WEBINAR SERIES

Public Reviews for the 2025 National Construction Codes

Canadian Home Builders' Association

Webinar #4: Alterations to Existing Buildings (Renovations) – Part 2

Webinar #5: Code Change Overview – Winter And Spring 2024 Public Reviews

HERE

Webinar #6: Energy Modelling and Airtightness Testing

April 12th, 12:00-1:30 PM ET

Webinar #7: Accessible Dwellings

April 26th, 12:00-1:00 PM ET

RESERVE YOUR SEAT!

MISSED A WEBINAR IN THIS SERIES?

Webinar #1: Proposed code changes - overview

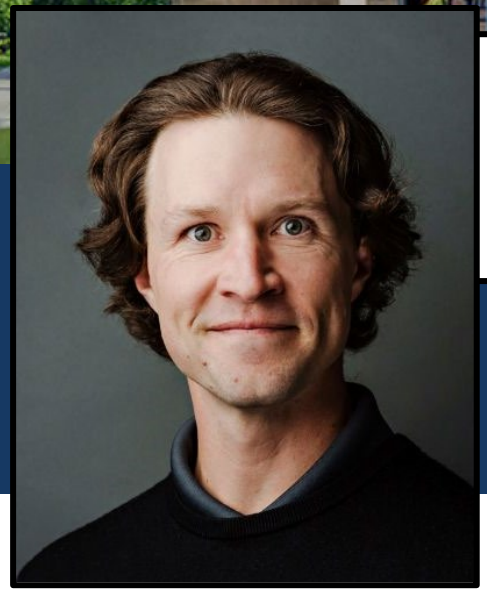
Webinar #2: Introducing proposed code changes for renovation

Webinar #3: Deep dive into Part 9 energy efficiency and GHG requirements

Check out the archive here

Energy Modelling & Airtightness Testing

Alex Ferguson,
Housing Team Project Leader,
Natural Resources Canada



Mark Rosen,
Director of Building Science,
Building Knowledge Canada

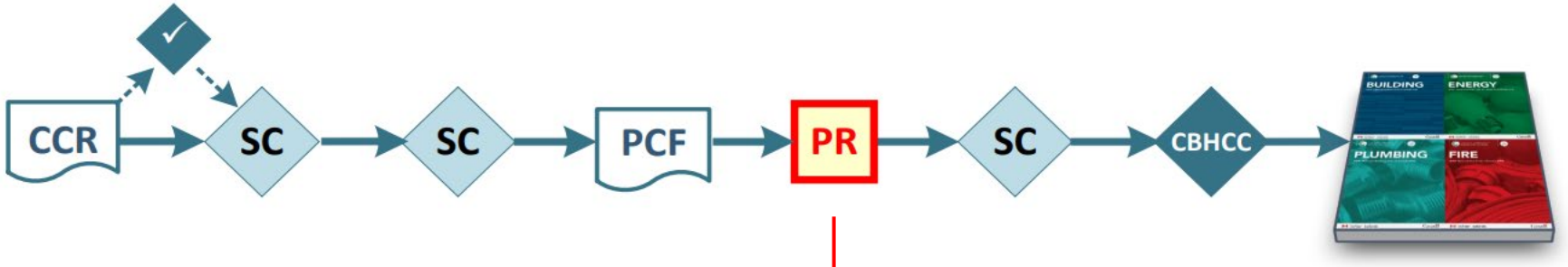
Host: Alex Bols, Q & A: Frank Lohmann

April 12th, 2024

Check out the archive here

OVERVIEW OF CODE PROCESS

Canadian Home Builders' Association



Codes Timelines	Public Review Opens	Public Review Closes
Fall 2023	October 23, 2023	December 18, 2023
Winter 2024	February 27, 2024	April 29, 2024
Spring 2024	May 22, 2024	July 27, 2024
Fall 2024 (Ref'd Docs)	October 21, 2024	December 16, 2024
Code Publication	Planned for **December 2025**	
P/T Code Adoptions	Planned for **18 months after** publication	

YOU ARE HERE

WHAT HAPPENS AROUND PUBLIC REVIEW?

Canadian Home Builders' Association

Before

Committees develop changes with

- ~~existing~~ and proposed wording
- Problem & Justification
- Cost/Benefit
- Enforcement

During

We submit comments on proposed changes

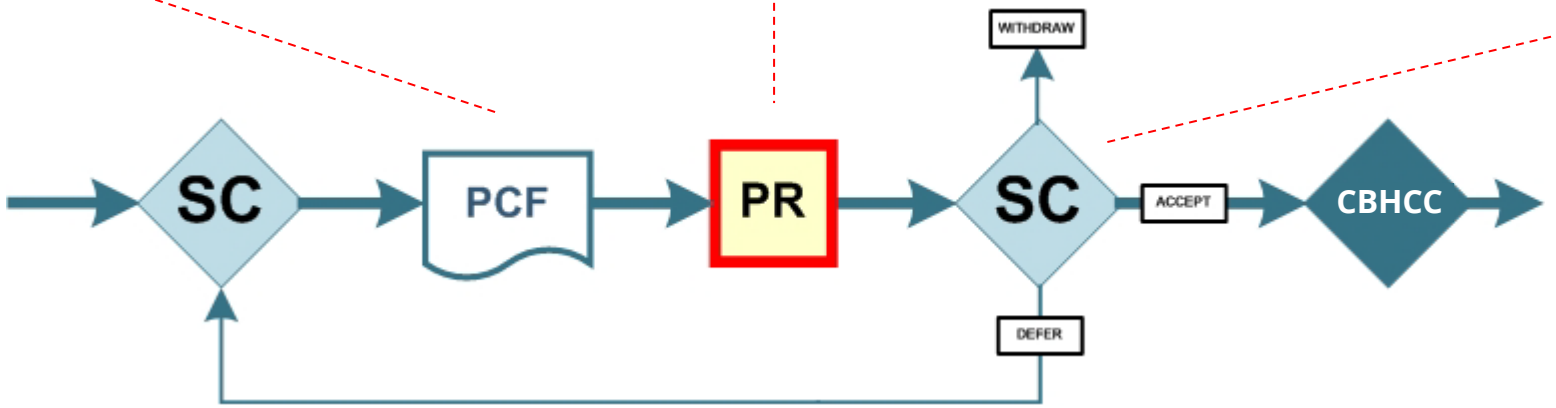
- Support as is
- Support with Comments
- **Support with modifications**
- **Do Not Support**
- No comment

After

Committees

- **review all comments**
- **recommend to:**
  - accept PCF
    - as proposed
    - as revised – with modifications
  - withdraw PCF
  - defer work on the issue

NRC Codes Meeting Calendar



PUBLIC REVIEW COMMENTS

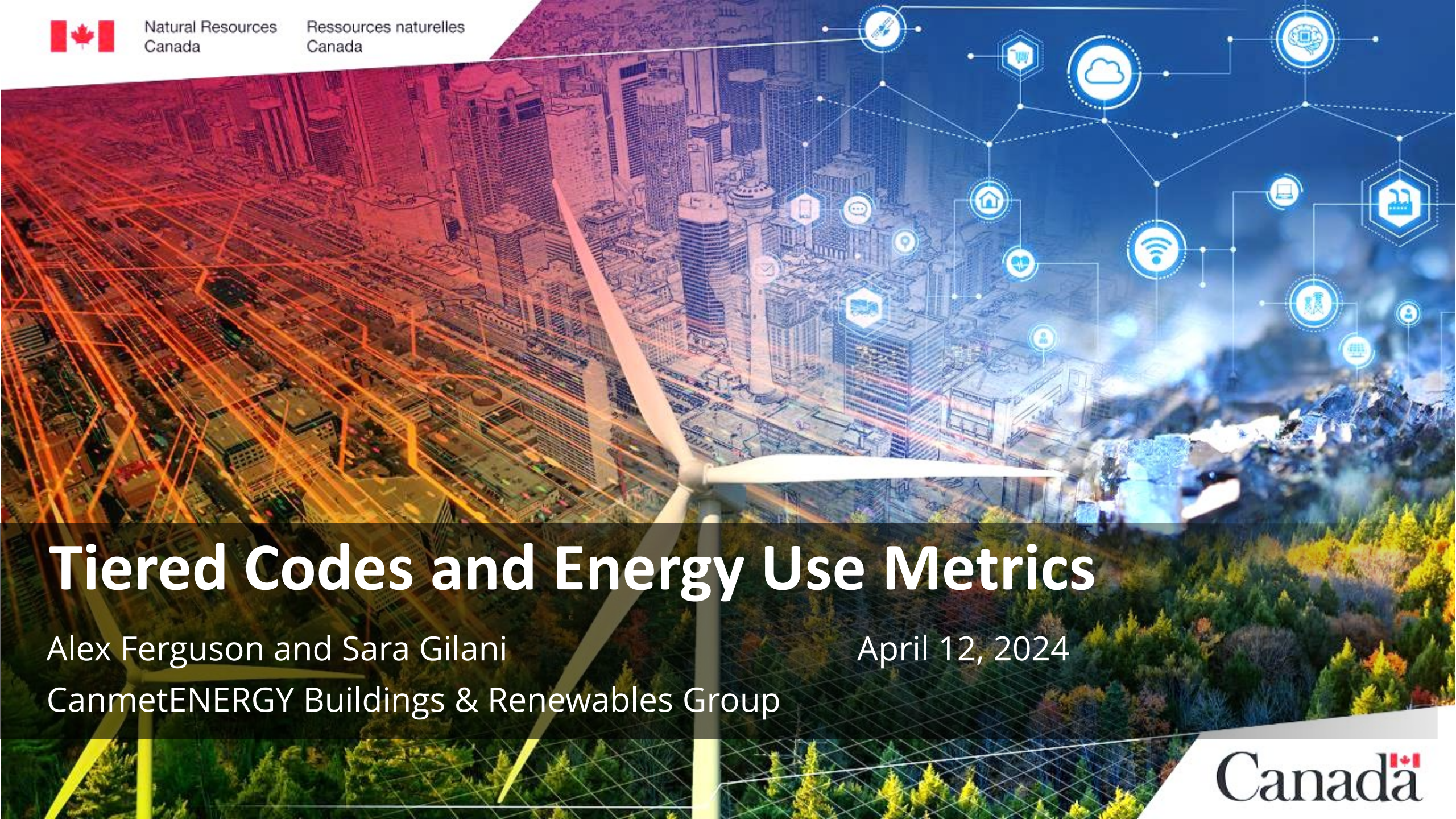
Canadian Home Builders' Association

Well-written comments can make a big difference!

- Describe how the proposed change applies to your situation
- Explain why you can't support the change
- Propose modifications, suggest alternative approaches
- Support them with evidence, or cost, if possible
- Public Review Comments Categories
  - Do not Support (reason)
  - Remain Silent – No Comment
  - Support as is
  - Support with Comments
  - Support with Modifications

CBHCC Canadian Board for Harmonized Construction Codes | CCHCC Comité canadien de l'harmonisation des codes de construction

Go to CBHCC's Public Review Site



Natural Resources Canada | Ressources naturelles Canada

Tiered Codes and Energy Use Metrics

Alex Ferguson and Sara Gilani
CanmetENERGY Buildings & Renewables Group

April 12, 2024

Canada

Abstract

- This presentation outlines proposed changes to Canada's National Building Code (NBC) that will make it easier for some builders to comply with the NBC's tiered energy requirements.

- These changes relate to the metrics that builders and code officials use to measure household energy use.

- If adopted, the changes are expected to make it easier and less-expensive for builders of some housing types level housing products to meet present and future energy requirements.

Key Highlights

- Draft changes to the national building code provide an alternate pathway for builders to meet energy tier requirements.

- These changes allow builders to use efficient architectural form to demonstrate energy savings, providing a lower cost means to comply with NBC energy targets.

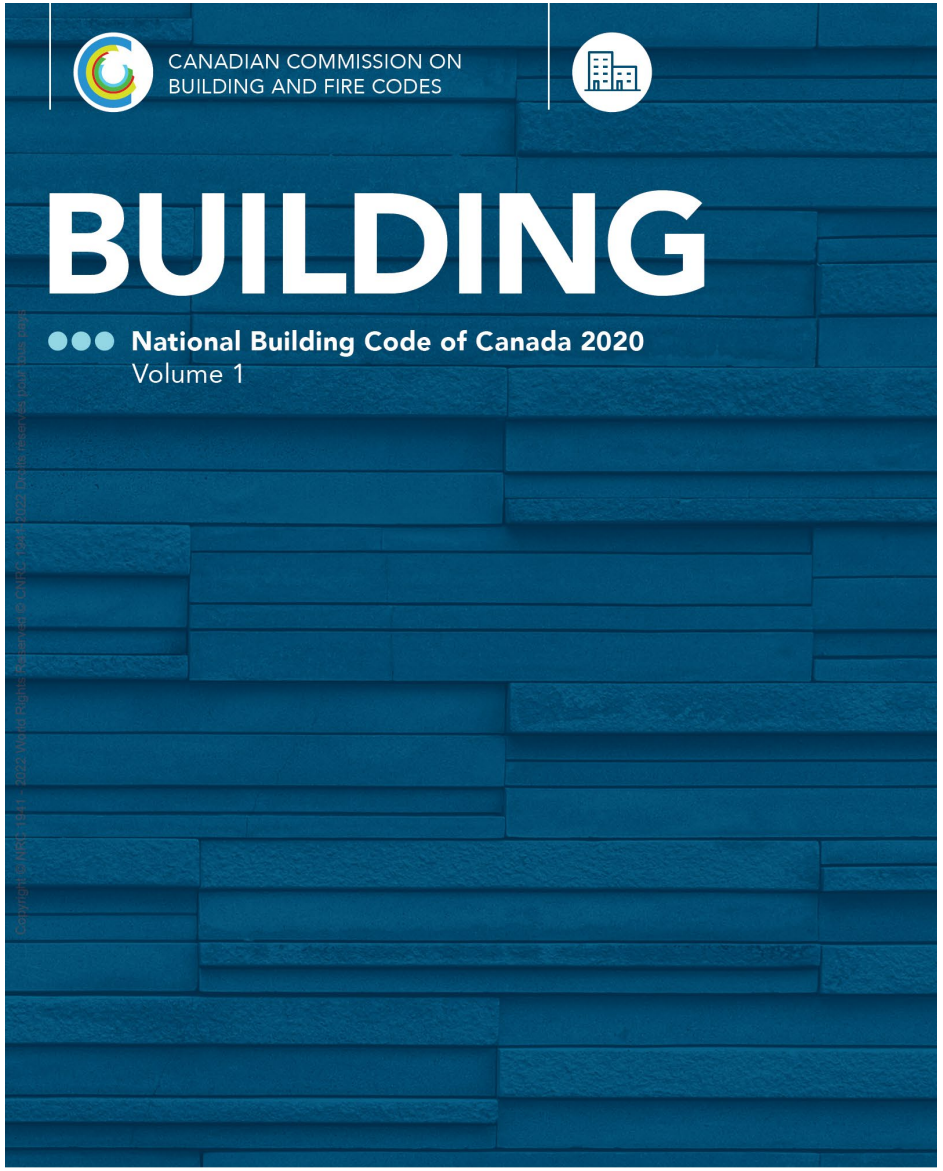
- These changes are expected to reduce the cost of constructing common affordable and entry-level housing designs, including row homes and MURBS.

Caveats

- These draft changes will be posted for public review in 2024. They may be further altered or withdrawn from the future 2025 National Building Code.

- As currently drafted, these changes provide an alternate compliance pathway for Part 9 housing.

- They do not alter or limit existing prescriptive or performance pathways in the code (NBC 9.36 Sections 2-8).



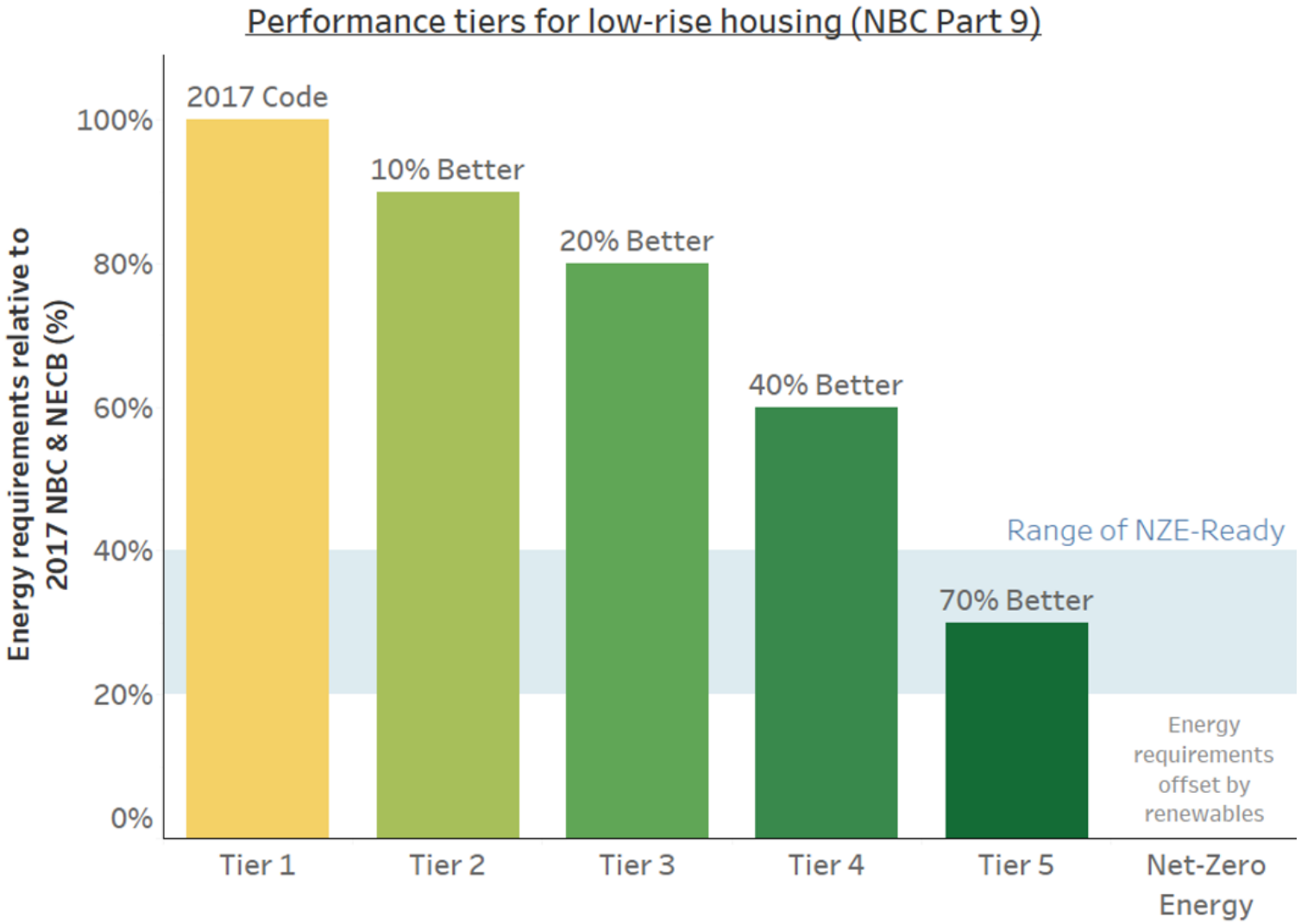
Current Status: Canada's Tiered Energy Code

The 2020 NBC includes forward looking targets to reduce energy use. These requirements were inspired by the earlier BC Energy Step Code. They are intended to help builders and code officials get ready for future code requirements.

Tiers and Targets

NBC Section 9.36 provides five performance tiers, the highest of which targets 70% energy savings.

Each tier also includes targets for building envelope performance, as well as limits on cooling loads.

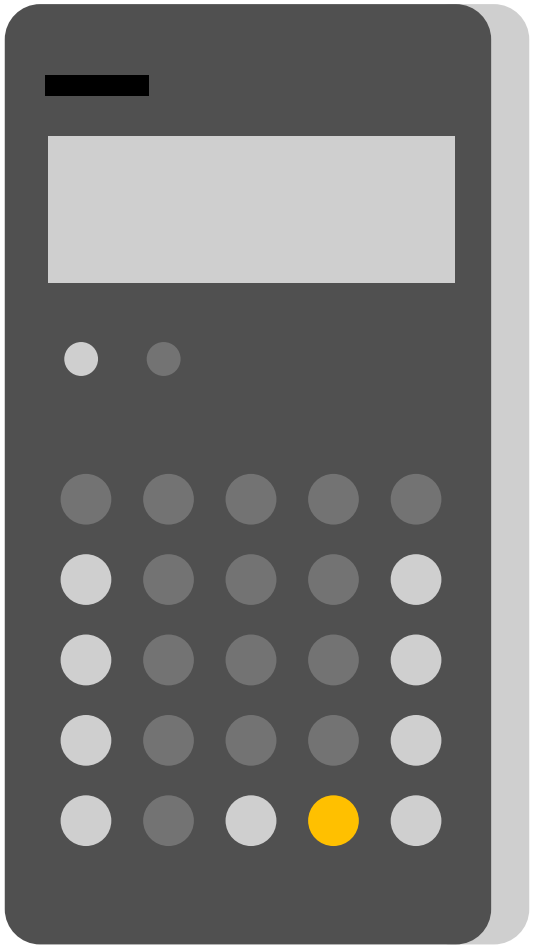


NBC Energy Calculations

Code compliance is determined through energy calculations. Builders use energy calculation software, such as HOT2000, to predict the energy savings that the energy conservation measures will achieve.

Savings are computed relative to a **reference energy benchmark.** Each energy tier fraction of savings that must be achieved relative to the energy benchmark.

The 2020 NBC uses the **reference House** approach to establish that energy benchmark.



Reference House Compliance Pathway

Reference House Energy Model:
Envelope, mechanical systems
as per code-minimum

Proposed Design Energy Model:
Envelope, mechanical systems
as per house design

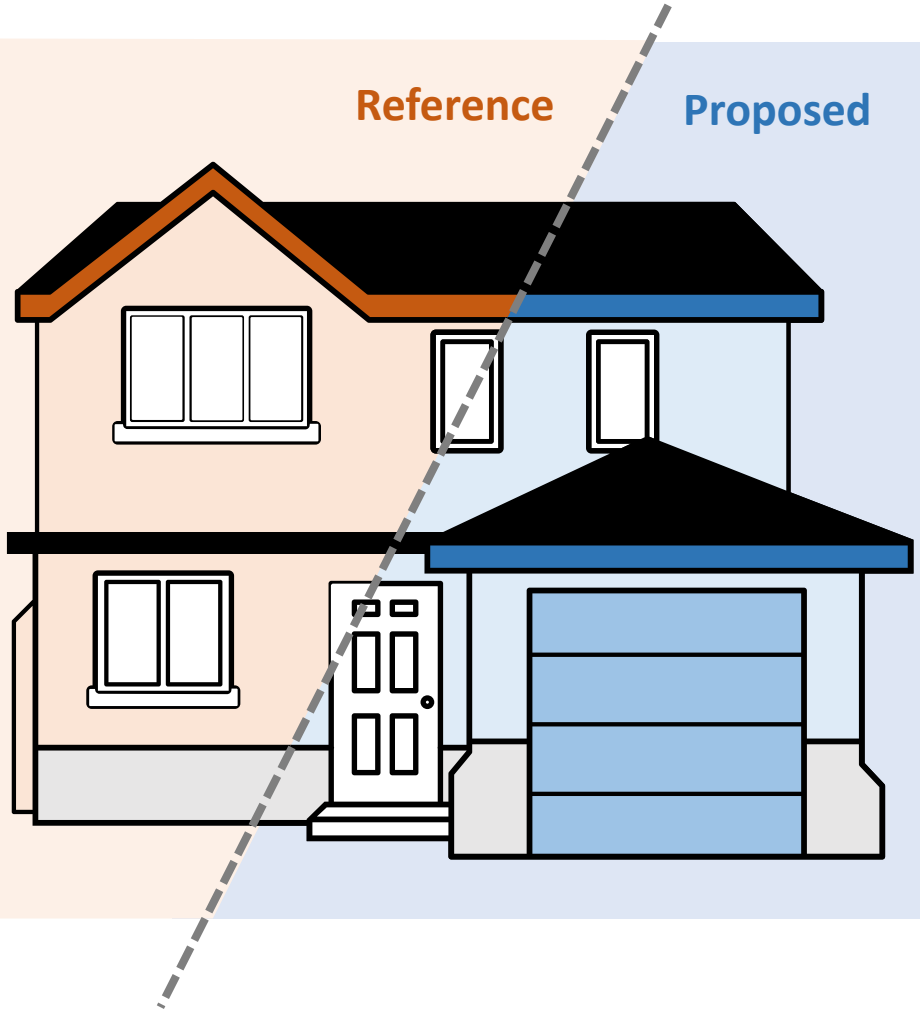
The code requires builders to construct two energy models. One reflects the proposed house design. The other is an exact copy of the house, as if it had been built to code minimum requirements.

Builders comply with the code by showing that the proposed design model uses less energy than the reference house energy model.

The Reference House & Architectural Form

The reference and proposed models have the same architectural form and features.

Builders can only use energy efficiency measures (insulation, equipment) to demonstrate energy savings and comply with the code.



6-unit Net Zero MURB in Laval, Quebec

Application to MURBS

This approach means that the code ignores the energy savings achieved with efficient architectural forms — attached, row and stacked MURB homes.

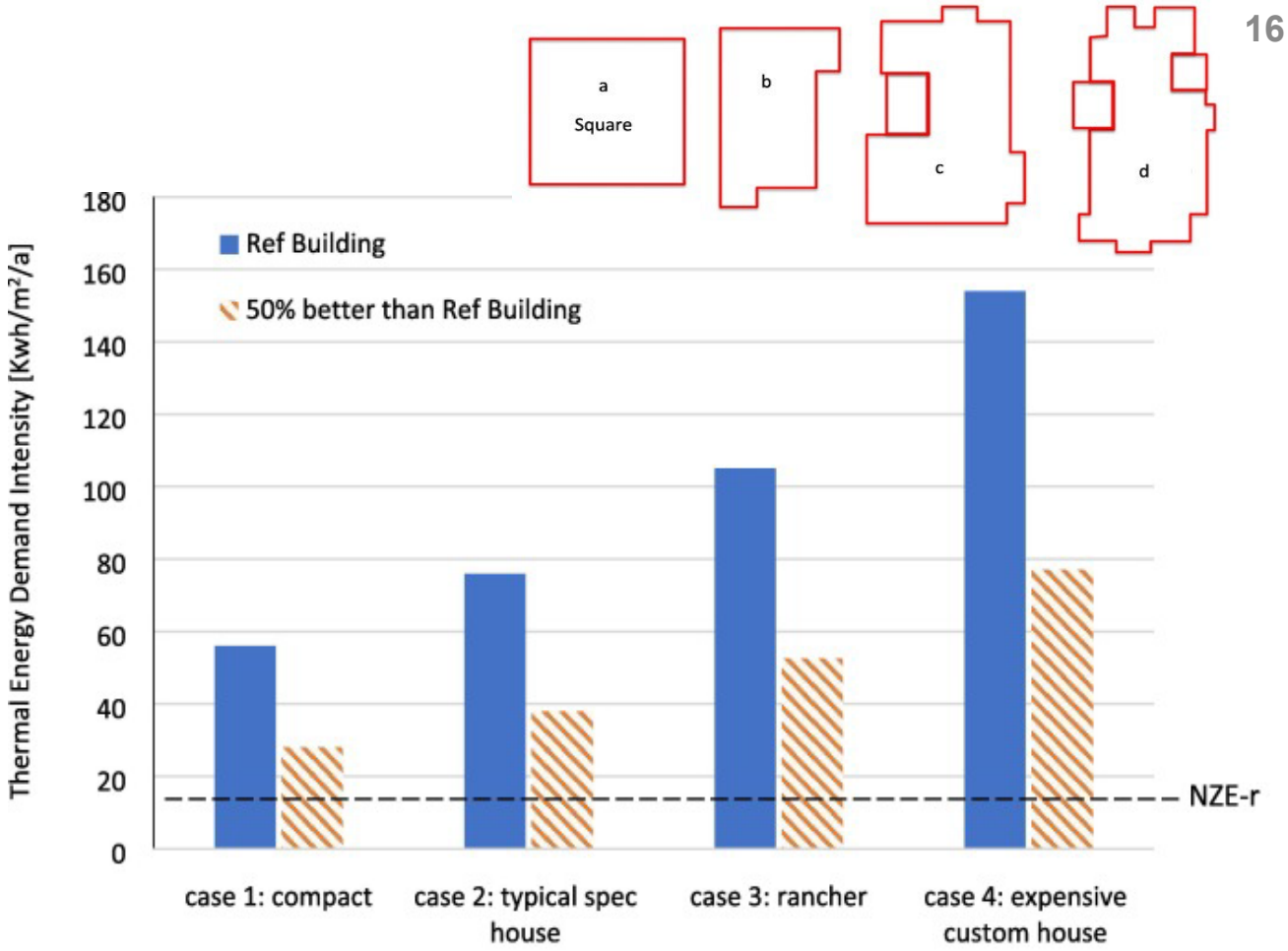
These homes are more efficient than traditional housing because they have less envelope area. They need less heat in winter, and they use less energy.

But they must still meet the code's stringent requirements for insulation, air sealing and equipment efficiency.

Pending Changes for 2025: Energy Use Intensity

A new compliance path is being developed for the 2025 code. This approach is based on energy use intensity (EUI) metrics, Canadian applications oof EUI metrics were pioneered in the BC Energy Step Code.

EUI metrics are intended to address complaints that the reference house approach affords stringent energy budgets for compact houses, but is more generous when used on articulated homes.



Source: S. Foroushani, R. Bernhardt, M. Bernhardt (2022) "On the use of the reference building approach in modern building energy codes"

Alternate EUI-based compliance pathway

Existing Performance Compliance Pathway

Reference building energy model

Proposed design energy model

Alternate EUI Compliance Pathway

kWh/m²

Reference energy intensity

Proposed design energy model

The EUI compliance pathway replaces the reference building model with an energy use intensity (EUI) target. EUI depend on the local climate, and scale by floor area.

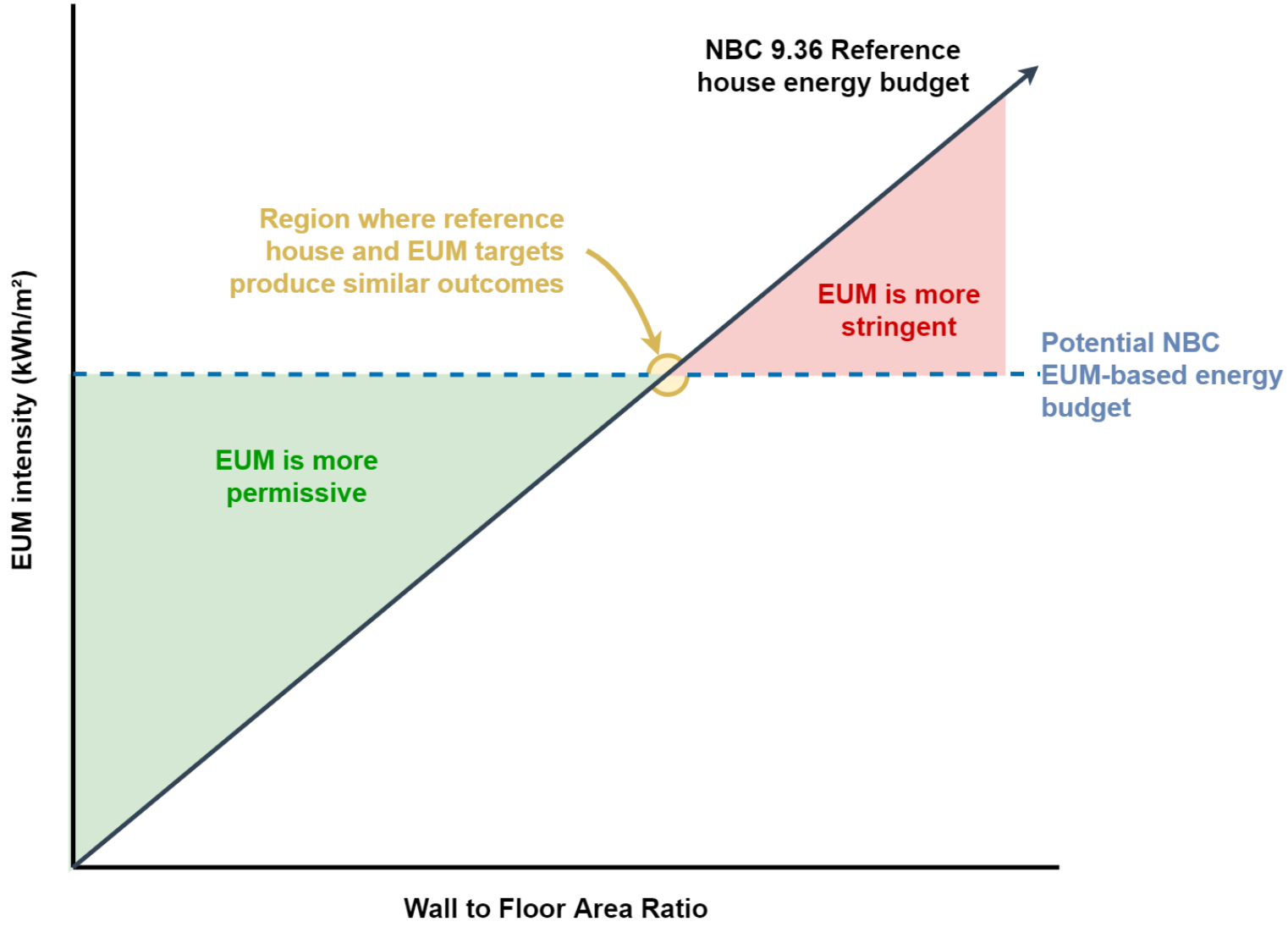
Most importantly, they are not affected by architectural form. That means builders are credited for shapes that are more energy efficient.

EUI Budgets

While the reference house energy budget, varies with house geometry, EUI budgets are the same for homes of the same size.

Builders of detached and articulated housing forms will find EUI metrics more stringent.

Builders of compact & attached homes will find EUI metrics more permissive.



Proposed Changes For NBC 2025

CBHCC has published proposed code changes that implement an alternate compliance pathway based on Energy Use metrics.

This pathway uses many of the same modelling rules in NBC 9.36.5, but eliminates the reference house.

Proposed Change 1869

Code Reference(s):	**NBC20 Div.B 9.36. (first printing)**
Subject:	Energy Use Intensity
Title:	Energy Use Intensity Metric Path
Description:	This proposed change introduces a new energy performance compliance path to Section 9.36. of Division B of the NBC based on the energy use intensity target of the building.

This change could potentially affect the following topic areas:

- ☐ Division A
- ☐ Division C
- ☐ Building operations
- ☑ Small Buildings
- ☐ Fire Protection
- ☐ Accessibility
- ☐ Building Envelope
- ☐ Heating, Ventilating and Air Conditioning
- ☑ Division B
- ☑ Design and Construction
- ☑ Housing
- ☐ Large Buildings
- ☐ Occupant safety in use
- ☐ Structural Requirements
- ☑ Energy Efficiency
- ☐ Plumbing
- ☐ Construction and Demolition Sites

Requirements: Local Heat Loss Factor & Local Energy Use Factor

- The proposed EUI metrics are based on two climate-specific parameters: the **Local Heat Loss Factor** and the **Local Energy Use Factor**

- Both factors depend on the local climate, and are computed using regional heating degree day data.

Local heat loss factor (kWh/m²·year) = (0.02 × HDD) + 32.6

Local energy use factor (kWh/m²·year) = (0.02 × HDD) – 12.3

Requirements: Gross space heat loss budget

- The local heat loss factor is multiplied by the floor area to establish the Gross Space Heat Loss budget.
- The range of floor areas used when computing the budget is limited to 115-350m²
- Homes smaller than 115 m² have an easier compliance pathway; homes bigger than 350m² have a harder compliance pathway.

Table [9.36.8.3.-B]
Annual Gross Space Heat Loss Budget

Heated Floor Area, m^2	Annual Gross Space Heat Loss Budget, kWh/year
Heated Floor Area < 115 m^2	local heat loss factor × 115
115 m^2 < Heated Floor Area < 350 m^2	local heat loss factor × heated floor area
Heated Floor Area > 350 m^2	local heat loss factor × 350

Requirements: Gross space heat loss budget

- The local energy use factor is also scaled by the floor area, and capped for homes smaller than 115m² or bigger than 350m²
- The reference energy budget is also increased by 6500 kWh/year. This represents the water heating load, and does not scale by floor area.

Table [9.36.8.5.-B]
Reference Energy Use Budget

Heated Floor Area, m^2	Reference Energy Use Budget, kWh/year
Heated Floor Area < 115 m^2	(local energy use factor × 115) + 6500
115 m^2< Heated Floor Area < 350 m^2	(local energy use factor × heated floor area) + 6500
Heated Floor Area > 350 m^2	(local energy use factor × 350) + 6500

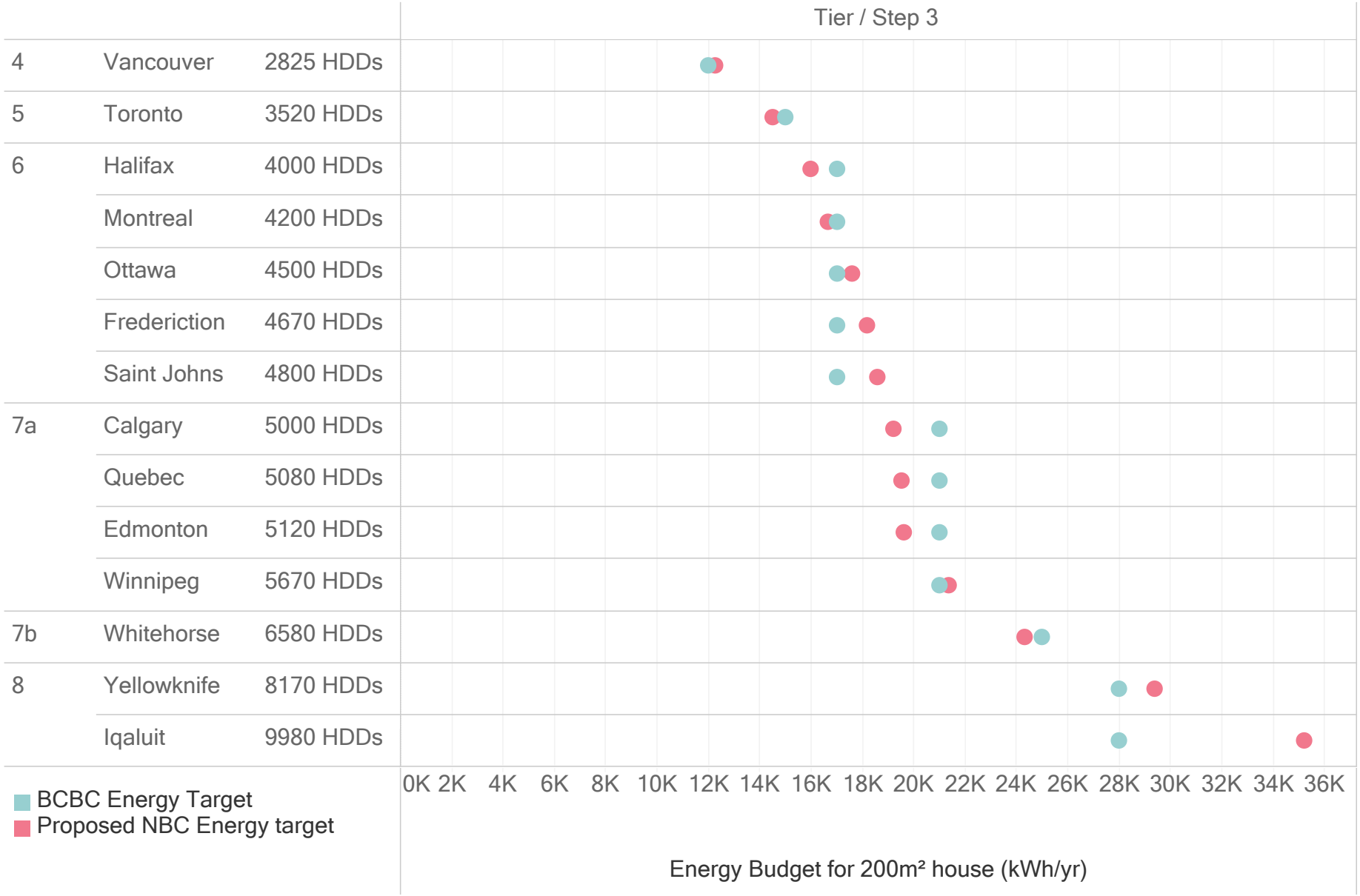
Requirements:
Gross Space Heat Loss & Energy Consumption Targets

The EUI budgets are then scaled by adjustment factors to compute targets for each tier.

Applicable Energy Performance Tier	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Gross Space Heat Loss Adjustment Factor	1.00	0.95	0.90	0.80	0.60
Energy Consumption Target Adjustment Factor	1.00	0.90	0.80	0.60	0.30

(These are the same ratios as 9.36.7's Envelope performance Improvement & Overall Energy Performance Improvement targets)

Comparison to BC Energy Step Code – Step 3

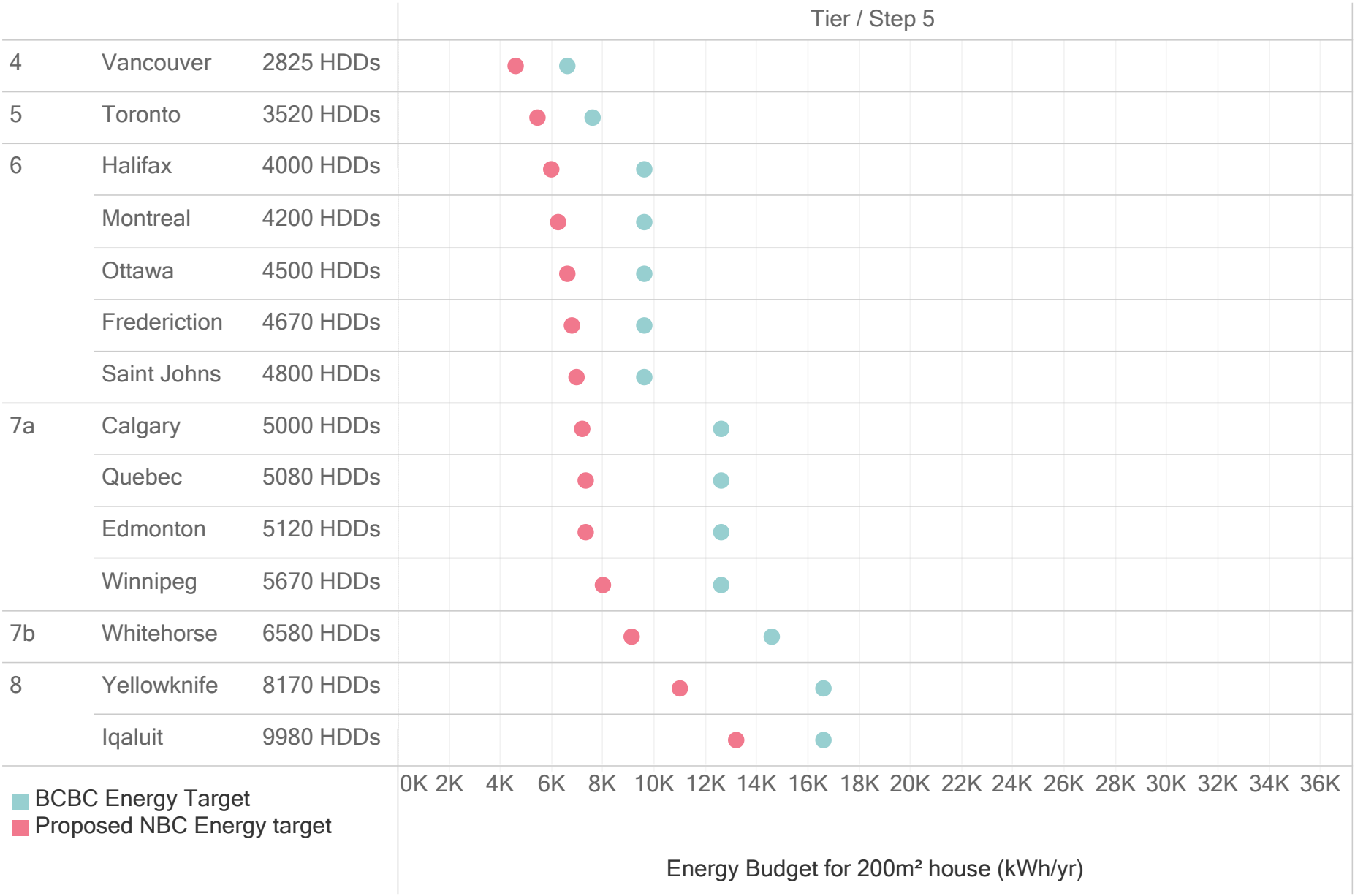


This graph compares energy budgets from the BC Energy Step Code and the proposed EUI based Tier 3 for a 200m² house

Comparison to BC Energy Step Code – Step 4

This graph compares energy budgets from the BC Energy Step Code and the proposed EUI based Tier 3 for a 200m² house

Comparison to BC Energy Step Code – Step 5



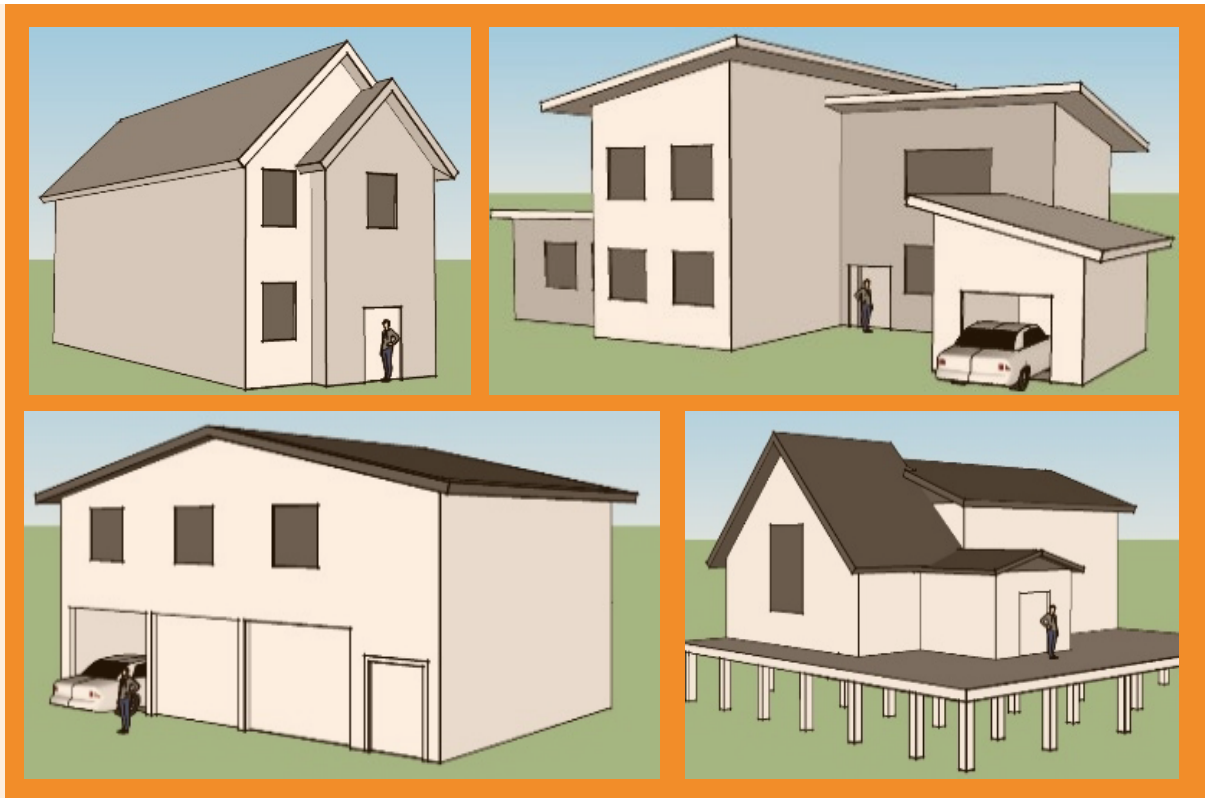
This graph compares energy budgets from the BC Energy Step Code and the proposed EUI based Tier 3 for a 200m² house

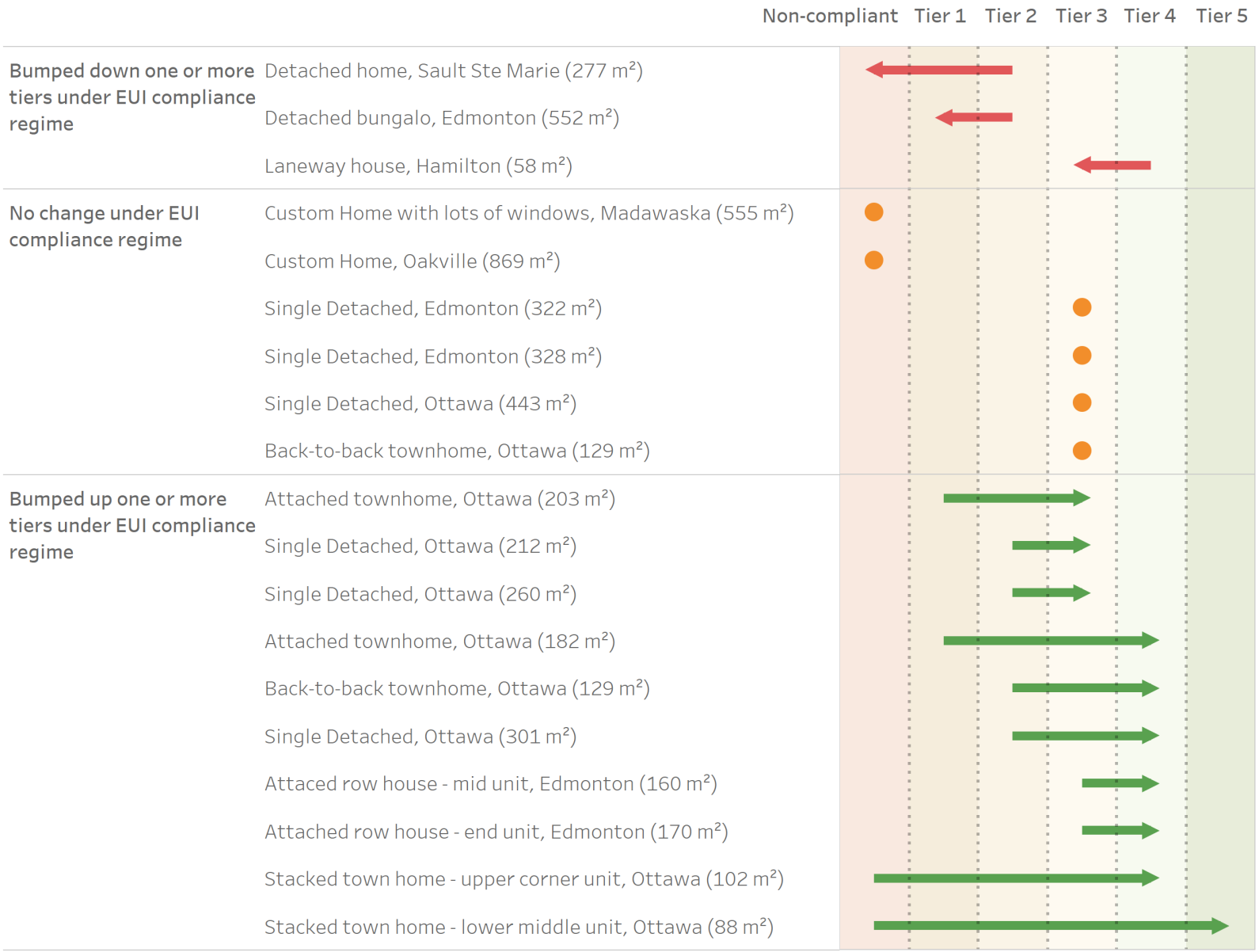
Expected outcomes with EUI metrics

Our analysis shows that compact designs — especially those that are attached to adjacent units — benefit from using EUI metrics. These homes use less energy than more complicated and articulated shapes. For the first time, builders can use simplified architectural forms to demonstrate energy savings alongside traditional conservation measures.

Easier compliance under EUI pathway

Easier compliance under existing reference building pathway

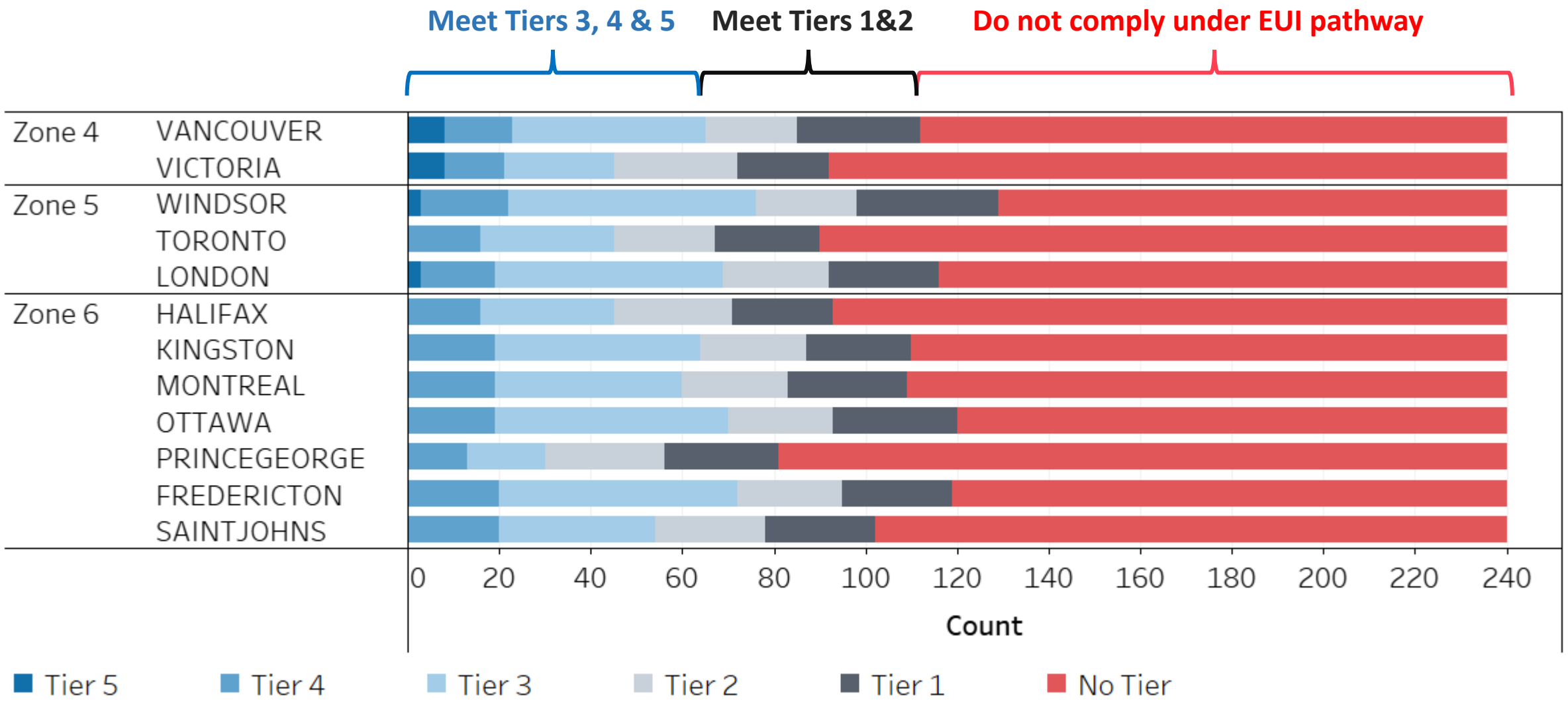




Results from real-world case studies

We collected HOT2000 data from 19 recently constructed dwellings, and contrasted their compliance under NBC 9.36.7 vs PCF 1823.

Expected outcomes with EUI metrics



Expected outcomes with EUI metrics

Significant Benefit Stacked & row homes	Some Benefit: Compact & semi-attached	No Benefit: Complex, detached homes
~25% of homes will reach Tier 3 or higher when constructed to code minimum requirements. These homes proximately feature attached forms that reduce envelope area. Costs to reach each energy tier is expected to be much lower for these homes.	~25% of homes will reach Tier 1 or 2 when constructed to code minimum requirements. These types of homes feature compact detached or semi-detached forms. Builders will still need some energy savings measures to reach higher tiers.	~50% of homes will not comply under EUI compliance pathways. These homes feature complex shapes, and will continue to depend on traditional energy savings measures to comply via the reference building pathway

Status of EUI Metrics

These proposed code changes are scheduled to be submitted for public review and comment in February 2024. If approved, they will be incorporated into the NBC in 2025.

References

S. Gilani, A. Ferguson & M. Stylianou (2022) *"A simulation-based evaluation of the absolute and comparative approaches in a code compliance process from the energy use perspective: Cold-climate case study"* *https://link.springer.com/article/10.1007/s12273-021-0859-7*

S. Foroushani, R. Bernhardt, M. Bernhardt (2022) *"On the use of the reference building approach in modern building energy codes"* *https://www.sciencedirect.com/science/article/pii/S0378778821010100*

BC Housing (2018) *"BC Energy Step Code — 2018 Metrics Research Report"* *https://www.bchousing.org/research-centre/library/residential-design-construction-guides/energy-step-code-2018-metrics*

Thank-you!

This presentation draws extensively on Dr. **Sara Gilani**'s research into energy use metrics for residential buildings.

This work was informed by prior research by Dr. **Sepehr Foroushani** and **Mark Bernhardt**.

Jack Zhou (A&J Consultants), **Troy Tilbury** (Building Knowledge Inc.) and **Dave Turnbull** (Enerspec Consulting) provided the case study data presented on Slide 23.

This work was completed with funding from the Office of Energy Research and Development, at Natural Resources Canada.

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NBC 2025 PCF 1819

AIRTIGHTNESS: NLR_{50}

An Update on Proposed Code Changes

MARK ROSEN
Director of Building Science

Apr 12th, 2024

BUILDING KNOWLEDGE CANADA INC.

Overview

- Terminology
- Challenges: ACH_{50} in the 2020 NBC
- Proposed Changes: NLR_{50} in the 2025 NBC (**PCF 1819**)
- What this means for houses

Terminology

Proposed House

The house you plan to build

Reference House

Code minimum version of the house you plan to build

Terminology

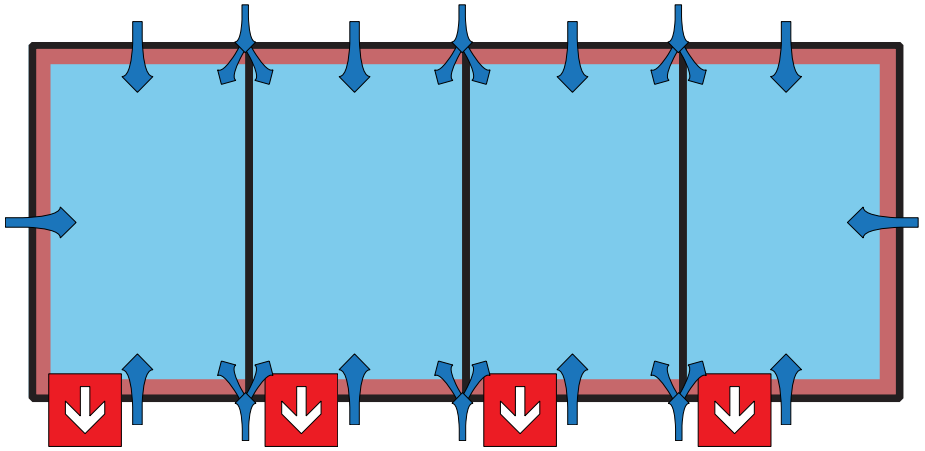
Guarded Test

Blower door test on an attached home where additional fans are used in adjacent units to neutralize leakage through shared surfaces

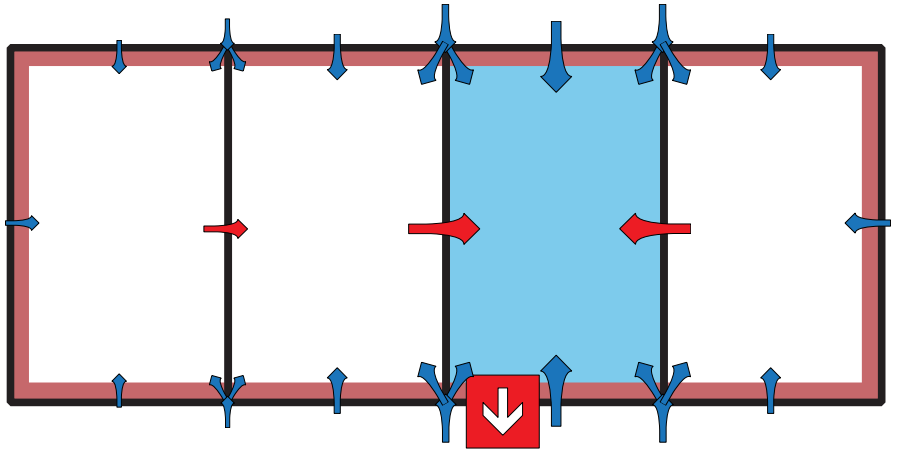
Unguarded Test

Blower door test on an attached home where fans are only used on the tested unit

Guarded Test



Unguarded Test



Terminology

ACH_{50}	NLR_{50}
Air Changes at 50 Pa	Normalized Leakage Rate at 50 Pa
Unitless	**$L/s \bullet m^2$** (Metric) or **cfm/ft^2** (Imperial)
Relates to Volume	Relates to Surface Area

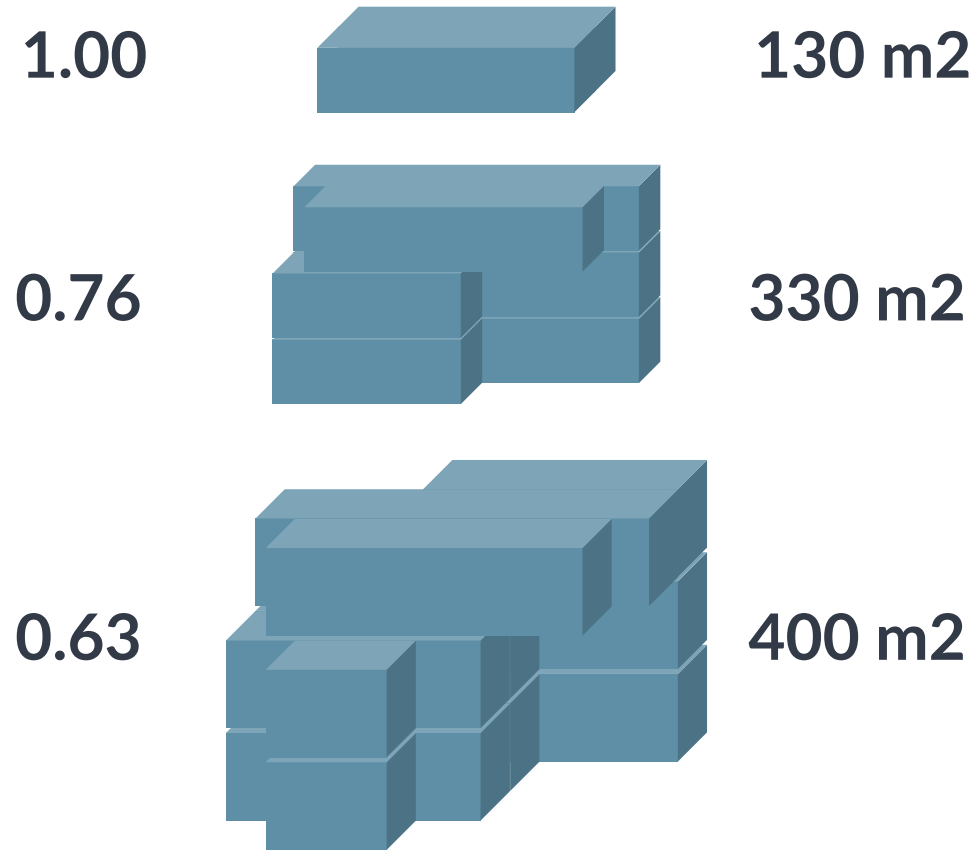
Terminology

SV Ratio

Surface Area to Volume Ratio

Unitless
(but based on metric inputs)

Tends to decrease
as homes get larger



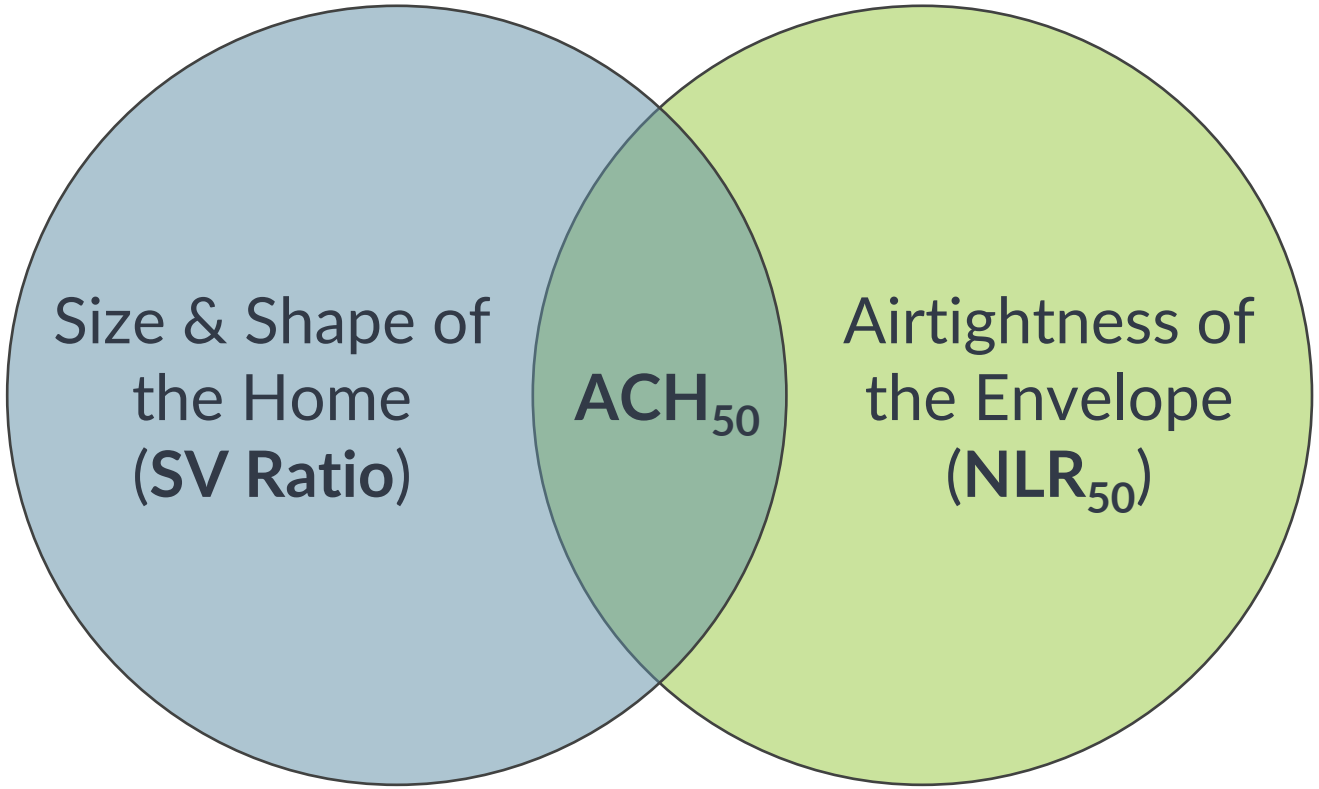
Problem #1

Size & Shape of the Home (**SV Ratio**)

Airtightness of the Envelope (**NLR_{50}**)

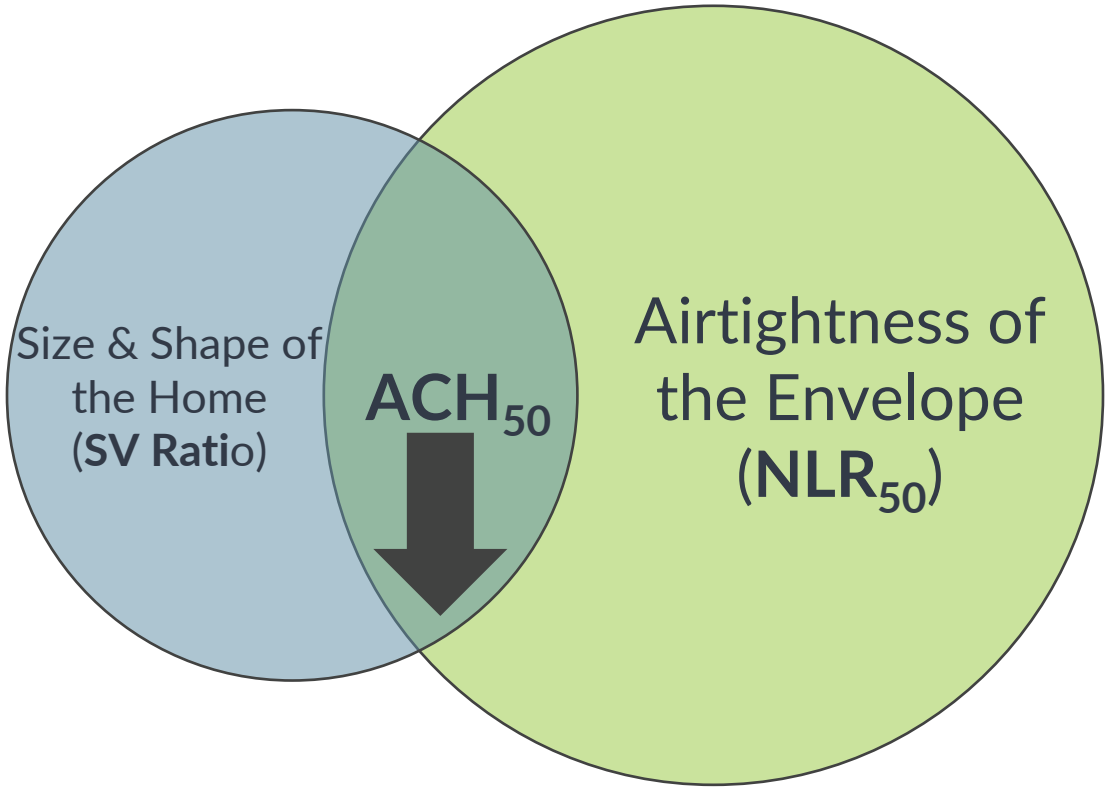
Problem #1

Not controlled by code

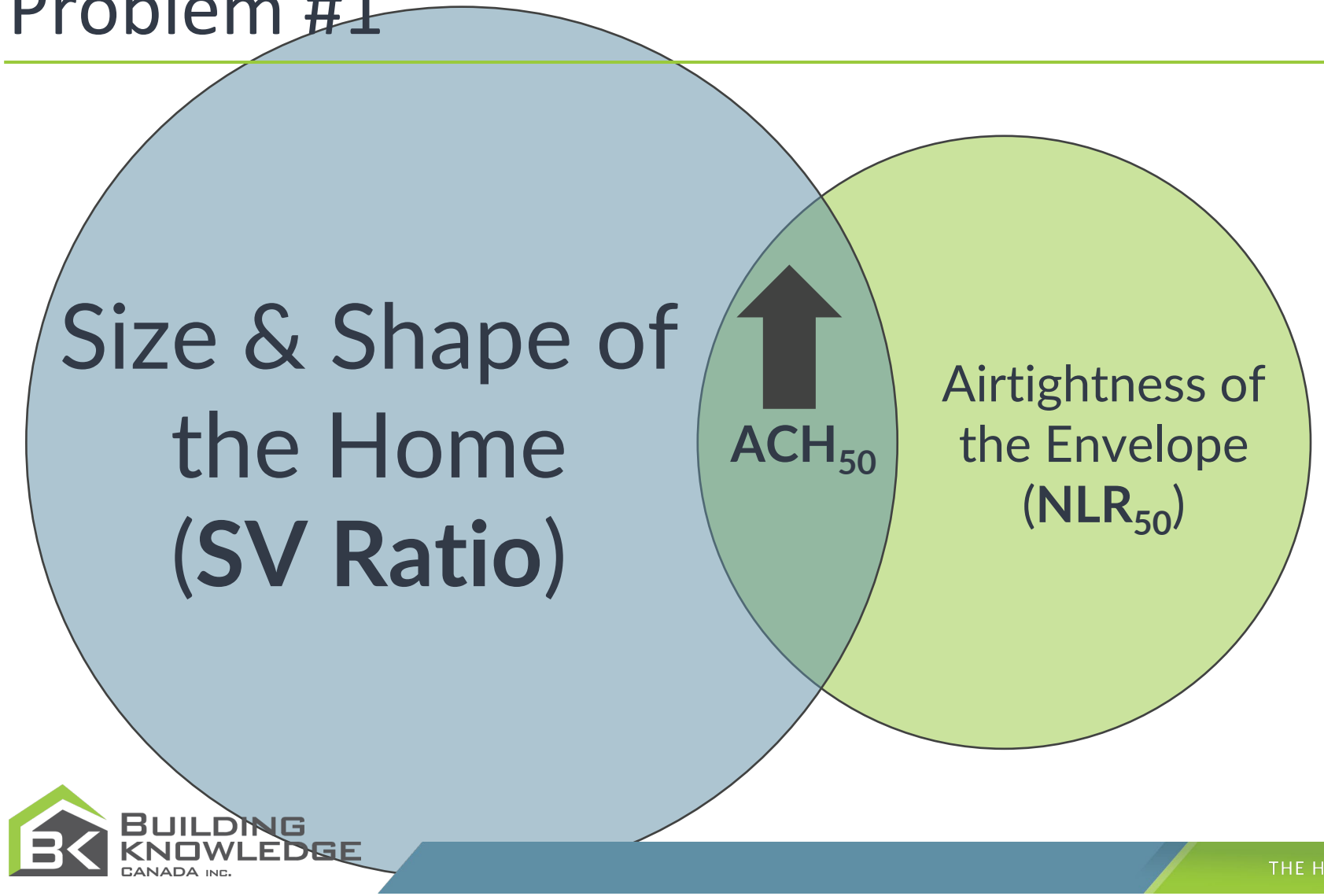


Section 9.25.3 and 9.36.2.9-.10 (Prescriptive)

Problem #1

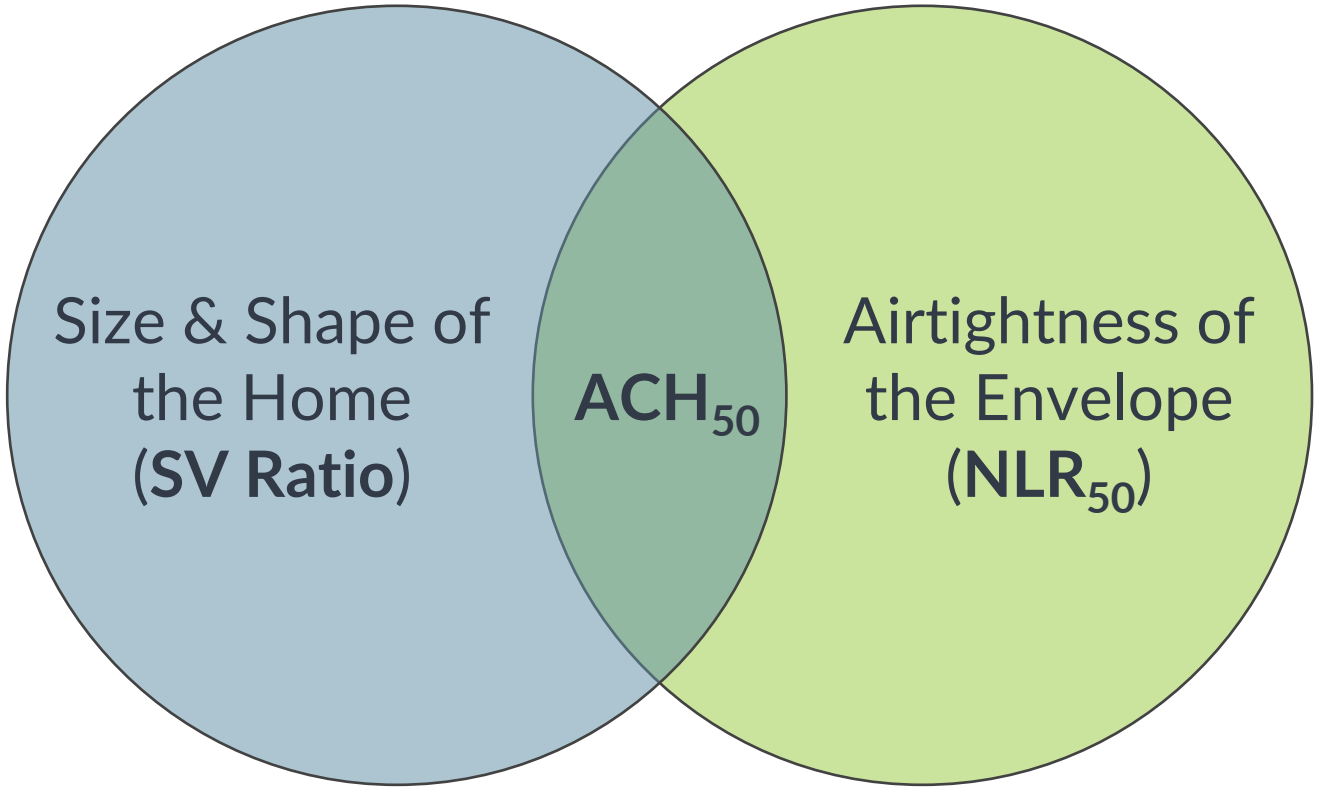

Size & Shape of the Home (SV Ratio)
ACH50
Airtightness of the Envelope (NLR50)

Problem #1


Size & Shape of the Home (SV Ratio)
ACH50
Airtightness of the Envelope (NLR50)

Problem #1

Not controlled by code



Section 9.25.3 and 9.36.2.9-.10 (Prescriptive)

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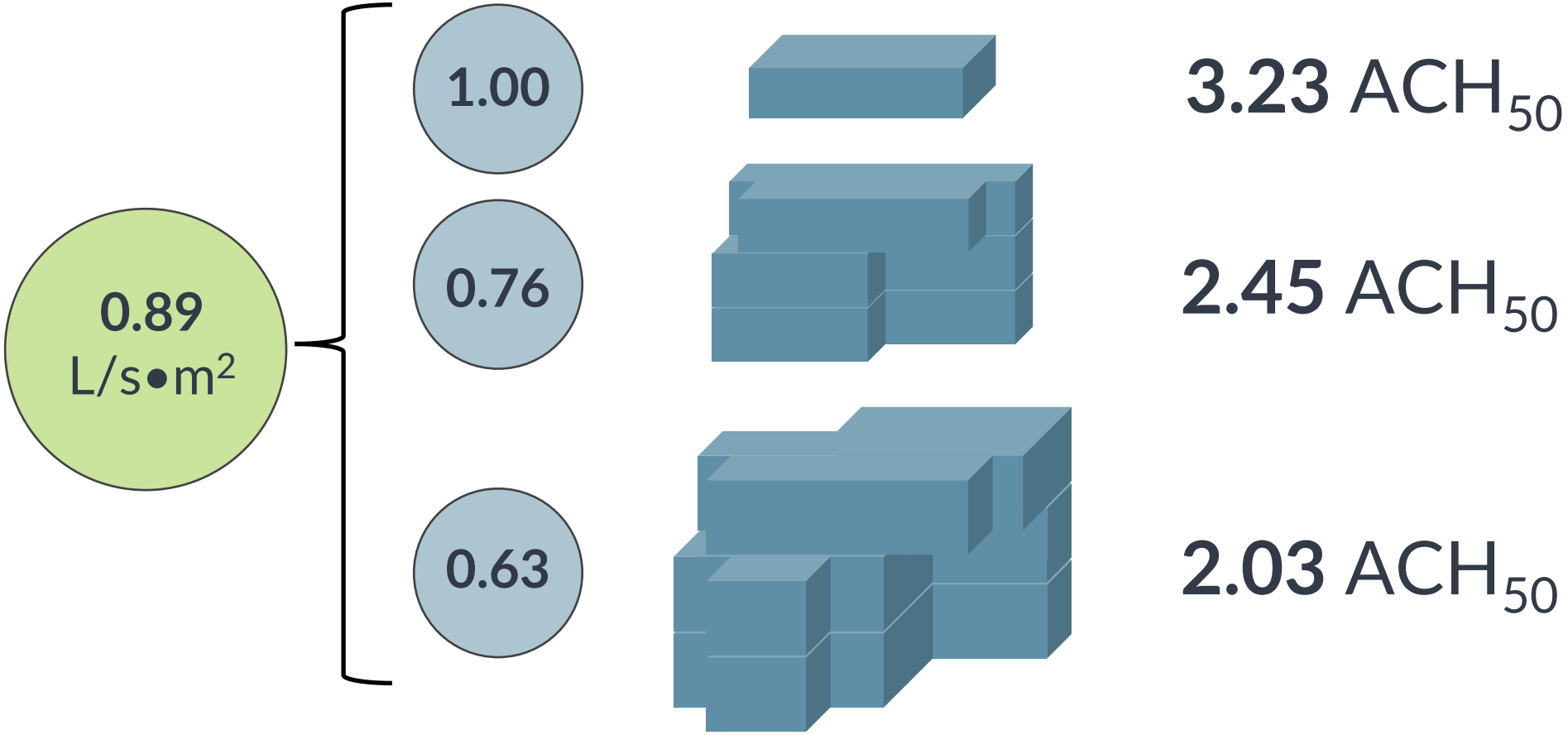

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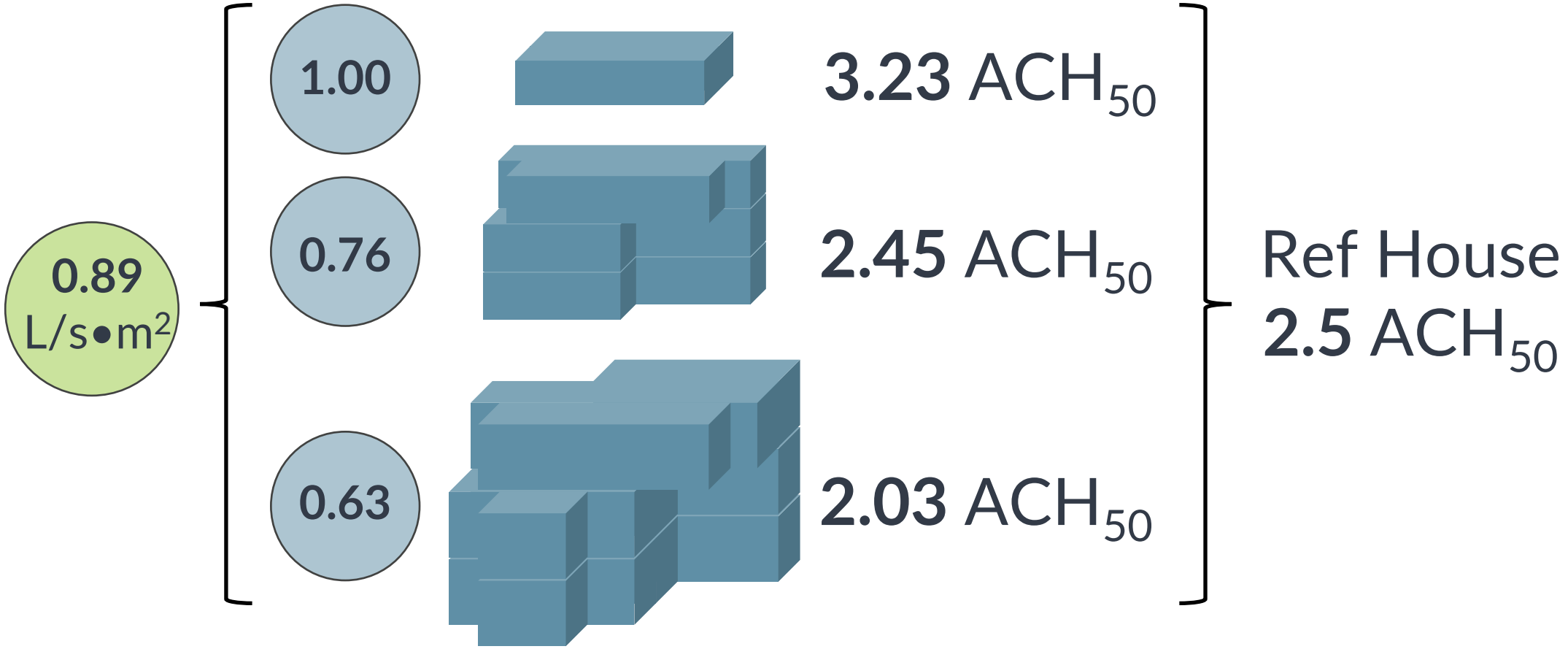
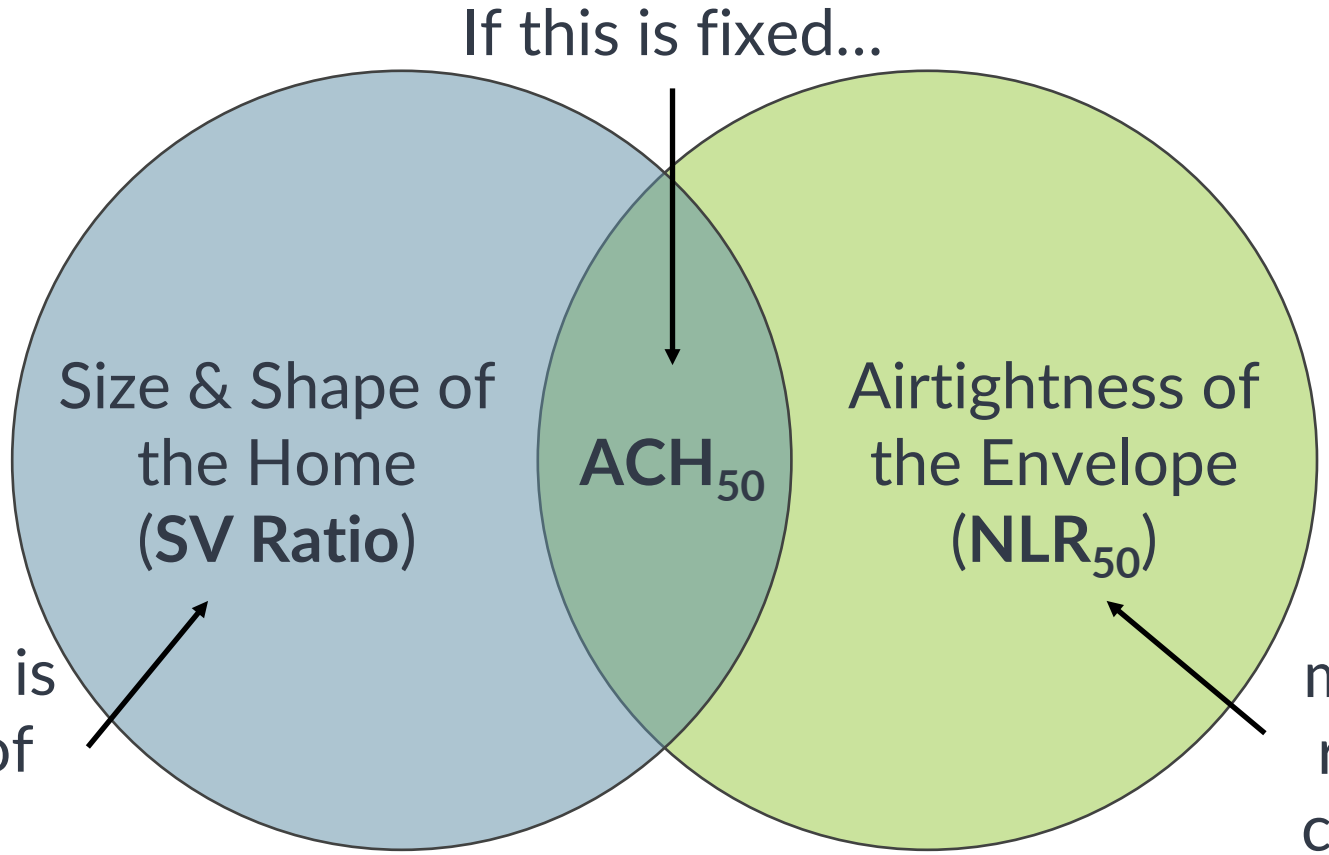
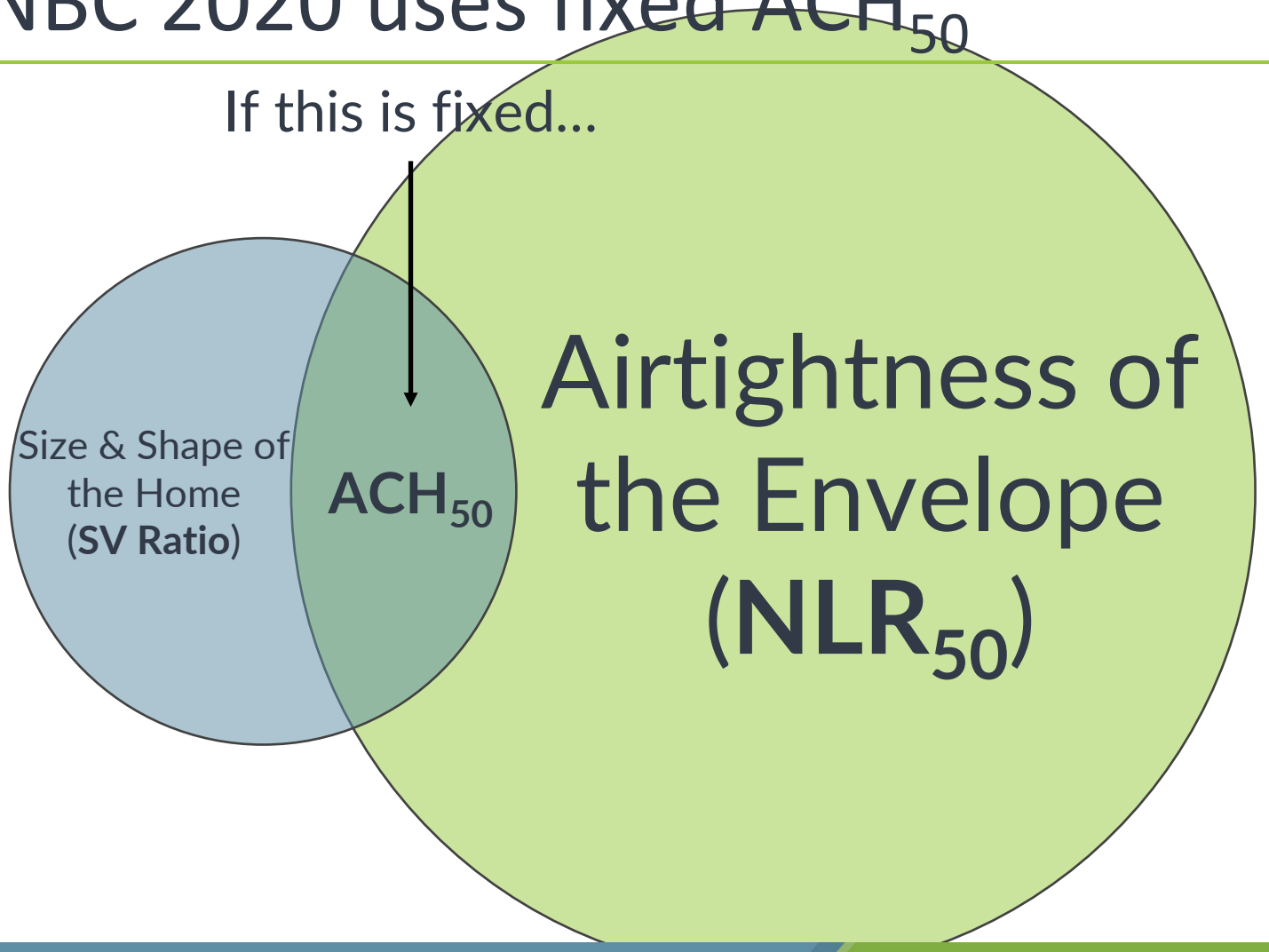

0.89
L/s•m²
1.00
0.76
0.63
3.23 ACH50
2.45 ACH50
2.03 ACH50
Ref House
2.5 ACH50

Problem #1: NBC 2020 uses fixed ACH_{50}



Problem #1: NBC 2020 uses fixed ACH_{50}



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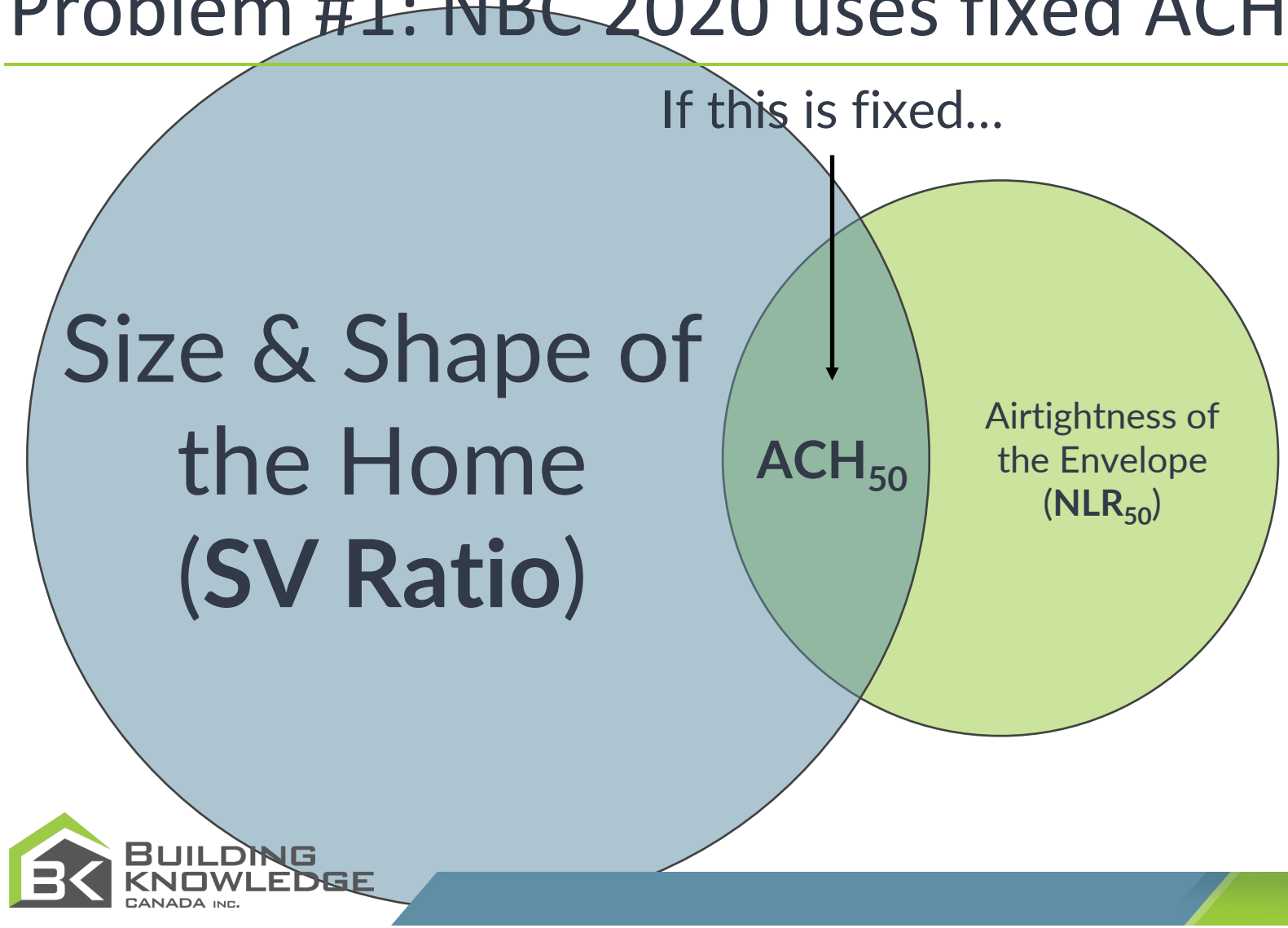
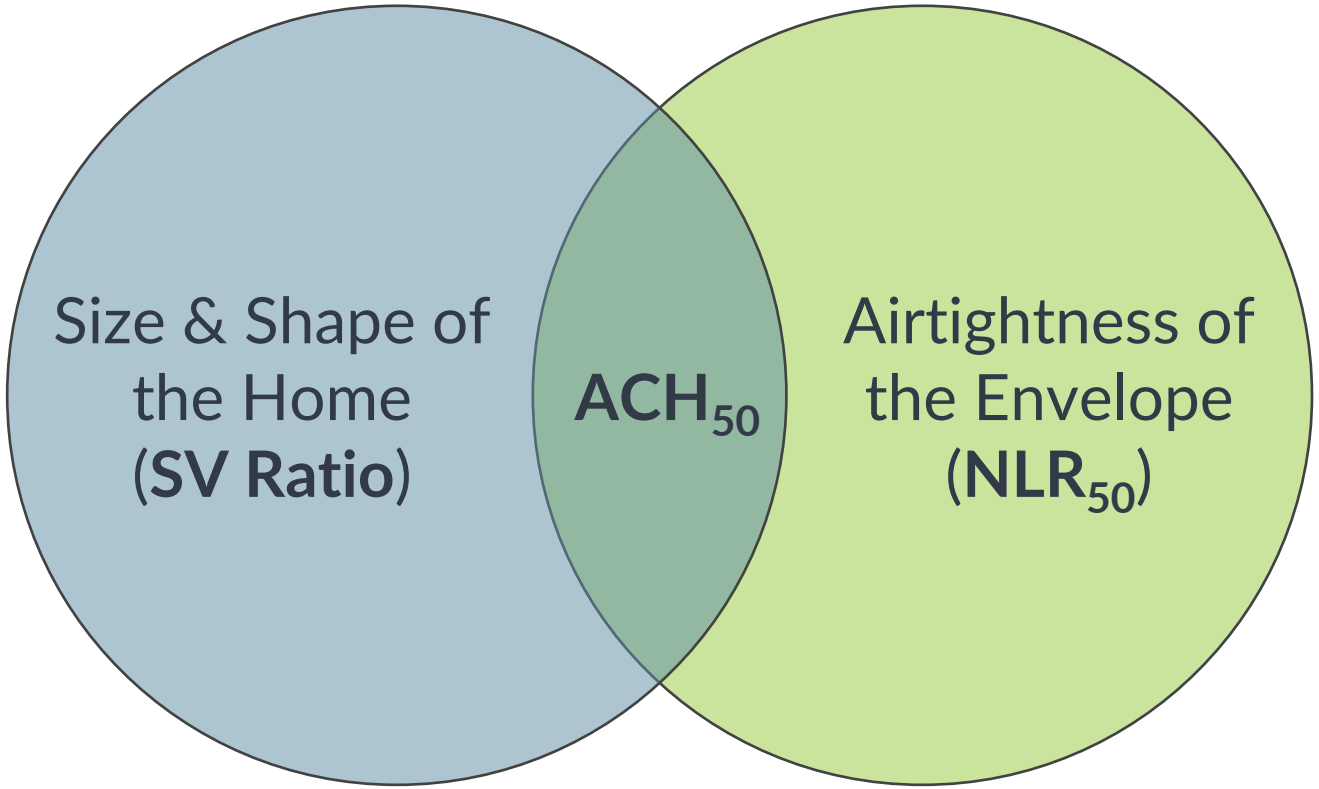


Problem #1: NBC 2020 uses fixed ACH_{50}



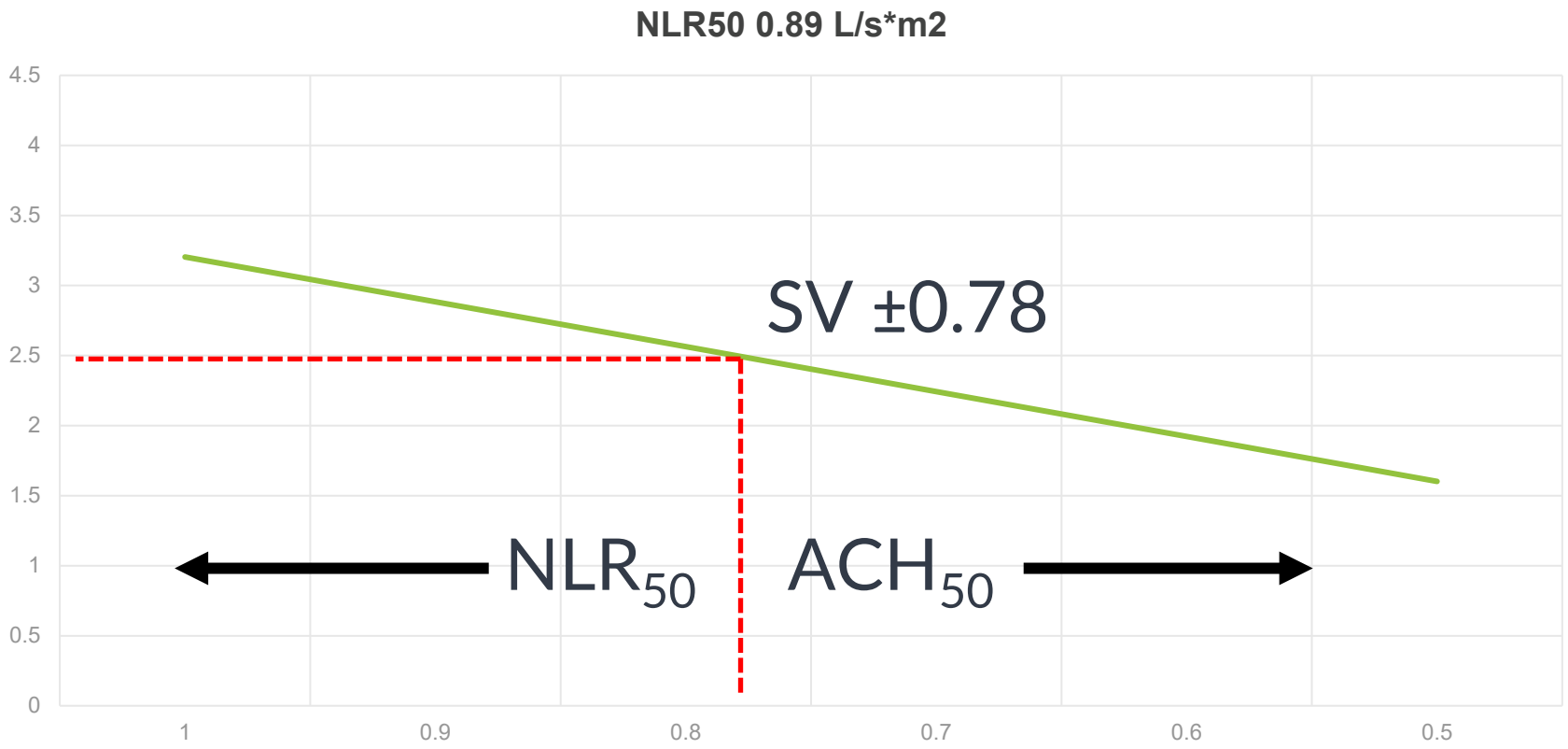
Problem #1: NBC 2020 uses fixed ACH_{50}

Why is this a problem?

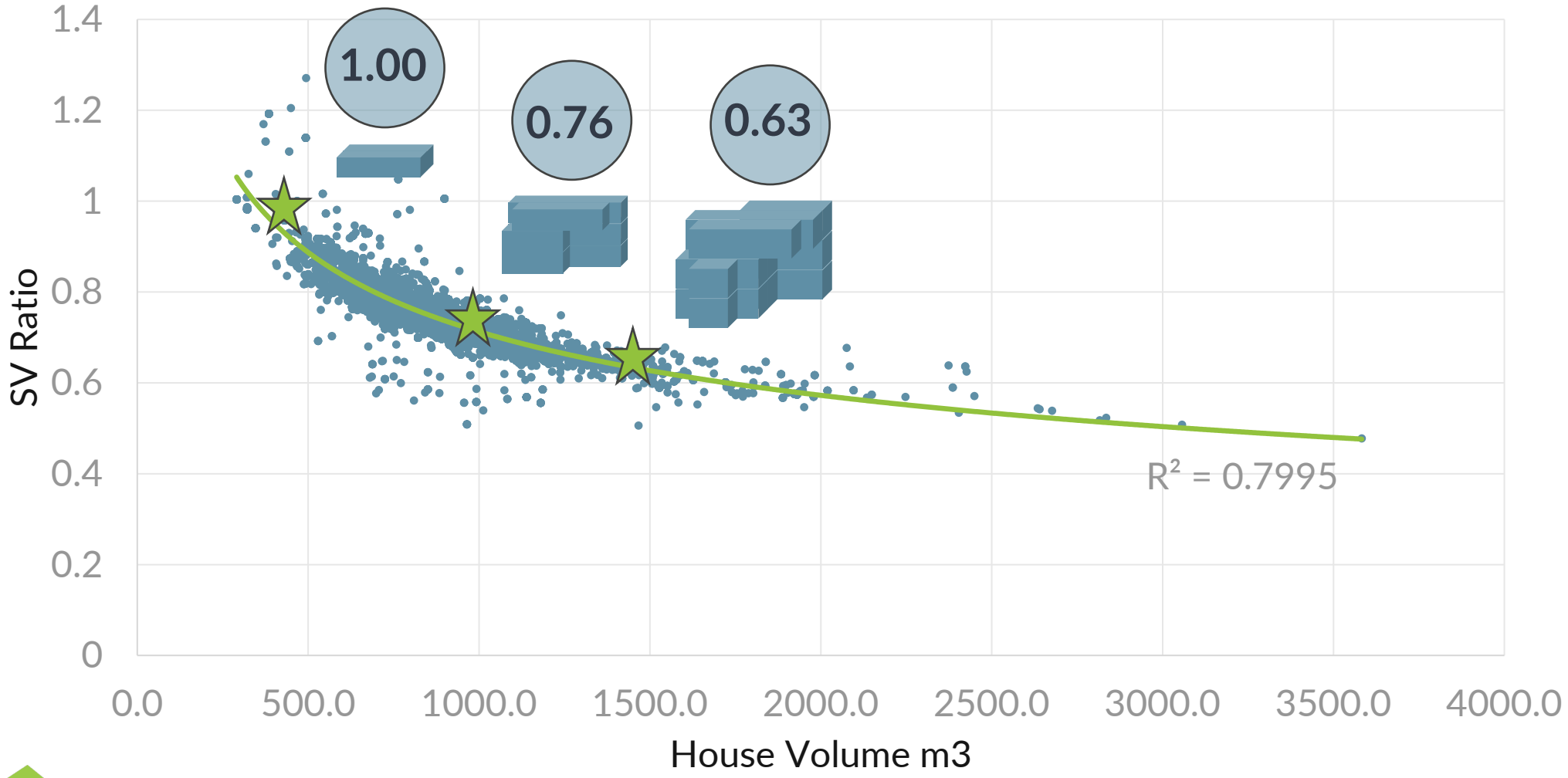
Problem #1: NBC 2020 uses fixed ACH_{50}

- Small homes tend to have higher SV ratios, making it more difficult to achieve ACH_{50} targets,
- Large homes tend to have lower SV ratios, making it less difficult to achieve ACH_{50} targets,
- Regardless of size or SV ratio, the Reference House **always uses a fixed ACH_{50} value**

SV Ratio & Compliance



SV Trend by House Volume



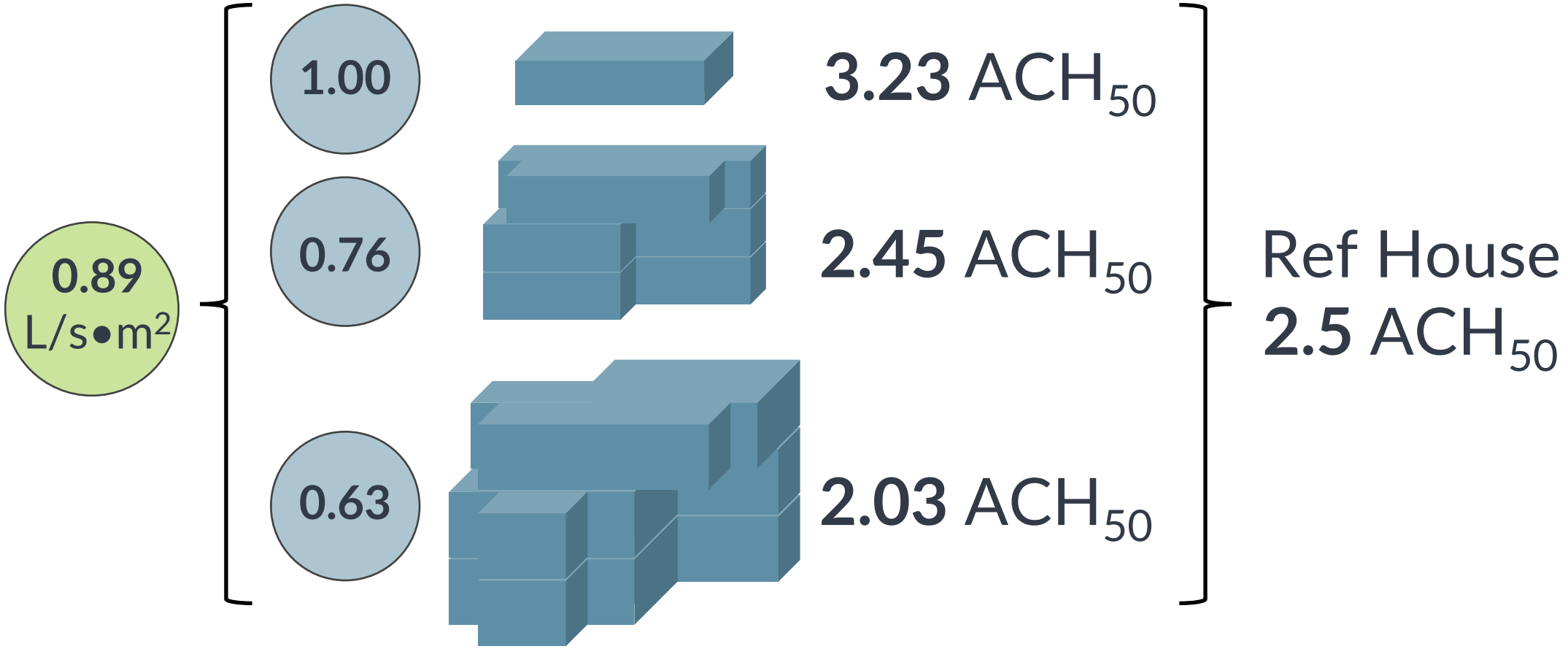
Proposed Change #1: Fixed NLR_{50}

PCF 1819: Proposes using **fixed NLR_{50} values** instead:

- **0.89 L/s•m²** for detached homes (0.18 cfm/ft²)
- **1.17 L/s•m²** for attached homes (0.23 cfm/ft²)

ACH_{50} values for the Reference House are calculated from these fixed NLR_{50} values

Problem #1: Fixed ACH_{50}



Proposed Change #1: Fixed NLR_{50}

Ref House

0.89 L/s•m²

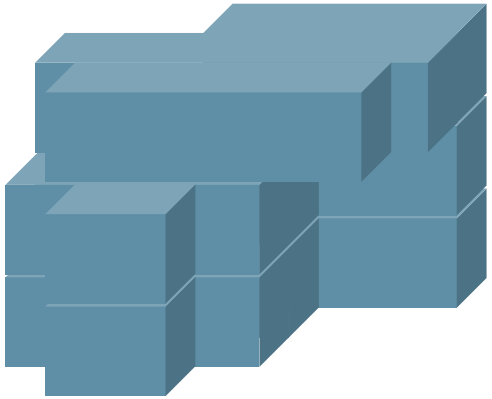
1.00

3.23 ACH_{50} = **3.23** ACH_{50}

0.76

2.45 ACH_{50} = **2.45** ACH_{50}

0.63



2.03 ACH_{50} = **2.03** ACH_{50}

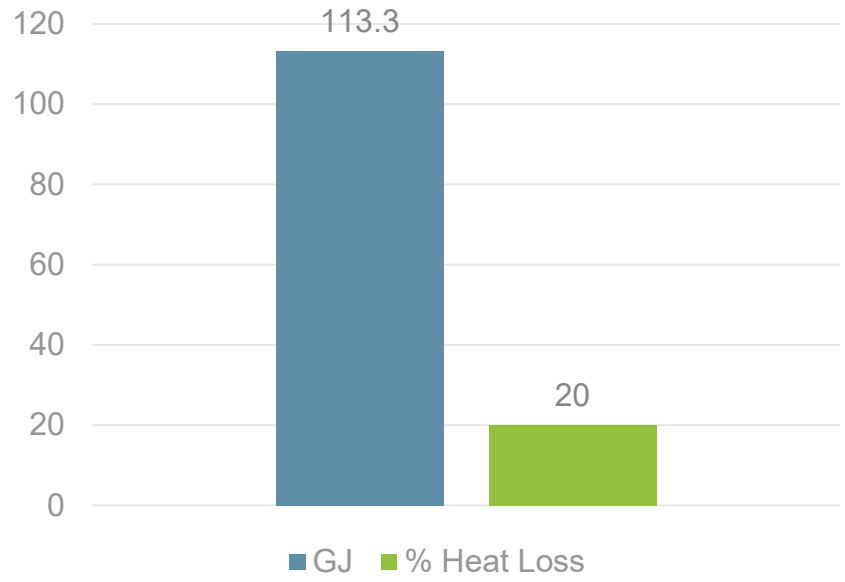
What Does This Mean for Houses?

Example #1

- Detached 2 storey home
- 3300sf
- Volume 785m^3, Surface Area 532m^2
- **SV ratio 0.68**

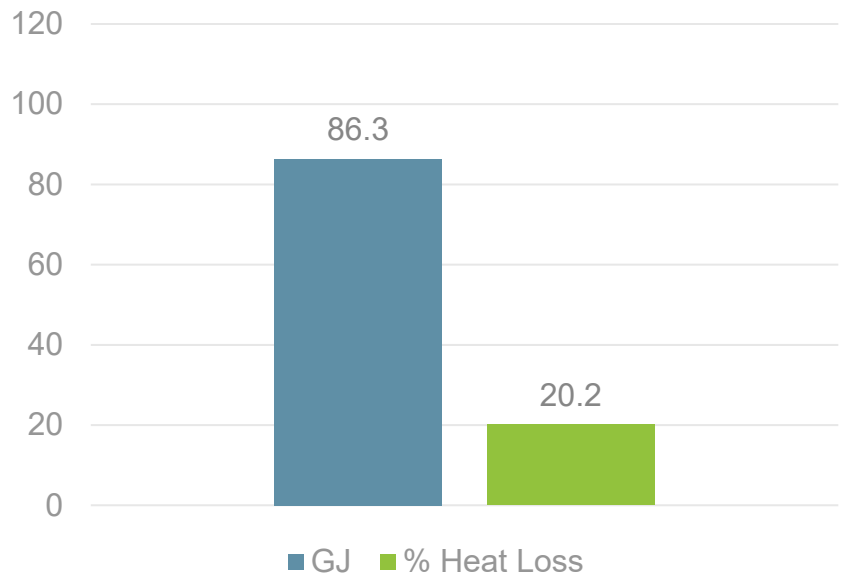
Example #1: 3300sf Detached Home

NBC Ref @ 2.5 ACH_{50}



OBC A1 @ 2.5 ACH_{50}

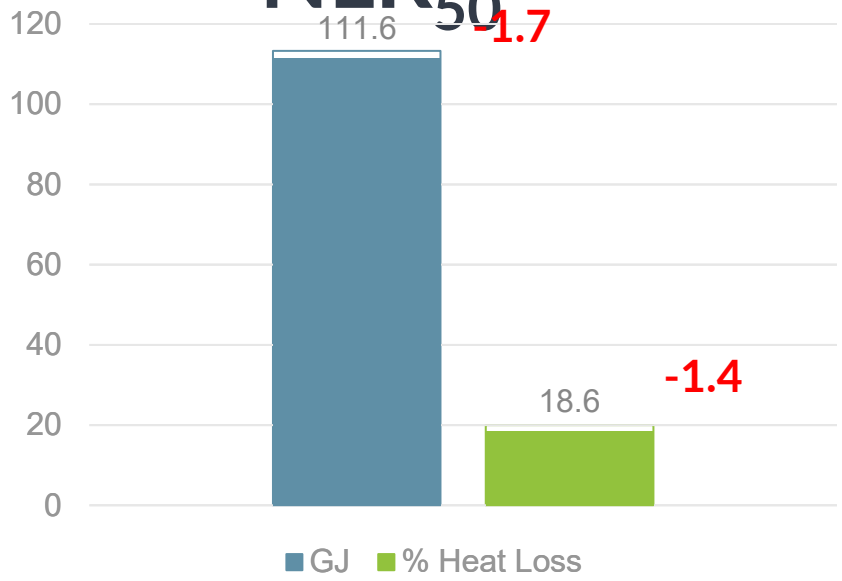
AL-1A



24% LTRH = Tier 3

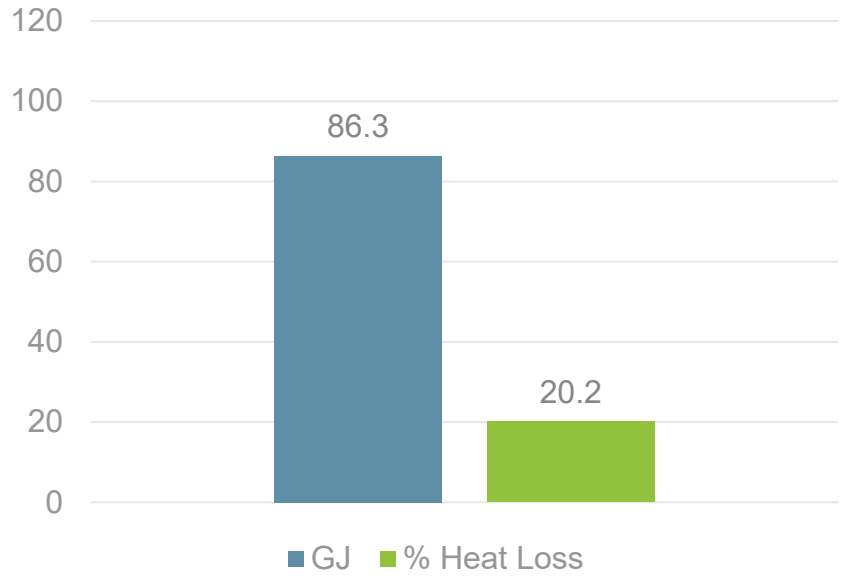
Example #1: 3300sf Detached Home

NBC Ref @ 0.89 NLR_{50}*



OBC A1 @ 2.5ACH_{50}

AL-1A



23% LTRH (-1%) = Tier 3 (No Change)

* 2.17 ACH_{50}

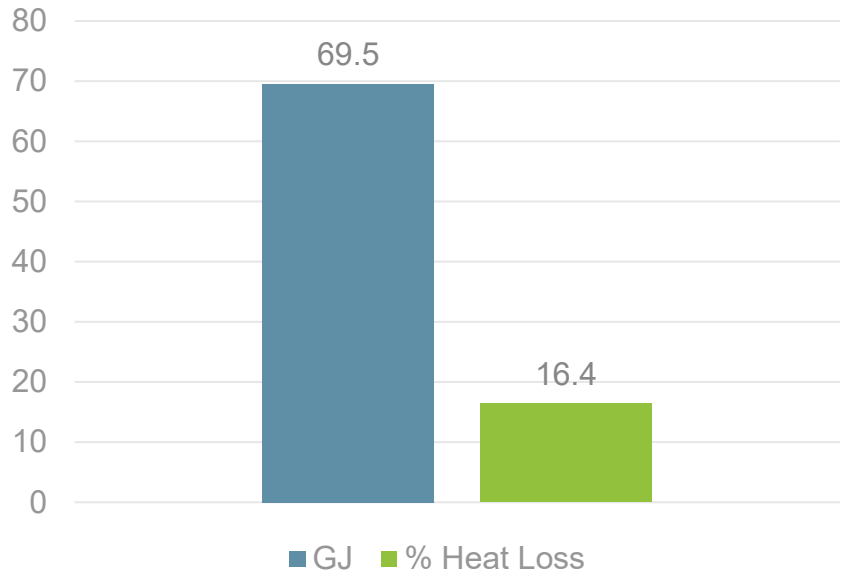
What Does This Mean for Houses?

Example #2

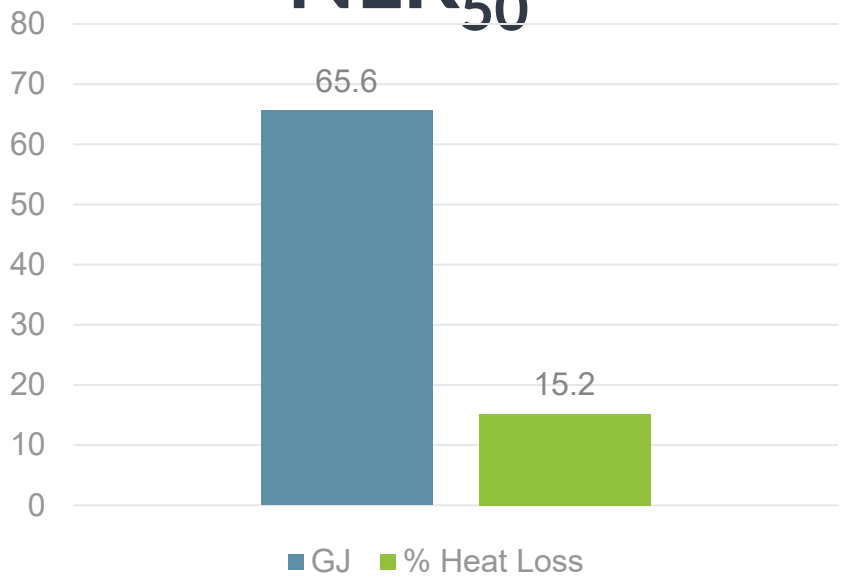
- Small Detached 1 storey home
- 1300 sf
- Volume 299m^3, Surface Area 310m^2
- **SV ratio 1.04**

Example #2: 1300sf Detached Home

NBC Ref @ 2.5 ACH_{50}



OBC A1 @ 0.89 NLR_{50} *



6% LTRH = Tier 2 (<300m^3)

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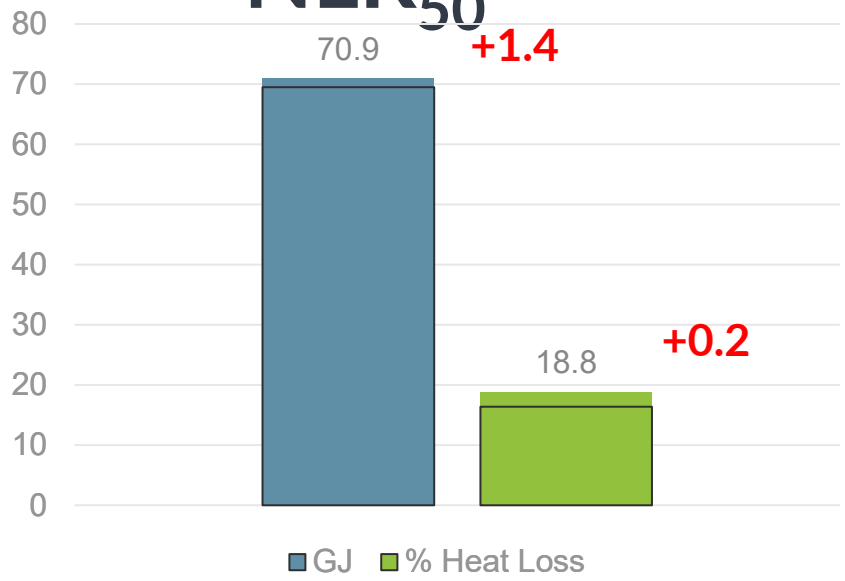
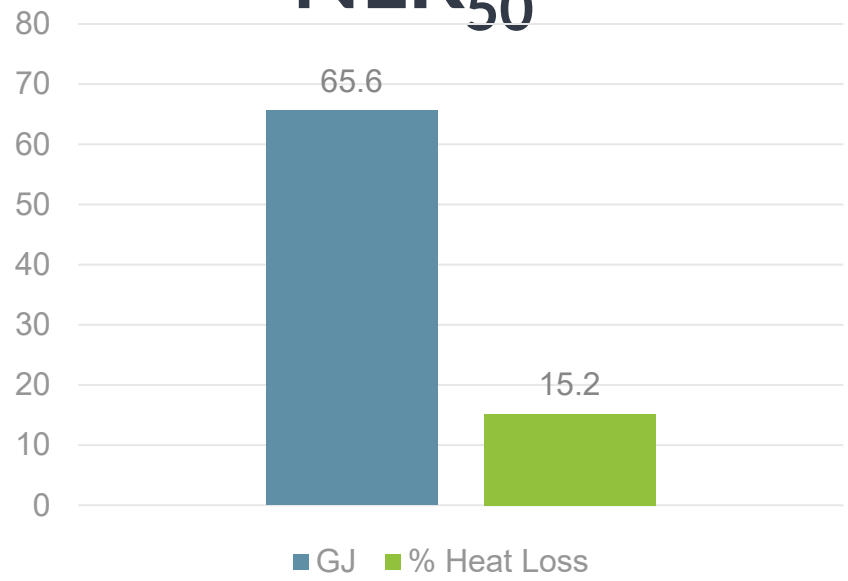
* 3.32 ACH_{50}

Example #2: 1300sf Detached Home

NBC Ref @ 0.89 NLR_{50}**



OBC A1 @ 0.89 NLR_{50}*



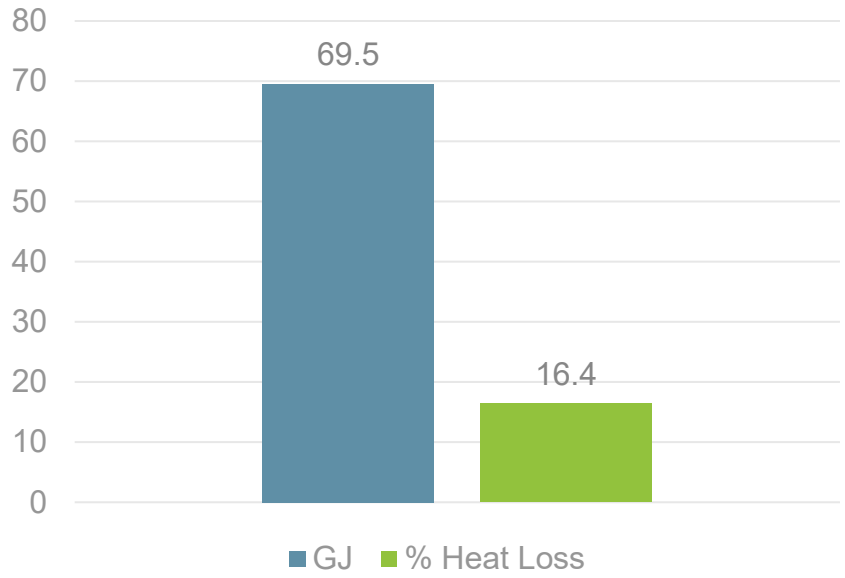
7% LTRH (+1%) = Tier 2 (No Change)

** 3.32 ACH_{50}

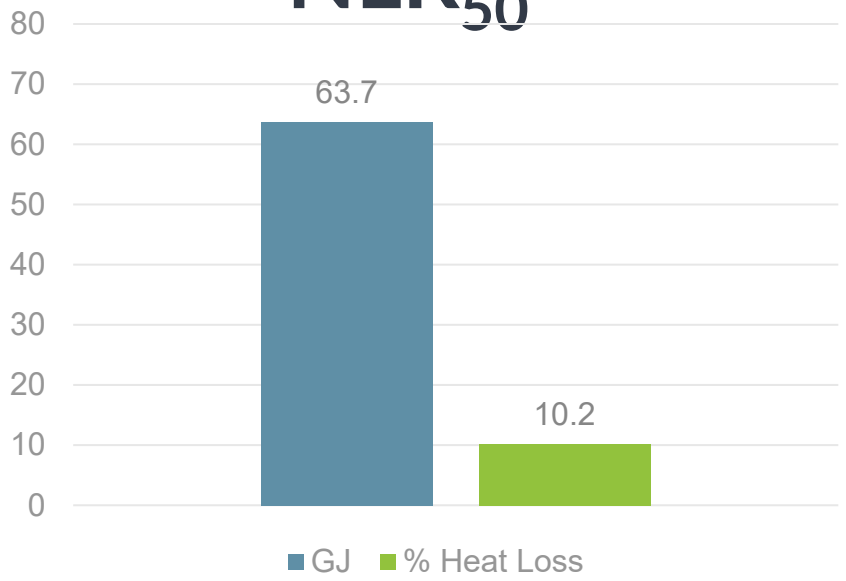
* 3.32 ACH_{50}

Example #2: 1300sf Detached Home

NBC Ref @ 2.5 ACH_{50}



OBC A1 @ 0.53 NLR_{50}* AL-3A



8% LTRH = Tier 2 (<300m^3)

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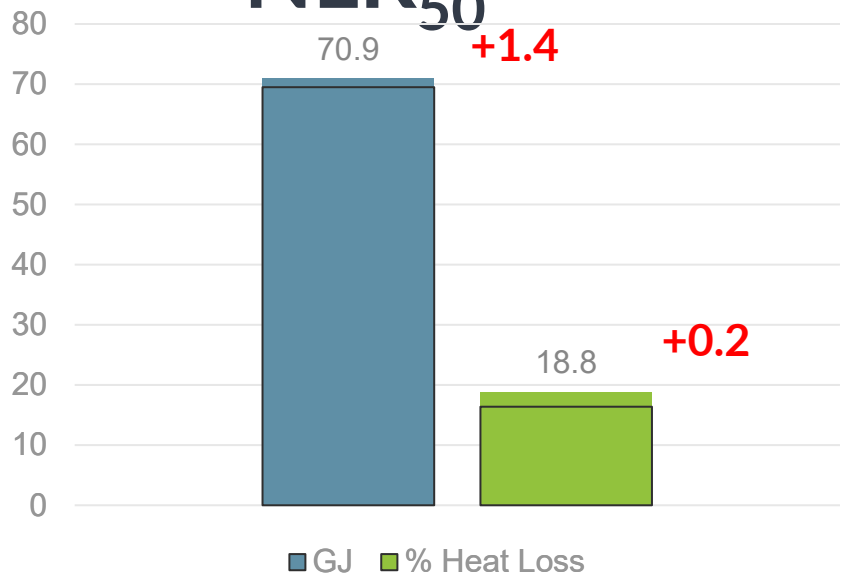
* 2.0 ACH_{50}

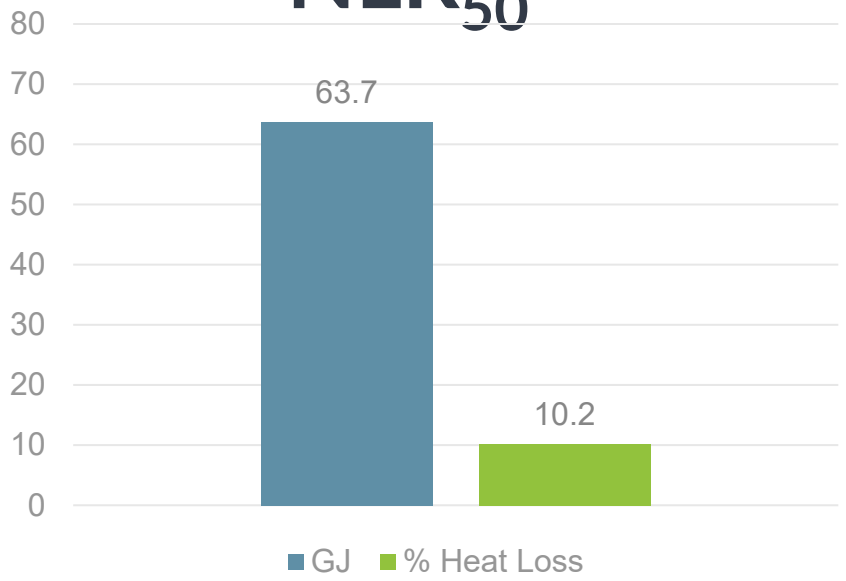
Example #2: 1300sf Detached Home

NBC Ref @ 0.89 NLR_{50}**



OBC A1 @ 0.53 NLR_{50}*

AL-3A



10% LTRH (+2%) = Tier 3 (+1)

** 3.32 ACH_{50}

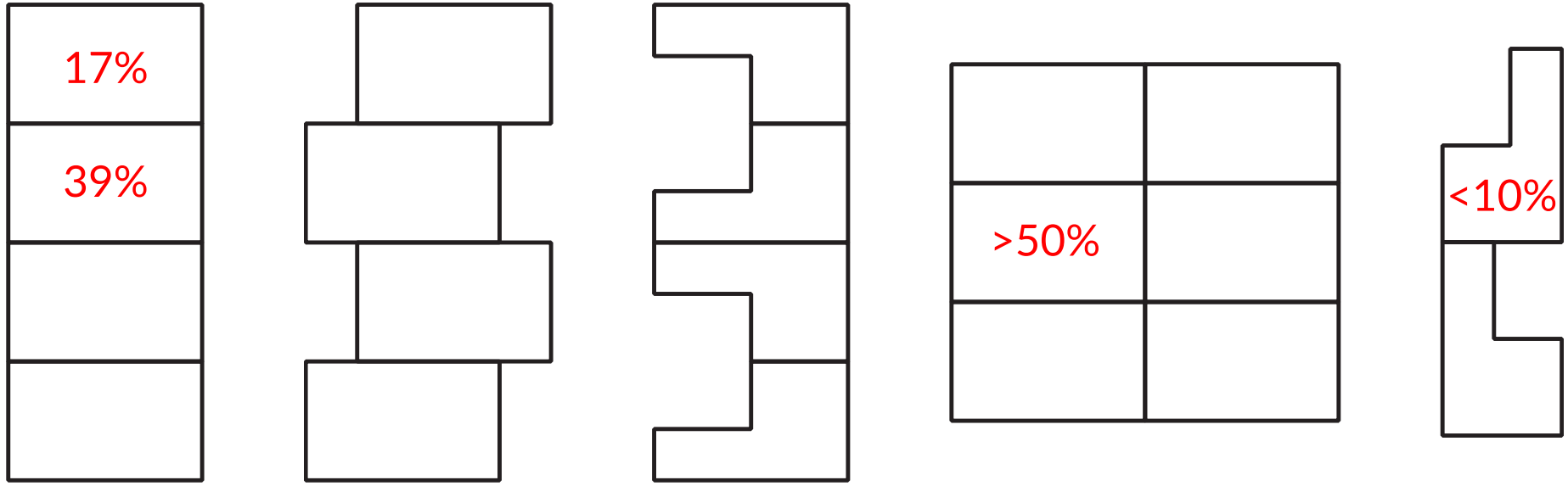
* 2.0 ACH_{50}

Problem #2: Attached Homes

NBC 2020 uses fixed 3.0 ACH_{50} for all attached homes

Problem #2: Attached Homes

NBC 2020 uses fixed 3.0 ACH_{50} for all attached homes



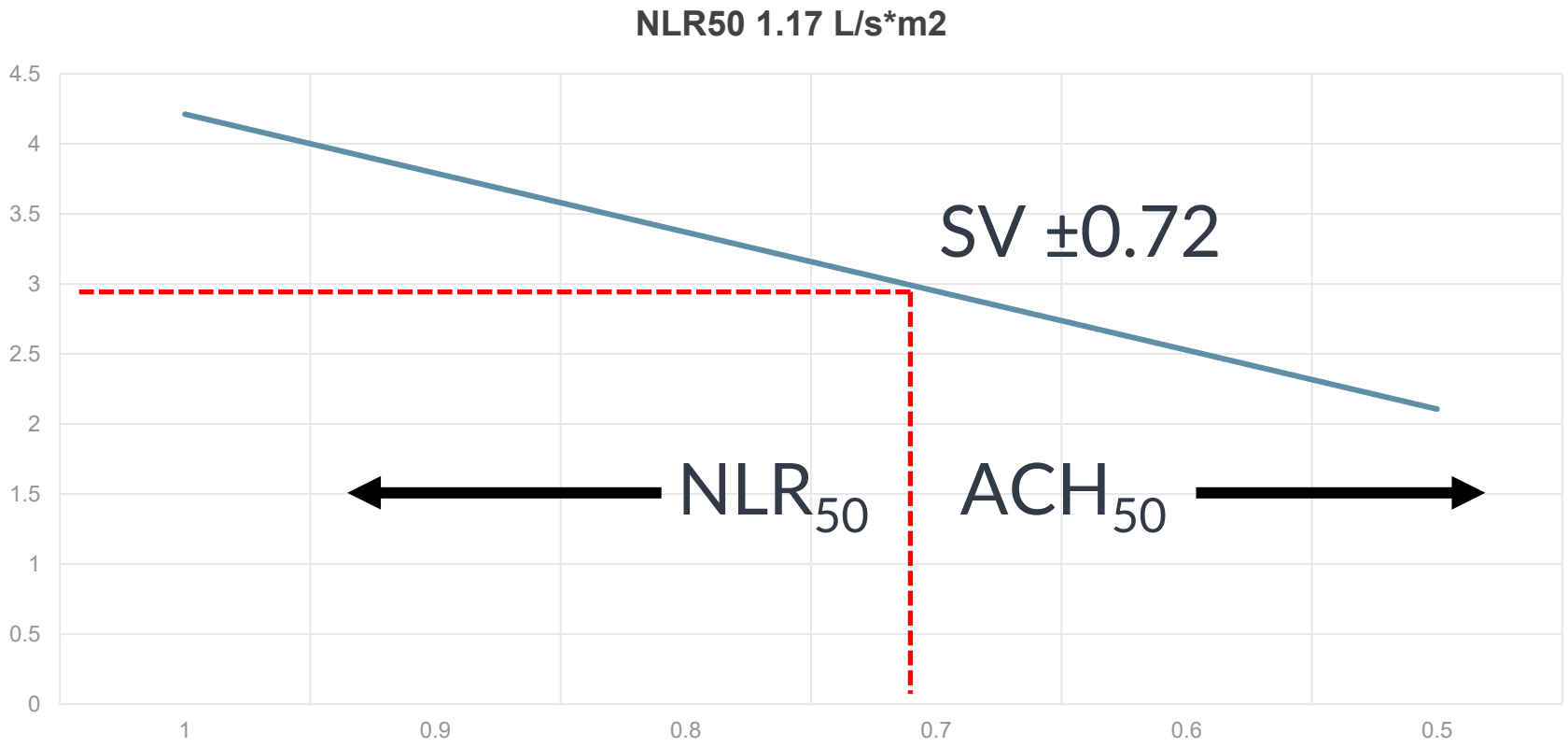
Problem #2: Attached Homes

NBC 2020 uses fixed 3.0 ACH_{50} for all attached homes

Hot2000 assumes all leakage is from the exterior (therefore representing heat loss or gain)

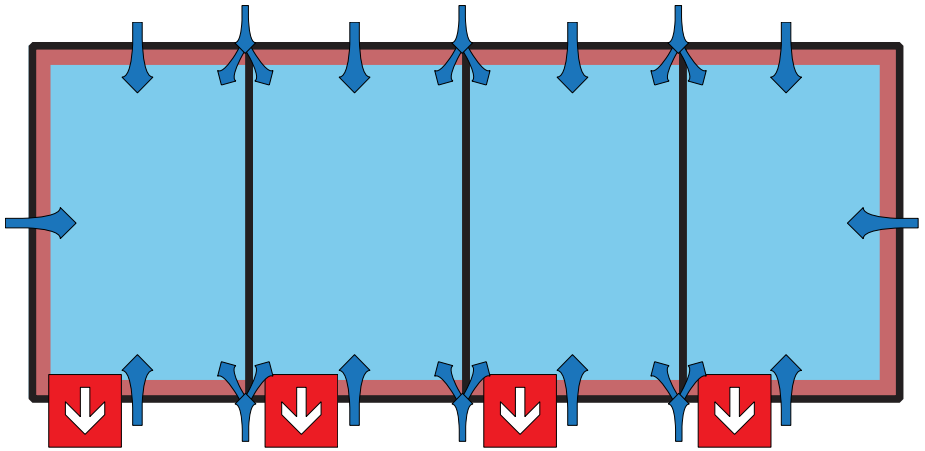
Unguarded testing measures all leakage and can't differentiate, leading to misalignment in Hot2000

SV Ratio & Compliance

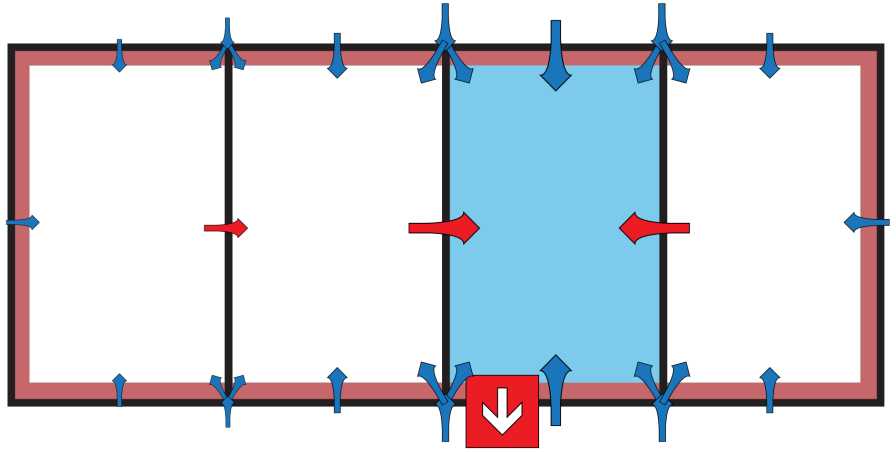


Problem #2: Attached Homes

Guarded Test



Unguarded Test



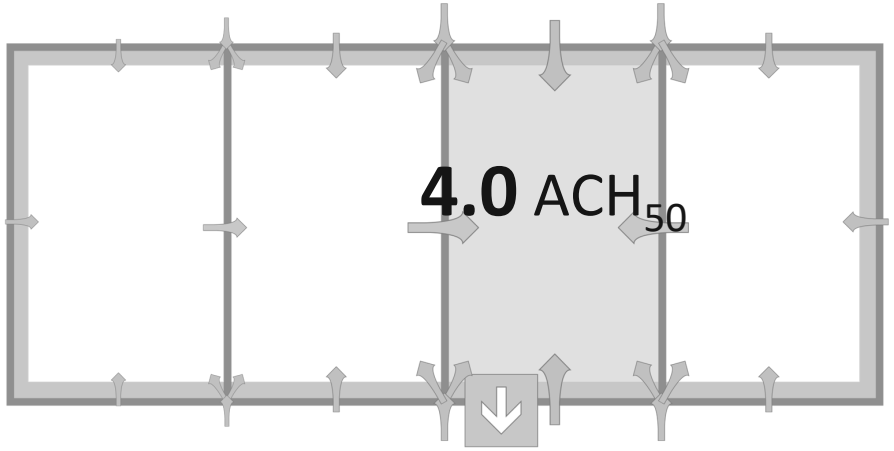
Problem #2: Attached Homes

Medium mid-row house

- SV Ratio **0.95** (whole zone)
- **402** m^3 volume
- **60%** Exposed Envelope Area

- NLR50 **1.17** L/s•m2

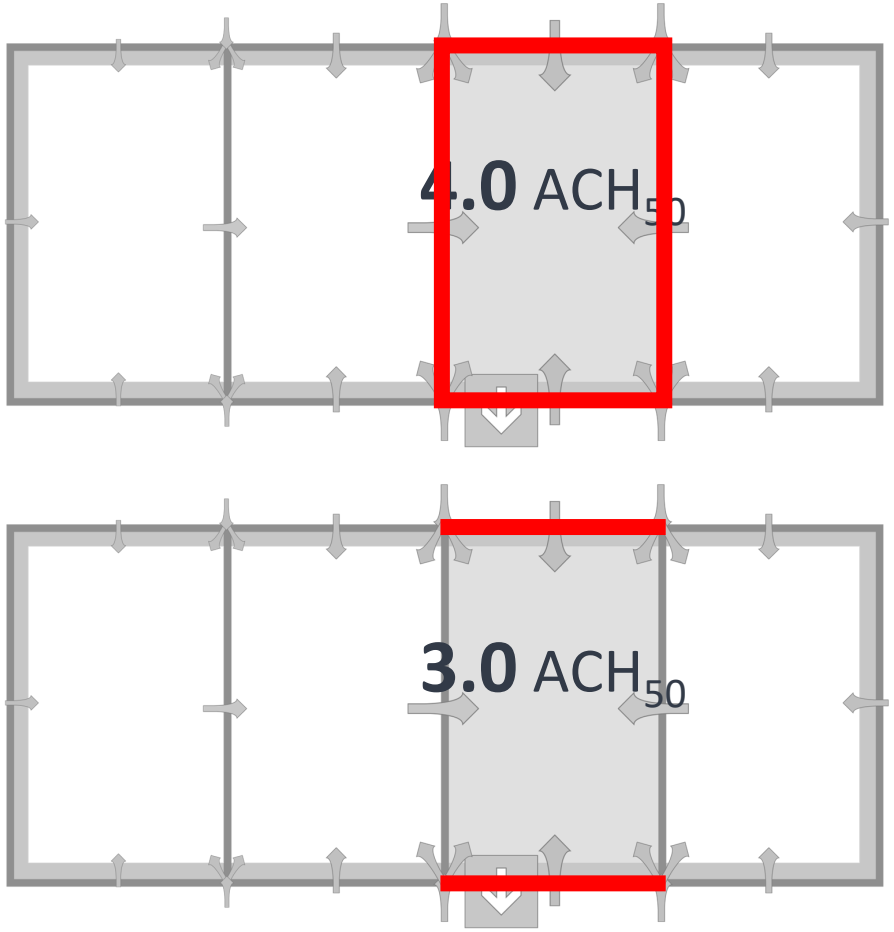
Unguarded Test



Problem #2: Attached Homes

Proposed House:

Results from blower door test entered directly into energy model, despite inclusion of party wall leakage



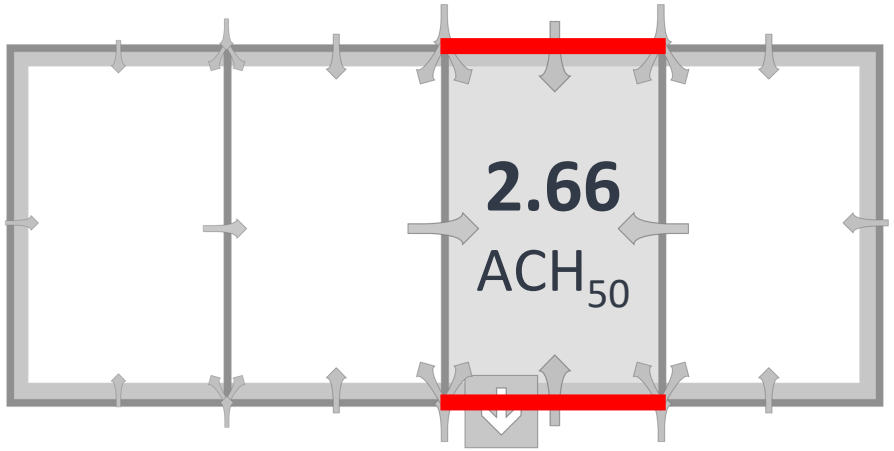
Reference House:

Assumes 3.0 ACH50, all leakage from the exterior

Proposed Change #2: Exterior Surfaces

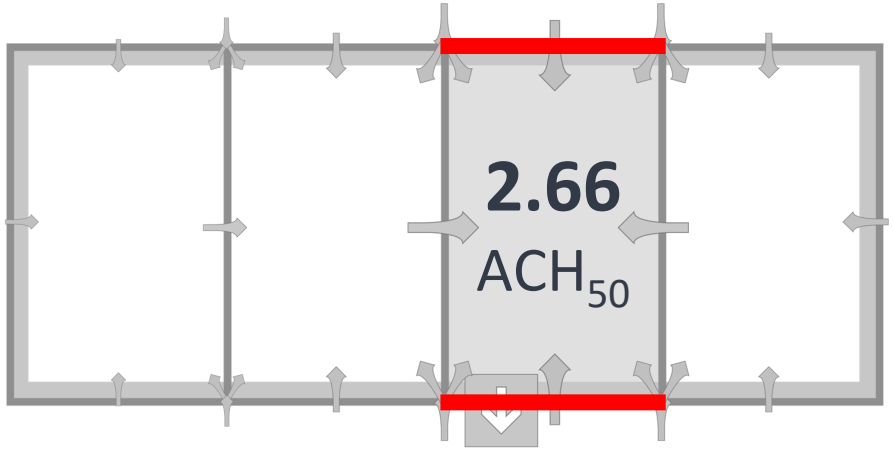
Proposed House:

NLR_{50} results (1.17 L/s•m^2) are applied only to exterior surfaces to determine ACH_{50} for energy model



Reference House:

Assumes 1.17L/s•m2 through exterior surfaces only to determine equivalent ACH_{50}



Proposed Change #2: Exterior Surfaces

PCF 1819: Proposes applying NLR_{50} to exterior surfaces only for attached homes

- Reduces the overall impact of measured air leakage on the total energy use of attached homes
- Better alignment between reference house and unguarded blower door test results

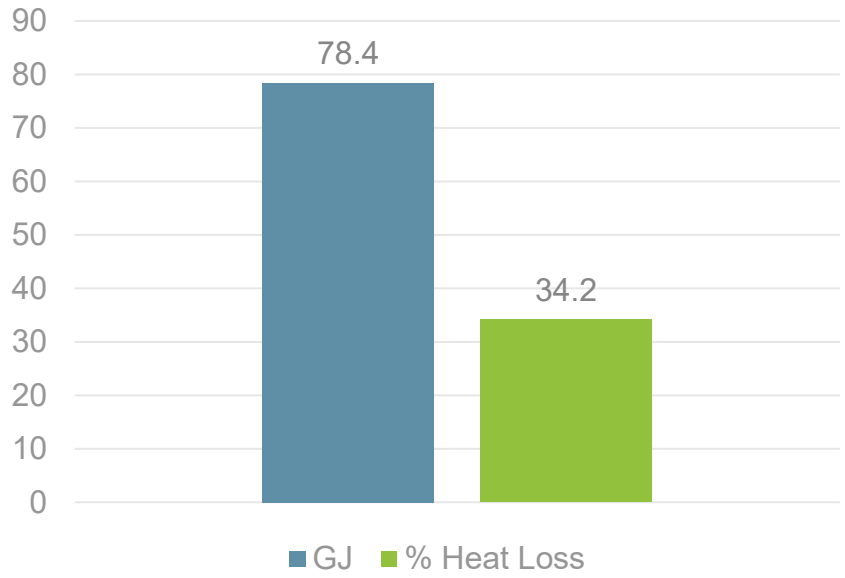
What Does This Mean for Houses?

Example #3

- Mid-unit 2 storey townhome
- 2500sf
- Volume 623m^3, Exterior Surface Area 307m^2
- **SV ratio 0.49**

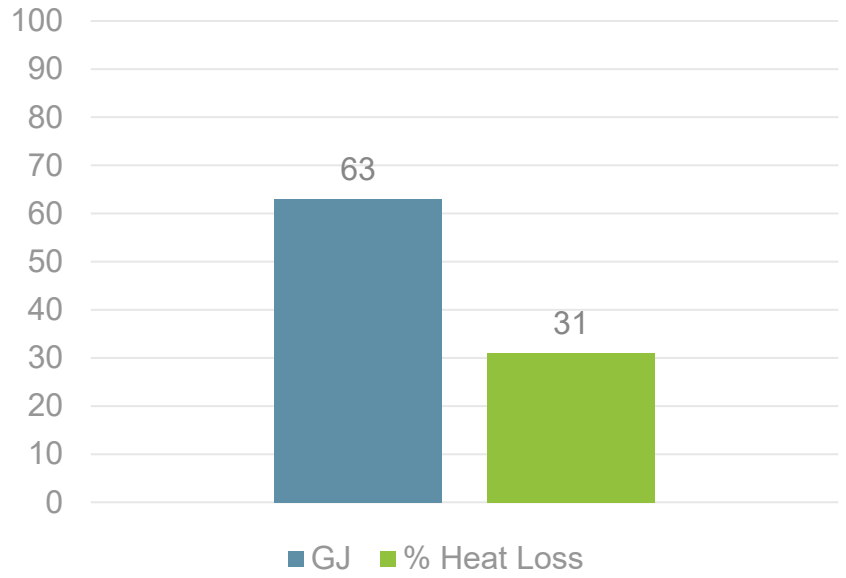
Example #3: 2500sf Mid-unit Townhome

NBC Ref @ 3.0 ACH_{50}



OBC A1 @ 3.0 ACH_{50}

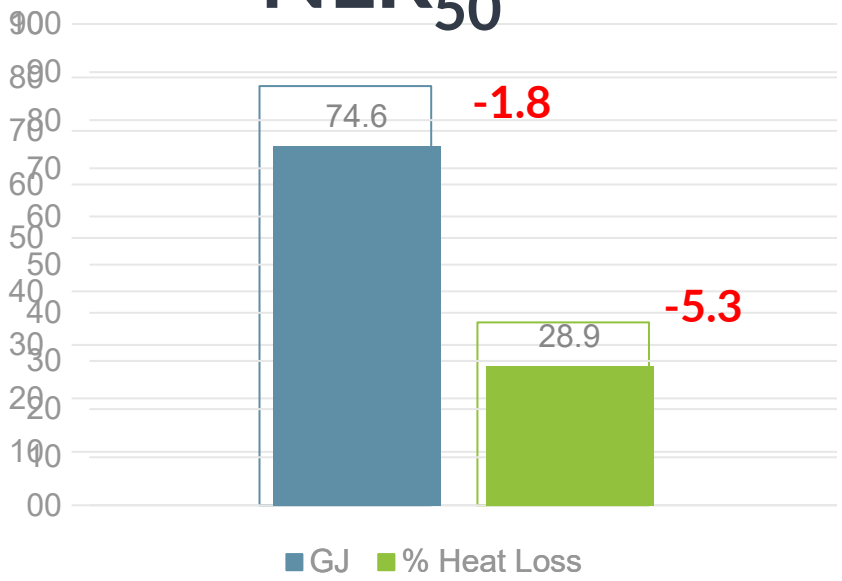
AL-1A



20% LTRH = Tier 3

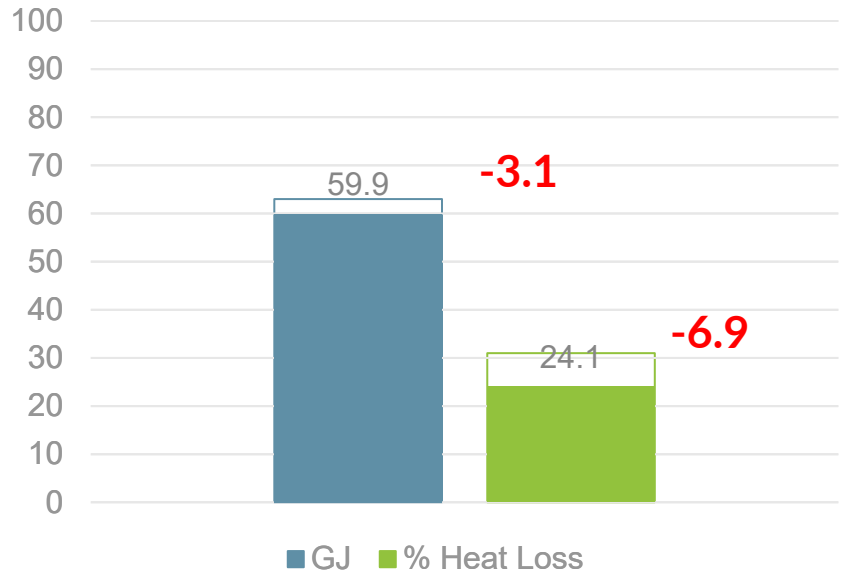
Example #3: 2500sf Mid-unit Townhome

NBC Ref @ 1.17 NLR_{50}*



OBC A1 @ 1.17 NLR_{50}

AL-1A



20% LTRH (No Change) = Tier 3 (No Change)

* 3.32 ACH_{50}

** 2.0 ACH_{50}

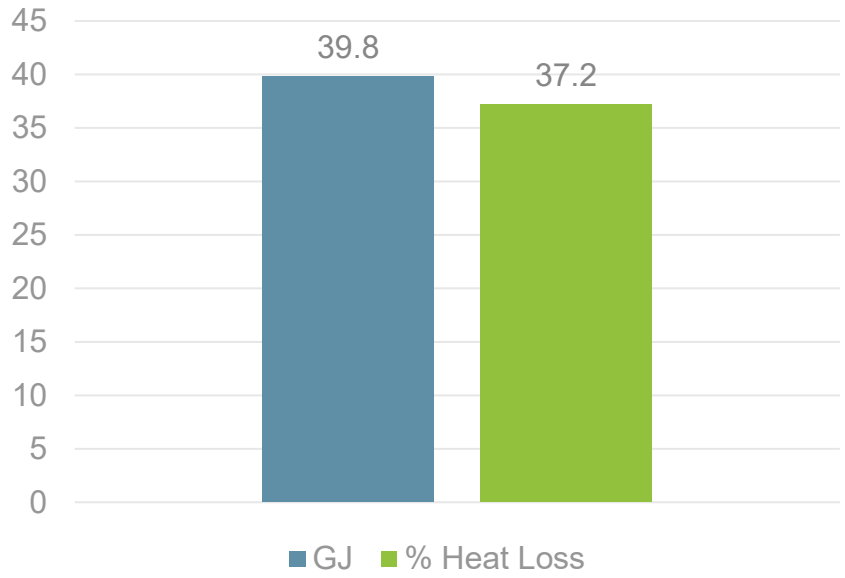
What Does This Mean for Houses?

Example #4

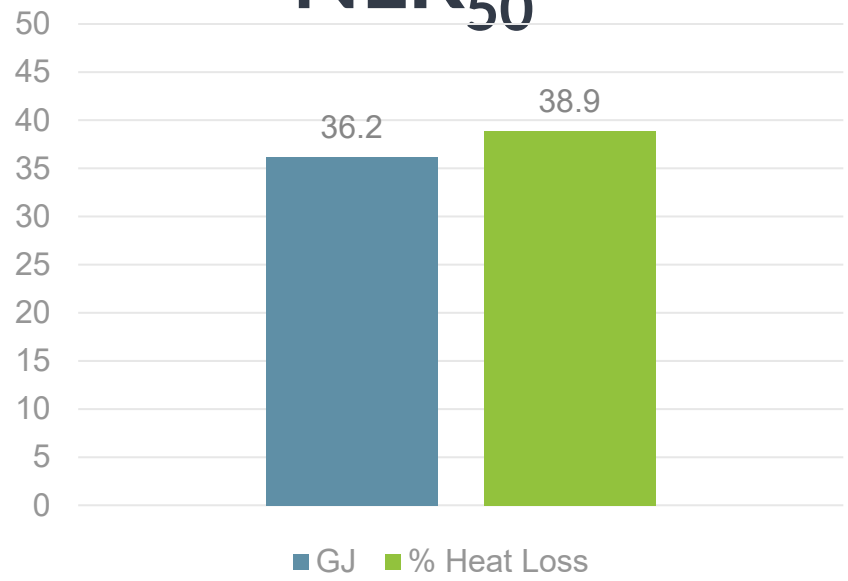
- Small MURB unit
- 1005sf
- Volume 270m^3, Exterior Surface Area 86m^2
- **SV ratio 0.32**

Example #4: Small MURB unit

NBC Ref @ 3.0 ACH_{50}



OBC A1 @ 0.89 NLR_{50} *

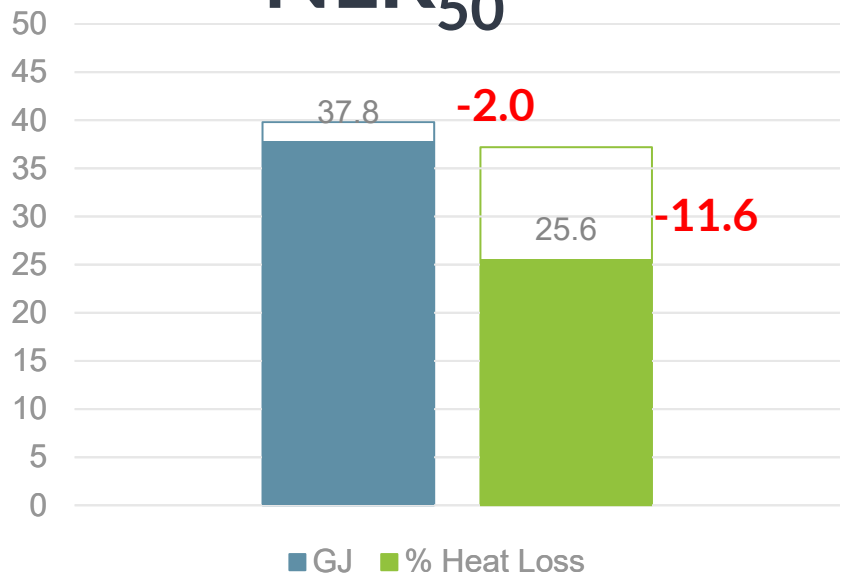


9% LTRH = Tier 2 (<300m^3)

* 4.27 ACH_{50}

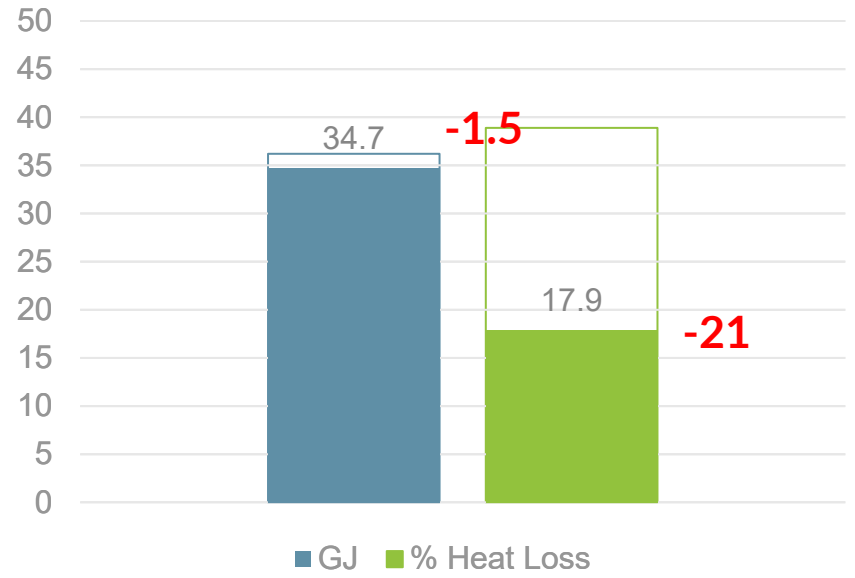
Example #4: Small MURB unit

NBC Ref @ 1.17 NLR_{50}*



OBC A1 @ 1.17 NLR_{50}**

AL-1A



8% LTRH (-1%) = Tier 2 (No Change)

* 1.34 ACH_{50}

** 1.34 ACH_{50}

Proposed Changes: A couple more things

PCF 1819 also proposes the following prescriptive changes:

- Differentiates assumed prescriptive airtightness for attached and detached homes (0.89 / 1.17 L/s•m$^{2)}$
- Alignment between 9.36 and Tiers to allow the use of prescriptive values of 0.89 / 1.17 L/s•m^2 without a blower door test (provided 9.25.3 and 9.36.2.9-.10 measures are followed)

PCF 1819: Recommended to Public Review

Watch for this proposed change to be included in the next Public Review period for the 2025 NBC

CHBA Technical Research Council

THANK YOU

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Webinar #7: Accessible Dwellings

April 26th, 12:00-1:00 PM ET

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