NRC Canadian Codes Centre

2011 National Energy Code for Buildings (NECB) – Building Energy Performance Compliance Path

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Introduction

- Presentation is part of a series of seven
- Model code developed by Canadian Commission on Building and Fire Codes
- Must be adopted by provincial/territorial authorities to become law

Outline

- Scope and application
- Calculation method
- Calculation rules
  - Envelope
  - Lighting
  - Heating, ventilating, air conditioning and service water heating

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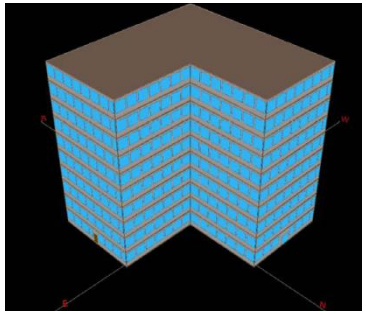
Scope

- Whole reference building built to prescriptive path
- Proposed building modeled against reference
  - Compliant if proposed building uses equal or less energy



Proposed

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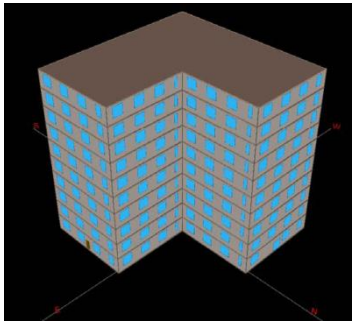
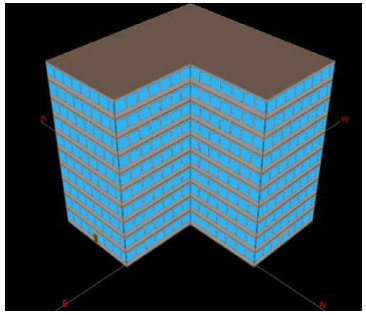


Reference

Scope

- *Building Energy Target* (BET): energy of the reference building
- *Annual Energy Consumption*: energy of the proposed building



Proposed

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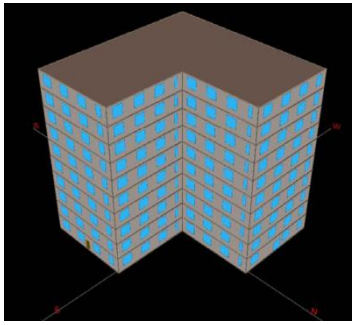

Reference

Application

- Based on prescriptive requirements +
  - Envelope
  - Lighting
  - HVAC and service water heating

Limitation

- Sufficient information must be known on
  - Building occupancy
  - Components, materials and assemblies

Limitation

- Envelope
  - Thermally active element above-grade requires insulation
    - Slab-on-ground permitted flexibility
  - Designed to avoid air leakage, wetting or moisture by-pass
- HVAC and service water heating
  - Equipment performance efficiency cannot be < required by Energy Efficiency Act

Renewable and process energy

- Flexibility by silence on process load and energy from renewable sources
  - Guidance provided in Appendix for inclusion
    - Industrial processes
    - Medical imaging equipment
    - Computer servers
    - Cooking appliances in commercial kitchen or restaurant
- No credit for efficiency of purchased energy

Outline

- Scope and application
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Calculation method

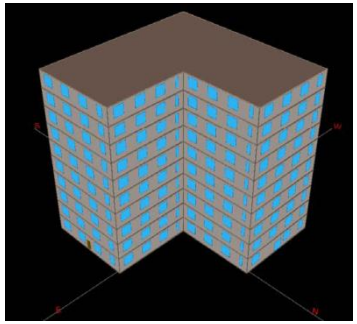
- Factors that calculation must account for
- Certain calculation steps that must be performed
  - e.g. verifying that heating load will be met
- In certain cases, the data that must be used

Required detail

- Hourly time step during one year
- 10 years of climatic data
- Account for
  - Effect of thermal mass
  - Space temperature
  - Heat transfer
    - Internal loads
    - Transfer of radiant and convective heat from lighting
  - Solar absorptance of opaque building assemblies
- Envelope assembly covering < 5% total assembly area need not be modeled separately

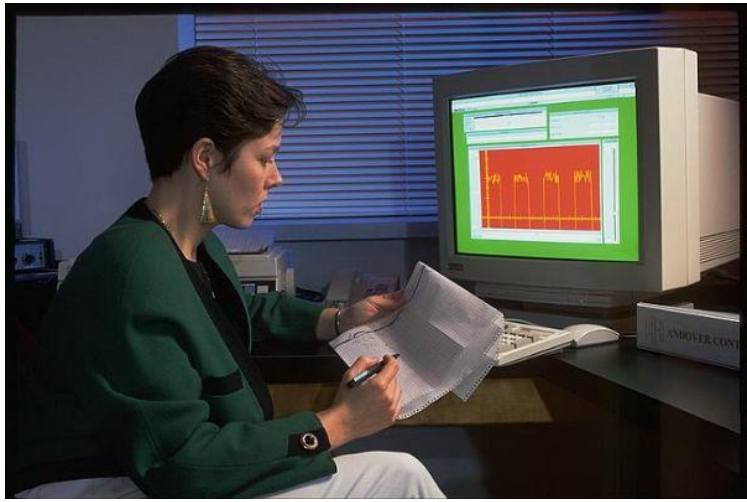
Reference identical to proposed building

- Floor area of conditioned space
- Building or space use
- Thermal blocks
- Shape and exterior dimensions
- Orientation
- Default schedules and loads due to number of occupants



User-dependant variables

- Defaults for user-dependant variables set equal in proposed and reference
  - Schedules
    - Building or space type
    - 24 hours, 7 days a week
  - Occupant density (m^2/occupant)
  - Service water heating loads (W/person)
  - Receptacle loads (W/m^2)



Semi-heated building

- Reference building internal temperature set to 18°C
  - Heating equipment capacity to no more than proposed building's peak heating load plus 5%
- Proposed building internal temperature as per design

Compliance calculation

- Framework for compliance calculation provided – no software specified
  - Flexible to allow use of various tools
- Compliance supplement calculation moved into code
  - User guide material and software manual to contain guidance not appropriate as code material

CAN QUEST

***Energy*PLUS**

EE4

eQUEST

DOE-2

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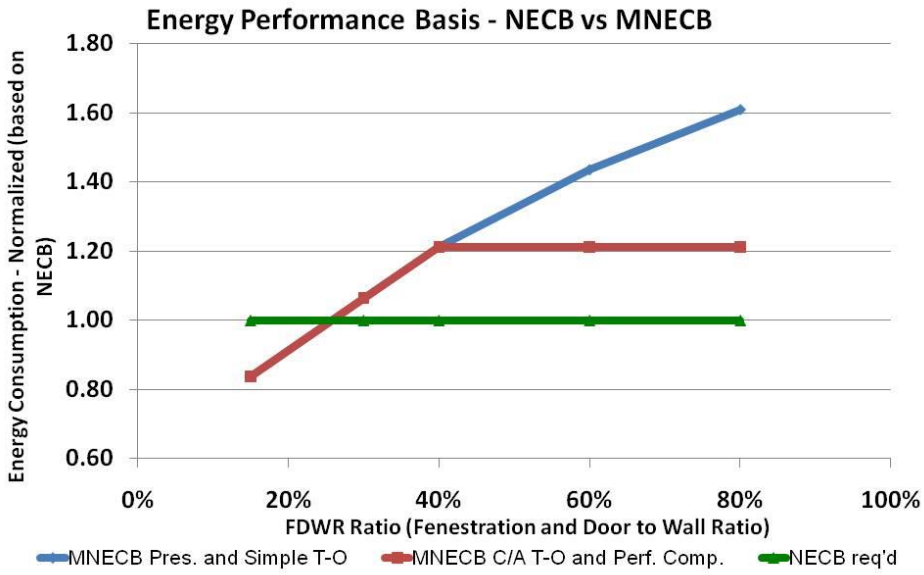
Envelope – change in prescriptive criteria

- Removed
  - Exemptions based on assembly type
  - Differentiation based on fuel type or region
  - 167% increase of thermal transmittance limitation
- Replaced
  - FWR with FDWR (% window to % window and doors)
  - Prescriptive based on climatic region



Thermal characteristics – credit provided

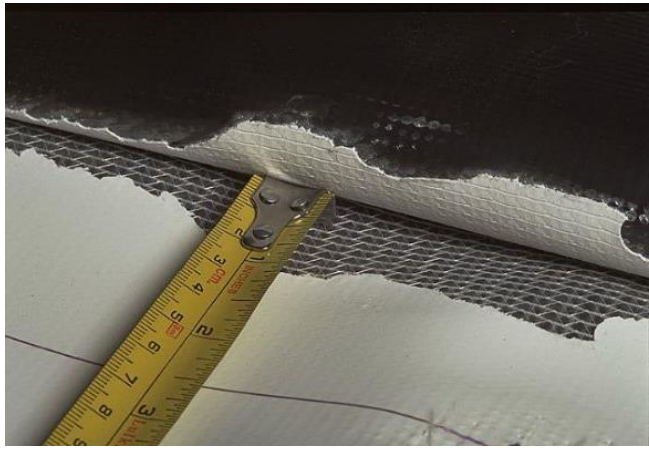
- Reference set to prescriptive
  - Opaque building assemblies (walls, roofs and floors)
  - Fenestration
  - Requirement for vestibules
  - Continuity of insulation
- Proposed building as per specification

Envelope – credit optional

- Thermal mass
  - Light for reference building
  - Proposed is as specified
- Roof solar absorptance
  - If proposed is known, 0.7 for reference building
  - If proposed not used, same in both buildings
- Exterior permanent shading devices
  - None for reference building
  - As per design for proposed building

Envelope – no credit

- Whole building air leakage: 0.25 L/(s•m2) – same in both
- Exterior shading by tree or other structure – same in both



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Lighting – credit provided

- Interior, site and exterior lighting power density
  - Reference building as per prescriptive requirement
  - Proposed building as specified
- Occupant sensors
  - 10% credit
- Daylighting
  - Use trade-off if none in software used

Lighting – no credit

- Lighting density in dwelling units not mandated in Part 4
  - 5 W/m^2 increased allowance for dwelling units

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System selection

- Based on space function or building type
- System selection table

Building or Space Type of the Proposed Building	Size of Building or Space	Type of HVAC System Required
Sleeping Area: dormitory, detention cell, sleeping quarters	All sizes	System - 3
Data Processing Area: control room, data center	All sizes	Where the proposed building or space has a cooling capacity exceeding 20 kW, the reference building or space shall use System - 2;otherwise, the reference building or space shall use System - 1

System types

- Seven system types to represent reference, based on current practice
- ‘Fuel neutral’ means same as proposed building

System Number	Type of HVAC System	Fan Control	Type of Cooling System	Type of Heating System
System - 1	Unitary air-conditioner with baseboard heating	Constant - volume	Air-cooled direct-expansion with remote condenser	Hot water with fuel-fired water boiler or electric resistance baseboard
System - 2	Four-pipe fan-coil	Constant - volume	Water-cooled water chiller	Fuel-fired or electric resistance water boiler
System - 3	Single-zone packaged rooftop unit with baseboard heating	Constant - volume	Air-cooled direct-expansion	Fuel-fired or electric resistance furnace for rooftop, hot water with fuel-fired boiler, or electric resistance for baseboards

Ventilation – credit provided

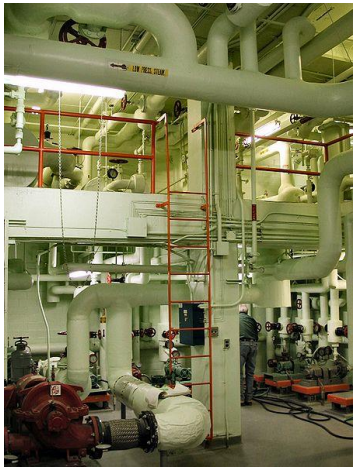
- Heat recovery credit above Part 5 requirement
  - Central exhaust > 150 kW, above 50% efficiency
  - Any in dwelling units with self-contained ventilation in climatic zones 4, 5 and 6
- Ventilation
  - Reference constant volume, except general area type > 2 storeys
- Cooling with outside air above Part 5 requirements

Radiant systems – credit provided

- In-floor, in-ceiling or in-wall radiant systems modeled with 2˚C difference in temperature set-point (e.g. heating to 21°C versus 19°C)

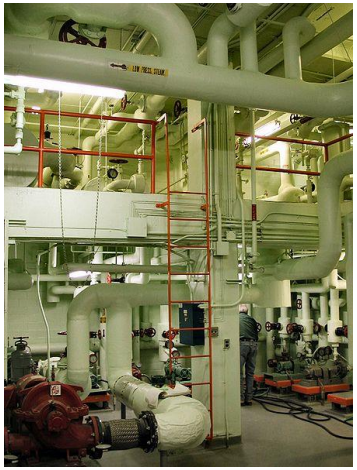
Equipment operation – credit optional

- Oversizing addressed
  - Reference heating equipment not oversized by > 30%
  - Reference cooling equipment not oversized by > 10%
- Part load performance characteristics
  - Reference defaults provided
  - Proposed as specified can be used



Other – credit optional

- Heating system
  - Constant speed pumping
  - Hot water supply temperature reset
- Cooling system
  - For hydronic, number of chillers based on plant size
  - For direct expansion, number of stages based on size
  - For cooling tower, number of cells based on size
  - Temperature drops
- Fan part load performance characteristics



HVAC & SWH – no credit

- Outdoor air rate same
  - Except for displacement ventilation
  - Demand control ventilation for heated parking garages
- Space temperature throttling of 1˚C
- Service water
  - Supply and storage tank temperature
  - Number of water heaters
- Priority order for use of equipment with multiple energy type systems provided
  - Match reference with proposed

Summary

- Reference building linked to prescriptive requirements
- More consistent reference
  - Introduction of FDWR based on HDD
  - HVAC selection based on building type
- Most flexibility and detail of all compliance paths in acceptable solutions

Questions?

www.nationalcodes.nrc.gc.ca

Thank you