Overview of Energy Codes in Alberta

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Tom Lauder BSc SCO

What is the Energy Code?

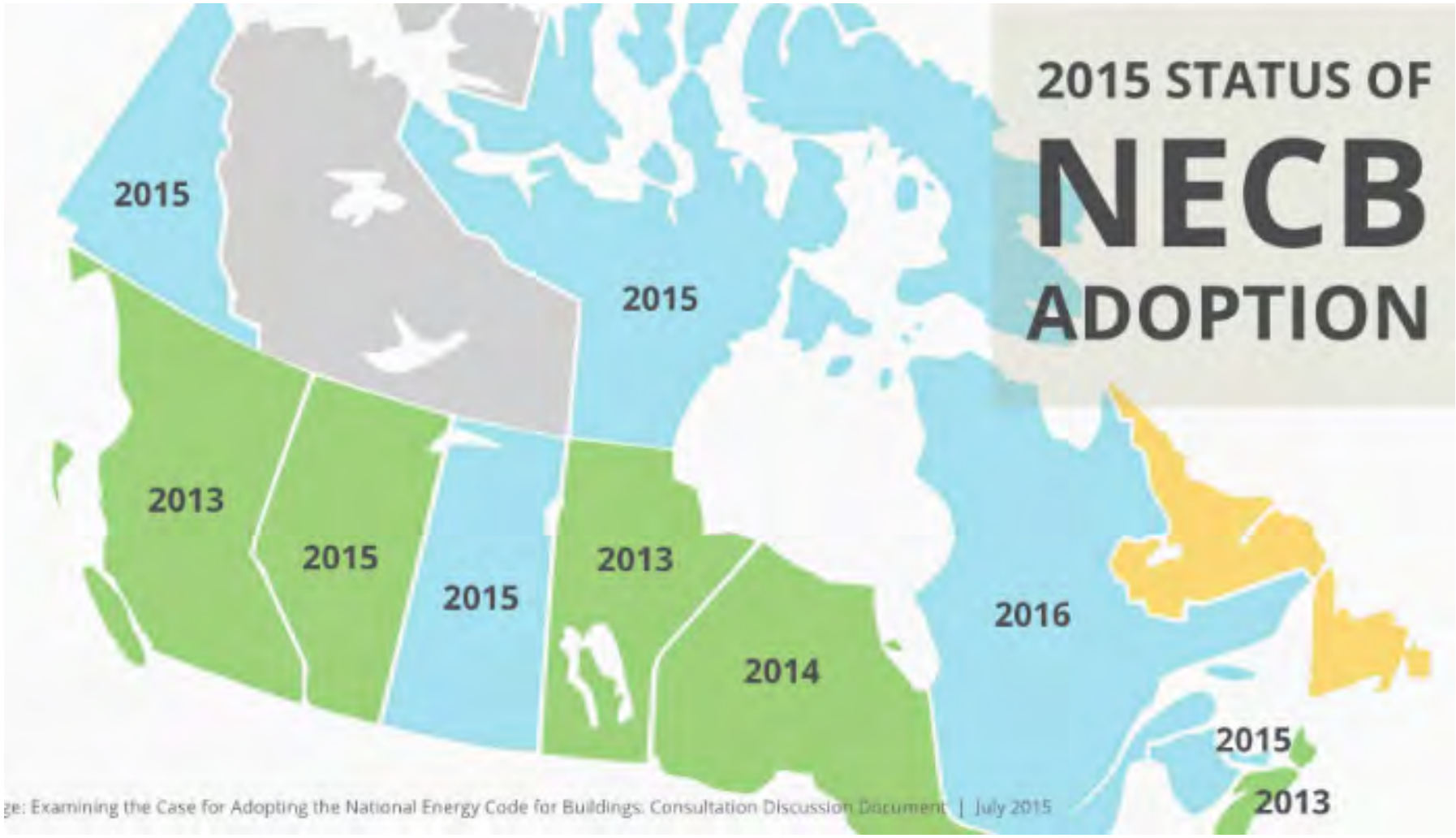
The Energy Code is a document produced by the National Research Council in 2011 in order to regulate the energy efficiency of new buildings by providing a minimum enforceable standard.

The National Energy Code for Buildings in Canada 2011(NECB) came into force in Alberta on Nov 1, 2015 but had a transition period until Nov 1, 2016.

It superseded the Model National Energy Code for Buildings 1997 which was never adopted as an actual code anywhere in Canada but became the default good practice guide.

As adopted in Alberta it stands alongside the Alberta Building Code (ABC) with equal status.

Why Alberta?


2015 STATUS OF
NECB
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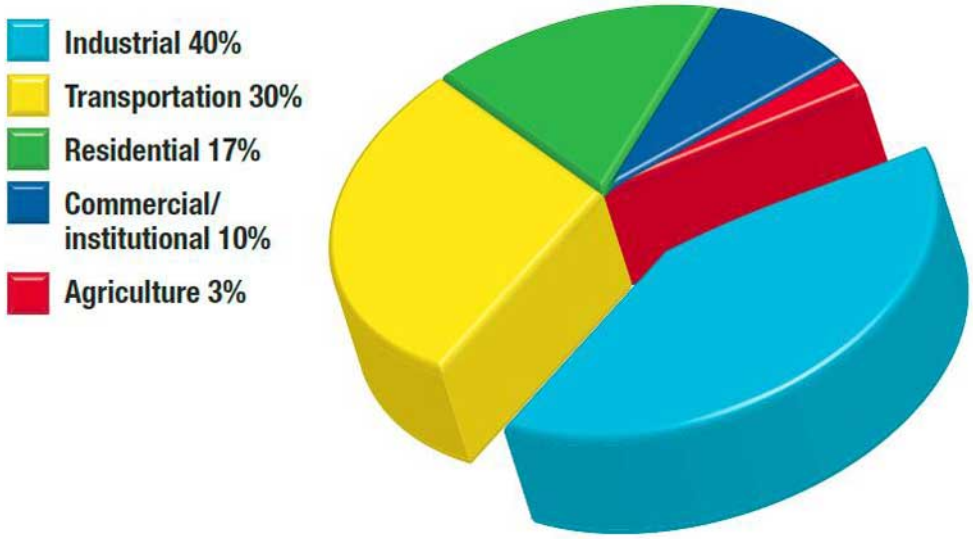
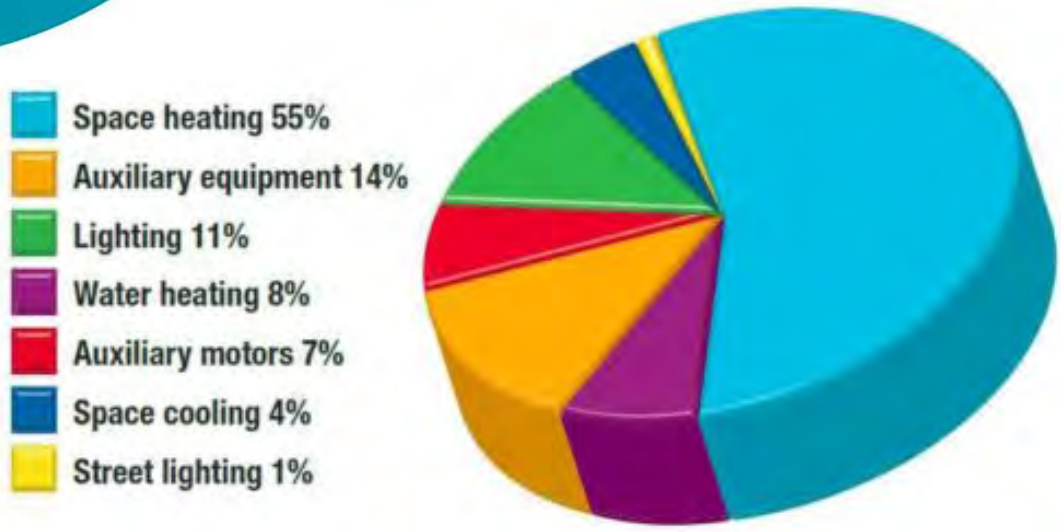
ge: Examining the Case for Adopting the National Energy Code for Buildings: Consultation Discussion Document | July 2015

Why now?

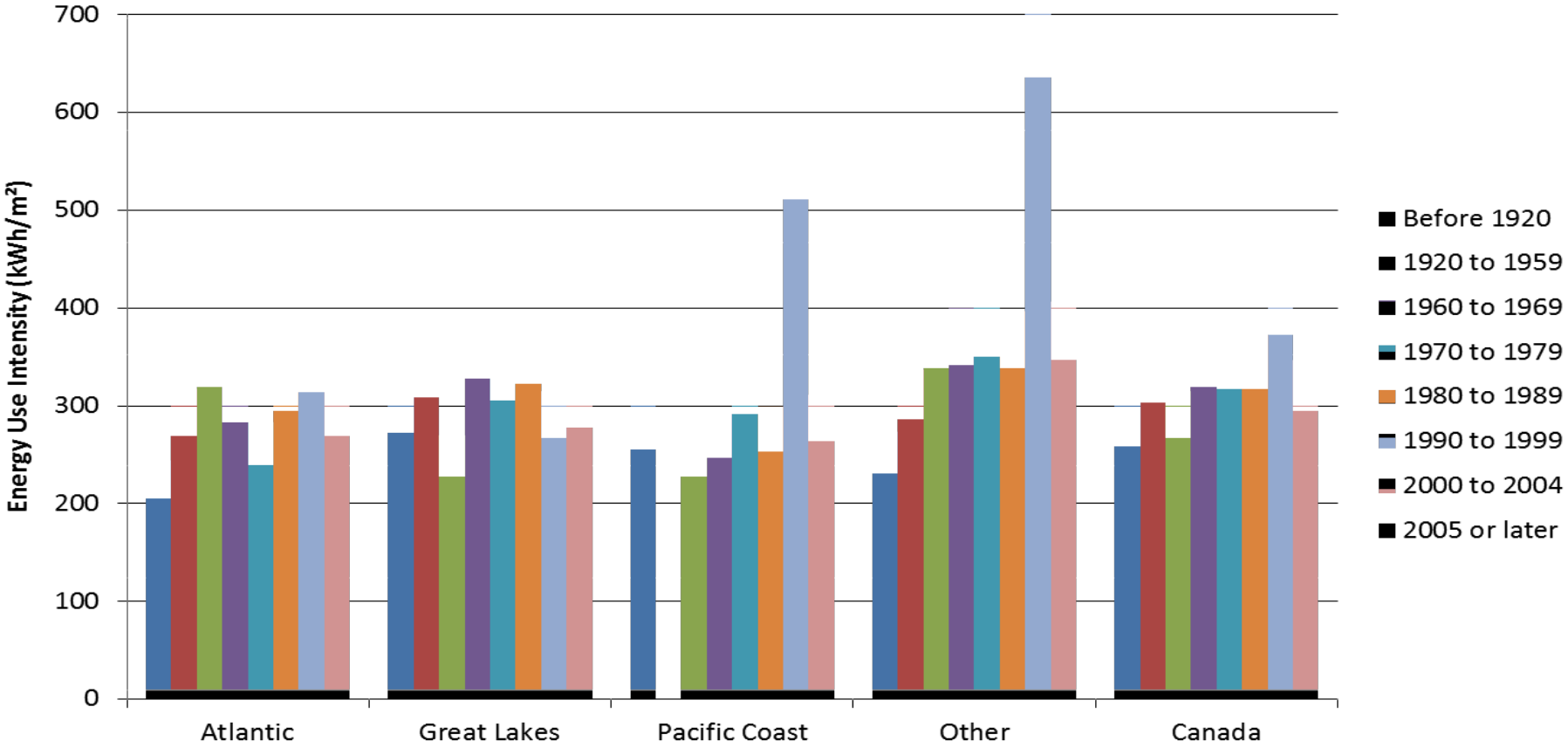
Energy use breakdown by sectors





Energy end use breakdown for commercial/industrial sector

Why regulation?



Energy use intensity has largely stayed flat in recent times.

What about LEED or BOMA BESt?

There are a number of certification schemes available in Canada at this time that recognise and promote energy efficiency in buildings.

These are optional programs that have no bearing on code compliance however they consider many of the same factors as the Energy Code and compliance with one may provide all the information you would need to show compliance with the code.

Certification schemes typically don't determine the final standard until after occupancy and in some cases after a period of commissioning and use. Obviously this poses a challenge to code authorities if these schemes were to be considered for code compliance.

What documents are in force?

The Energy Codes as implemented in Alberta actually consist of 2 documents;

The National Energy Code for Buildings Canada 2011

and

Section 9.36 of the Alberta Building Code 2014

Between these 2 documents almost all new buildings are covered by an energy efficiency requirement for the first time ever in this Province.

Which document applies to me?

NECB:-

ALL new Group A, B, and F1 buildings regardless of size

ALL new Group C, D, E, F2, and F3 buildings greater than 600m² or exceeding 3 storeys

Additions to any of the above buildings exceeding 10m² of floor area

Section 9.36:-

ALL new Group C buildings 600m² or less and 3 storeys or less in height,

ALL new Group C, D, E, F2, and F3 buildings less than 300m² floor area and 3 storeys or less in height.

Buildings that fall within 9.36 criteria can opt to use NECB but NECB buildings have no alternative options

What does the NECB deal with?

Essentially all the things noted in the end use graph from the earlier slide:

Space Heating (NECB pt 5) including,

consideration for the heat loss through the envelope (NECB pt 3),

Space Cooling (NECB pt 5),

Water Heating (NECB pt 6),

Lighting and its control (NECB pt 4),

Motors (NECB pt 7)

You can see that the NECB considers around 85% of the elements of energy use in a typical commercial building.

What it doesn't deal with?

The NECB will not deal with how you operate your building including,

- Anything you plug into the wall,
- Operating schedule,
- Numbers of staff or patrons,
- Equipment servicing or maintenance.
- Thermostat settings or other controls
- Renovations to existing buildings

The NECB is a construction code, it has little purpose after occupancy is granted for a new building.

The Building Code also only deals with construction of the new building but it is followed by the Fire code which deals with the operation of the safety systems of the building. There is at present no equivalent to the Fire Code in Energy.

How does the new code work?

Unlike any other code adopted in Alberta previously the NECB (and 9.36) are performance based codes. This means that they differ from Prescriptive codes which are essentially a list of dos & donts.

The energy efficiency standards actually have 3 distinct compliance paths,

Prescriptive

A list of dos & dont's similar to the rest of the codes in force.

Trade-off

An modified version of above where through the use of calculations you can compensate for a poorly performing element by improving another beyond the code standard.

Performance

A computer simulation of the energy use of a building

How is the code formatted?

As you would expect the code is written and laid out in the same format as the building code. The technical parts (Div B) are broken out essentially by discipline:

Part 1 – Admin functions	
Part 2 –Reserved	
Part 3 – Building Envelope	(Architect/Engineer)
Part 4 – Lighting	(Electrical Engineer)
Part 5 – HVAC	(Mechanical Engineer)
Part 6 – Service Hot Water	(Mechanical Engineer)
Part 7 – Electrical Distribution and Motors	(Electrical Engineer)
Part 8 – Performance Path	(All of the above)

NECB Technical Requirements

Part 3 Building Envelope

Prescriptive values for assemblies varying by climate zone

NECB Table 3.2.2.2.

Overall Thermal Transmittance of Above-ground Opaque Building Assemblies

	Heating Degree-Days of Building Location, Celsius Degree-Days					
	Zone 4: < 3000	Zone 5: 3000 to 3999	Zone 6: 4000 to 4999	Zone 7A: 5000 to 5999	Zone 7B: 6000 to 6999	Zone 8: ≥ 7000
	Maximum Overall Thermal Transmittance ($W/m^2 \cdot K$)					
Walls	0.315 (R18)	0.278 (R20)	0.247 (R23)	0.210 (R27)	0.210 (R27)	0.183 (R31)
Roofs	0.227 (R21)	0.183 (R31)	0.183 (R31)	0.162 (R35)	0.162 (R35)	0.142 (R40)
Floors	0.227 (R21)	0.183 (R31)	0.183 (R31)	0.162 (R35)	0.162 (R35)	0.142 (R40)

Note: R-values are equivalent effective imperial thermal resistance values

From NECB Tables 3.2.2.3 and 3.2.2.4.

Overall Thermal Transmittance of Fenestration and Doors

	Heating Degree-Days of Building Location, Celsius degree-days					
	Zone 4: < 3000	Zone 5: 3000 to 3999	Zone 6: 4000 to 4999	Zone 7A: 5000 to 5999	Zone 7B: 6000 to 6999	Zone 8: ≥ 7000
	Maximum Overall Thermal Transmittance ($W/m^2 \cdot K$)					
Fenestration and Doors	2.4	2.2	2.2	2.2	2.2	1.6

Fenestration Door Wall Ratio

$$FDWR \leq \frac{(2000 - 0.2 \cdot HDD)}{3000}$$

In Calgary this equals 33%

NECB Technical Requirements

Part 4 Lighting

Table 4.2.1.5.
Lighting Power Density by Building Type for Use with the Building Area Method
Forming Part of Sentences 4.2.1.5.(1), (4) and (5)

Building Type	Lighting Power Density, W/m²
Automotive facility	8.8
Convention centre	11.6
Courthouse	11.3
Dining:	
bar lounge/leisure	10.7
cafeteria/fast food	9.7
family	9.6
Dormitory	6.6
Exercise centre	9.5
Fire station	7.6
Gymnasium	10.8
Health-care clinic	9.4
Hospital	13.0
Hotel	10.8
Library	12.7
Manufacturing facility	11.9

These are extracts from the tables listing the LPD requirements for both the whole building method and the space by space method. The LPD is the amount of energy put into lighting it is independent of the output required. These requirements do not apply to emergency lighting.

This section also requires lighting controls in most spaces, very few spaces can now be on a switch alone, occupancy or movement sensors are required or timers in some cases.

Table 4.2.1.6.
Lighting Power Density Using the Space-by-Space Method
Forming Part of Sentences 4.2.1.6.(1) and 4.3.3.2.(1)

Common Space Types[1]	
Space Types	Lighting Power Density, W/m²
Atrium	
first 13 m in height	0.10 per m (height)
height above 13 m	0.07 per m (height)
Audience seating area – permanent	
for auditorium	8.5
for performing arts *theatre*	26.2
for motion picture *theatre*	12.3
Classroom/lecture/training	13.3
Conference area/meeting/multi-purpose	13.2

NECB Technical Requirements

Part 5 HVAC

This section essentially deals with the efficiency of the equipment used to provide heating, cooling and ventilation to a building. It considers the equipment itself as well as controls, heat recovery, duct insulation and pumps. An extract from one of the many tables is shown:

Table 5.2.12.1. (Continued)

Boilers				
Component or Equipment	Cooling or Heating Capacity, kW (Btu/h)	Standard	Rating Conditions(1)	Minimum Performance(2)
Electric *boilers*	—	—	—	(3)
Gas-fired *boilers*(4)	< 88 (300 000)	ANSI Z21.13/CSA 4.9	—	AFUE = 85%
	≥ 88 (300 000) and < 733 (2 500 000)	ANSI Z21.13/CSA 4.9 or ASME PTC 4	—	$E_c \geq 82.5\%$ $E_t \geq 83.0\%$
	≥ 733 (2 500 000)		—	$E_c \geq 83.3\%$
Oil-fired *boilers*	< 88 (300 000)	CSA B212 or ASME PTC 4	—	AFUE ≥ 84.7%
	≥ 88 (300 000) and < 733 (2 500 000)			$E_t \geq 83.4\%$
	≥ 733 (2 500 000)			$E_c \geq 85.8\%$
Oil-fired *boilers*, residual (No. 5 or No. 6 oil) and other	< 88 (300 000)	CSA B212	—	AFUE ≥ 84.7%
	≥ 88 (300 000) and < 733 (2 500 000)	ASME PTC 4		$E_t \geq 83.4\%$
	≥ 733 (2 500 000)			$E_c \geq 85.8\%$
Warm-Air Furnaces, Combination Warm-Air Furnace/Air-conditioning Units, Duct Furnaces and Unit Heaters				

NECB Technical Requirements

Part 6 Service Water Heating

Like part 5 this section is most concerned with the efficiency of the equipment used for water heating as well as pipe insulation and controls for that system.

Table 6.2.2.1.
Service Water Heating Equipment Performance Standards
Forming Part of Sentences 5.2.12.3.(1), 6.2.2.1.(1), 6.2.2.4.(2), 6.2.2.5.(1), 6.3.2.5.(1) and 6.3.2.6.(1)

Storage-Type and Non-Storage-Type (Instantaneous) Service Water Heaters							
Component	Input	Capacity, L	V_t, L (US gal.)	Input/V_t, W/L (Btu/h/US gal.)	Standard	Rating Conditions	Performance Requirement(1)
Electric	≤ 12 kW	50 – 270	—	—	CAN/CSA-C191	See standard	SL ≤ 35 + 0.20V (top inlet) SL ≤ 40 + 0.20V (bottom inlet)
	—	> 270 and ≤ 454					SL ≤ (0.472V) – 38.5 (top inlet) SL ≤ (0.472V) – 33.5 (bottom inlet)
	> 12 kW	> 454			ANSI Z21.10.3/CSA 4.3(2)	Δt = 44.4°C (80°F)	E_t ≥ 98% EF ≥ 0.98
Heat pump water heaters	≤ 24 A and ≤ 250 V	—	—	—	CAN/CSA-C745	—	EF ≥ 2.1
Gas-fired	< 22 kW	—	—	—	CAN/CSA-P.3	—	EF ≥ 0.67 – 0.0005V
	22 – 117 kW						
	> 117 kW		—	< 310 (4000)	ANSI Z21.10.3/CSA 4.3	Δt = 50°C (90°F)	E_t ≥ 80%
			< 37.8 (10)	≥ 310 (4000)			E_t ≥ 80%(3)
			≥ 37.8 (10)			Δt = 50°C (90°F)	E_t ≥ 77%(3)

NECB Technical Requirements

Part 7 Electrical Power and Motors

This section requires that a building containing dwellings have a means to monitor each dwellings electrical consumption independently. It also defines maximum voltage drops for feeders and branch circuits as well as defining the standards that transformers and motors must meet.

NECB Technical Requirements

Part 8 Performance Compliance

Performance compliance is a compliance path that allows you to use a computer simulation to override any or all of the values we looked at previously.

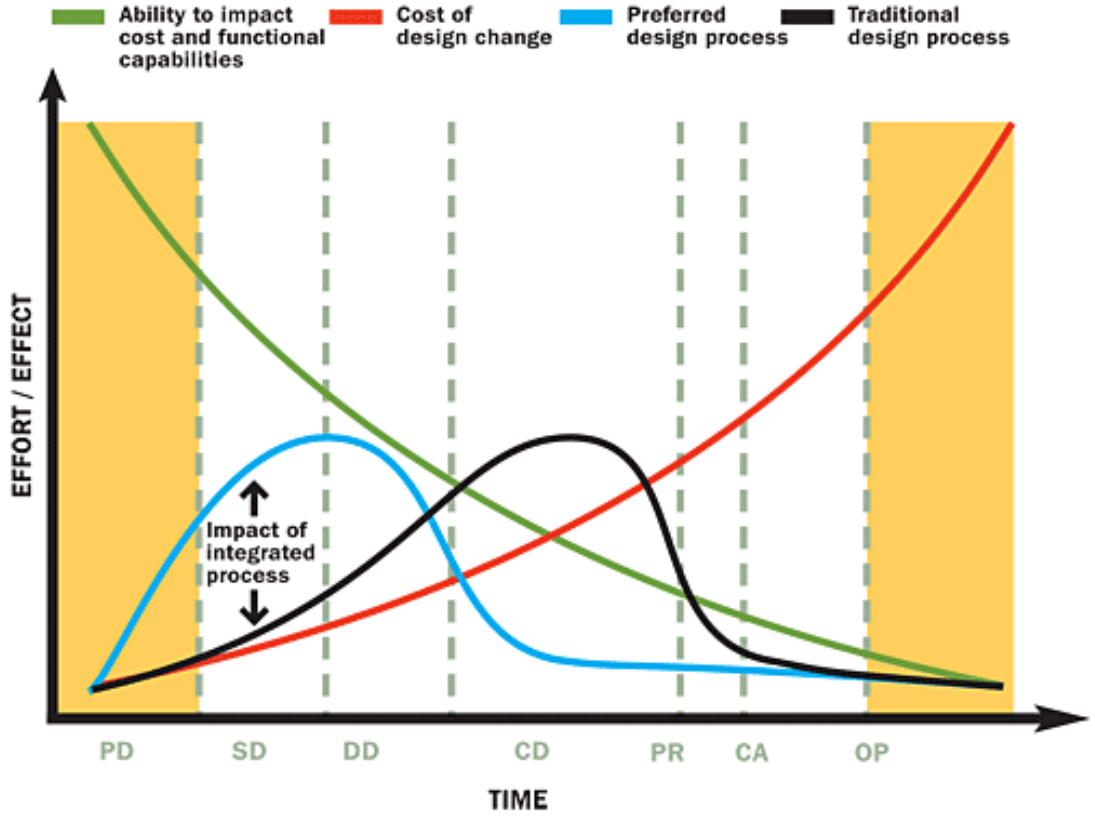
This path provides flexibility by comparing a model of your building using all of the prescriptive values with a model that uses your preferred values and providing your total energy use for the proposed building is equal to or less than the reference model compliance has been demonstrated.

Obviously this requires the use of some complex software that can run multiple calculations simultaneously but it brings with it the ability to target areas of design or cost that matter the most to the client.

Will energy code compliance add cost to my projects?

This really depends upon you, The anecdotal evidence suggests that energy efficiency improvements may add around 1% capital cost to your project. Consultants experienced in Energy Efficiency have expressed a view that it can be nearer 0.5% or even lower.

The earlier you factor energy efficiency into your project planning and design the less it will cost



Summary

- Energy codes are construction codes dealing with energy efficiency of NEW buildings
- How you operate or run your buildings is not affected by the new codes
- Costs associated with the implementation of Energy Codes can be somewhat mitigated by using experienced consultants and having clear energy efficiency aims and objectives for the project.
- Renovations to existing buildings are generally not covered however additional floor area will be e.g. Mezzanines.
- The NECB is on a constant improvement cycle of 5 years, NECB 2011 is current in Alberta. NECB 2015 is live elsewhere and NECB 2020 is currently at public consultation.
- Discussions about adding renovations and operational regulations (fire code equivalent) have taken place although I understand its early days.
- www.calgary.ca/NECB for more information on submissions.

QUESTIONS