NRC·CNRC

Net Zero Energy Codes in Canada

goals, status and research

ACEEE Washington DC

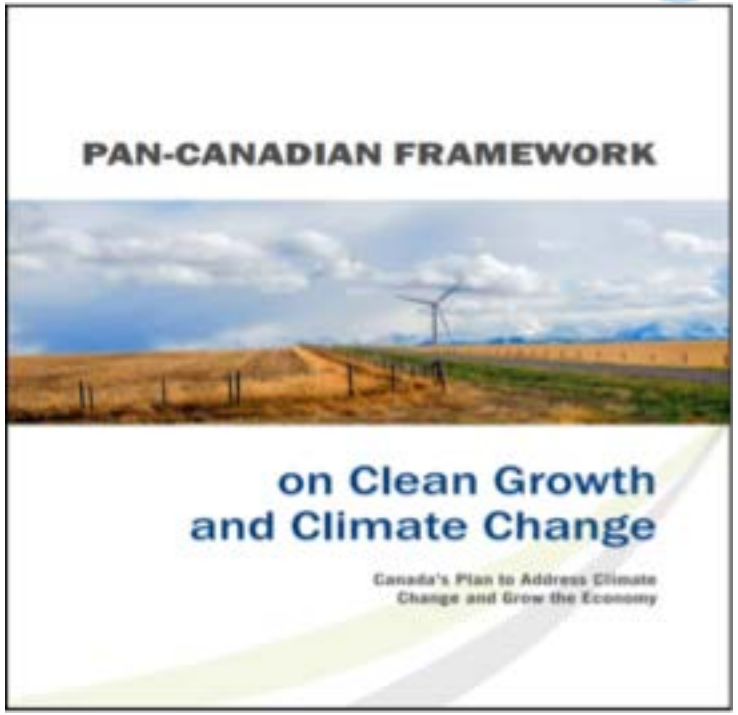
26 June 2018

National Research Council Canada

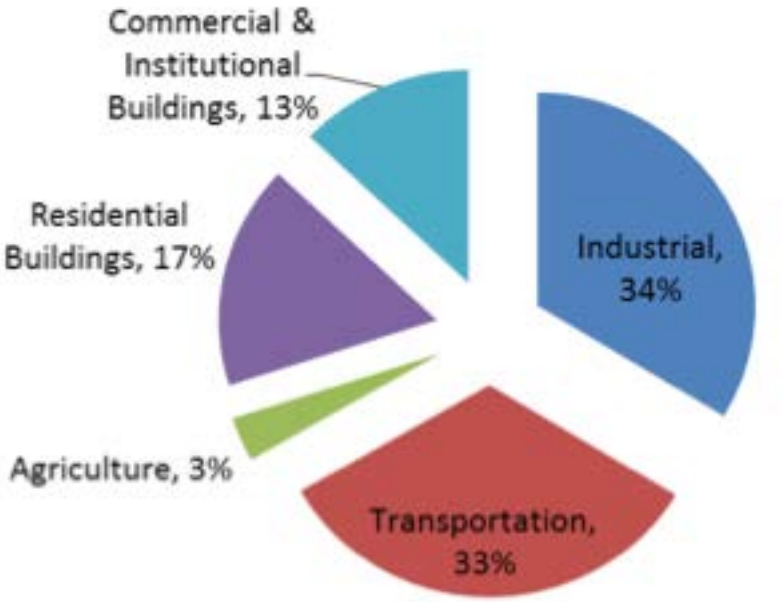
- $900 Million Budget
- Over 3,500 employees
- Operating in every province in Canada
- 100 Year of Innovation with Global Reach

Pan-Canadian Framework

Provinces and Territories adopt a net-zero energy ready building code for new construction by 2030 and agree to improve energy efficiency of existing housing and buildings



Energy Use and Policy in Canada



- Aligned F/P/T emission targets with cap and trade
  - 17% below 1990 levels by 2020, 40% by 2030 and 80% by 2050
- Buildings are important
- Existing stock: retrofitted
- New stock: built above target

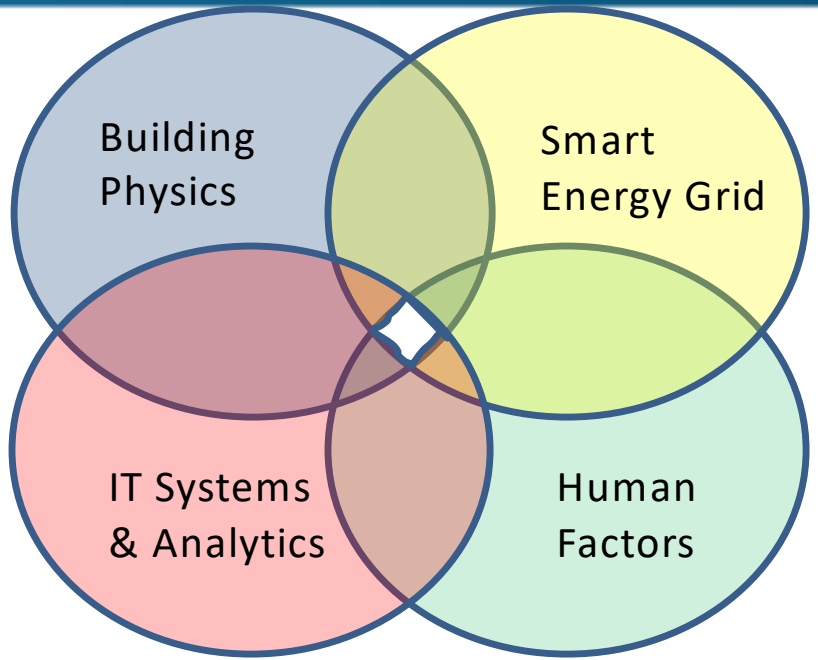
Emission targets are only achievable by retrofitting existing stock

Source, http://www.statcan.gc.ca/pub/57-003-x/2016002/t010-eng.pdf

High Performance Buildings (HPBs) Have Multiple Value Propositions

Lower Emissions

Lower Energy Costs



Lower O&M

- Lower plug loads
- Higher Productivity

HPBs also require a multi-disciplinary approach to buildings and broader set of competencies

NRC & OAA Office Net-Zero Retrofit

- Pre/Post-retrofit evaluation
- Design challenge function
  - Energy modelling
  - Material testing
- Product selection
  - Matching opportunities with new technologies
  - Technical spec's for RFPs
- Best-practice guides

EUI demand: ~65 kWh/m^2
matched by renewable generation.
Zero carbon.

NZEB Take-Aways

Form
- Low-rise with large roof area
- Minimise loads & optimise for renewables

Technology
- Off the shelf – no silver bullets

Performance
- Cost typically more than conventional
- Payback may be longer than equipment life
- Energy performance very much better than “code”
- No Canadian buildings achieved NZE goal (yet)

More than 160 NZEBs in USA – In Canada, it’s more difficult

Some Recent and Emerging Technologies

Dynamic Building Envelope

- PV: building integrated + thermal, racked bifacial, micro inverter
- Dynamic glazing & durable low-e coatings
- Super insulators (vacuum panels and glazing)

Smart Building Environmental Controls

- Human-centric LED-lighting & HVAC
- Embedded and printable sensors

Connecting Smart Buildings to Smart Grid

- Energy analytics, remote auditing, disaggregation
- Automated fault detection & prognostics
- Building-level integration with optimised control
- Smart Grid interaction including arbitrage

New HPB technologies promise shorter payback

Model Codes Development Process Context

Technology Development & Validation

Incentives & Voluntary Programs

R-2000

Code Requirements Development & Validation

Wide Scale Industry Application

R & D

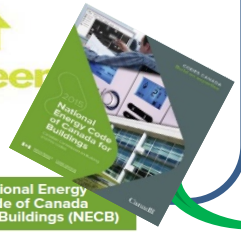
ENERGY STAR

ENERGUIDE

Canadian Home Builders' Association

Model Code Development & Publishing

BuiltGreen



Adoption by PT's

CODES CANADA

- **75 years of collaboration and partnership between Provinces and Territories, NRC and the independent Canadian Commission on Building and Fire Codes**
  - Open & transparent model codes development
  - Regulatory impact analysis for all changes
  - Funded by governments and codes sales
  - Research and evidence-based codes
  - Consensus-based decision making
  - Bilingual documents

CODES CANADA 2015 Build on expertise

New Ideas & Products = Code Change Requests

+1,000 Committee Members = Broad, Balanced, Diverse Expertise

CODES CANADA

Annual Public Reviews = Checks & Balances

Consensus Based Decision Making = Effective Regulations

Proposed Changes

The **new model codes** enhance the **health and safety of Canadians**, address **accessibility** and improve **energy and water-use efficiency** by providing effective **regulatory solutions** for authorities.

National Building Code of Canada (NBC)

National Fire Code of Canada (NFC)

National Energy Code of Canada for Buildings (NECB)

National Plumbing Code of Canada (NPC)

NRC will offer online presentations on the **technical changes** starting in early 2017.

Visit **CodesCanada.ca** for more details!

Canada's National Research Council | Conseil national de recherches du Canada

Canada

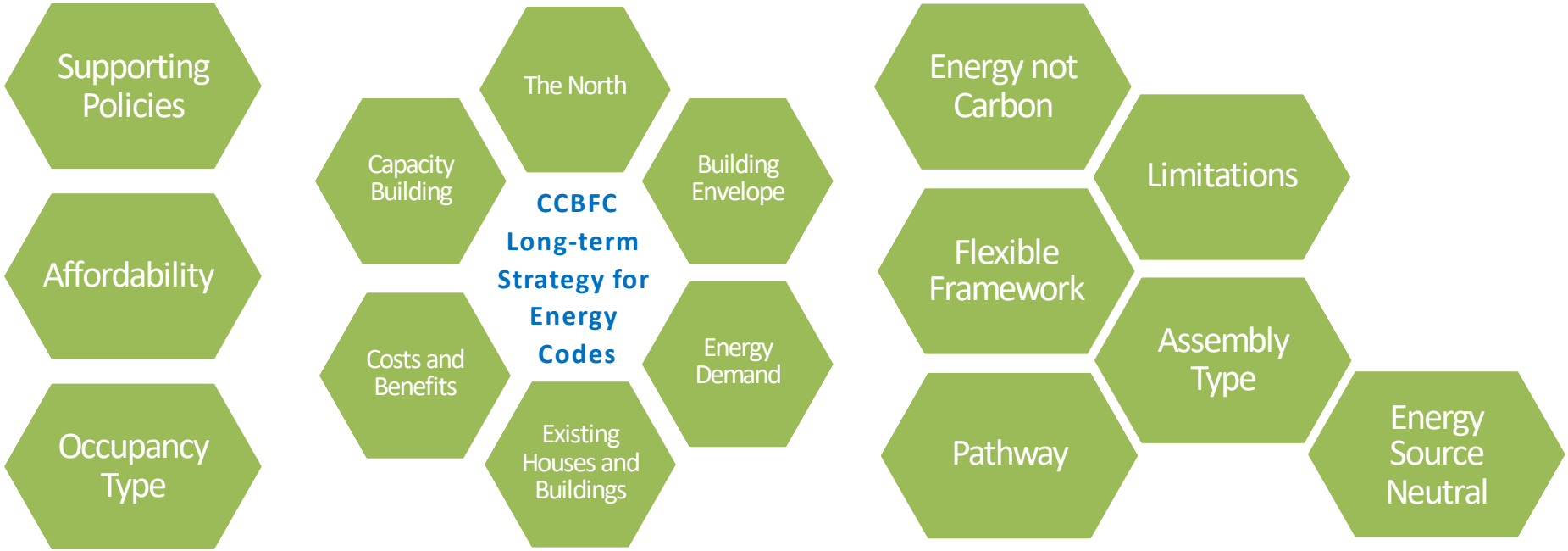
Code Development/Change/Improvement Process

Continuous Process

CCBFC (Canadian Commission on Building and Fire Codes) Position Paper on Energy Codes

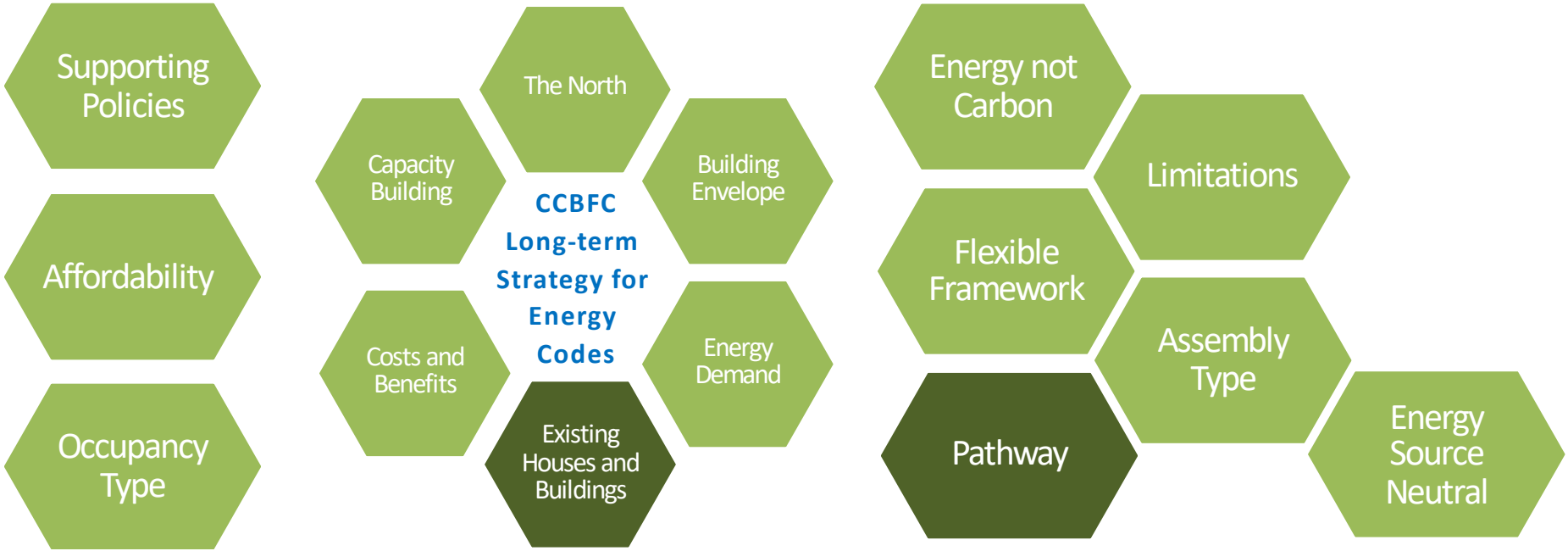
- Provides direction for committees & stakeholders
- Allows planning for long-term performance targets
- Sets 15 significant policy positions
- Broadly in alignment with Pan Canadian Framework

CCBFC Policy Positions



https://www.nrc-cnrc.gc.ca/obj/doc/solutions-solutions/advisory-consultatifs/codes_centre-centre_codes/commission/Policy_Paper_Longterm_Energy_Strategy.pdf

CCBFC Policy Positions



https://www.nrc-cnrc.gc.ca/obj/doc/solutions-solutions/advisory-consultatifs/codes_centre-centre_codes/commission/Policy_Paper_Longterm_Energy_Strategy.pdf

CCBFC Policy Positions

Existing Houses and Buildings

Policy Position:

- *The CCBFC recognizes that improving the energy performance of existing houses and buildings is a critical component to achieving meaningful energy reductions.*

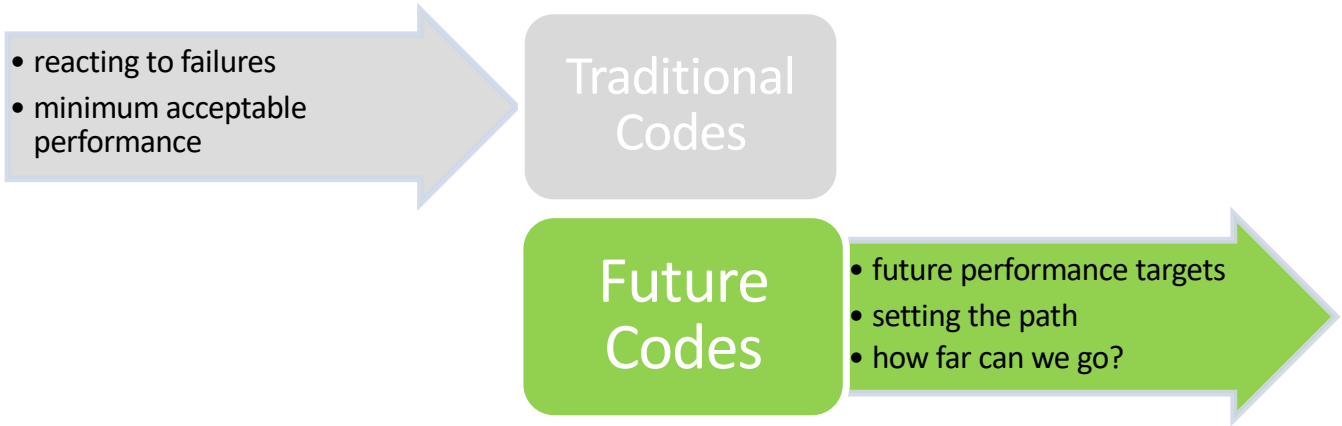
  The CCBFC will work with PTPACC and the Federal Government (NRCan) to develop technical guidance on energy efficiency improvements during alterations and renovations for existing houses and buildings.

CCBFC Policy Positions

Pathway

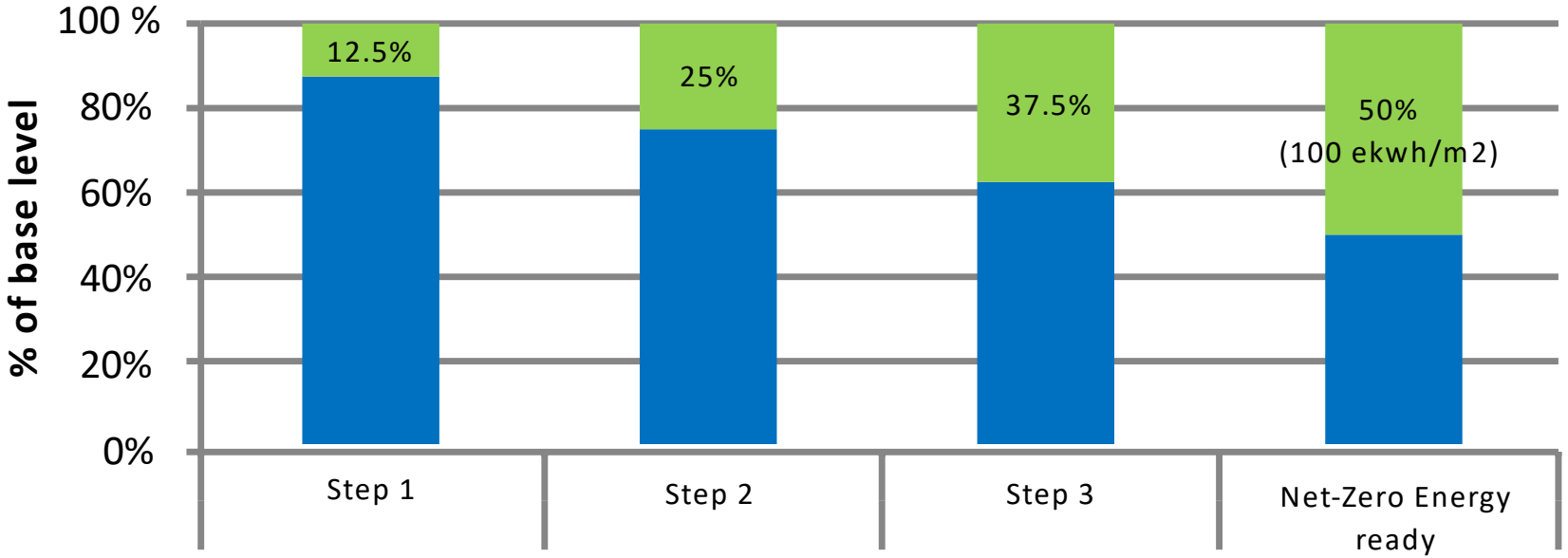
Policy Position:

- *The CCBFC will develop an energy code road map that lays out how energy codes should evolve to reduce the energy impact and carbon footprint of buildings.*

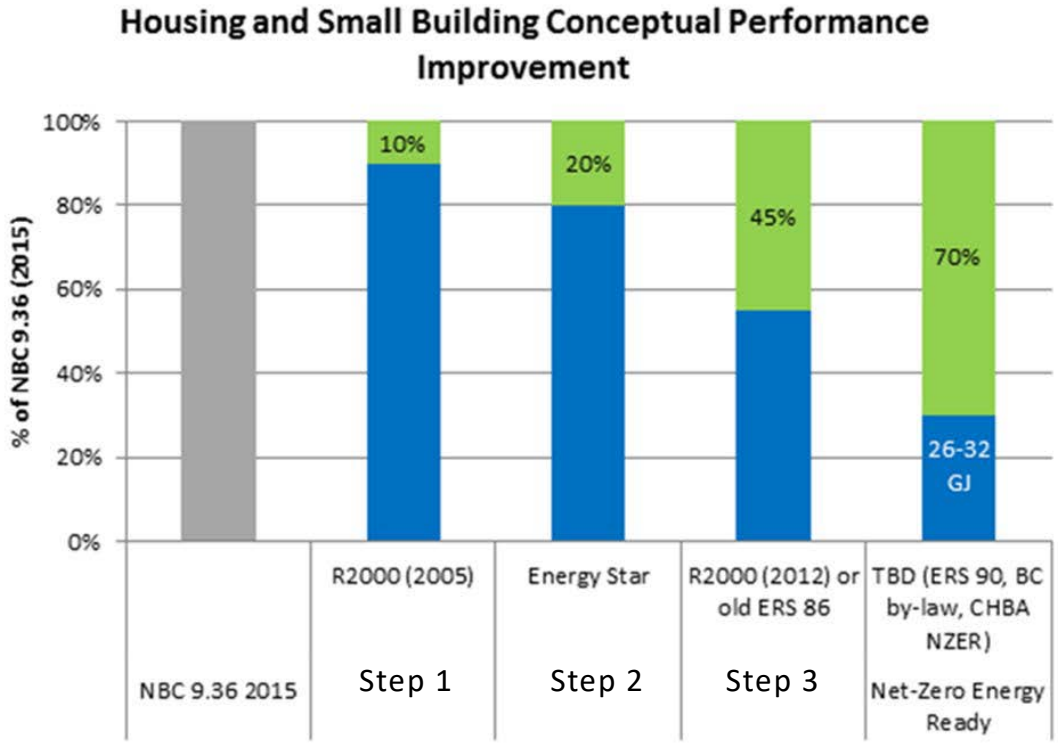


Energy Efficiency in Buildings (New)

Conceptual Performance Improvement



Housing and Small Buildings (New)



Net Zero Energy Ready Project – Context

Technology Development & Validation

Incentives & Voluntary Programs

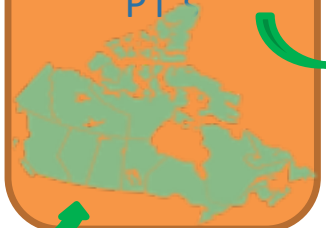
Code Requirements Development & Validation

Wide Scale Industry Application

R &D

Model Code Development & Pub hing

Adoption by PT's



Net Zero Energy Ready Project – Goals

Provide support to facilitate and encourage the:

1. Development of NZER Model Codes for new buildings and housing by 2022/23 to allow provinces to adopt all tiers by 2030.
2. Development of energy efficiency requirements for Existing buildings and housing by 2022/23.

Thank you

References and photo credits

New Buildings Institute

- [redacted]

Jacques-Lemoyne-de-Sainte-Marie Library

- [redacted]
- [redacted]

Mosaic Centre

- [redacted]
- [redacted]

Centre for Interactive Research in Sustainability

- [redacted]
- [redacted]
- [redacted]
- [redacted]

Centre of Excellence in Sustainable Building Technologies and Renewable Energy Conservation, Okanagan College

- [redacted]
- [redacted]
- [redacted]

Dr. David Suzuki Public School

- http://www.hpbmagazine.org/attachments/article/11947/12F-Dr-David-Suzuki-Public-School-Windsor-[redacted]
- http://www.suzukipublicschool.ca/overview.html
- [redacted] report.html#Analysis21

VanDusen Botanical Garden Visitor Centre

- [redacted]
- [redacted]

UniverCity Childcare Facility

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

Wayne Aspinall Federal Building

- [redacted]

Ontario Association of Architects Headquarters

- [redacted]

Organisational Productivity

- [redacted]
- Do green buildings outperform conventional buildings? Indoor environment and energy performance in North American, [redacted]
- Are green buildings better buildings? New research [redacted]
- [redacted]
- [redacted]

Energy Use Intensity

- [redacted]
- [redacted]
- [redacted]

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