allows property owners to finance energy upgrade through property taxes.**

Recognized under the City of Calgary Charter 2018 Regulation

Thought Model

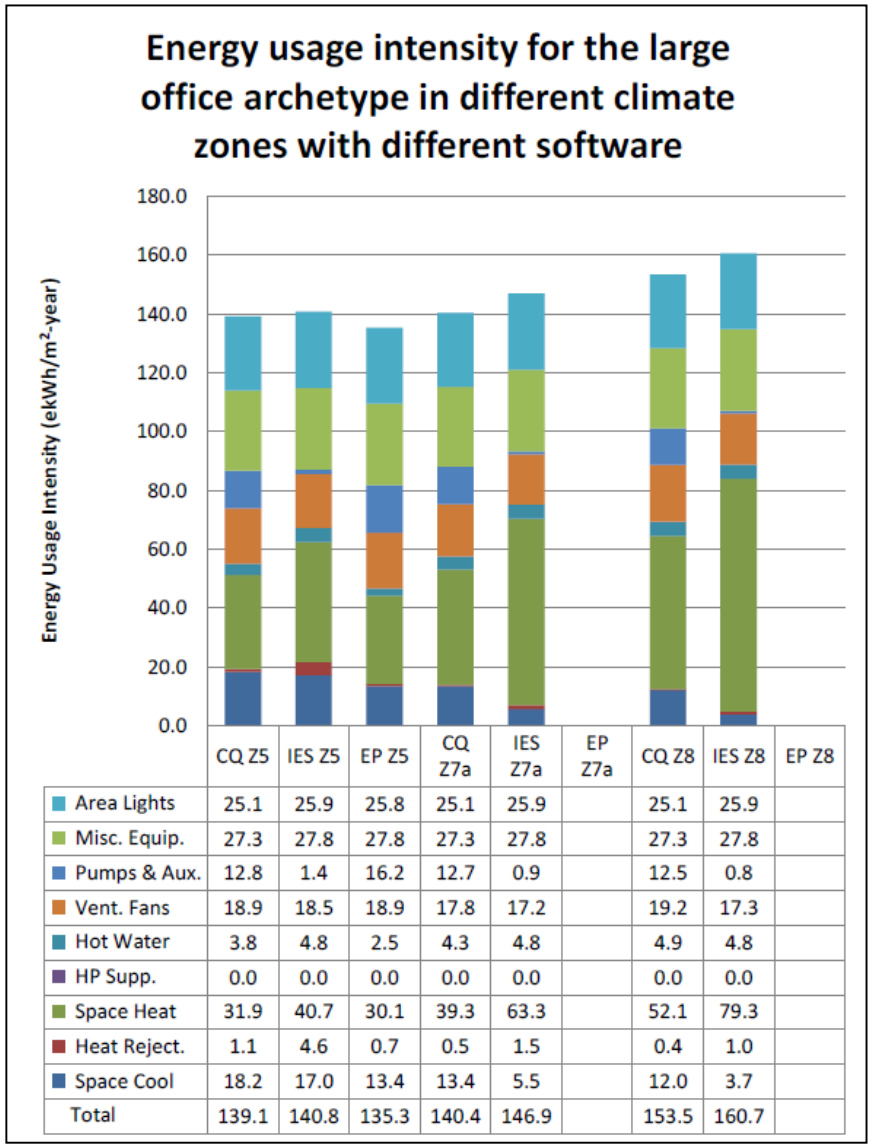


The Basics of Building Energy Use

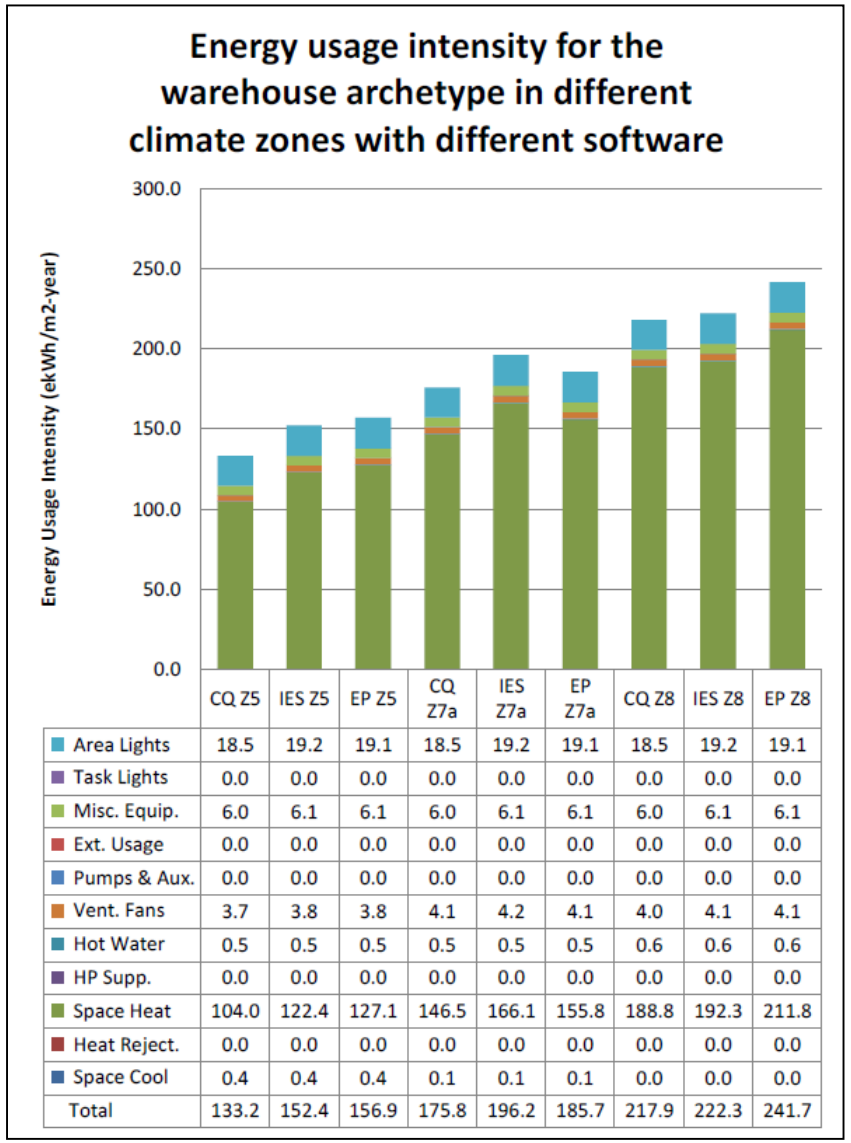
Two major concepts

1. What impacts energy consumption
2. What systems affect energy consumption

Why Energy Fundamentals Matter

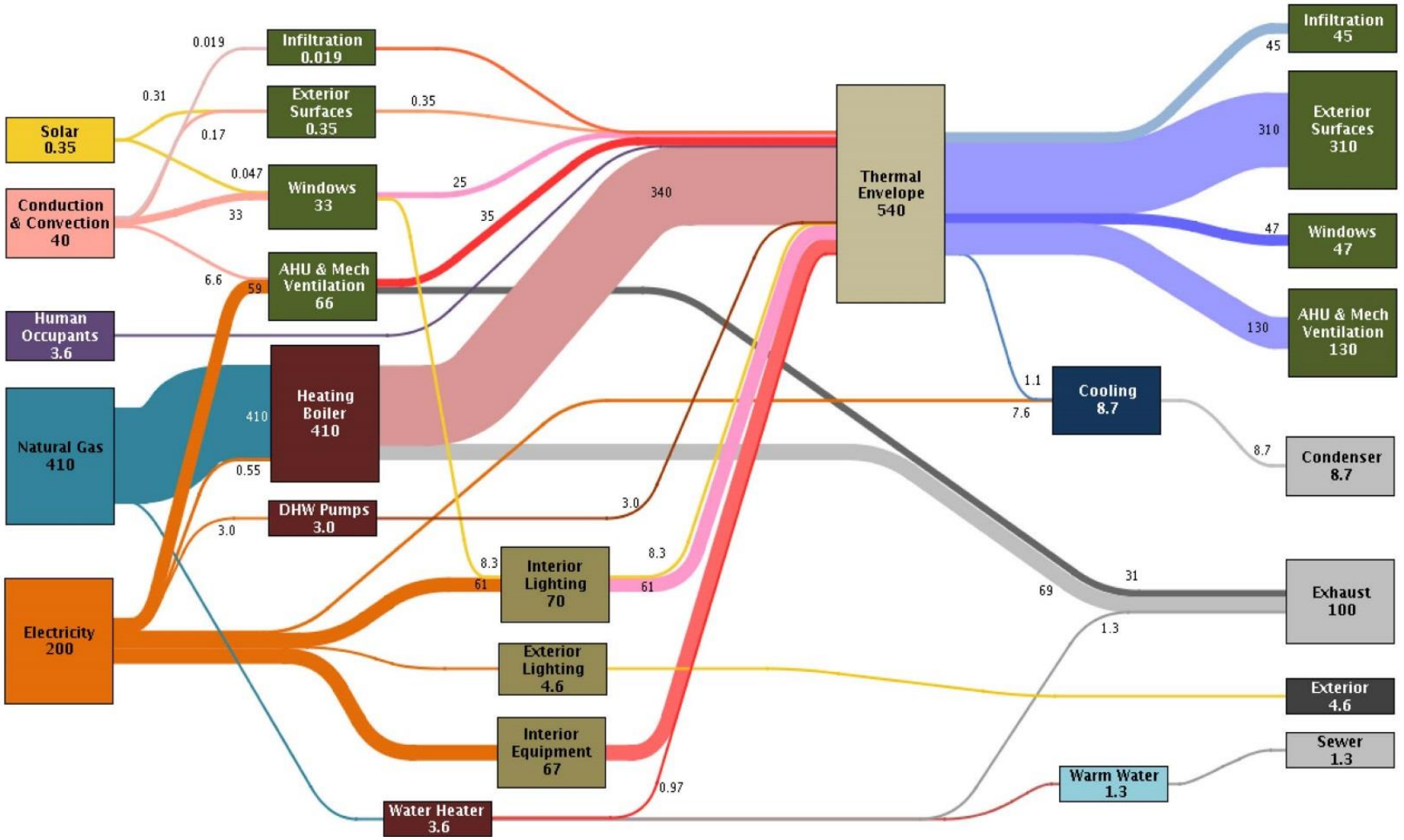


	CQ Z5	IES Z5	EP Z5	CQ Z7a	IES Z7a	EP Z7a	CQ Z8	IES Z8	EP Z8
Area Lights	25.1	25.9	25.8	25.1	25.9		25.1	25.9	
Misc. Equip.	27.3	27.8	27.8	27.3	27.8		27.3	27.8	
Pumps & Aux.	12.8	1.4	16.2	12.7	0.9		12.5	0.8	
Vent. Fans	18.9	18.5	18.9	17.8	17.2		19.2	17.3	
Hot Water	3.8	4.8	2.5	4.3	4.8		4.9	4.8	
HP Supp.	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
Space Heat	31.9	40.7	30.1	39.3	63.3		52.1	79.3	
Heat Reject.	1.1	4.6	0.7	0.5	1.5		0.4	1.0	
Space Cool	18.2	17.0	13.4	13.4	5.5		12.0	3.7	
Total	139.1	140.8	135.3	140.4	146.9		153.5	160.7	



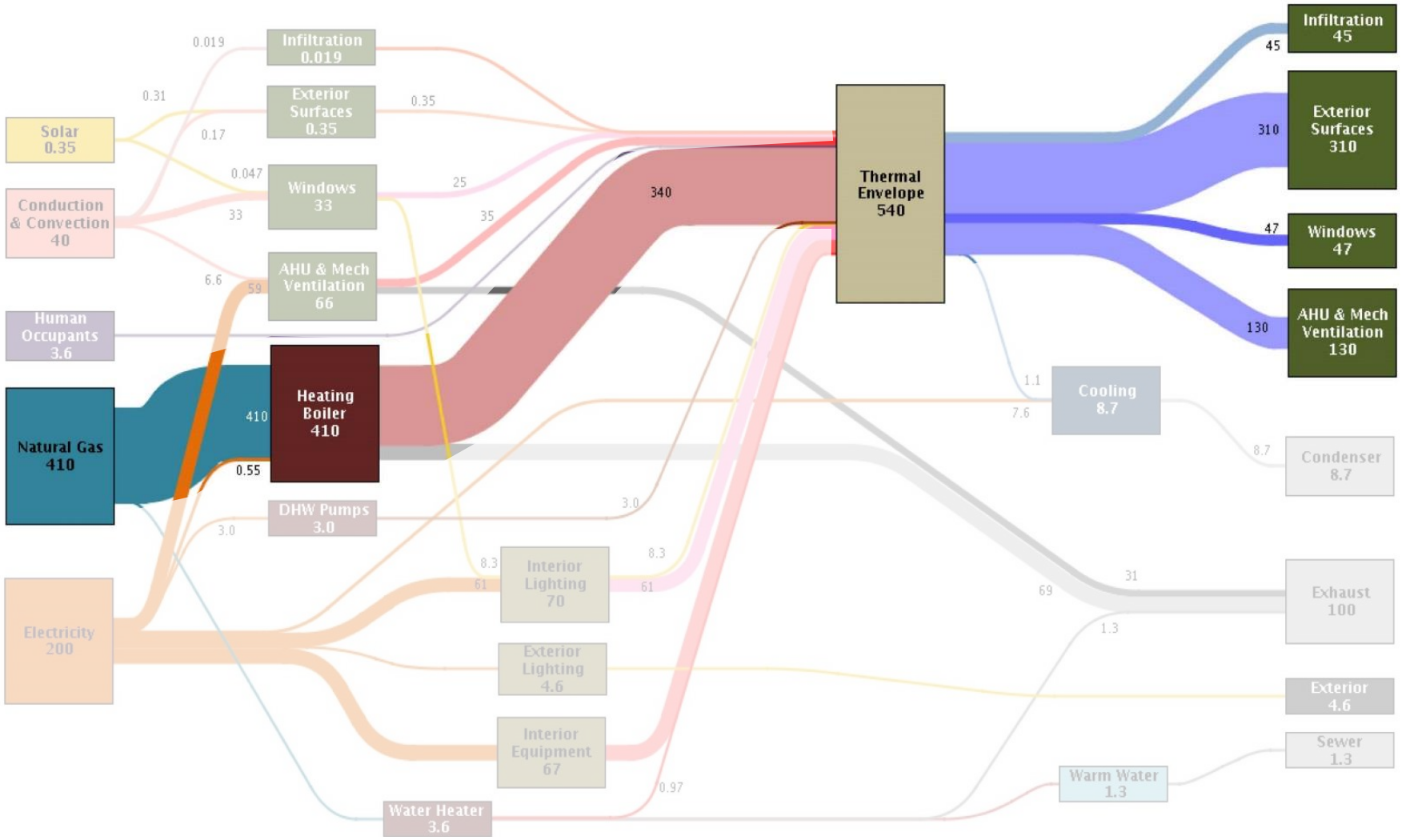
	CQ Z5	IES Z5	EP Z5	CQ Z7a	IES Z7a	EP Z7a	CQ Z8	IES Z8	EP Z8
Area Lights	18.5	19.2	19.1	18.5	19.2	19.1	18.5	19.2	19.1
Task Lights	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Misc. Equip.	6.0	6.1	6.1	6.0	6.1	6.1	6.0	6.1	6.1
Ext. Usage	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pumps & Aux.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Vent. Fans	3.7	3.8	3.8	4.1	4.2	4.1	4.0	4.1	4.1
Hot Water	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6
HP Supp.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Space Heat	104.0	122.4	127.1	146.5	166.1	155.8	188.8	192.3	211.8
Heat Reject.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Space Cool	0.4	0.4	0.4	0.1	0.1	0.1	0.0	0.0	0.0
Total	133.2	152.4	156.9	175.8	196.2	185.7	217.9	222.3	241.7

Let’s understand building energy consumption…



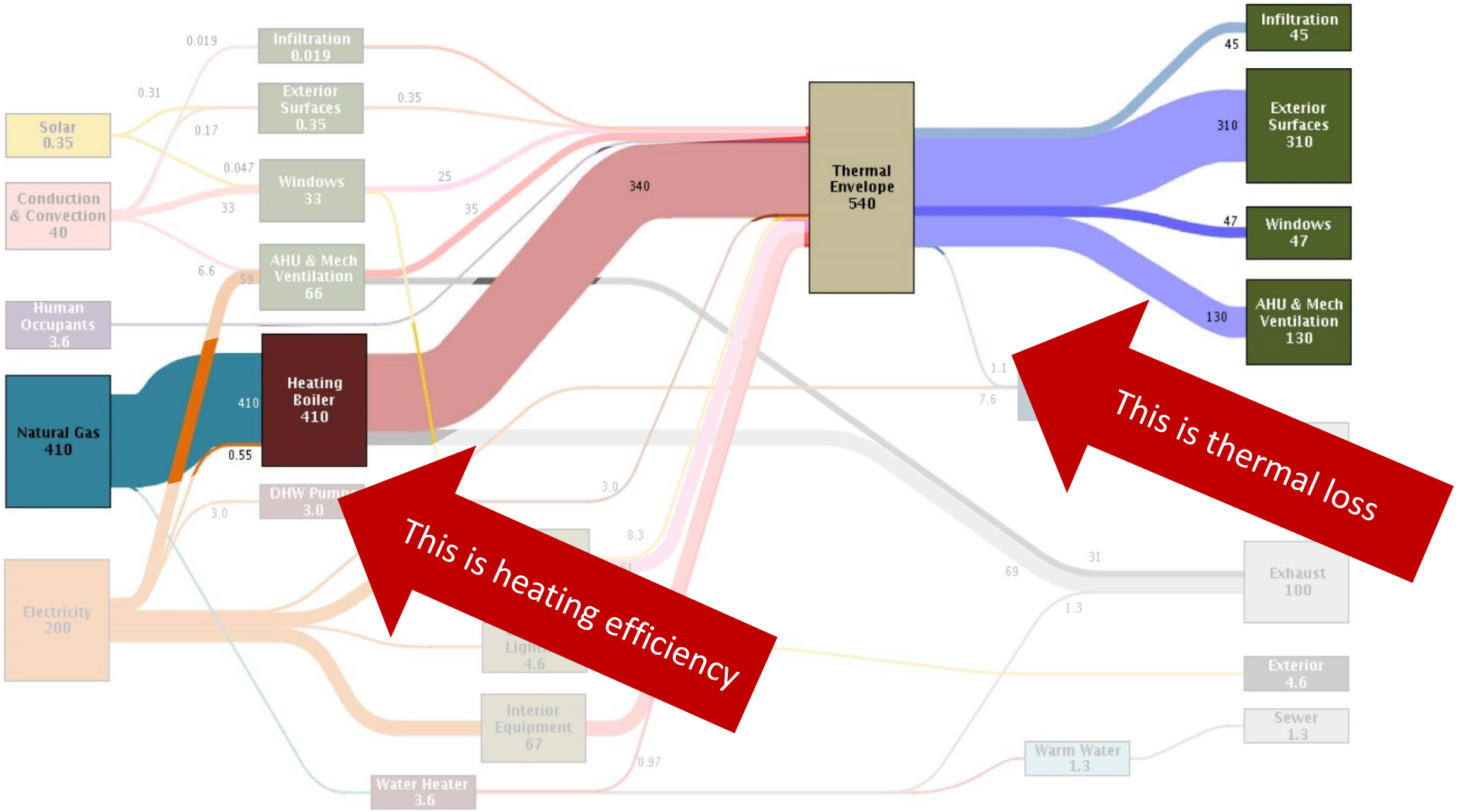
Energy Flow Fundamentals

Let’s understand building energy consumption…



Energy Flow Fundamentals

Let's understand building energy consumption…



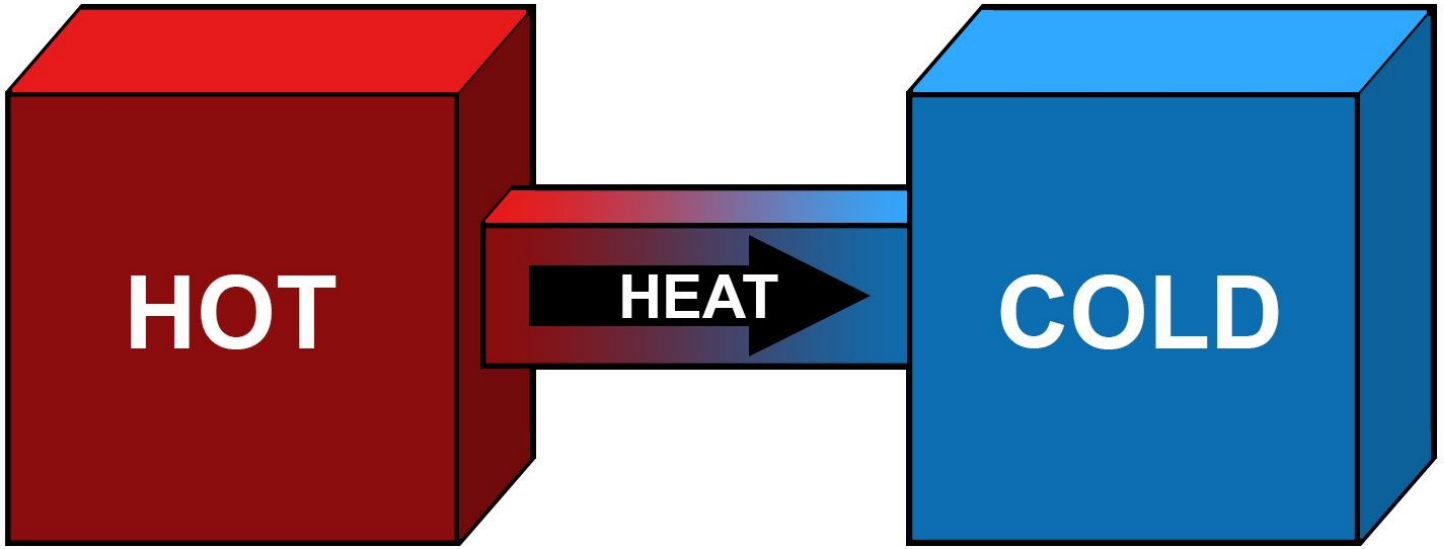
Energy Flow Fundamentals

Energy Fundamentals

(Time for some boring but important physics)

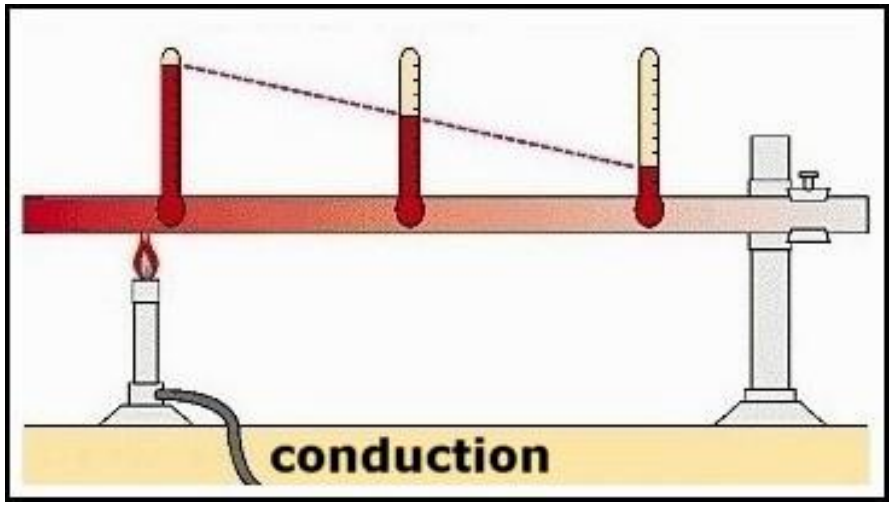
Basic Science of Energy Flow

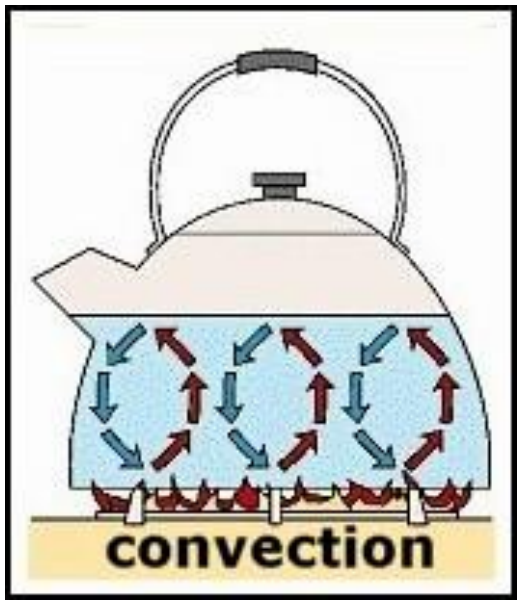
It’s all about energy and heat.

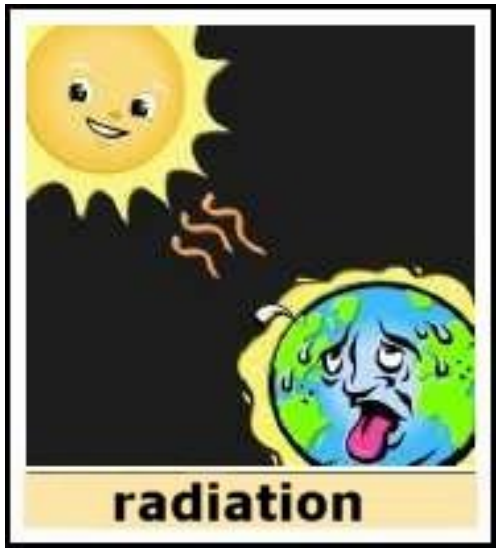


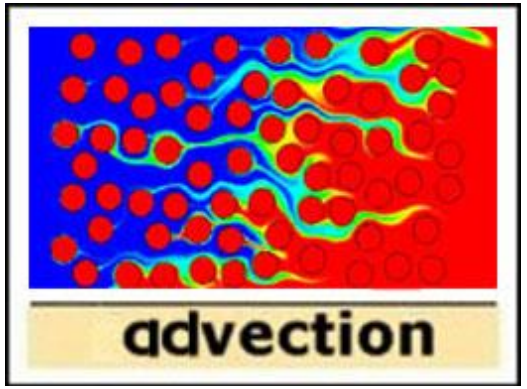
Second Law of Thermodynamics: As energy is transferred or transformed, it eventually ends up as **heat**.

Mechanism of Heat Loss in Buildings

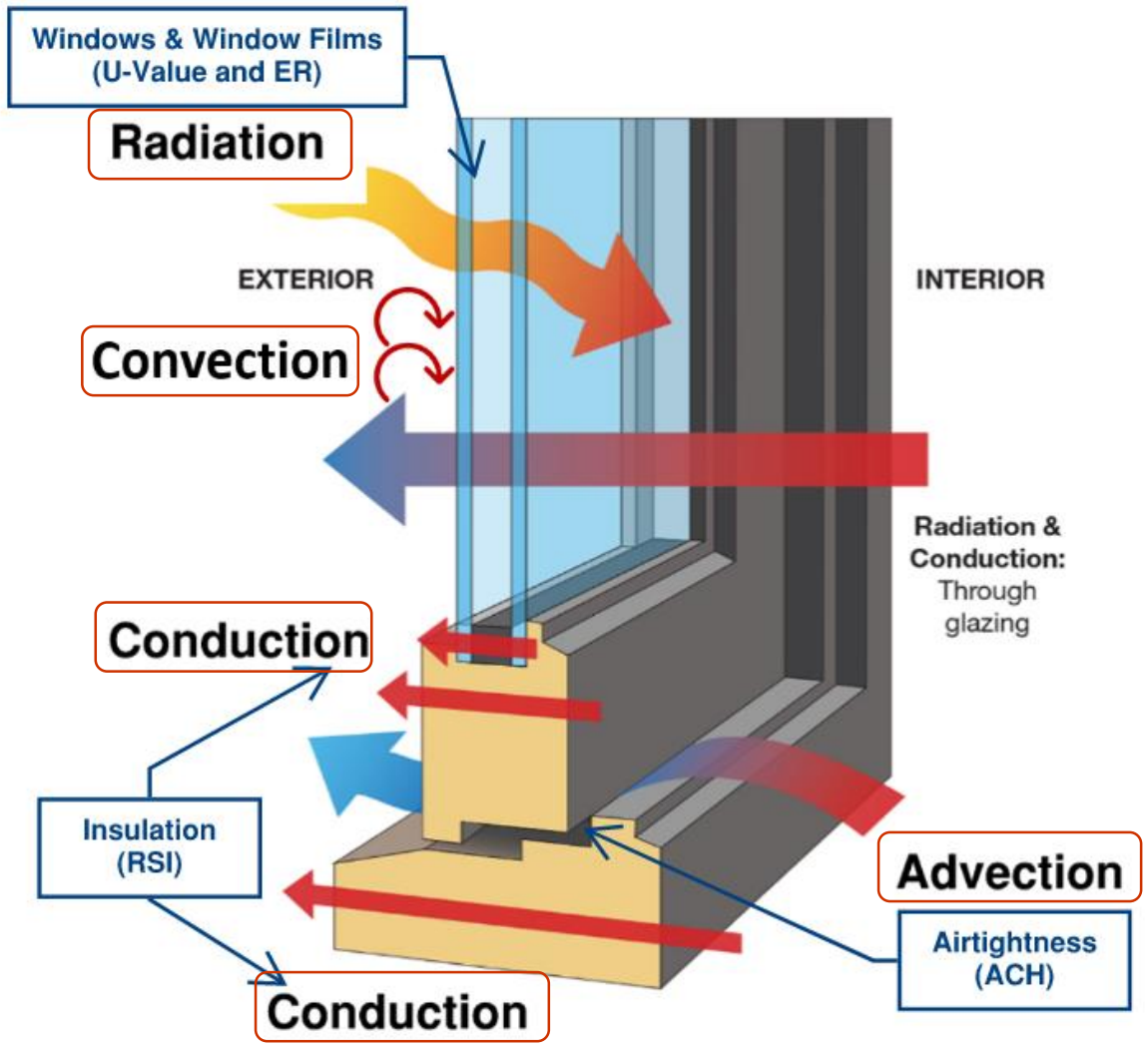








Mechanism of Heat Loss in Buildings



Understanding (U) Thermal Transmittance

- Indicates how easily heat flows through a building component.
- Its effectiveness is measured by:
  - U-value (Imperial)
  - USI (Metric) - $W/(m^2.K)$
- Lower U-Value ⇒ Better insulation performance

Usi = $W/m^2.k$

U = $Btu/ft^2 \cdot °F \cdot hr$

Relationship Between Thermal Resistance and Thermal Transmittance

- Both are inversely proportional to one another

U-Value = 1/R-Value

A quick group discussion...

Question

What are the greatest barriers to energy efficiency?

Question

What incentives, regulations, or programs are most relevant to improving energy efficiency in NECB buildings?

NECB – What's New

- Some requirements and table updates in Part (1 – 8)
  - No update to Part 7
- Some sections reserved
  - Section 5.3 – HVAC (**Trade-off Removed**)
  - Section 6.3 – Service Water Systems (**Trade-off Removed**)
- New Part 10: Tiered Energy Performance (Tiers 1 – 4)

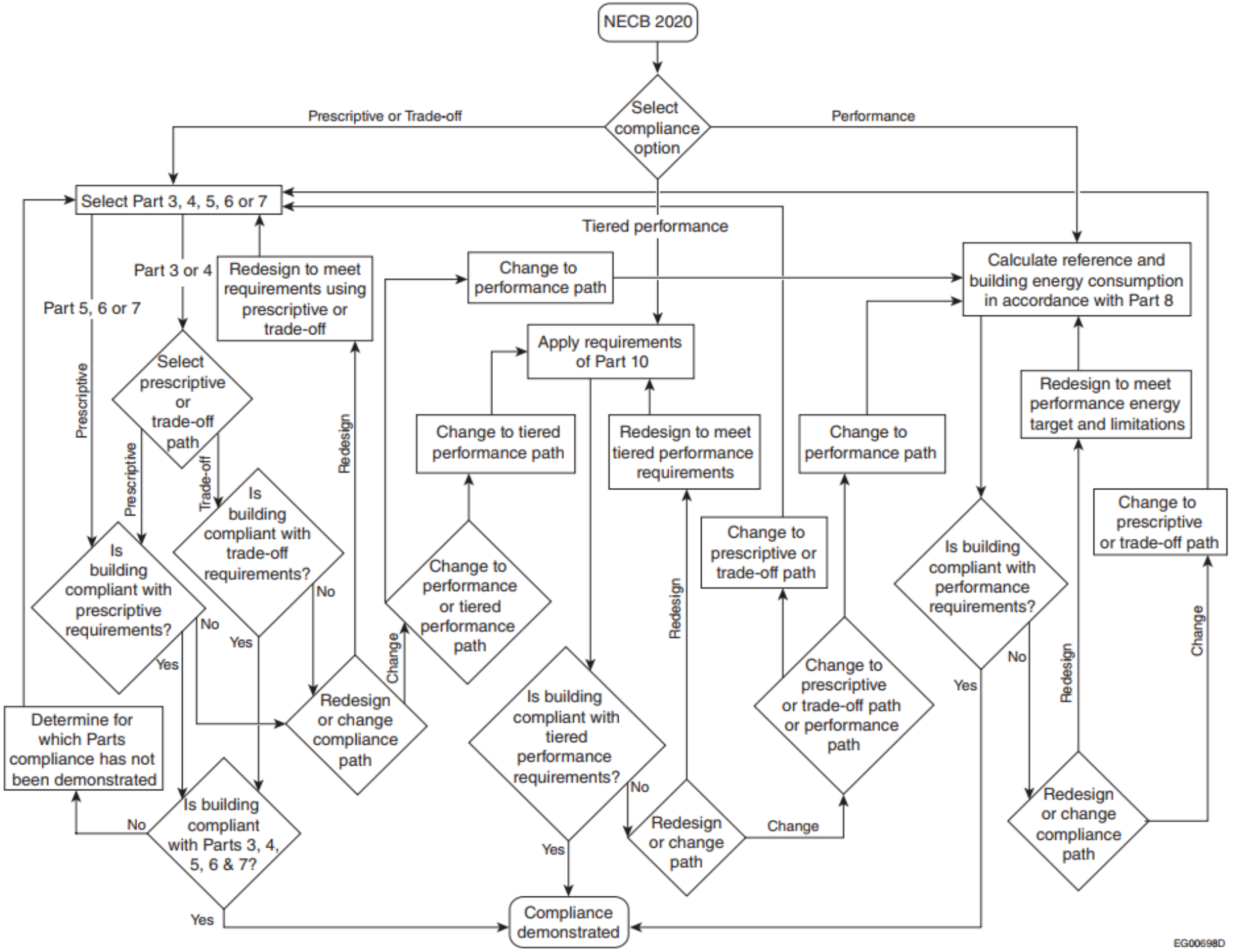
NECB 2020

Division B Part Overview

- ❑ Part 3: Building Envelope
- ❑ Part 4: Lighting Systems
- ❑ Part 5: HVAC Design
- ❑ Part 6: Service Water Heating
- ❑ Part 7: Electrical Systems & Motors
- ❑ Part 8: Energy Modeling (Performance Path)
- ❑ Part 10: Tiered Energy Code (net-Zero Energy Readiness)

NECB - Compliance

- ❑ Prescriptive Path (Parts 3 - 7)
- ❑ Performance Path (Part 8 whole-building modeling)*
- ❑ Trade-off Path (limited) (Parts 3 - 4)
- ❑ Tiered Energy Performance (NEW - Part 10)


NECB 2020
Select compliance option
Prescriptive or Trade-off
Performance
Select Part 3, 4, 5, 6 or 7
Tiered performance
Part 3 or 4
Part 5, 6 or 7
Redesign to meet requirements using prescriptive or trade-off
Change to performance path
Calculate reference and building energy consumption in accordance with Part 8
Apply requirements of Part 10
Select prescriptive or trade-off path
Prescriptive
Trade-off
Redesign
Change to tiered performance path
Redesign to meet tiered performance requirements
Change to performance path
Redesign to meet performance energy target and limitations
Change to prescriptive or trade-off path
Is building compliant with prescriptive requirements?
Is building compliant with trade-off requirements?
Change to performance or tiered performance path
Change to prescriptive or trade-off path
Is building compliant with performance requirements?
Change
No
Yes
Redesign or change compliance path
Change to prescriptive or trade-off path or performance path
Determine for which Parts compliance has not been demonstrated
Is building compliant with tiered performance requirements?
Redesign or change path
Is building compliant with Parts 3, 4, 5, 6 & 7?
Compliance demonstrated
EG00698D

NECB 2020

Part 3 - Building Envelope

Part 3 – What's New

3.2.2.3	Update to fenestration thermal transmittance.
3.2.2.4	Update to door thermal transmittance.
3.2.4	Update to air leakage requirements
A-3.2.4.2.(1)	Exception to air leakage testing

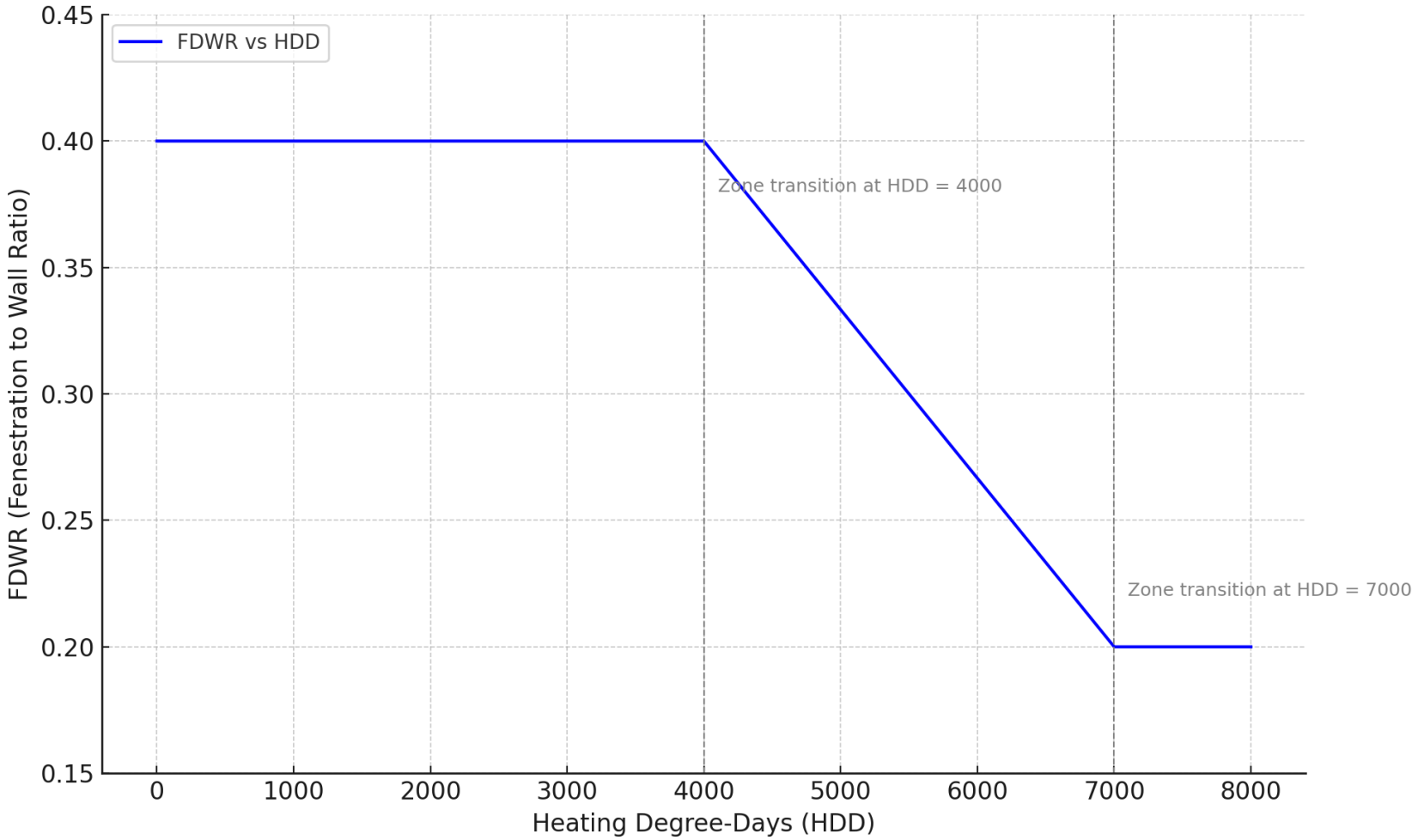
NECB 2020

Part 3 – Prescriptive Requirements

- ❑ Maximum Usi values based on building component and climate zone.
  - Fenestrations
  - Above-ground Components
  - Ground Components
- ❑ **FDWR limits apply**
- ❑ **Air Leakage**

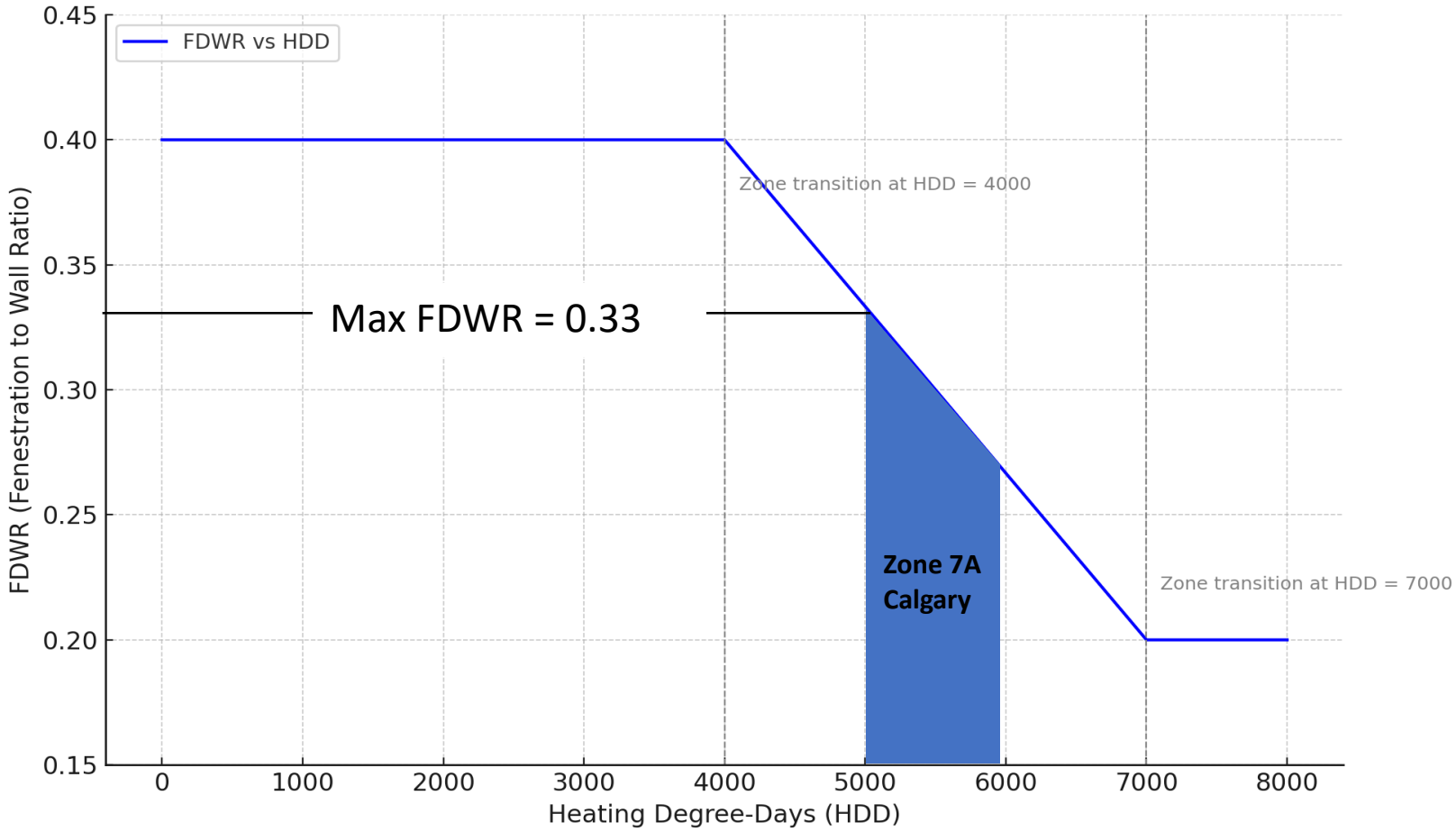
NECB 2020

NECB 3.2.1.4. Allowable Fenestration and Door Area



NECB 2020

NECB 3.2.1.4. Allowable Fenestration and Door Area



NECB 2020

NECB 3.2.2.2. Thermal Characteristics of Above-ground Building Assemblies

Table 3.2.2.2.
Overall Thermal Transmittance of Above-ground Opaque Building Assemblies
Forming Part of Sentences 3.2.2.2.(1) and (2)

Above-ground *Opaque Building Assembly*	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4:(2) < 3000	Zone 5:(2) 3000 to 3999	Zone 6:(2) 4000 to 4999	Zone 7A:(2) 5000 to 5999	Zone 7B:(2) 6000 to 6999	Zone 8:(2) ≥ 7000
	Maximum *Overall Thermal Transmittance*, W/(m²×K)					
Walls	0.290	0.265	0.240	0.215	0.190	0.165
Roofs	0.164	0.156	0.138	0.121	0.117	0.110
Floors	0.193	0.175	0.156	0.138	0.121	0.117

Table 3.2.2.3.
Overall Thermal Transmittance of Fenestration
Forming Part of Sentences 3.2.2.3.(2) and (3)

Component	Heating Degree-Days of *Building* Location,(1) in Celsius Degree-Days					
	Zone 4:(2) < 3000	Zone 5:(2) 3000 to 3999	Zone 6:(2) 4000 to 4999	Zone 7A:(2) 5000 to 5999	Zone 7B:(2) 6000 to 6999	Zone 8:(2) ≥ 7000
	Maximum *Overall Thermal Transmittance*, W/(m²×K)					
Vertical *fenestration*	1.90	1.90	1.73	1.73	1.44	1.44
Skylights	2.69	2.69	2.41	2.41	2.01	2.01

NECB 2020

NECB 3.2.4. Air Leakage

- 3.2.4 requires continuity of air barrier, sealed penetrations.
- Compliance via assembly testing :
  - ASTM E3158
  - CAN/ULC-S742
- Assembly air leakage ≤ 1.50 L/(s×m2)
- Specific test standards for items like curtain walls etc.
- Testing optional but encouraged.

NECB 3.2.4.1 General – Compliance Option

General

1) To control air leakage into and out of the *conditioned space*, the *building envelope* shall be designed and constructed with a continuous air barrier system comprised of *air barrier assemblies* by complying with

a) Article 3.2.4.2., or

b) Article 3.2.4.3.

NECB 2020

NECB 3.2.4.2 Air Barrier System Test

Air Barrier System

1) The air barrier system shall have a normalized air leakage rate not greater than 1.50 L/(s×m²) when tested in accordance with ASTM E3158, "Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building," at a pressure differential of 75 Pa, using the following criteria:

a) the *building* shall be prepared in accordance with the *building envelope* test described in the standard,

b) the air leakage test shall be conducted under both pressurized and depressurized conditions, and

c) the air leakage area used to determine the normalized air leakage rate shall include all the surfaces separating *conditioned space* from unconditioned space.

(See Note A-3.2.4.2.(1).)

2) The air leakage rates measured in accordance with Sentence (1) shall be averaged.

ALLOWS AIR LEAKAGE TO INTO PERFORMANCE COMPLIANCE – HUGE!!

NECB 2020

NECB 3.2.4.3 Air Barrier Assemblies Testing

Air Barrier Assemblies

1) *Air barrier assemblies* shall have an air leakage rate not greater than 0.2 L/(s×m²) at a pressure differential of 75 Pa. (See Note A-3.2.4.3.(1) and (2).)

2) *Air barrier assemblies*

a) shall conform to CAN/ULC-S742, "Standard for Air Barrier Assemblies – Specification," or

b) shall

i) be designed, evaluated and constructed to provide the principal resistance to air leakage,

ii) be designed using the 1-in-50 hourly wind pressure for the *building* location, and

iii) have at least one air barrier material intended to provide the principal resistance to air leakage that conforms to CAN/ULC-S741, "Standard for Air Barrier Materials – Specification."

(See Note A-3.2.4.3.(1) and (2).)

NECB 2020

Part 4 - Lighting

Part 4 – What's New

4.2.1.5	Update to lighting power density values - Building Area Method.
4.2.1.6	Update to lighting power density values - Space-by-Space Method.
4.2.3.1.(2)	Limit to exterior lighting power.
4.2.3.1.-D	Update to exterior lighting power allowances

NECB 2020

Part 4 – Lighting: Scope

- ❑ All lighting connected to building service (interior + exterior)
- ❑ Exempts emergency fixtures, dwelling-unit interior, some process lighting

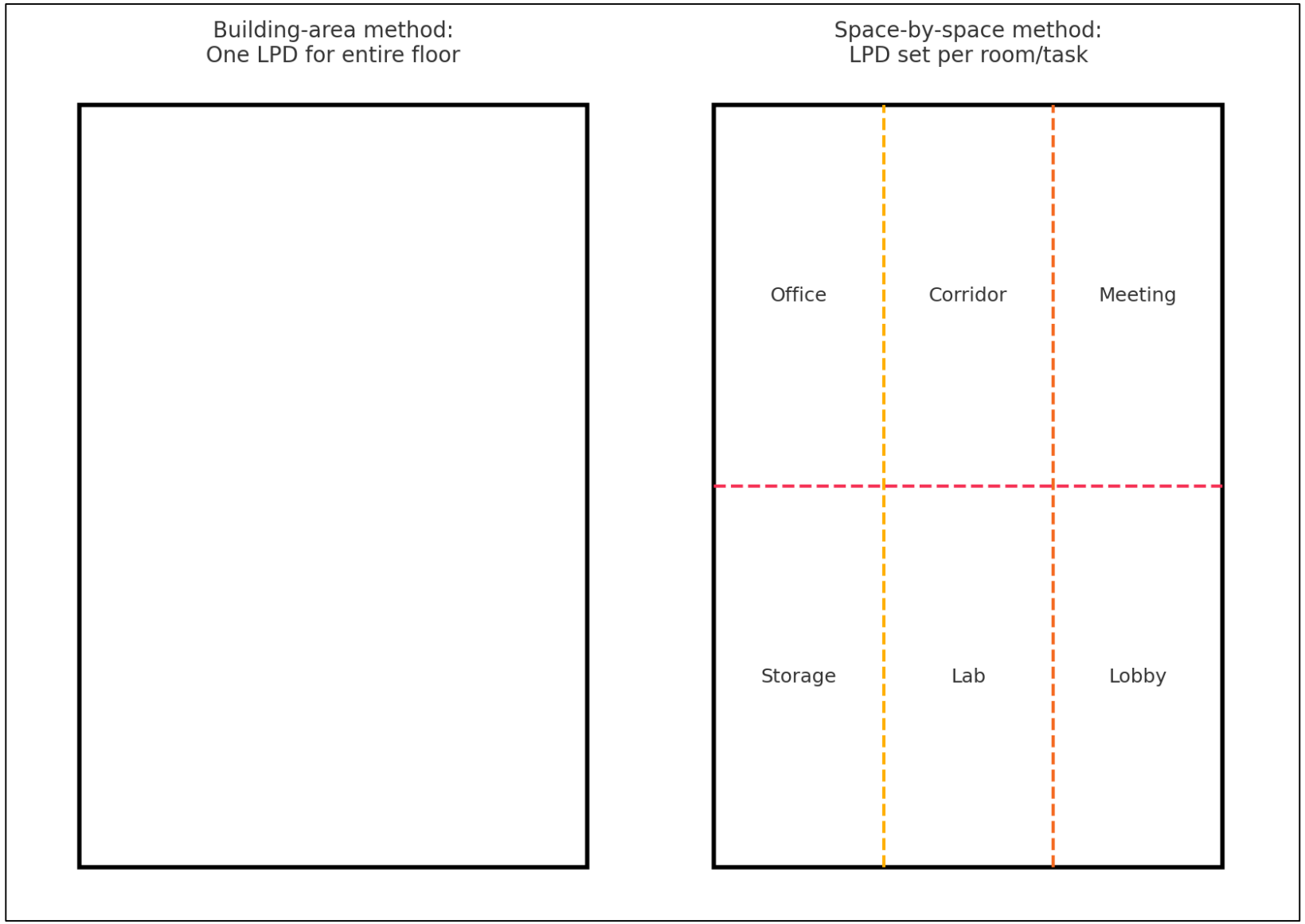
Part 4 – Lighting Power Density (LPD)

- Prescriptive LPD values by building type (e.g., office, library).
- Two compliance paths:
  - Building-area method
  - Space-by-space.

Mixing the two methods not allowed! A-4.2.1.3.

NECB 2020

Part 4 – Lighting Power Density (LPD)



NECB 2020

Part 4 – Lighting Power Density (LPD) – Space-by-Space Method (4.2.1.6)

Table 4.2.1.6.
Lighting Power Density Using the Space-by-Space Method and Minimum Lighting Control Requirements
Forming Part of Sentences 4.2.1.6.(1), 4.2.2.1.(2), (3), (6), (8), (9), (10), (13), (16), (18) and (20), 4.3.1.3.(5), 4.3.3.2.(1) and 8.4.4.5.(8)

Space Type	Lighting Power Density, W/m²	Type of Lighting Control[1]								
		Manual [see 4.2.2.1.(3)]	Restricted to Manual ON [see 4.2.2.1.(6)]	Restricted to Partial Automatic ON[2] [see 4.2.2.1.(8)]	Bi-Level [see 4.2.2.1.(9)]	Automatic Daylight Responsive Controls for *Sidelighting* [see 4.2.2.1.(10)][3]	Automatic Daylight Responsive Controls for *Toplighting* [see 4.2.2.1.(13)][4]	Automatic Partial OFF [see 4.2.2.1.(16)]	Automatic Full OFF[5] [see 4.2.2.1.(18)]	Scheduled Shut-off [see 4.2.2.1.(20)]
Common Space Types[6]										
Atrium										
< 6 m in height	4.2	X	A	A	–	X	X	–	B	B
≥ 6 m and ≤ 12 m in height	5.2	X	A	A	X	X	X	–	B	B
> 12 m in height	6.5	X	A	A	X	X	X	–	B	B
Audience seating area – permanent										
for auditorium	6.5	X	A	A	X	X	X	–	B	B
for gymnasium	2.5	X	A	A	X	X	X	–	B	B
for motion picture *theatre*	2.9	X	A	A	X	X	X	–	B	B
for penitentiary	7.2	X	A	A	–	X	X	–	B	B
for performing arts *theatre*	12.5	X	A	A	X	X	X	–	B	B
for religious *building*	7.8	X	A	A	X	X	X	–	B	B
for sports arena	3.5	X	A	A	–	X	X	–	B	B
other	2.5	X	A	A	–	X	X	–	B	B
Banking activity area and offices	6.5	X	A	A	X	X	X	–	B	B
Classroom/Lecture hall/Training room										
for penitentiary	9.5	X	A	A	X	X	X	–	X	–
other	7.6	X	A	A	X	X	X	–	X	–
Computer/Server room	10.1	X	A	A	X	X	X	–	B	B
Conference/Meeting/ Multi-purpose room	10.5	X	A	A	X	X	X	–	X	–

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Part 4 – Lighting Power Density (LPD) – Space-by-Space Method (4.2.1.6)

Table 4.2.1.6.
Lighting Power Density Using the Space-by-Space Method and Minimum Lighting Control Requirements
Forming Part of Sentences 4.2.1.6.(1), 4.2.2.1.(2), (3), (6), (8), (9), (10), (13), (16), (18) and (20), 4.3.1.3.(5), 4.3.3.2.(1) and 8.4.4.5.(8)

Space Type	Lighting Power Density, W/m²	Type of Lighting Control[1]								
		Manual [see 4.2.2.1.(3)]	Restricted to Manual ON [see 4.2.2.1.(6)]	Restricted to Partial Automatic ON[2] [see 4.2.2.1.(8)]	Bi-Level [see 4.2.2.1.(9)]	Automatic Daylight Responsive Controls for *Sidelighting* [see 4.2.2.1.(10)][3]	Automatic Daylight Responsive Controls for *Toplighting* [see 4.2.2.1.(13)][4]	Automatic Partial OFF [see 4.2.2.1.(16)]	Automatic Full OFF[5] [see 4.2.2.1.(18)]	Scheduled Shut-off [see 4.2.2.1.(20)]
Common Space Types[6]										
Atrium										
< 6 m in height	4.2	X	A	A	–	X	X	–	B	B
≥ 6 m and ≤ 12 m in height	5.2	X	A	A	X	X	X	–	B	B
> 12 m in height	6.5	X	A	A	X	X	X	–	B	B
Audience seating area – permanent										
for auditorium	6.5	X	A	A	X	X	X	–	B	B
for gymnasium	2.5	X	A	A	X	X	X	–	B	B
for motion picture *theatre*	2.9	X	A	A	X	X	X	–	B	B
for penitentiary	7.2	X	A	A	–	X	X	–	B	B
for performing arts *theatre*	2.2	X	A	A	X	X	X	–	B	B
for religious *building*	7.6	X	A	A	X	X	X	–	B	B
for sports arena	3.5	X	A	A	–	X	X	–	B	B
other	2.5	X	A	A	–	X	X	–	B	B
Banking activity area and offices	6.5	X	A	A	X	X	X	–	B	B
Classroom/Lecture hall/Training room										
for penitentiary	9.5	X	A	A	X	X	X	–	X	–
other	7.6	X	A	A	X	X	X	–	X	–
Computer/Server room	10.1	X	A	A	X	X	X	–	B	B
Conference/Meeting/ Multi-purpose room	10.5	X	A	A	X	X	X	–	X	–

DAYLIGHTING MUST BE ACCOUNTED FOR IN PERFORMANCE COMPLIANCE

NECB 2020

Part 5 - HVAC Systems

Part 5 – What's New

5.2.2.5.(4)	Exception to thermal insulation for ducts and plenums
5.2.8.9.(4)	Exception to HVAC system control
5.2.12.1	Update to HVAC equipment efficiency
5.2.12.2	Performance requirement update for heat rejection equipment
5.3.	No Trade-off option
A-5.2.2.5.(4)	Insulation exemption for supply ducts and plenums.

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Part 5 – HVAC: Overview

- ❑ Regulates HVAC systems, including sizing, efficiency, controls.
- ❑ Covers air distribution, economizers, fan power, energy recovery.

Part 5 – HVAC: Scope

- ❑ Applies to HVAC in conditioned space
- ❑ Back-up systems must meet prescriptive path (Section 5.2)

Does Not Apply:

- ❑ Smoke-control systems and equipment used during fire.
- ❑ Certain occupancies or equipment types that are impractical to apply requirements of this part.
- ❑ Existing HVAC Extensions.

5.2.10 – Energy Recovery

Energy recovery?
Used to capture heat from exhausted indoor to pre-warm fresh outdoor air.

Requirements for energy recovery systems depends on:

- ❑ Continuous or non-continuous operation
  - Table 5.2.10.1.-A and Table 5.2.10.1.-B
- ❑ Climate zone
- ❑ Airflow of exhaust air
- ❑ Percent of outside air

NECB 2020

5.2.10.1.-A Energy Recovery Requirements

Table 5.2.10.1.-A
Supply Fan Airflow Rate Threshold Values at which an Energy Recovery System is Required for the Exhaust Air System:
NON-CONTINUOUSLY OPERATING VENTILATION SYSTEMS(1)
Forming Part of Sentence 5.2.10.1.(1)

Heating Degree-Days of *Building* Location,(2) in Celsius Degree-Days	Percentage of Outdoor Air at Design Airflow Conditions							
	≥ 10% and < 20%	≥ 20% and < 30%	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
	Design Supply Fan Airflow Rate Threshold Values,(3) L/s (ft.³/min)							
Zone 4:(4) < 3000	NR	NR	NR	NR	NR	NR	NR	NR
Zone 5:(4) 3000 to 3999	≥ 12 270 (25 999)	≥ 7 550 (15 998)	≥ 2 600 (5 509)	≥ 2 120 (4 492)	≥ 1 650 (3 496)	≥ 940 (1 992)	≥ 470 (996)	R
Zone 6:(4) 4000 to 4999	≥ 12 270 (25 999)	≥ 7 550 (15 998)	≥ 2 600 (5 509)	≥ 2 120 (4 492)	≥ 1 650 (3 496)	≥ 940 (1 992)	≥ 470 (996)	R
Zones 7A and 7B:(4) 5000 to 6999	≥ 2 120 (4 492)	≥ 1 890 (4 005)	≥ 1 180 (2 500)	≥ 470 (996)	R	R	R	R
Zone 8:(4) ≥ 7000	≥ 2 120 (4 492)	≥ 1 890 (4 005)	≥ 1 180 (2 500)	≥ 470 (996)	R	R	R	R

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5.2.10.1.-B Energy Recovery Requirements

Table 5.2.10.1.-B
Supply Fan Airflow Rate Threshold Values at which an Energy Recovery System is Required for the Exhaust Air System: CONTINUOUSLY OPERATING VENTILATION SYSTEMS(1)
Forming Part of Sentence 5.2.10.1.(1)

Heating Degree-Days of *Building* Location,(2) in Celsius Degree-Days	Percentage of Outdoor Air at Design Airflow Conditions							
	≥ 10% and < 20%	≥ 20% and < 30%	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
	Design Supply Fan Airflow Rate Threshold Values,(3) L/s (ft.³/min)							
Zone 4:(4) < 3000	NR	≥ 9 200 (19 494)	≥ 4 250 (9 005)	≥ 2 360 (5 001)	≥ 1 890 (4 005)	≥ 1 420 (3 009)	≥ 710 (1 504)	R
All other zones:(4) ≥ 3000	R	R	R	R	R	R	R	R

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5.2.12. HVAC Equipment Efficiency

- Boilers, chillers, furnaces, heat pumps must meet minimum energy efficiency per Table 5.2.12.1.-A (Minimum SEER, HSPF, EER, AFUE, Et)
- Field-assembled systems must meet weighted component efficiency – 5.2.12.3.

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HVAC Equipment Efficiency (Tables 5.2.12.1.-A to 5.2.12.1.-P.)

Table 5.2.12.1.-D
Performance Requirements for Condensing Units
Forming Part of Sentences 5.2.12.1.(1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance[1]
Air-cooled[2]	≥ 40 and < 70	CAN/CSA-C746	See standard	EER = 11.2
Water-cooled and evaporatively cooled[2]				EER = 13.1
Air-cooled	≥ 70	ANSI/AHRI 366 (SI)	≥ 70 kW	EER = 10.5 IEER = 11.8
Water-cooled and evaporatively cooled				EER = 13.5 IEER = 14.0

Table 5.2.12.1.-N
Performance Requirements for Boilers
Forming Part of Sentences 5.2.12.1.(1), 6.2.2.4.(2), 6.2.2.5.(1) and 8.4.4.18.(6)

Type of Equipment	Cooling or Heating Capacity, kW	Performance Testing Standard	Rating Conditions	Minimum Performance[1]
Electric	< 88	[2]	—	Must be equipped with automatic water temperature control[3]
	≥ 88		—	—
Gas-fired[4]	< 88	CAN/CSA-P.2	See standard	AFUE = 90% (water)[3] AFUE = 82% (steam)[3]
	≥ 88 and < 733	DOE 10 CFR, Part 431, Subpart E, Appendix A	See standard	E_t ≥ 90% (water) E_t ≥ 81% (steam)
	≥ 733 and < 2 930		See standard	E_c ≥ 90% (water) E_t ≥ 82% (steam)

NECB 2020

Part 6 - Service Water Systems

Part 6 – What's New

6.1.1.3. No trade off compliance.

6.2.2.1. Update to water heating equipment efficiency.

NECB 2020

Part 6 – Scope and Approach

Deals with the generation and distribution of potable hot-water.

Does not cover:

Firefighting systems and equipment.

Part 7 - Electrical Power Systems and Motors

Part 7 – What's New

No Update!

Part 8 - Building Energy Performance Compliance Path

Part 8 – What's New

8.4.2.9.	Update to air leakage calculation for energy model
8.4.3.3	Update to building envelop air leakage rate.
8.4.4.18	Update to air supply temperature for modelling HVAC systems.
A-8.4.2.9.(2)	Definition of building envelope total area

NECB 2020

Part 8.1 – General

- Instead of prescriptive and trade-off requirements, this part can be used. **8.1.1.1.(1)**

- You can use this part **(8.1.1.2.)**:
  - If you know the building occupancy
  - If you have enough detail about the building material, systems and assembly
  - If you don't know enough, use prescriptive requirements.

- If your design is changed later, you must re-do the simulation

- If multiple buildings are separated by firewalls, whole structure can be treated as a building

Energy Performance: How It Works

- Simulate (model) proposed building energy use.
- Compare to a reference building (same size, layout, occupancy, weather data)
- Compliance is when **(8.4.1.2(2)):**

Annual Energy consumption of PROPOSED building.	≤	Target Energy consumption of REFERENCE building.

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Energy Performance: Building Energy Model?

A virtual test run of a buildings energy use over a full year on an hourly basis (8760 hours).

What It Does:

- ❑ Tracks heat gains (people, sunlight, appliances etc.
- ❑ Tracks heat losses (through walls, windows, roof etc.)
- ❑ Includes local weather data
- ❑ Uses 3D model of the building
- ❑ Calculates how much energy to stay comfortable for the year.

Part 10 – Tiered Energy Code

Ambitions of Tiered Energy Codes

1 **Clear and Flexible Path to Net-Zero Ready**

Structured, progressive path to energy-efficient buildings

2 **Supports City Climate Goals**

Aligns with Calgary’s building energy and emission targets

3 **Encourages Market Transformation**

Drives the adoption of high-performance building practices and technologies

4 **Scalable Energy Performance**

Gradual improvement allows time for industry to adapt.

5 **Verifiable Metrics and Measurement Tools**

Scope Outside Tiered Energy Code

- Operation Energy ✓
- Life Cycle GHG Emissions (Embodied Carbon) (**For Now !!!**) ✗
- EV and Renewable Energy Requirements ✗
- Sustainable Objectives (Biodiversity | Resilient Infrastructure | Water and Waste Management etc.) ✗

Part 10.1 – General

NECB Tiered compliance can only utilize performance modeling

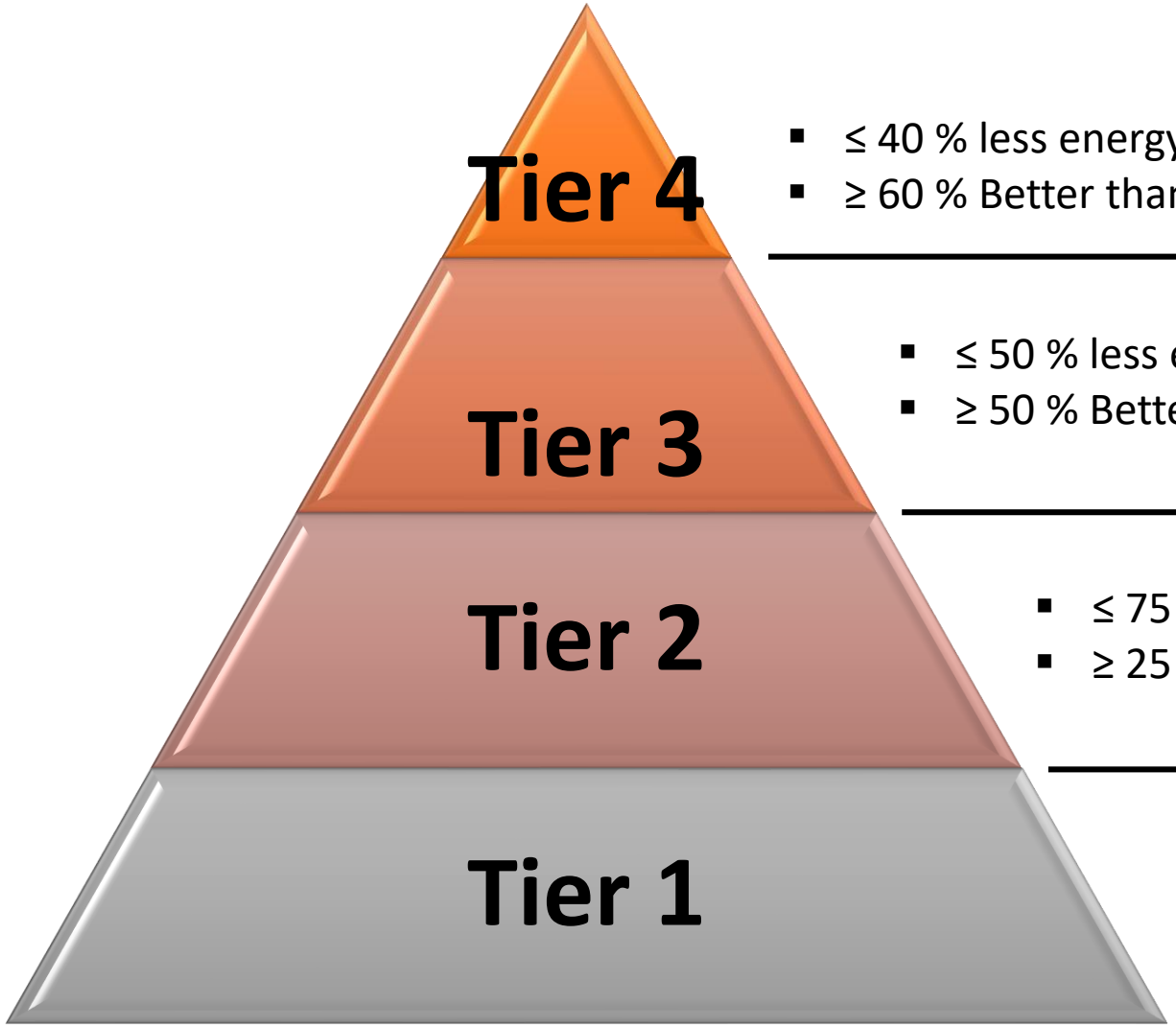
Same application requirements as Part 8

10.1.2. Compliance

To comply:

- ❑ Perform energy modelling per Part 8 (for both proposed and reference building)
- ❑ Compare energy use for both.
- ❑ Show proposed building is X % better or uses Y % energy as reference building.
- ❑ Select appropriate tier.

Tier Levels



- ≤ 40 % less energy than ref. building
- ≥ 60 % Better than Tier 1

- ≤ 50 % less energy than ref. building
- ≥ 50 % Better than Tier 1

- ≤ 75 % less energy than ref. building
- ≥ 25 % Better than Tier 1

- Benchmark
- ≤ 100 % less energy than ref. building
- ≥ 0 % more energy improvement

NECB 2020

Time for another discussion...

Question(s)

1. How are higher tiers achieved most economically? (Energy/$)
2. What can help motivate these solutions?

Thank you

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