

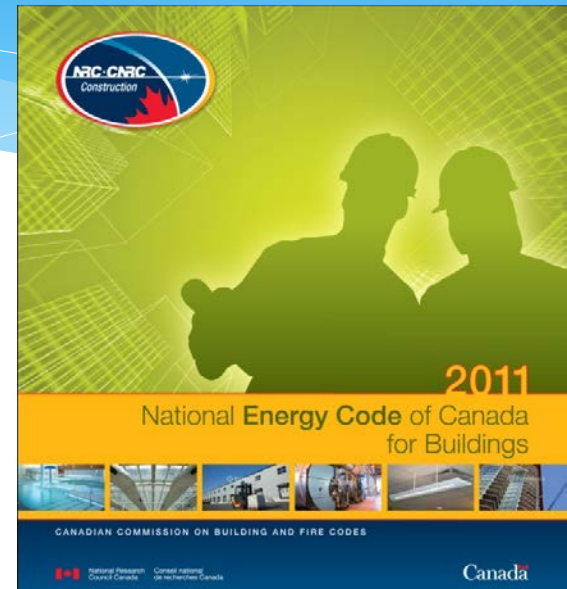
MECB 2011 Overview Outline

1. Introduction to National Codes
2. MNECB bridge to NECB 2011
3. Part 5 HVAC Comparison
4. Part 5 HVAC Trade-off Path
5. Part 6 Service Water Heating Comparison
6. Comparison to ASHRAE 90.1 - 2010
7. Future Sensing for Energy Codes
8. Challenges of Energy Code Development
9. Questions



Introduction

- * Model Code developed by Canadian Commission on Building and Fire Codes
- * NECB must be adopted by provincial/territorial authorities to become law



MNECB 1997 – use

- * Referenced in Ontario Building Code
- * Used in voluntary and incentive programs
 - * Commercial Buildings Incentive Program
 - * Utility and other programs
 - * LEED®

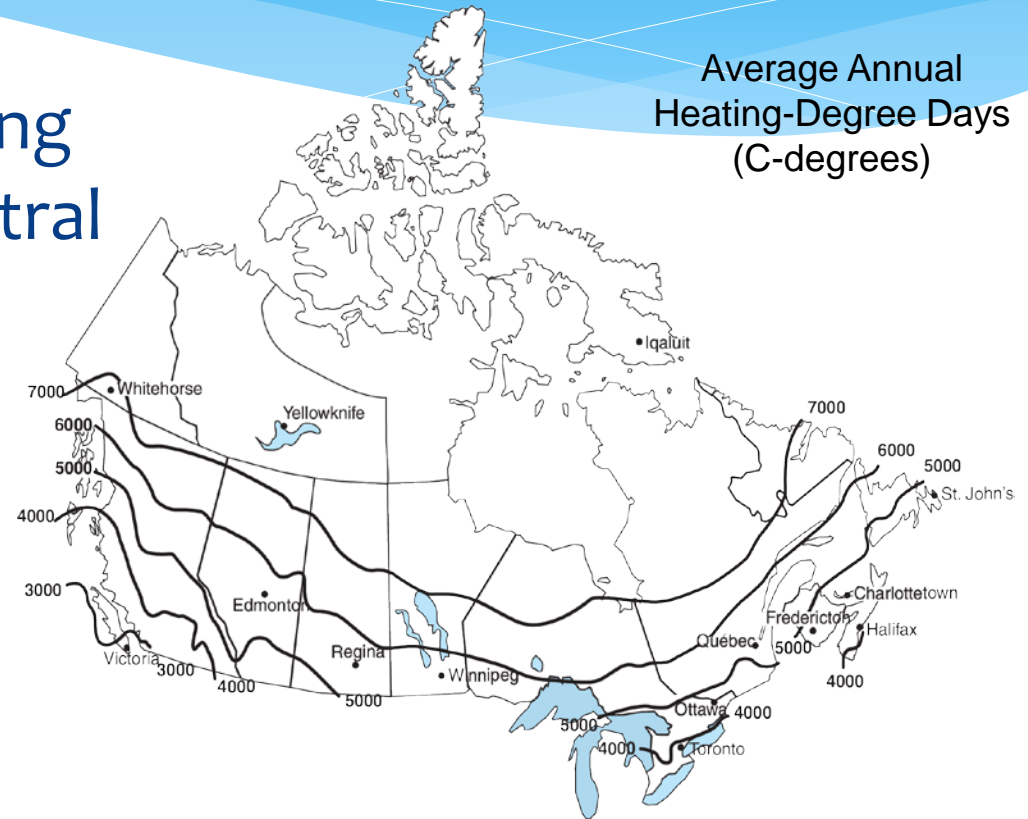


MNECB 1997 – why low adoption rate?

- * Energy/economics code
 - * Requirements and exemptions based on
 - * Principal energy source
 - * “Administrative region”
 - * Climatic criteria
 - * Energy distributor
 - * Outdated very quickly
 - * “Energy budget” code

NECB 2011 – approach

- * Energy used by building
→ energy source neutral
- * Based on climatic
zone – heating
degree-days
(HDD)



NECB 2011 – approach

- * Silent on renewable, waste and site-generated energy
 - * Wide variety of technology
 - * No barriers placed for their use
 - * Reference standards for use, not necessarily efficiency
- * Silent on most process loads
 - * Except pools and ice surfaces



MNECB 1997 and NECB 2011

- * No differentiation based on occupancy
- * Same structure
 - * Part 3: Building Envelope
 - * Part 4: Lighting
 - * Part 5: Heating, Ventilating and Air-Conditioning Systems
 - * Part 6: Service Water Heating Systems
 - * Part 7: Electrical Power Systems and Motors
 - * Part 8: Performance Path

Compliance Paths

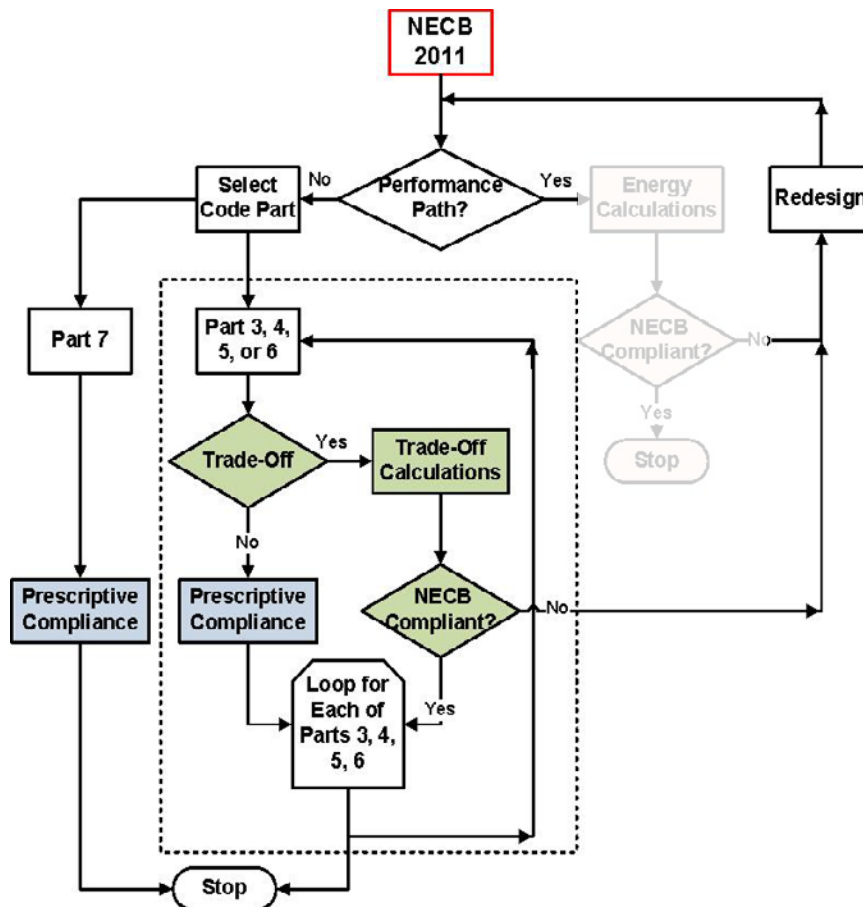
MNECB 1997

- * Simple prescriptive
- * Building envelope trade-off
 - * Simple
 - * Computer-assisted
- * Performance compliance
 - * Whole-building modeling – engineering solution

NECB 2011

- Simple prescriptive
- Building envelope trade-off
 - Simple
 - Detailed
- Lighting, HVAC, service water trade-off
- Performance compliance
 - Whole-building modeling – engineering solution

MECB 2013 compliance paths



- * Mix and match simple prescriptive and trade-off paths
- * Use trade-off within same Part only

MECB 2013 – Part 5 Comparison

Prescriptive requirements

- Heating equipment
- Ventilating equipment
- Air-conditioning equipment
- HVAC control systems
- Piping and ducts

Trade-off Path

- System Approach



MECB 2013 – Part 5 Comparison

* Air Distribution Systems

MNECB 1997	MECB 2013	Current Practice
Ability to balance	Ability to balance	Yes
SMACNA 1985	Duct Sealing to SMACNA Standards	Mixed results (duct tape)
Exemptions	Exhaust – Return ducts in conditioned spaces	Yes

2015 will be tighter “classes” based upon 2012 standards



MECB 2013 – Part 5 Comparison

* Duct and Plenum Insulation

MNECB 1997	MECB 2013	Current Practice
Yes	Thermal insulation requirements	No*
Yes	Systems in dwelling units	Yes
Yes	Ductwork outside envelope	No

*Air conditioning for dew point

MECB 2013 – Part 5 Comparison

* Cooling with Outdoor Air

MNECB 1997	MECB 2013	Current Practice
Yes	Use O.A. for cooling with mechanical A.C.	For the most part (Enabling Economizers)
Yes	>3000 CFM >5.5 Tons Cooling	Yes
Yes	Capacity Modulation	Yes

MECB 2013 – Part 5 Comparison



* Fan Systems

MNECB 1997	MECB 2013	Current Practice
Yes	Constant volume 1.6 W per L/s (0.75 W per cfm)	?
Yes	Variable Air Volume 2.65 W per L/s (1.25 W per cfm)	?
Yes	$\leq 55\%$ design W at 50% design air flow when > 7.5 kW and < 25 kW	

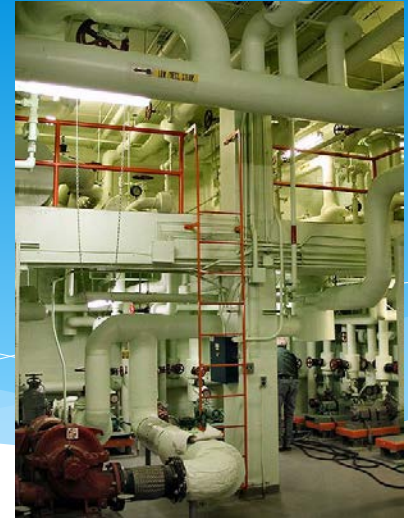
ASHRAE 90.1 2010 very similar

MECB 2013 – Part 5 Comparison

* Dampers

MNECB 1997	MECB 2013	Current Practice
Yes	> 12" X 10" (0.08 m ³) Motorized dampers	Varies
Yes	< 12" X 10" Manual or Back-draft dampers	Varies
Outside Air Damper leakage	<3 CFM per sq ft at 1" W.C.	Available

MECB 2013 – Part 5 Comparison



* Piping and Insulation

MNECB 1997	MECB 2013	Current Practice
Yes	Ability to Balance	Somewhat
Yes	Thermal conductivity requirements based upon pipe size and temperature difference	Somewhat*
Yes	Protection of insulation	Limited

Big changes to large systems (2015 NECB) ASHRAE 90.1



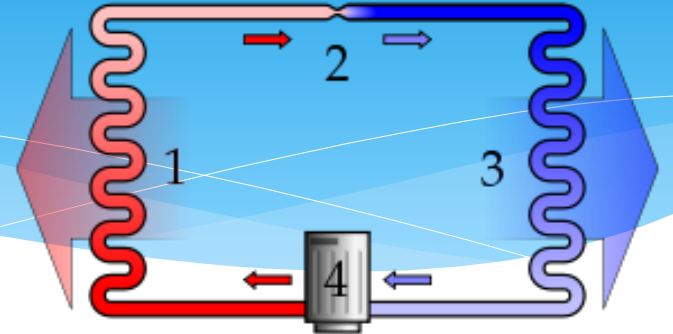
MECB 2013 – Part 5 Comparison

* Pumping System Design

MNECB 1997	MECB 2013	Current Practice
Yes	HVAC Pumping Variable Flow $\leq 50\%$	Still Best Practice
Yes	Exemptions for Boiler and Chiller minimums	

MECB 2013 – Part 5 Comparison

* Temperature Controls



MNECB 1997	MECB 2013	Current Practice
Yes	Thermostat locations	Need common sense
Yes	Controllability and accuracy	Standard through CSA
Yes	Heat Pump (no supplemental heating if load covered by HP)	Not usually commissioned

MECB 2013 – Part 5 Comparison

* Space Temperature Controls

MNECB 1997	MECB 2013	Current Practice
Yes	Heating – Cooling Zones separately controlled	Yes
Yes	De-coupling allowed	Not sure*
No	Vestibule Heating < 15°C	No

*Simultaneous heating and cooling

MECB 2013 – Part 5 Comparison

* Temperature Controls

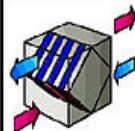
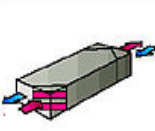
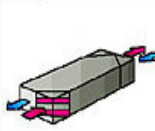


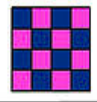
MNECB 1997	MECB 2013	Current Practice
Yes	Controls to adjust Leaving Air Temperature	Best Practice Only
Yes	Do not: heat previously cooled air, cool previously heated air	
Yes	Exemption = Humidity Control	

MECB 2013 – Part 5 Comparison

* Control of Space Temperature by Reheating (clg)

MNECB 1997	MECB 2013	Current Practice
Yes	HVAC Systems that control temperature of a space by reheating previously cooled air shall be equipped with controls that automatically adjust the temperature of the cool air supply to the highest temperature that will satisfy the zone requiring the coolest air	Occasionally

MECB 2013 – Part 5 Comparison

Principle			
Profile			
Counter current Heat exchanger	Vertical flat plate	Horizontal flat plate	Cellular

* Heat Recovery Systems

MNECB 1997	MECB 2013	Current Practice
Swimming Pools, Ice Arenas and Curling Rinks	Added: Exhaust/Relief systems with Sensible heat > 150 KW*	No
	HR equipment \geq 50% efficiency	Incentive driven
	Heat recovered shall be used in Building System	

*Exceptions for certain exhaust gases

MECB 2013 – Part 5 Comparison

* Heat Recovery Systems

- * Exhaust Air System Sensible Heat > 150 kW
- * 2360 L/s at 55°C Temperature Difference
- * Equivalent to buildings such as:
 - * 50 suite apartment
 - * 20,000 sq ft office

MECB 2013 – Part 5 Comparison

* Heat Recovery Systems

MNECB 1997	MECB 2013	Current Practice
Dwelling Units, principal exhaust, 45% Sensible Heat Recovery Effectiveness	Same	Residential Homes and Condominiums

MECB 2013 – Part 5 Comparison

* Shut-off and Set Back Control

MNECB 1997	MECB 2013	Current Practice
Off hours controls	Yes	Set-back “capable”, but not necessarily enabled
Space temperature and Outside Air reduction	Yes	
Heat pump adaptive anticipation	Yes	Best Practice

MECB 2013 – Part 5 Comparison

* Shut-off and Set Back

MNECB 1997	MECB 2013	Current Practice
Air Flow Control Areas shall be divided into < 2500 sq. m	Yes	Varies, large building yes, “spec-build” varies
Limited to one storey	Yes	No
DDC controls required	Yes	Mostly

MECB 2013 – Part 5 Comparison

* Shut-off and Set Back Control - Boilers



MNECB 1997	MECB 2013	Current Practice
Prevent heat loss when not in operation	Multiple boilers > 176 kW (600 MBH), two stage or multi-stage	Varies, but capability has been around for 25 years
No	> 352 kW (1200 MBH) shall be fully modulating	Very little cost premium to be added

MECB 2013 – Part 5 Comparison

* Shut-off and Set Back Control

MNECB 1997	MECB 2013	Current Practice
Not in code	Loop temperature reset required	Capable, yes, if properly enabled
	Hot or Chilled water systems > 88 kW (300 MBH) Indoor/outdoor controller Load represented by return water	Doubtful for > 75% of buildings

Emulates ASHRAE 90.1 2010



MECB 2013 – Part 5 Comparison

* Unitary/Packaged Equipment

MNECB 1997	MECB 2013	Current Practice
Yes, HVAC Equipment “Performance” Requirements	Enhanced Table	Cross Border shipping complies with Energy Efficiency Act and Regulations*
Minimum performance in EER, COP, IPLV, AFUE, E_c and E_t	Performance required shall not be lower than MECB, EER, or other Provincial Requirements (most stringent applies)	*Timing of EER and NECB publications overlap

MECB 2013 – Part 5 Comparison

- * Unitary/Package Equipment

- * Design practitioners need to be diligent in specifying minimum equipment efficiencies and familiarize themselves the other federal and provincial regulations

MECB 2013 – Part 5 Trade-Off Path

- * Trade-off System Approach
 - * Mechanical systems versus components in isolation
 - * Metered energy to end use
 - * Needed to have research done

MECB 2013 – Part 5 Trade-Off Path

- * Trade-off System Research
 - * Technosim
 - * 27,000 simulation runs
 - * eQuest curve match
 - * Weighting factors established for components

MECB 2013 – Part 5 Trade-Off Path

HVAC _{TOI}		0.140810	
Compliance:		System is NECB Compliant	
		HVAC Type ID - #1	
System Type:		Built-up variable-volume	
Cooling System Type:		Room Air Conditioners and Room Air Conditioner Heat Pumps	
Cooling Sub-System Type:		Room air conditioners with reserve cycle with louvered sides < 10.55 (36000)	
Cooling capacity:	W		
Heating System Type:		Gas-fired boilers, >= 88 kW and < 733 kW	
	Component	Units	
		Components Efficiencies	
	Supply fan mechanical efficiency	%	60.0%
	Supply motor efficiency	%	91.7%
	Return fan mechanical efficiency	%	38.0%
	Return fan motor efficiency	%	80.0%
	Supply temperature control	Selection	Constant <= 15°C
	Airflow control efficiency	Selection	Forward curve with vanes
	Supply fan total static pressure	Pa	996.4
	Supply duct insulation	RSI Value	0.6
	Return fan total static pressure	Pa	249.1
	Heating coil design temperature drop	°C	11.1
	Baseboard heater design temperature drop	°C	11.1
	Boiler/furnace/heat pump heating efficiency	Fraction	1.000
	Chillers/direct expansion system/heat pump cooling efficiency	COP	2.5
	Rejection fan input power ratio	W/W	0.051
	Cooling by direct use of outdoor air (air economizer)	Selection	Dual DBT
	Outdoor airflow control	Selection	Fixed
	Exhaust air heat-recovery efficiency	%	0.0%
	Cooling by indirect use of outdoor air (water economizer)	%	0.0%
	Piping insulation - hot water	RSI Value	0.9
	Piping insulation - chilled water	RSI Value	0.9

MECB 2013 – Part 6 Comparison

* Service Water Heating Systems

“Service water means water for plumbing services, excluding systems exclusively for space heating or cooling or for processes”



MECB 2013 – Part 6 Comparison

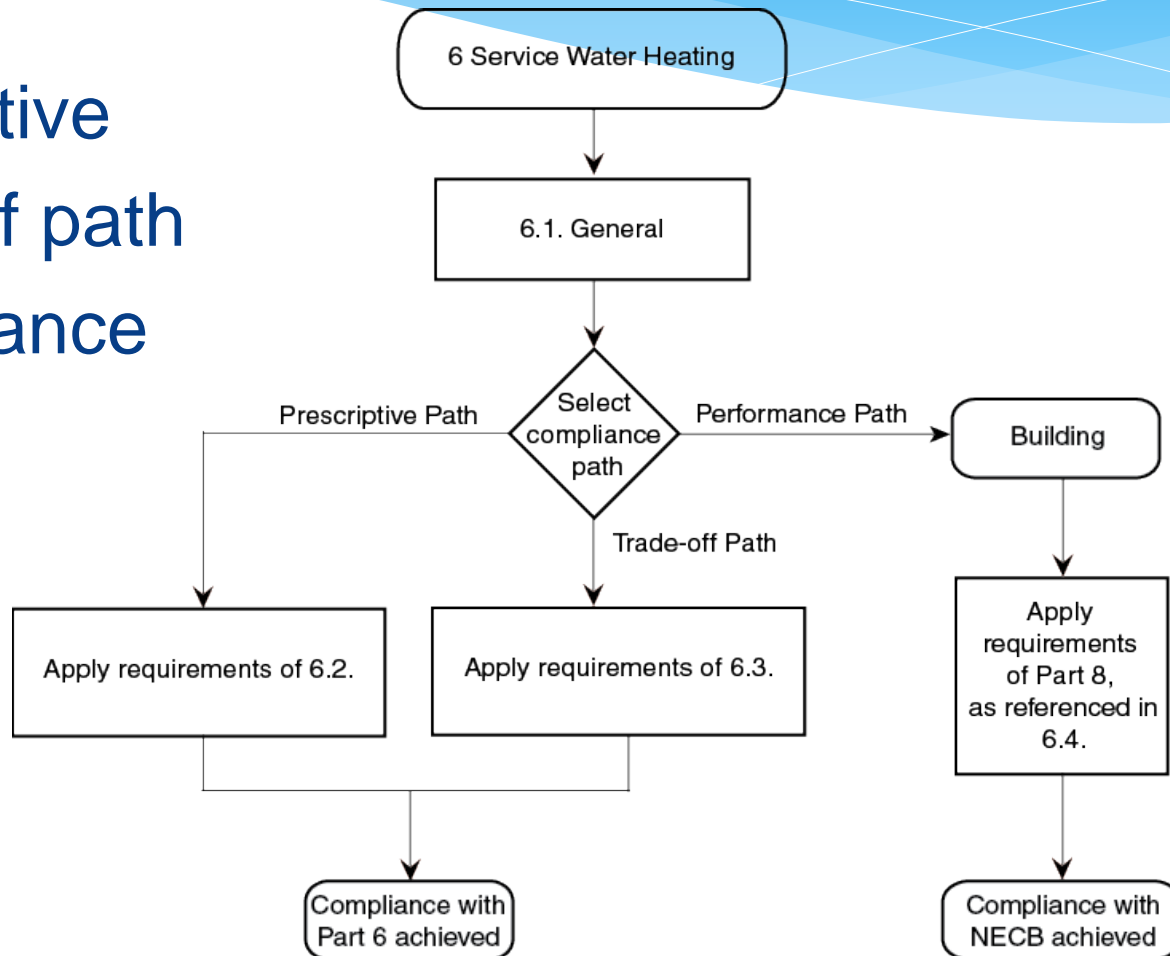
* Prescriptive Requirements

- Heating equipment
- Piping insulation
- Controls
- Hot water discharge flow

* Trade-off Path

MECB 2013 – Part 6 Comparison

- * Prescriptive
- * Trade-off path
- * Performance path



MECB 2013 – Part 6 Comparison

* Equipment Minimum Efficiency Performance

MNECB 1997	MECB 2013	Current Practice
Yes, older regulations and performance levels	Aligned with Energy Efficiency Regulations (EER) as of May 2010	Baselines established by EER for cross border sales
	Performance required shall not be lower than MECB, EER, or other Provincial Requirements (most stringent shall apply)	

MECB 2013 – Part 6 Comparison

* Equipment Performance – Manitoba Amendments

Water Heaters	Input	Performance Requirement
Gas-fired instantaneous	$\geq 14.7 \text{ kW}$ and $\leq 73.2 \text{ kW}$	$EF \geq 0.8$
Gas-fired storage	$\leq 21.98 \text{ kW}$	$EF \geq 0.67 - 0.0005 V$
Gas- Fired storage	$> 21.98 \text{ kW}$ and $\leq 117 \text{ kW}$	$E_t \geq 80\%$

MECB 2013 – Part 6 Comparison

* Equipment Insulation

MNECB 1997	MECB 2013	Current Practice
Yes, storage tanks	Insulation increased	Varies
Less stringent	Combination SWH and Space Heating, where: < 22 kW (75 MBH) < twice SWH load	Not all too common

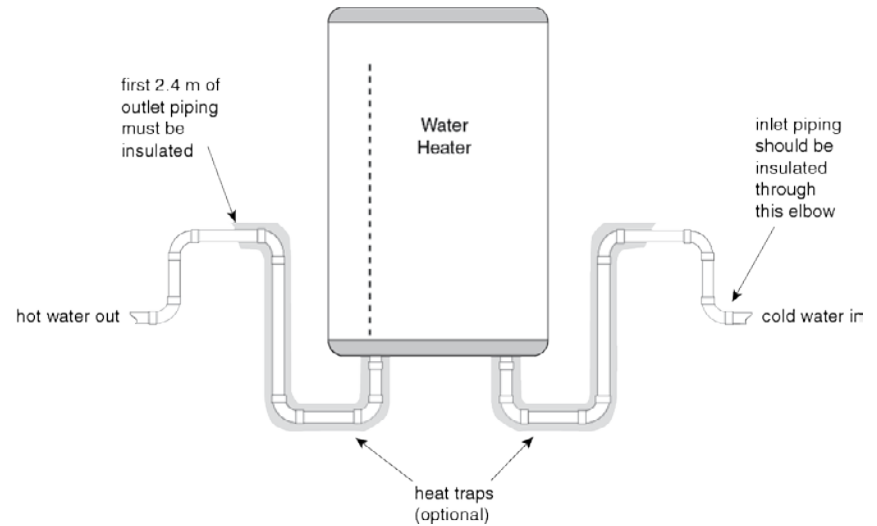
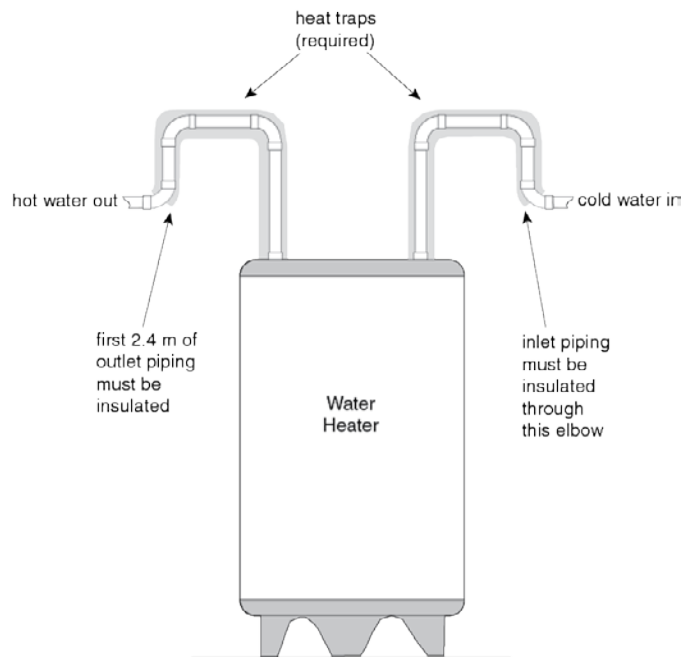
MECB 2013 – Part 6 Comparison

* Piping Insulation

MNECB 1997	MECB 2013	Current Practice
Hot water circulation systems and Hot water non-circulation systems without heat traps or with heat tracing	No Change	Varies, provincially funded buildings, some MURB's and condominiums
Minimum thickness for conditioned and non-condition spaces	No Change	

MECB 2013 – Part 6 Comparison

* Piping Insulation Clarification



MECB 2013 – Part 6 Comparison



* More than one end use temperature

MNECB 1997	MECB 2013	Current Practice
Booster heater required: <ul style="list-style-type: none">• More than one end use on system• Design discharge $> 60^{\circ}\text{C}$• $< 50\%$ of design flow	No Change	Not very common

MECB 2013 – Part 6 Comparison



* Hot Service Water

MNECB 1997	MECB 2013	Current Practice
Showers = 9.5 L/min	6.6 L/min (1.45 Igal/min)	Legislated through Manitoba Plumbing Code
Lavatories = 8.3 L/min	5.7 L/min (1.25 Igal/min)	Legislated 2011
Automatic shut off valves for assembly occupancies	Same	Very Common

MECB 2013 – Part 6 Trade-Off Path

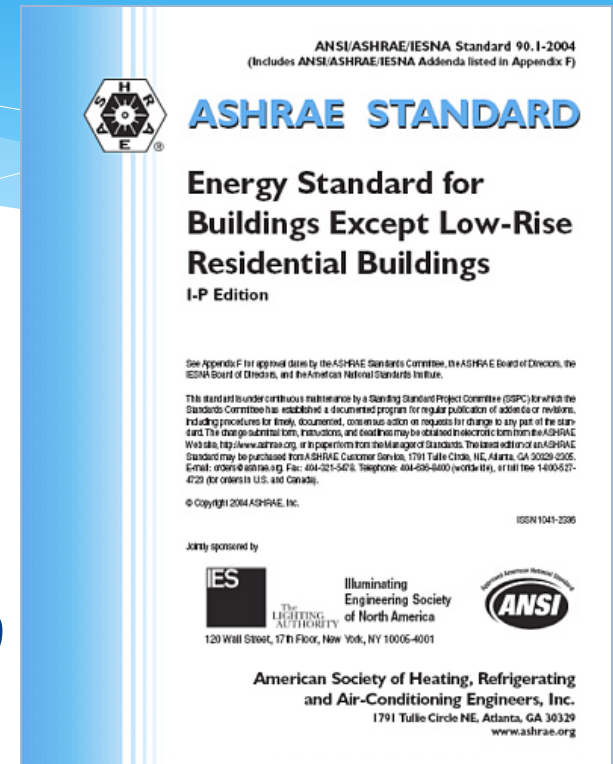
- * Trade-off Path Approach
 - * Similar to Part 5 HVAC
 - * Fewer components, but a realistic path to provide trade-offs

MECB 2013 – Part 6 Trade-Off Path

SWH_{TOI}		0.158180
Compliance:		System is NECB Compliant
		<i>SWH Type ID - #1</i>
System Type:		Tank
Equipment Type:		Gas-fired > 117 kW
Tank Volume:	L	60
Component	Units	Component Efficiency
Service water heating equipment efficiency	%	98.0%
Tank insulation value	RSI Value	2.2
Piping insulation value	RSI Value	0.7
Pump motor efficiency	%	80.0%
Pump efficiency	%	60.0%
Heat recovery ratio	W/W	0.0
Average flow of all faucets	L/min	8.3
Average flow of all showers	L/min	9.5
Average flow of other uses	L/min	7.6
Faucet flow ratio	%	50.0%
Shower flow ratio	%	50.0%

MECB 2013 – ASHRAE 90.1-2010 Comparison

- * ASHRAE 90.1
 - * Standard for the U.S. since 1975
 - * Sponsored by EPA/DOE
 - * Mandated for all 50 states
 - * Continuous maintenance since 1999



MECB 2013 – ASHRAE 90.1-2010 Comparison

* HVAC & SWH

- * Vestibule maximum temperature control
- * Exhaust/Relief Energy Recovery, sensible load vs. design O.A. % and climate zone
- * Ice plant heat recovery (NECB)
- * Pipe insulation – ASHRAE higher for larger high temperature systems
- * Simple Trade-off Path



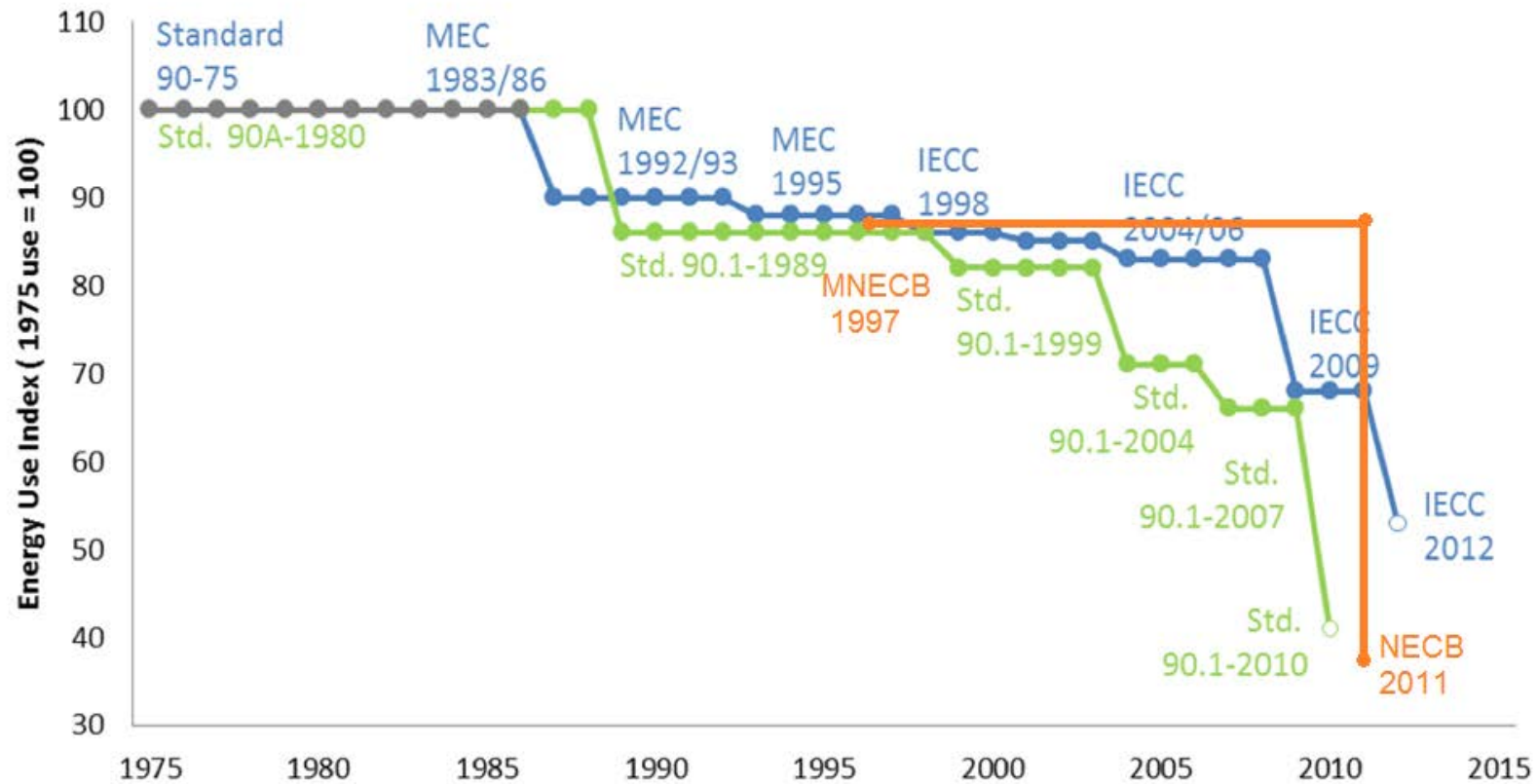
MECB 2013 – ASHRAE 90.1-2010 Comparison

* HVAC & SWH

- * Air Side Economizer – ASHRAE smaller units
- * Demand Control Ventilation (DCV) mandatory with ASRHAЕ
- * Equipment Performance Tables, NECB generally more stringent
- * Furnaces 78% versus 92.4 AFUE



MECB 2013 – ASHRAE 90.1 Comparison



NECB 2015 and Beyond

* Future Sensing

- * Heating Boiler % Efficiency
- * Commercial Kitchen Ventilation
- * Energy Recovery Threshold
- * Point of Use Water Heater Systems
- * Domestic Water Heat Recovery



NECB 2015 and Beyond

- * Future Sensing

- * Under Floor Air Distribution (UFAD)
- * Dedicated Outdoor Air Systems (DOAS)
- * Energy Use Intensity (EUI) Targets
- * Air Barriers and Commissioning

NECB Development

* Challenges

- * Time requirements
- * Resources, both technical and administrative
- * Cost Benefit Analysis
- * Regional and Political differences
- * Minimum Code vs. Best Practices

NECB Development

- * Benefits

- * Made in Canada
- * Benchmarked to other codes and standards
- * Ongoing review (continuous maintenance)
- * Common ground for construction industry
- * Adoption country wide?



MECB 2013 – Overview

QUESTIONS?

