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Overview of the National and Provincial Energy Codes for buildings

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Overview of the National and Provincial Energy Codes for Buildings

Cathy Taraschuk, Mihailo Mihailovic, Heather Knudsen and Elisabeth Girgis

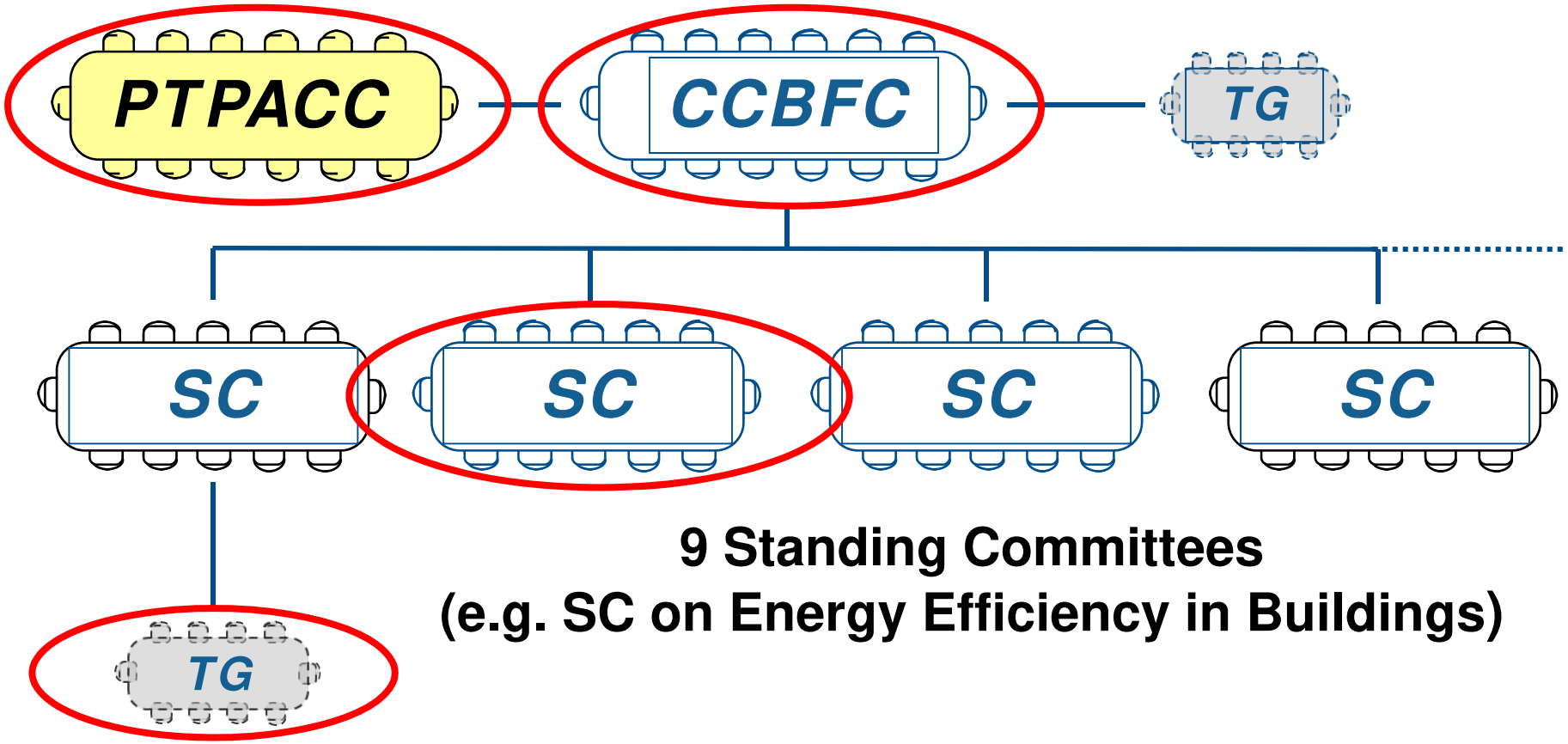
National Research Council Canada | Conseil national de recherches Canada

Canada

Outline

- History of the Energy Code development in Canada
- National Energy Code for Buildings (NECB) 2011
  - Impetus for updating the 1997 Model National Energy Code for Buildings
  - Approach used in NECB and details
- Provincial/Territorial Energy Requirements for Building Construction

National Code System

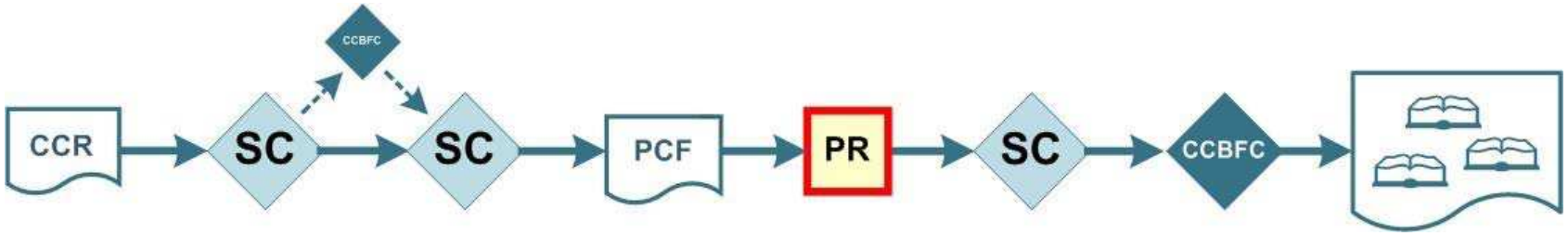


9 Standing Committees
(e.g. SC on Energy Efficiency in Buildings)

Task Groups
(e.g. TG on Building Envelope)

The Process

- From proposed changes to requirement:
  - Change Request from Proponent
  - Standing Committee – Review
  - Standing Committee – Development
  - Public Review
  - Standing Committee – Final Recommendation
  - Commission Decision
  - Publication of Codes



History

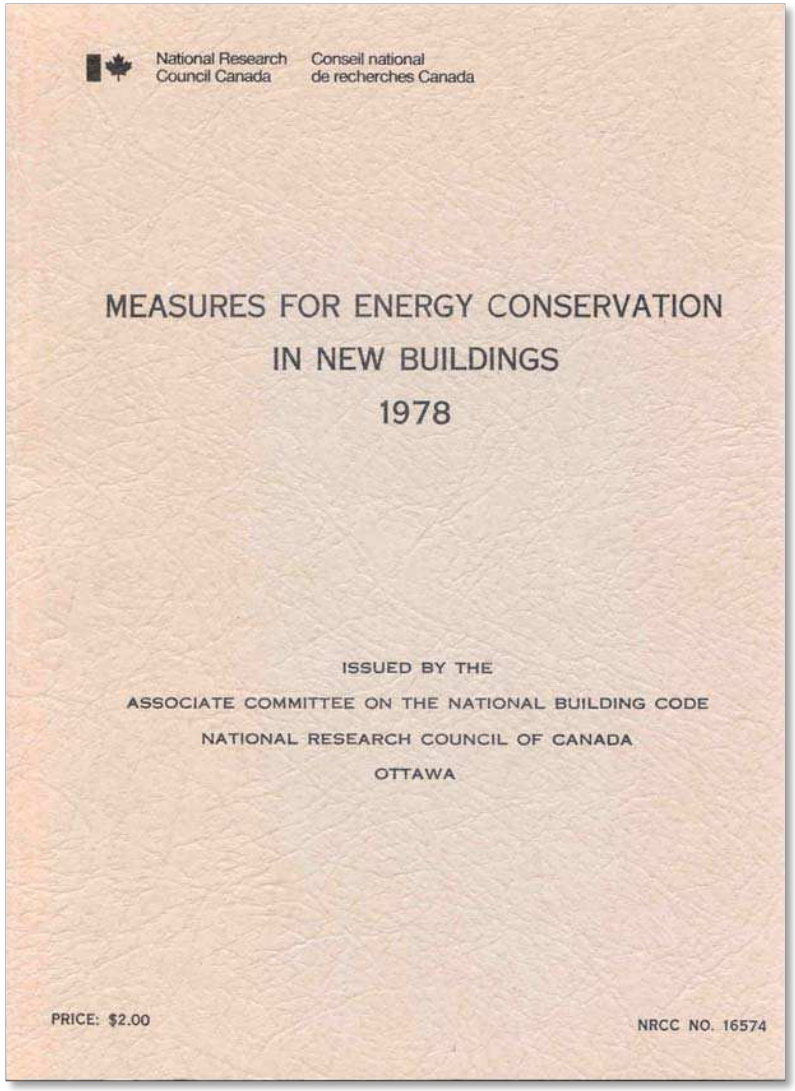
- 1974 – Department of Energy Mines and Resources requested interdepartmental committee to draft guidelines for energy efficiency of government buildings
- Associate Committee on the National Building Code (ACNBC) given mandate

History *(cont'd)*

- Standing Committee on Energy Conservation in Buildings
  - first meeting – November 1976
  - technology for performance modeling not sufficiently advanced
  - Code set as prescriptive
  - Code based on ASHRAE 90 Standard
- Fall 1977 – first draft document for public comment

History *(cont'd)*

- 1978 – First edition of the "Measures for Energy Conservation in New Buildings"



History *(cont'd)*

- Second edition of Measures for Energy Conservation in Buildings was published in 1983
  - new section for houses
  - only province to adopt the Measures was Quebec, with some changes
  - 1990 Ontario Building Code included insulation levels for houses based on 1983 edition
  - CMHC – compliance mandatory for housing financed under the National Housing Act

History *(cont'd)*

- 1989 – Suspension of technical work
- 1990 – Funding, market forces → technical work recommences

History *(cont'd)*

Model National Energy Code for Buildings 1997

- Prescriptive approach: building envelope, HVAC, service water heating, lighting, electrical power
- Engineering approach: performance → "Performance Compliance for Buildings"
  - reference and proposed building modeling
- Model National Energy Code for Houses (MNECH) published in 1997

History *(cont'd)*

- Total life-cycle costing
- Different construction requirements for different energy sources
- Regional variations in energy costs
- Not widely adopted

Decision to Update

- June 2005 Canadian Commission on Building and Fire Codes (CCBFC) meeting
  - NRCan presentation and request for update
- Motion
  - "Moved … and seconded … that CCBFC supports, as a first phase, the work on the technical basis for the development of the revisions to the MNECB as a progeny document on condition that the necessary support and funding for the project is provided from NRCan and/or others."

Decision to Update

- Building Energy Codes Collaborative (BECC)
  - business plan
  - P/T support
  - funding from NRCan
- February 2007 CCBFC meeting
  - "Moved by …, seconded by …, that the updating of the MNECB as a progeny document based on the BECC business plan be approved, subject to:
    - the process to develop the document would follow the policies and procedures of the Commission
    - the work would not compromise the capacity to complete the current and ongoing priorities of the coordinated codes development system"

NECB 2011

- Standing Committee on Energy Efficiency in Buildings (SC-EEB) formed in 2007
- First meeting in December 2007
- Task groups
  - Building Envelope
  - HVAC and Service Water Heating
  - Lighting and Power
  - Performance Compliance
  - Code Consolidation

NECB 2011

- Objective-based
- Energy used by the building
- Paths of compliance
  - Prescriptive path
  - Trade-off path (within the Part)
  - Performance path
- Simple payback approach
- Energy target

Task Group on Building Envelope

- Air leakage requirements are being introduced for building envelope assemblies
- Maximum overall thermal transmittances (U-values) will not differ for different types of construction
  - will be one U-value for roofs, one U-value for opaque walls, one for vertical glazing, etc.
- Thermal requirements categorized by climate zone, defined by heating degree days – six Canadian climate zones
- Thermal requirements will be fuel source neutral

Task Group on Building Envelope *(cont'd)*

Existing Provisions

Table A-3.3.1.1.(1)
Prescriptive Requirements – Above-ground Building Assemblies
Forming Part of Sentence 3.3.1.1.(1)

Assembly Description	Principal Heating Source		
	Electricity, Other	Oil, Propane, Heat Pump	Natural Gas
	Maximum Overall Thermal Transmittance (U-value), W/m^2 ºC		
Roofs			
Type I - attic-type roofs	0.140	0.200	0.200
Type II - parallel-chord trusses and joist-type roofs	0.230	0.230	0.230
Type III - all other roofs (e.g., concrete decks with rigid insulation)	0.290	0.410	0.470
Walls	0.330	0.480	0.550
Floors			
Type I - parallel-chord trusses and joist-type floors	0.220	0.220	0.220
Type II - all other floors (e.g., concrete slabs with rigid insulation)	0.290	0.410	0.470

Task Group on Building Envelope *(cont'd)*

Proposed Approach

Assembly Description	Principal Heating Source		
	Electricity, Other	Oil, Propane, Heat Pump	Natural Gas
	Maximum Overall Thermal Transmittance (U-value), W/m² ºC		
Roofs		x	
Type I - attic-type roofs	0.140	0.200	0.200
Type II - parallel-chord trusses and joist-type roofs	0.230	0.230	0.230
Type III - all other roofs (e.g., concrete decks with rigid insulation)	0.290	0.410	0.470
Walls		x	
Floors		x	
Type I - parallel-chord trusses and joist-type floors	0.220	0.220	0.220
Type II - all other floors (e.g., concrete slabs with rigid insulation)	0.290	0.410	0.470

Task Group on Lighting and Electrical Power

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Lighting

- Lighting requirements are generally being harmonized with ASHRAE 90.1 2010
- Additional requirements for automatic control devices, including automatic daylighting controls
- Lighting power allowances for building exteriors will be introduced for more exterior lighting applications

Task Group on Lighting and Electrical Power *(cont'd)*

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Lighting *(cont'd)*

- Lighting Power Density (LPD) tables updated

Lighting Power Densities Using the Building Area Method

Building Area Type	W/m^2
Automotive facility	9.79
Convention center	11.30
Courthouse	11.51
Dining: bar lounge/leisure	10.87
Dining: cafeteria/fast food	10.01
Dining: family	10.11

Task Group on Lighting and Electrical Power *(cont'd)*

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Lighting *(cont'd)*

- LPD tables updated

Lighting Power Densities
Using the Space-by-Space Method

Common Space Types	LPD, W/m^2	Building-Specific Space Types	LPD, W/m^2
Office – Enclosed	x	Gymnasium/Fitness Centre	x
Office – Open Plan	x	Playing Area	x
Conference/Meeting/Multipurpose	x	Fitness Area	x
Classroom/Lecture/Training	x	Courthouse/Police Station/Penitentiary	x
For Penitentiary	x	Courtroom	x

Task Group on Lighting and Electrical Power *(cont'd)*

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Lighting *(cont'd)*

- Simple trade-off compliance path
  - quantify the impact of daylighting/daylight dependent and other controls
  - compare the overall lighting energy use of a building to a prescriptive baseline

Task Group on Lighting and Electrical Power *(cont'd)*

Electrical Power

- Few technical changes are proposed

Task Group on HVAC and Service Water Heating

- For **prescriptive path**, values for efficiency ratings, insulation thicknesses, etc., are being updated to minimum values listed in other standards and efficiency acts
- New requirements
  - maximum temperature set points for vestibules
  - more requirements for when cooling is installed
  - more requirements for heat recovery systems
  - requirements for solar thermal service water heating equipment

Task Group on HVAC and Service Water Heating *(cont'd)*

- For **trade-off path**, system efficiencies as opposed to individual component efficiencies – would include losses through the ducts and pipes
- For **compliance path**, criteria/systems that cannot be altered from the prescriptive or trade-off approaches

Task Group on HVAC and Service Water Heating *(cont'd)*

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Existing Provisions

Table 5.2.13.1.
Heating, Ventilation and Air-Conditioning Equipment Performance Standards
Forming Part of Sentence 5.2.13.1.(1)

Component	Cooling Capacity	Standard	Rating Conditions	Minimum Performance
Air-cooled unitary air-conditioners and heat pumps – electrically operated (Except packaged terminal air-conditioners and room air-conditioners				
Split-system	≤ 19 kW	CAN/CSA-C273-M (including General Instruction No. 4)		In Standard
Single package	≤ 19 kW	CAN/CSA-C656-M (including General Instruction No. 2)		
All phases	> 19 and < 73 kW	CAN/CSA-C746		
Air-conditioners, all phases	73 - 222.7 kW (250 000 - 760 000 Btu/h)	ARI 360		EER = 8.5(1) IPLV = 7.5(2)
	> 222.7 kW (760 000 Btu/h)			EER = 8.2(1) IPLV = 7.5(2)

Task Group on HVAC and Service Water Heating *(cont'd)*

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Proposed Provisions

System	Type	System Differential on	System Components	Minimum Component Efficiency	Minimum Total System Efficiency (per all of the minimum Components)	Notes
Heating	Forced air	Up to 225,000 Btu/h	• Heat source • Fan • Static press • Ducting • Controls • Terminal units • Insulation	• E_{hs} = 85% • E_f = • E_{sp} = • E_{du} = • E_c = • E_{tu} = • E_i =	SE_{fah} = 75% (85% x E_f x E_{sp} x E_{du} x E_c x E_{tu} x E_i)	Any other relevant info or comments go here; you can also include the relevant section of the MNECB here, i.e. see below

Task Group on HVAC and Service Water Heating *(cont'd)*

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System Efficiency Compliance Calculator				
Efficency Gain/Penalty:	**1.3%**	Reset Reference Settings		
Comliance:	**System is MNECB Compliant**			
System Type:	Built-up Variable Volume			
Location:	Montreal			
Components Efficiencies		**Units**		
Supply Fan	60.0%	%		
Supply Motor	91.7%	%		
Return Fan	37.5%	%		
Return Motor	80.0%	%		
Supply Temperature Control	Constant, below 15 oC	Selection		
Airflow Control	60.4%	%		
Supply Static Pressure	4.0	in. w.g.		
Supply Duct Leakage	5.0%	%		
Supply Duct Insulation	5.0	R-value		
Return Static Pressure	1.0	in. w.g.		
Heating Coil	20.0	°F		
Reheat Coils	20.0	°F		
Baseboards	6.0	°F		
Boilers	80.0%	%		
Cooling Coil	3.7%	°F		
Chillers	6.2	COP		
Heat Rejection	0.015	W/btuh		

Task Group on Building Performance Compliance

- Compliance will ultimately be based on building energy targets – for either 2011 version or subsequent
  - if use reference and proposed building approach, criteria/systems that are in the proposed building will be included in the reference building (e.g., cooling)
- Contents of supplement "Performance Compliance for Buildings" is being shifted to either the Code, the explanatory appendix to the Code, or a proposed users guide

NECB 2011

Stay tuned….

Energy Efficiency in Houses and Small Buildings

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- The Model National Energy Code for Houses (MNECH) was last published in 1997.
  - Has not been maintained since.
- Present development:
  - January 2008 – CCBFC Executive Committee reviewed a code change request to add an energy objective to the NBC.
  - Also received correspondence from CHBA in support of refurbishing the MNECH.

Energy Efficiency in Houses and Small Buildings

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- A Joint CCBFC/PTPACC Task Group was formed and recommend the following approach:
  - Follow application/scope of Part 9
  - incorporate technical requirements on Energy Efficiency into a separate section of Part 9 of the NBC.
  - include prescriptive requirements
  - Attempt to include performance targets
    - **use NRCan's EnerGuide for New Homes and MNECH 1997 as a resource.**

Energy Efficiency in Houses and Small Buildings

- Add energy efficiency in housing and small buildings to the Terms of Reference and work plans of SCEEB and SCHSB.
- A joint SCEEB and SCHSB task group will be formed to develop the technical requirements.
- Objectives and functional statements for buildings will be suitable for housing.
- Publish technical requirements as an interim change no later than 2012.

Energy Efficiency in Houses and Small Buildings

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- Will address:
  - Building Envelope
  - HVAC
  - Service Water Heating (?)
- Water use efficiency is currently being reviewed for inclusion.

Energy Efficiency in Houses and Small Buildings

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- Current Status:
  - Terms of Reference being drafted
  - Seeking volunteers for membership (from SCEEB, SCHSB and external)
  - First meeting to be held before end of the year.

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