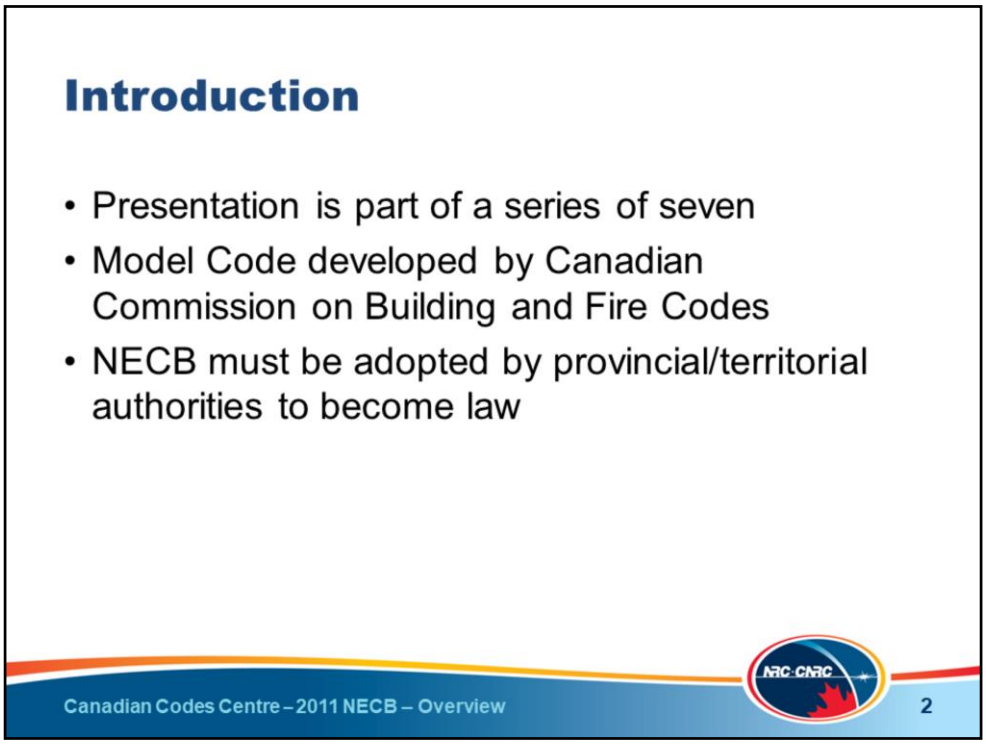
Welcome.

My name is Cathy Taraschuk.

This is the first in a series of presentations that provide a significant amount of detail regarding the approach used in developing the requirements for the 2011 National Energy Code of Canada for Buildings (NECB). It will provide an overview of the NECB'S content, the approach taken, and the reasons for that approach.



This presentation is part of a series of 7 on the 2011 NECB.

It is important to note that the NECB is a model code developed by the Canadian Commission on Building and Fire Codes, with technical support and funding provided by the National Research Council and Natural Resources Canada. The NECB must be adopted by provincial and territorial authorities in order to become law.

This means that Code requirements enacted by legislation within your province or territory might differ from what is presented here. Please check with your local authority.

First, some terminology.

References to the 1997 Model National Energy Code of Canada for Buildings will be shortened to MNECB. References to the edition just published, which is titled National Energy Code of Canada for Buildings 2011, will be shortened to NECB. The key difference indicator is the "M", which has been dropped for the 2011 edition to be consistent with our other model codes (National Building, Fire and Plumbing Codes).

SCEEB is the Standing Committee on Energy Efficiency in Buildings.

CCBFC is the Canadian Commission on Building and Fire Codes.

PTPACC is the Provincial/Territorial Policy Advisory Committee on Codes.

MNECB – use

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

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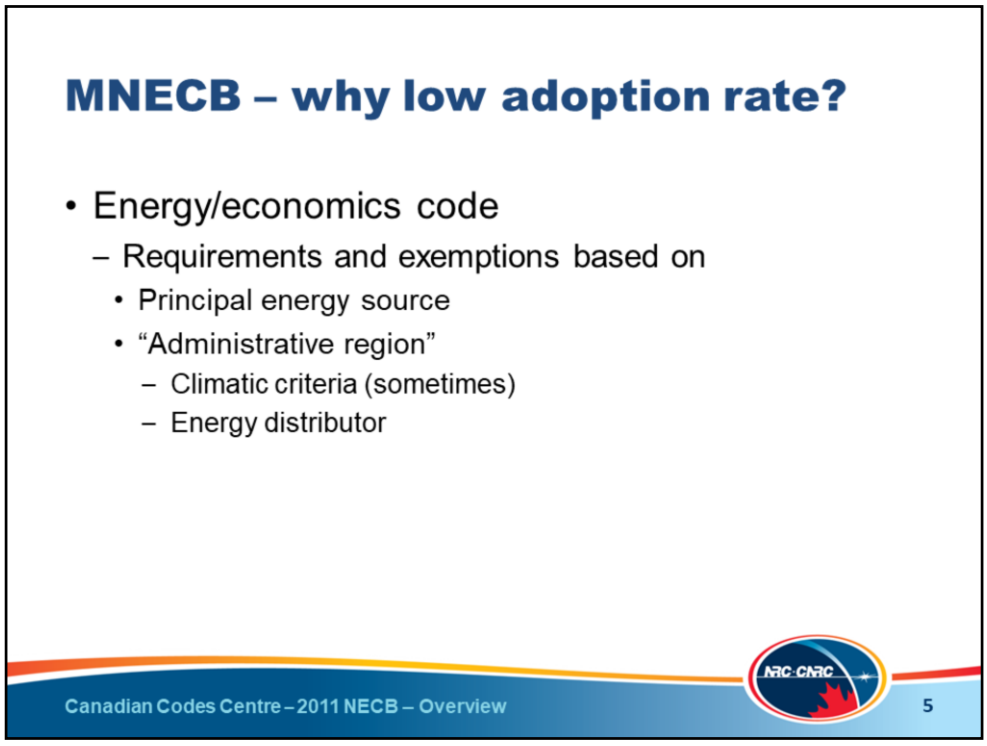
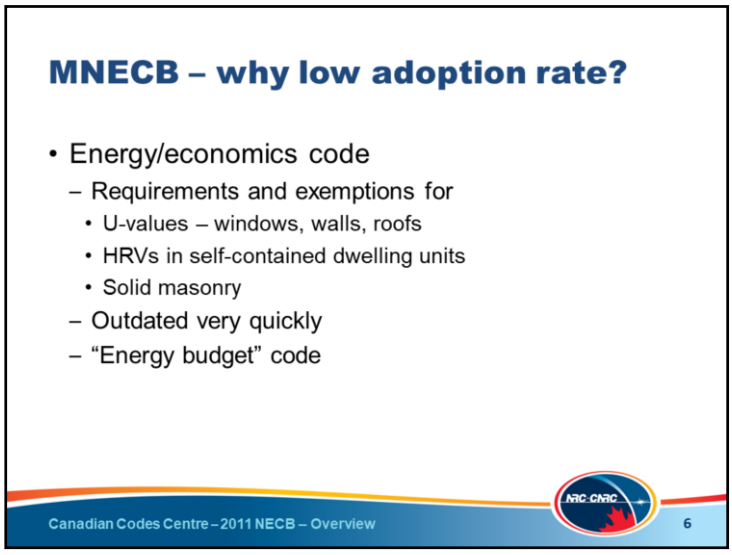
The MNECB was not adopted to any great degree by the provinces and territories, but it was referenced in the Ontario Building Code. A number of government, utility, and private sector programs used the MNECB as a complement to incentive programs and to establish a baseline for new energy-efficient building design. These programs included NRCan's Commercial Building Incentive Program (CBIP), utility and other programs in BC, Manitoba, New Brunswick, Ontario and Quebec, and LEED® Canada.



The first step in the updating process for the Standing Committee on Energy Efficiency in Buildings (SCEEB) was to try and determine why the MNECB had not been more widely used.

The SCEEB reviewed the MNECB and concluded that it was both an energy and an economics-based code. It had certain requirements and exemptions that were based on the principal energy source used and on the "administrative" region. The "administrative" regions were defined for each province and territory. For some, there was only one defined region. Some used the HDD (heating degree-days) as the boundary definition for regions, while others added the energy distributor as one

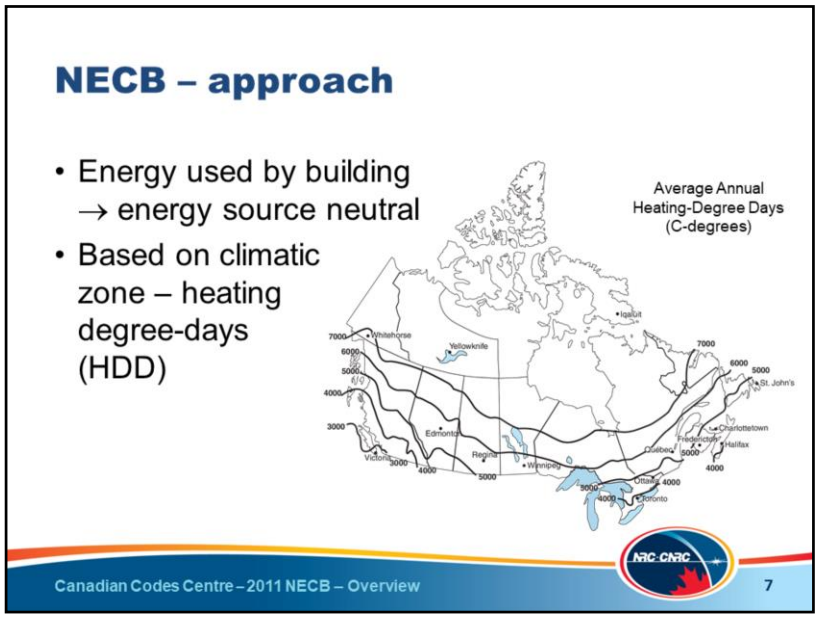
of the criteria for defining a region.



We will now discuss which components and assemblies had requirements that varied depending on energy source and/or administrative region. The U-values (which are related to the insulation values) for windows, for walls and for roofs varied depending on both the energy source and the administrative region. This U-value requirement was, in large part, based on economic considerations using the cost of the energy source at the time in a life-cycle costing analysis.

Requiring or exempting self-contained residential units from having heat recovery ventilators (HRVs) was based on a similar analysis, but rather than varying in magnitude, HRVs were either required or not. Finally, solid masonry walls, defined as being single wythe or multiple wythe construction with no void between the wythes, were exempt from having to be insulated in some regions and for some energy sources. The economic analysis does not appear to have been the primary basis for this exemption.

This “codification” of economics was seen to be one of the weaknesses of the MNECB. The economics used to establish requirements very quickly became outdated; some say it was outdated even before the MNECB was published. Also, it was not seen to be an “energy” code per se, but rather an “energy budget” code.



The SCEEB, after dialogue with the CCBFC, agreed with the principle that the NECB would be an energy code that focused on energy used by the building. It would not "codify" the economics, but a cost analysis would be carried out and included in the rationale of each proposed change, as is the case with all proposed changes to the National Model Codes. The NECB cost analyses would be shown as incremental capital costs and annual energy savings using a baseline of 2009 construction practices that were in effect at the time of the NECB's updating.

So, two of the primary differences between the NECB and the MNECB are that none of the NECB requirements are based on energy source and cost is not "codified" in the NECB. Also, there is no differentiation in requirements based on administrative region: requirements are set based on climate zone using the heating degree-day of the location.

Here you see the map of the HDD zones in Canada.

NECB – approach

- Silent on renewable, waste and site-generated energy
  - Wide variety of technology
  - Not place barriers for their use
  - Reference standards for use, not efficiency

Renewable energy sources encompass a wide variety of technologies. Depending on the context, they can be defined to include waste and site-generated energy . There are inherent difficulties with assigning a definition to these terms that might be acceptable to all provincial and territorial jurisdictions.

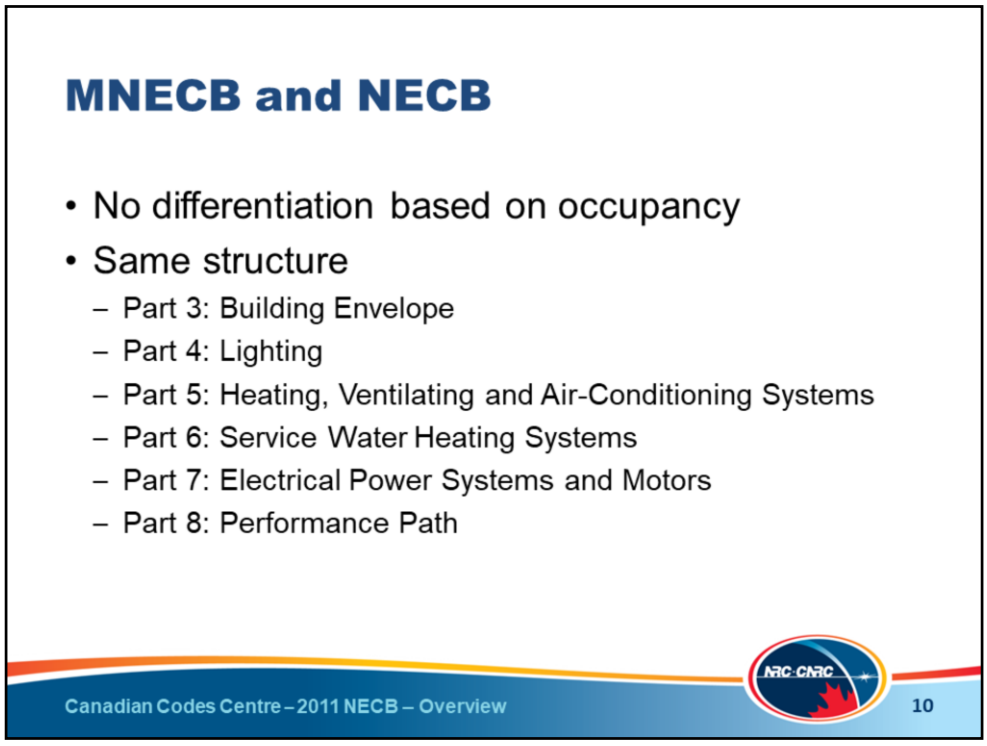
The NECB prescriptive requirements therefore do not mandate or give credit for renewable energy. Instead, the approach has been to reference a standard on the installation of a renewable technology when it is being proposed for a building. The intent of this is to not impose barriers on the use of renewable and alternative energy sources.

This approach leaves it to the discretion of the authorities having jurisdiction to consider proposals using renewable energy via the building energy performance path.

The NECB is also silent on process loads. Examples of process loads include heat generated from centralized computer servers, commercial cooking and refrigeration equipment and industrial processes. Very high process loads have an impact on heating and cooling loads. The NECB HVAC and SWH prescriptive compliance options generally do not mandate or give credit for process loads.

Two exceptions are swimming pools and ice surfaces (arenas or curling rinks), which were also covered in the 1997 Model National Energy Code for Buildings (MNECB) and are discussed in the specific presentations addressing them.

To permit greater flexibility with process loads, guidance is provided in the building energy performance compliance option of the code.

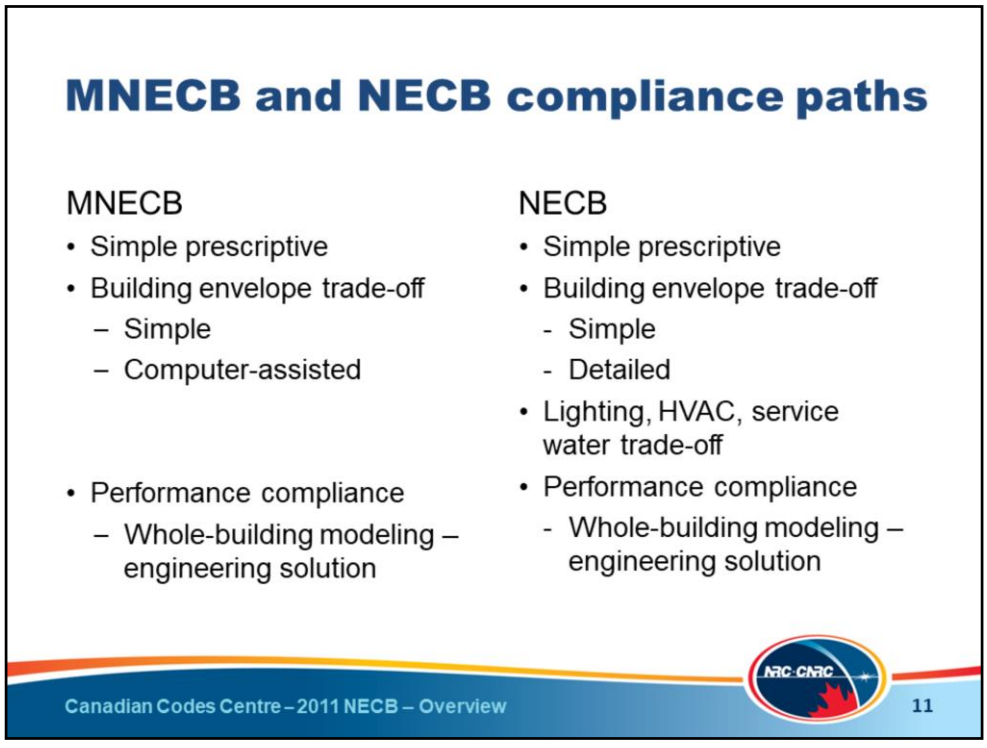


There are many parallels between the MNECB and the NECB. For example:

• Neither Code differentiates requirements based on occupancy, and

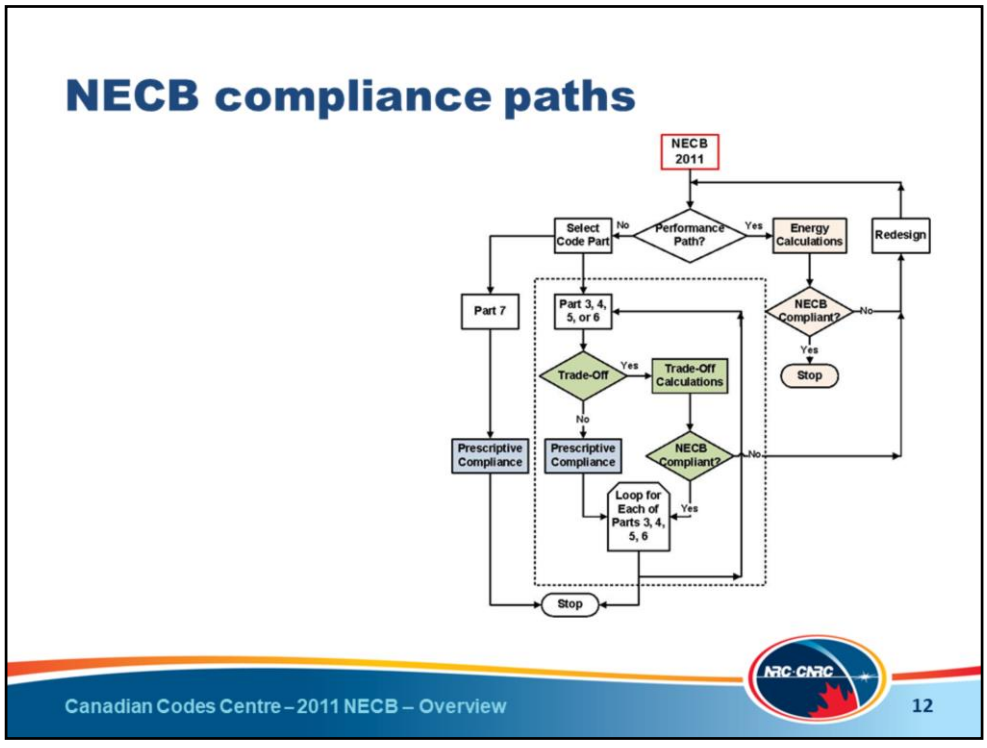
• Both Codes are structured in the same way, with separate Parts that address:

- building envelope
- lighting
- HVAC
- service water heating
- electrical power systems, and
- performance compliance.

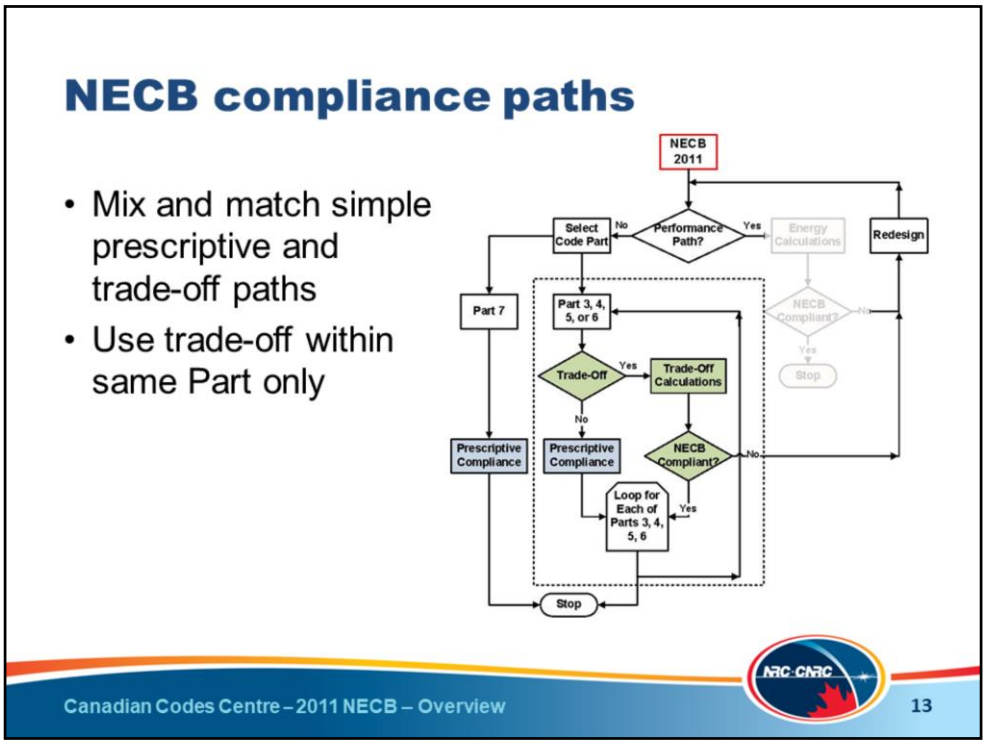


Both Codes have basic prescriptive requirements in each Part and a performance compliance path that is an engineering whole-building modeling approach.

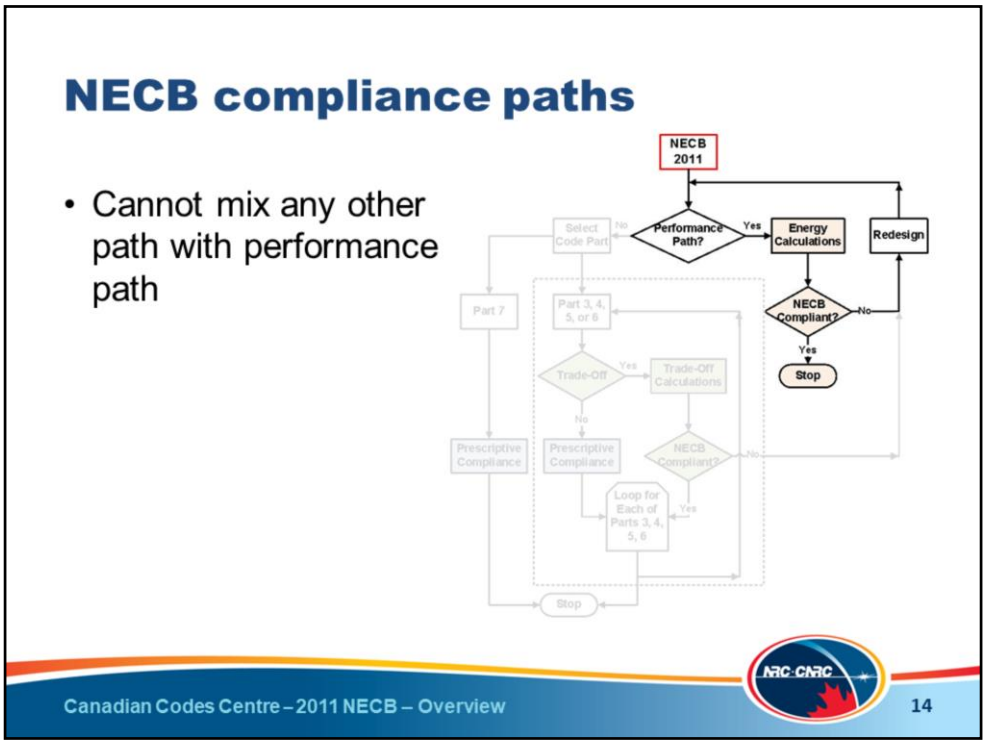
The NECB has added flexibility over the MNECB in that the MNECB had a trade-off method for the building envelope only. The NECB has a trade-off method for the building envelope, HVAC systems, service water heating systems, and lighting. The overall restriction with using the trade-off methods is that the designer can only trade off within the Part, not between Parts. As with the MNECB, the NECB has two trade-off paths for the building envelope – a simple trade-off and a detailed trade-off.



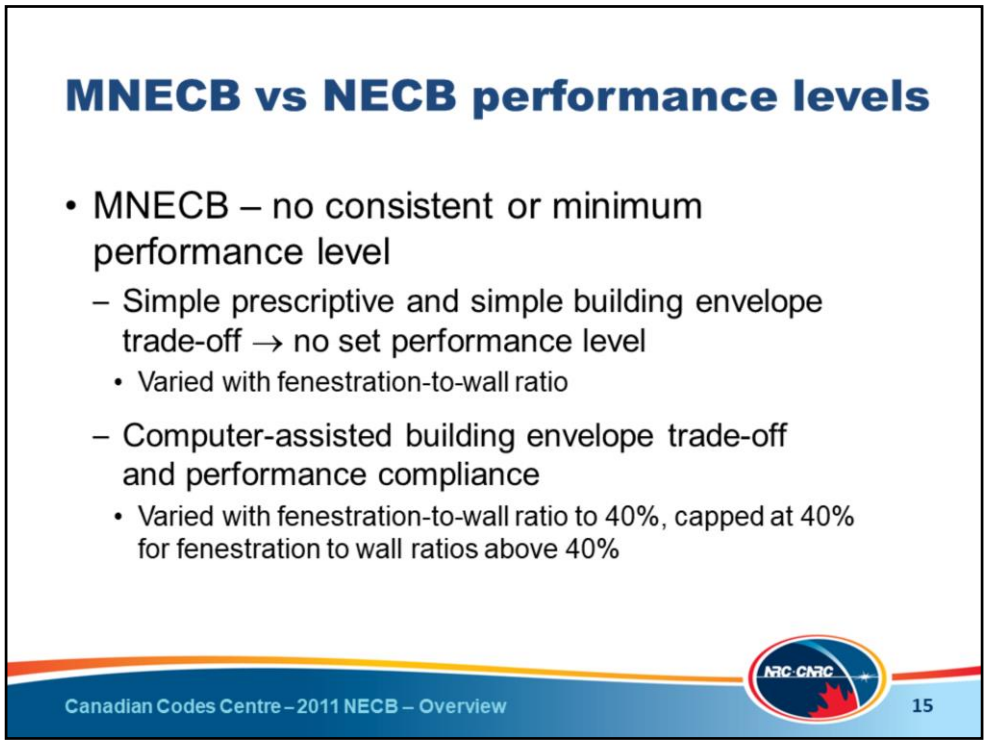
Let's discuss the compliance methodologies available to the designer. Here you see a simplified flowchart showing the compliance path options.



The designer can use any of the simple prescriptive or trade-off options available in each Part or a mix of simple prescriptive for some components and trade-off for others. Note that the trade-off option is Part-specific, i.e. component performance cannot be traded between Parts.

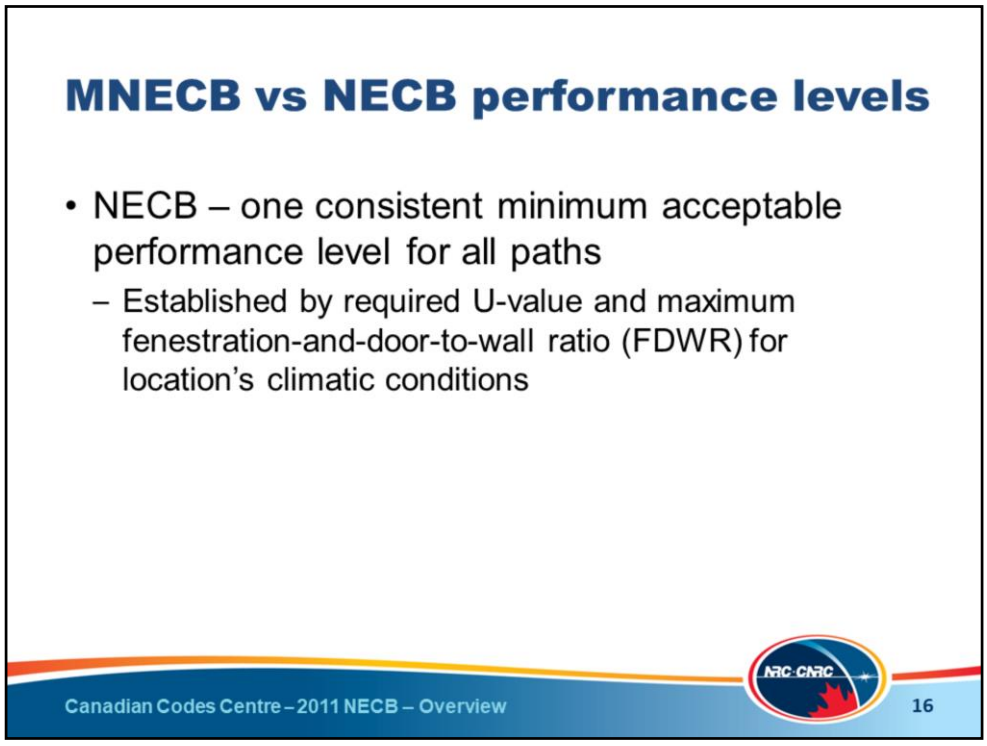


The performance compliance path is based on whole-building modeling, so if that path is chosen, then all building parameters are designed using that path. That is to say, the simple prescriptive and trade-off paths cannot be used at all for any building parameter if the performance compliance path is used.



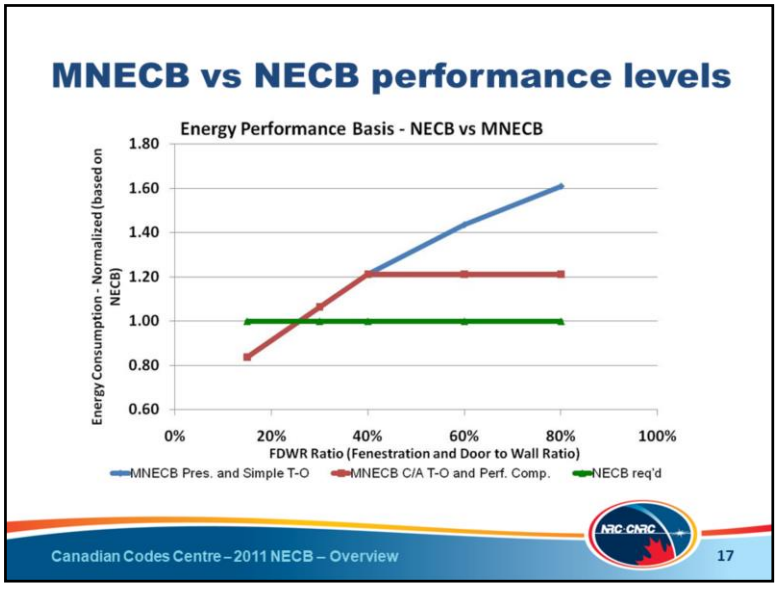
The MNECB had very different performance levels depending on the compliance path that was applied. The simple prescriptive path for the building envelope did not set any minimum performance level. U-values for opaque building envelope assemblies did not decrease (i.e. become more stringent) as the amount of fenestration increased. The simple building envelope trade-off path in the MNECB did not set a minimum performance level either.

However, the detailed building envelope trade-off did have a higher performance requirement for fenestration-to-wall ratios less than 40%, but set a minimum level for fenestration-to-wall ratios greater than 40% at the 40% level. The MNECB performance compliance option did the same.

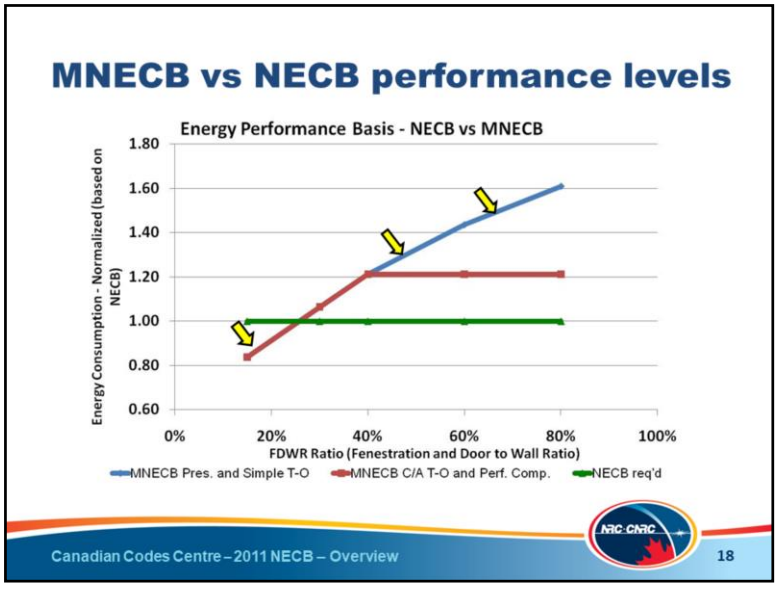


The NECB sets consistent performance levels for all paths of compliance, i.e. prescriptive, trade-off and performance.

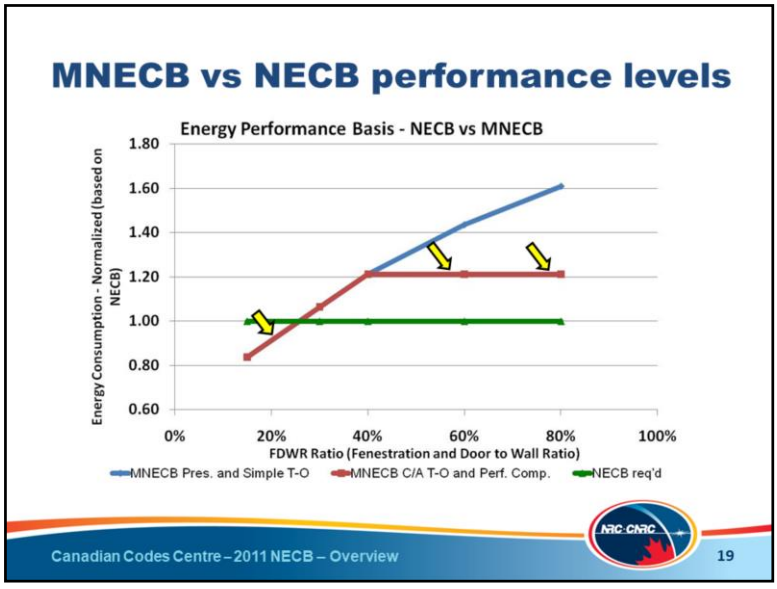
That level is, in large part, derived from the required U-value and maximum fenestration-and-door-to-wall ratio for the climatic conditions at the building's location.



In this graph, you can see the comparison between the general performance levels set in the MNECB versus those set in the NECB.

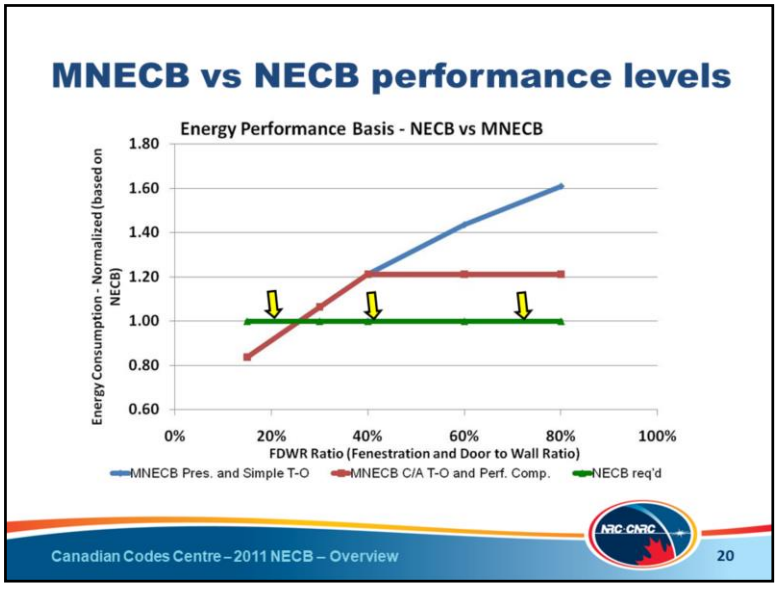


The prescriptive and simple building envelope trade-off paths in the MNECB use a set of tables that prescribe the required U-values of windows and opaque walls based on the fenestration-to-wall ratio. The maximum U-values for the opaque walls do not vary with the fenestration-to-wall ratio. For fenestration-to-wall ratios up to 40%, the U-values for windows remain at the 40% levels while for ratios above the 40% level, the window U-values decrease. The blue line in the graph illustrates the resulting trend, i.e. that the amount of energy a Code-compliant building can consume varies with the total area of windows in the building.

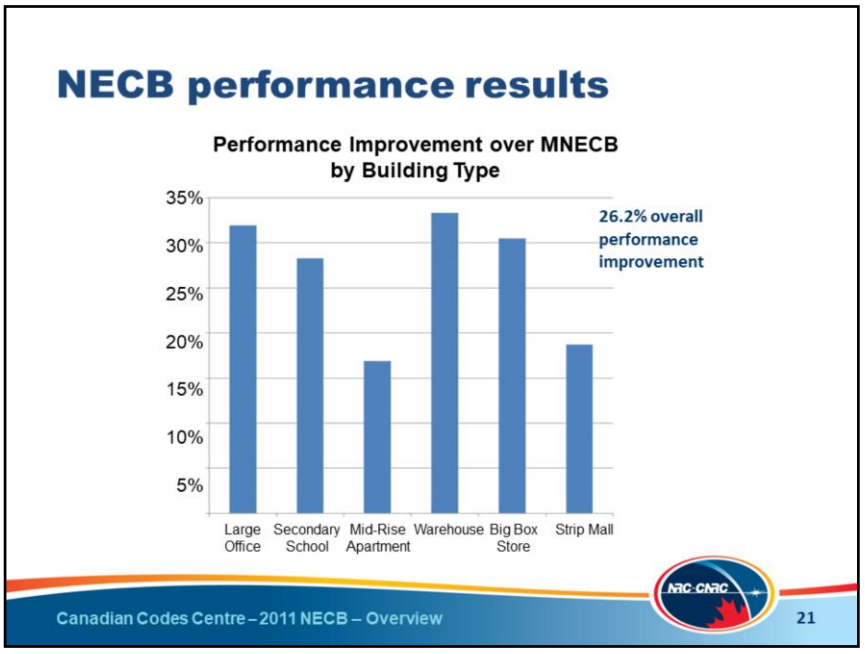


The computer-assisted building envelope trade-off and the performance compliance paths in the MNECB both set the performance levels for fenestration-to-wall ratios of 40% or less that are consistent with the simple prescriptive approach, resulting in a performance level that varies with the total area of windows. For fenestration-to-wall ratios greater than 40%, these two paths cap the acceptable energy consumption at the level that would be used by a building with a fenestration-to-wall ratio of 40%. This is illustrated by the red line in the graph.

The means by which a building could be compliant with the MNECB's simple prescriptive or simple building envelope trade-off paths may not be acceptable if the building were analyzed by the computer-assisted building envelope trade-off or the performance compliance paths.



The NECB's prescriptive path prescribes a maximum energy consumption in large part through the application of the FDWR and the U-values. All other compliance paths – for example the building envelope trade-off paths, the HVAC trade-off path, the performance compliance path – effectively assess the proposed building against the energy consumption of the simple prescriptive building. The result is one consistent prescribed minimum energy performance level for all options as shown by the green line in the graph.

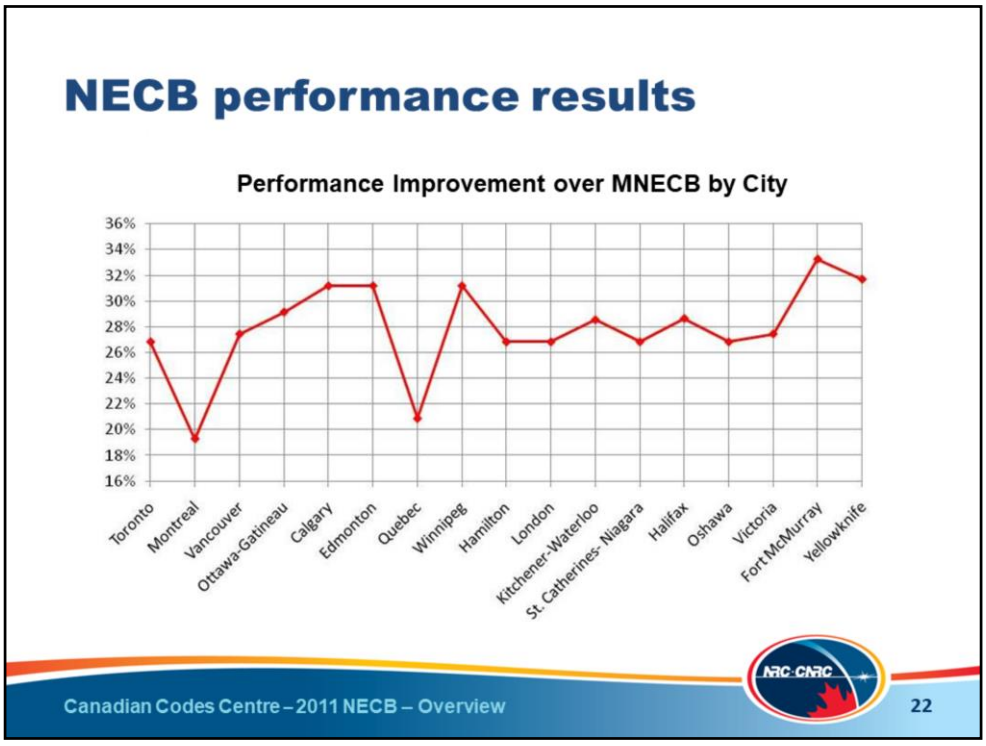


The overriding mandate in updating the NECB was to set performance levels that are 25% higher than those in the MNECB, i.e. to establish requirements that achieve 25% less energy use by the building than the MNECB requirements did.

Here you see the results of a prescriptive building energy consumption analysis based on archetypes from 6 building types: office, school, multi-unit residential, warehouse, big box store and strip mall.

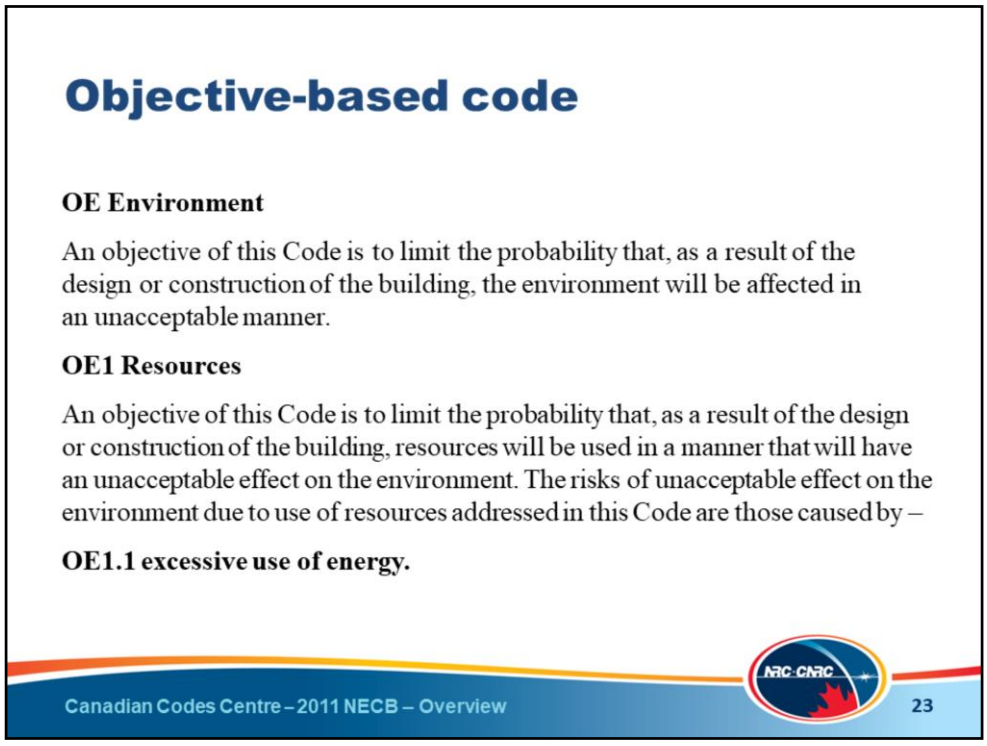
The analysis was carried out using a blended energy rate of natural gas and electricity. It was weighted based on the population of the 13 most populous metropolitan areas in the country. The general increase in overall energy performance level

achieved by the NECB compared to the MNECB is approximately 26.2%, or in other words, an NECB-compliant building consumes 26.2% less energy than an MNECB-compliant building.



This graph shows the overall increase in performance for several cities.

You will note that Montreal and Quebec City have lower overall performance improvements going from the MNECB to the NECB. This lower performance level increase is due to the fact that the Province of Quebec had more stringent energy requirements in the MNECB and so a higher performance level was used as the starting point in the comparison.



Lastly, the NECB is an objective-based code with an associated energy-efficiency objective and related functional and intent statements.

Here you see the nested objectives that were developed by the CCBFC in close consultation with the PTPACC.

This concludes the overview of the 2011 NECB.

Thank you