Canadian Home Builders' Association

ENERGY-EFFICIENCY CHANGES IN THE 2020 NBC PART 9

Canadian Home Builders' Association

June 17, 2022

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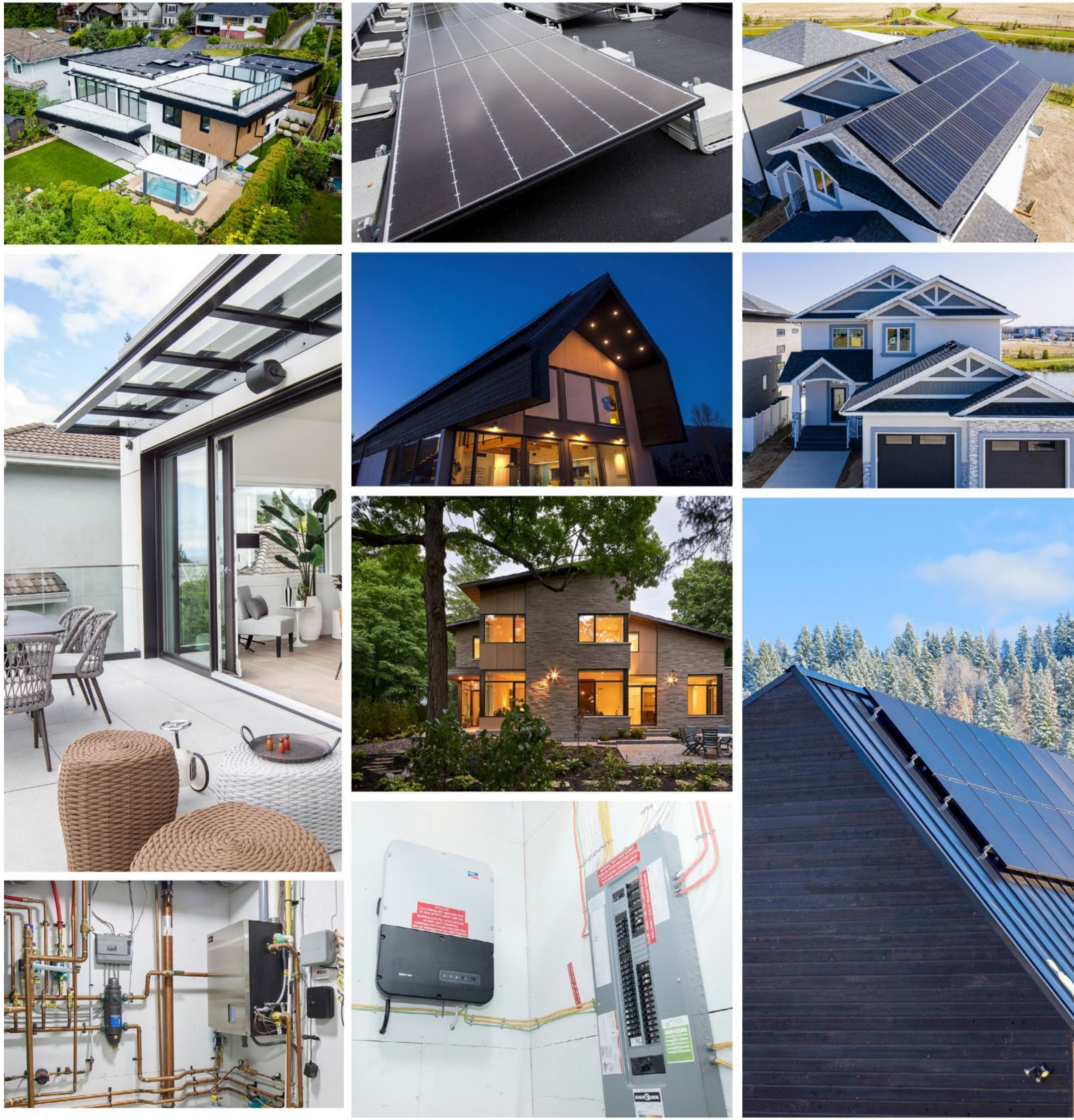
Outline

- Overview of energy-efficiency changes
- Key implications
- Summary
- Questions & Answers



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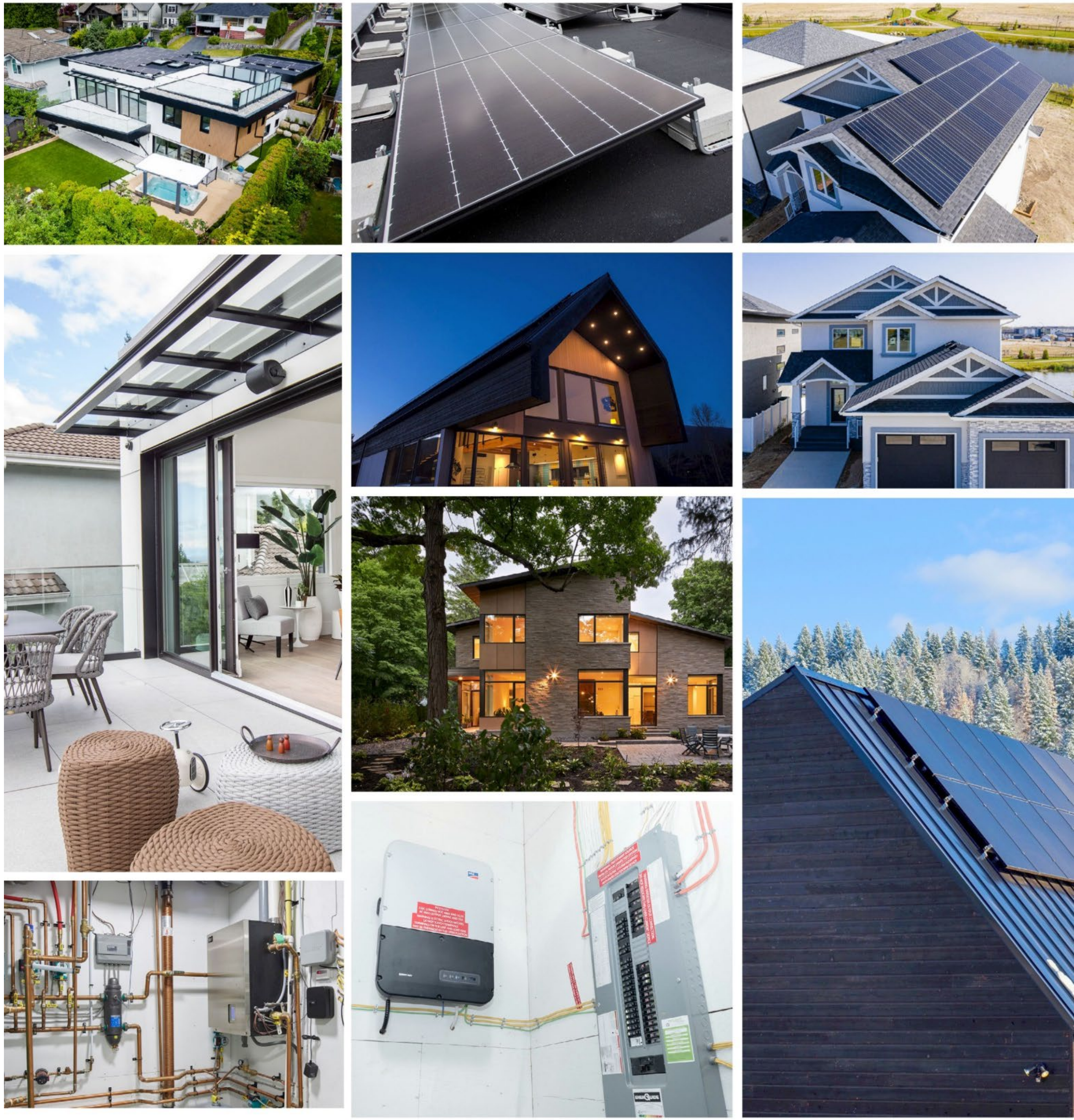
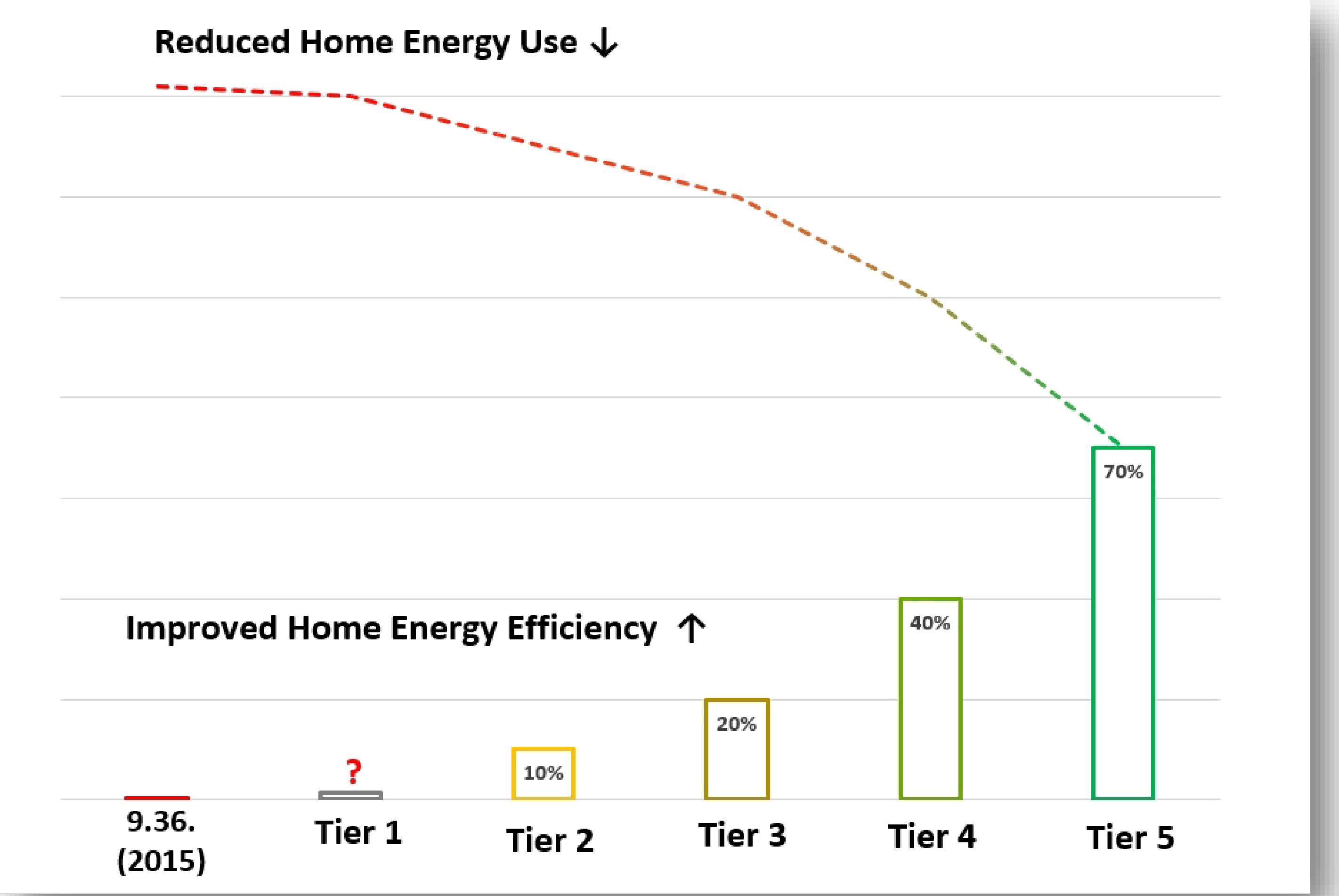


Energy-efficiency Changes – The Idea



Builders can choose any of the tiers

Provinces choose when tiers are required

Energy-efficiency Changes – 2020 Code Subsections

Existing Code

9.36.1. – Application and Compliance – all tiers, all paths (some changes)

9.36.2. to 9.36.4 – Prescriptive Path – tier 1 & 2 (all tiers as ref.) (some changes)

9.36.5. – Calculation of Performance Compliance – all tiers (some changes)

New Subsections in 2020 NBC

9.36.6. – Airtightness (Testing) of Building Envelopes – all tiers

9.36.7. – Performance Path – Improvement targets – tiers 1 to 5

9.36.8. – Prescriptive Path – energy conservation points – tiers 1 & 2

(no prescriptive path for tiers 3 to 5 in 2020 NBC)

Energy-efficiency Changes – 9.36.1, 9.36.2 to 9.36.4

Application and Compliance – All Tiers

- Changes in 9.36.1.
  - “volume of conditioned space” is now defined in the context of 9.36.
  - administrative changes to reference the new subsections

Prescriptive Path – Tier 1

- Changes in 9.36.2. to 9.36.4
  - ! Updated energy efficiency **performance ratings** for water- and space-heating equipment!
  - Trade-off path does not permit ER values for fenestration
  - Minor plumbing and electrical elements within external walls, which retain at least 60% of the required wall insulation, no longer need to use the trade-off path

Energy-efficiency Changes – 9.36.5 Modeling

Calculation of Performance Compliance – All Tiers

- Significant Changes to 9.36.5
  - ! **EnerGuide Rating System**, version 15, added as a compliance option
  - Added exponent 0.67 to airtightness modeling
  - Airtightness **testing AND ! prescriptive** requirements are required in order to use the 2.5 ACH for modeling (no testing = 3.2 ACH)
  - Significant changes to how service water is modeled (volume, temperature, flow)
  - Can include greywater heat recovery if calculated with new referenced standard; unit must serve all, or at least two (where more than two) above-ground showers

Implications of airtightness testing will be discussed later

Energy-efficiency Changes – Airtightness 9.36.6.

Airtightness of the Building Envelope

- Airtightness of buildings and dwelling units
  - Testing standard, details on procedures and conversions to other than ACH metrics
  - Default values for use in the energy model calculations in 9.36.5.
  - To determine airtightness level in 9.36.8. (prescriptive tier – energy conservation points)
- Determining the airtightness level
  - Airtightness Levels Using **Guarded** Method (single and attached homes)

Level	AL-1A	AL-2A	AL-3A	AL-4A	AL-5A
ACH	**2.5**	**2.0**	**1.5**	**1.0**	**0.6**

  - Airtightness Levels Using **Unguarded** Method (attached homes or apartments)

Level	AL-1B	AL-2B	AL-3B	AL-4B	AL-5B	AL-6B
ACH	**3.0**	**2.5**	**2.0**	**1.5**	**1.0**	**0.6**

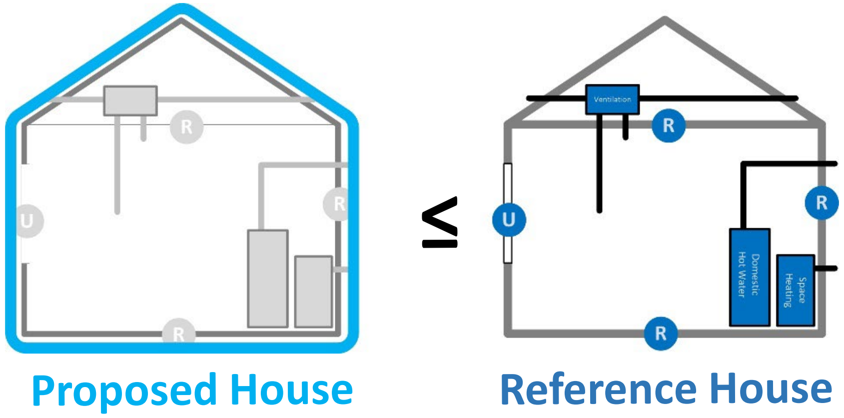
9.8.8.1
Energy Conservation Points by Climate Zone

Energy-efficiency Changes – Performance Path 9.36.7

Available for all tiers

Concept remains the same

- Proposed vs Reference House



Requirements:

1. **Peak Cooling:** Proposed house has lower cooling load than reference house
2. **Energy Improvement:** Proposed house uses less energy than the reference house for heating, cooling, ventilation and hot water combined.
   - Each tier specifies a target percentage!
3. **Envelope Improvement:** Proposed house loses less energy to the outside than the reference house does.
   - Each tier specifies a target percentage!

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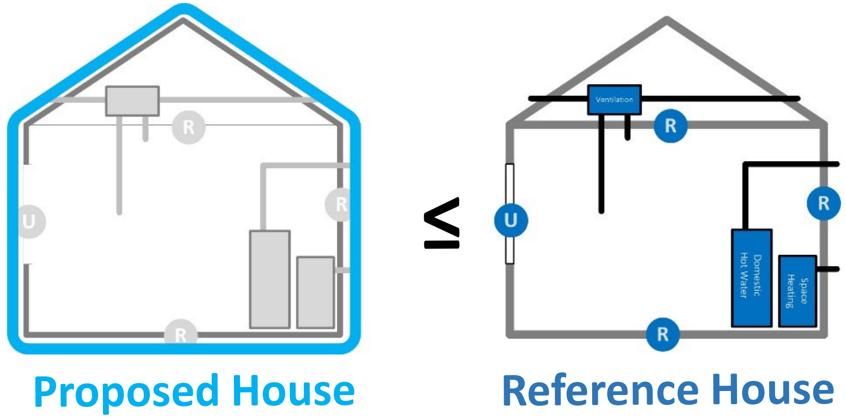
Energy-efficiency Changes – Performance Path 9.36.7

Available for all tiers

Concept remains the same

- Proposed vs Reference House



Requirements:

Target Metric	Applicable Performance Targets				
	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
1. Peak Cooling	✓	✓	✓	✓	✓
2. Energy Improvement	0%*	**≥ 10%**	**≥ 20%**	**≥ 40%**	**≥ 70%**
3. Envelope Improvement	0%*	**≥ 5%**	**≥ 10%**	**≥ 20%**	**≥ 40%**

** Ref House equipment efficiency will improve, different ACH regime, peak cooling load, mandatory HRV/ERV*

Energy-efficiency Changes – Prescriptive Path 9.36.8

Only available for tier 1 and 2

- Tier 1: ERV/HRV + 9.36.2 to 9.36.4
- Tier 2: Comply with tier 1 and collect 10 points

Category	Specification for points
Effective R-value of above ground walls	points for high R-value
Effective R-value of below ground walls	points for high R-value
Tested Airtightness	points for low air leakage
U-value or ER of fenestration and doors	points for low U-value or high ER*
Ventilation equipment	points for high efficiency
Service water heating equipment	points for high efficiency
Conditioned volume of building	points for small homes

Energy-efficiency Changes – Prescriptive Path 9.36.8.

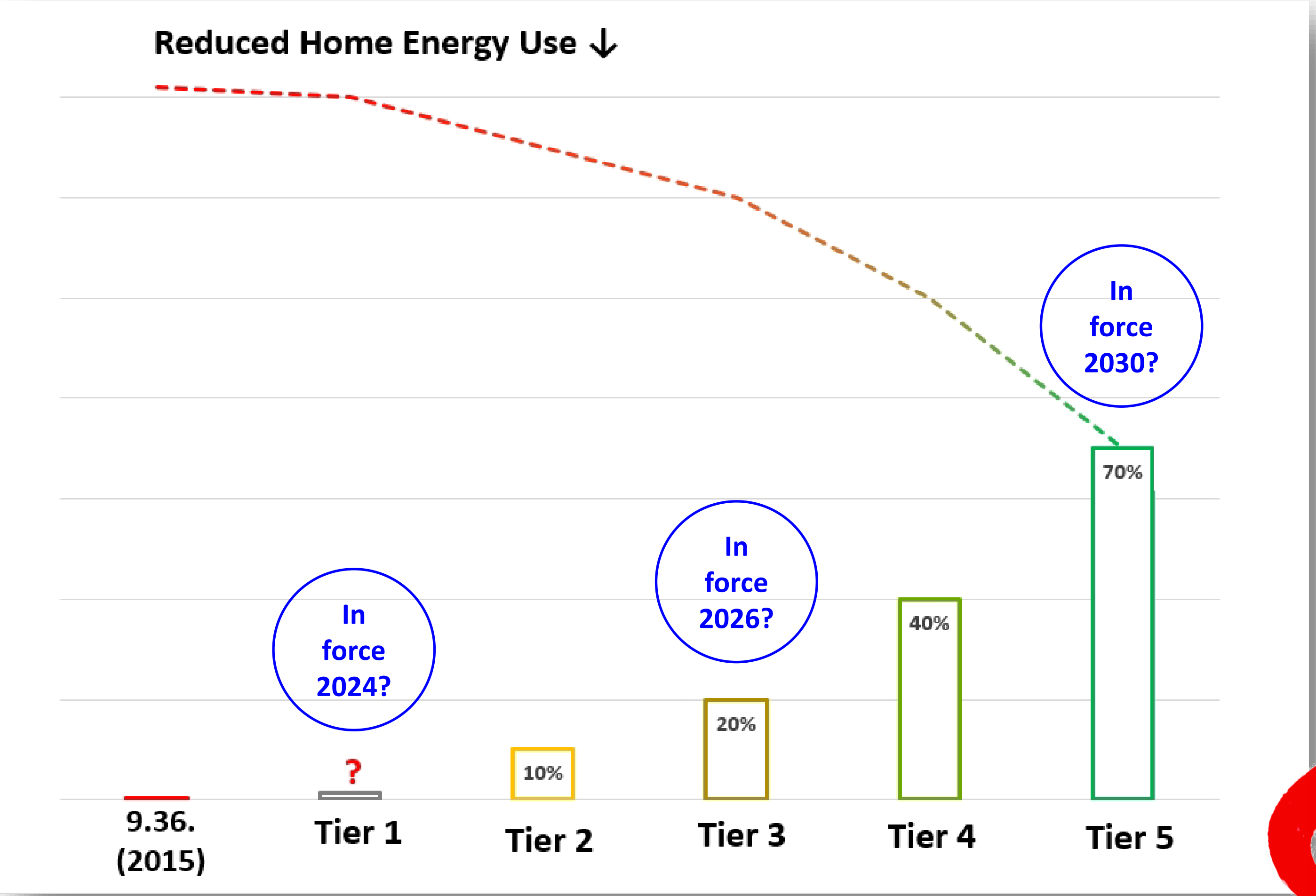
Example

- 2000 ft^2 single-family home in Edmonton (w. conditioned basement, Climate Zone 7B)
- Comply with tier 1 and collect **10 points** to comply with tier 2

Category	Specification	Points
Effective R-value of above ground walls	RSI 3.08 m^2K/W (~R17.5)	0
Effective R-value of below ground walls	RSI 2.98 m^2K/W (~R16.9)	0
Tested Airtightness	**2.0 ACH** (AL-2A)	**6.1**
U-value or ER of fenestration and doors	U-value 1.44	0
Ventilation equipment	**SRE 60%** (HRV or ERV pre-requisite)	**0.8**
Service water heating equipment	**Gas fired storage type EF=0.8**	**3.1**
Conditioned volume of building	780m^3	0

10 points

Energy-efficiency Changes – The Idea



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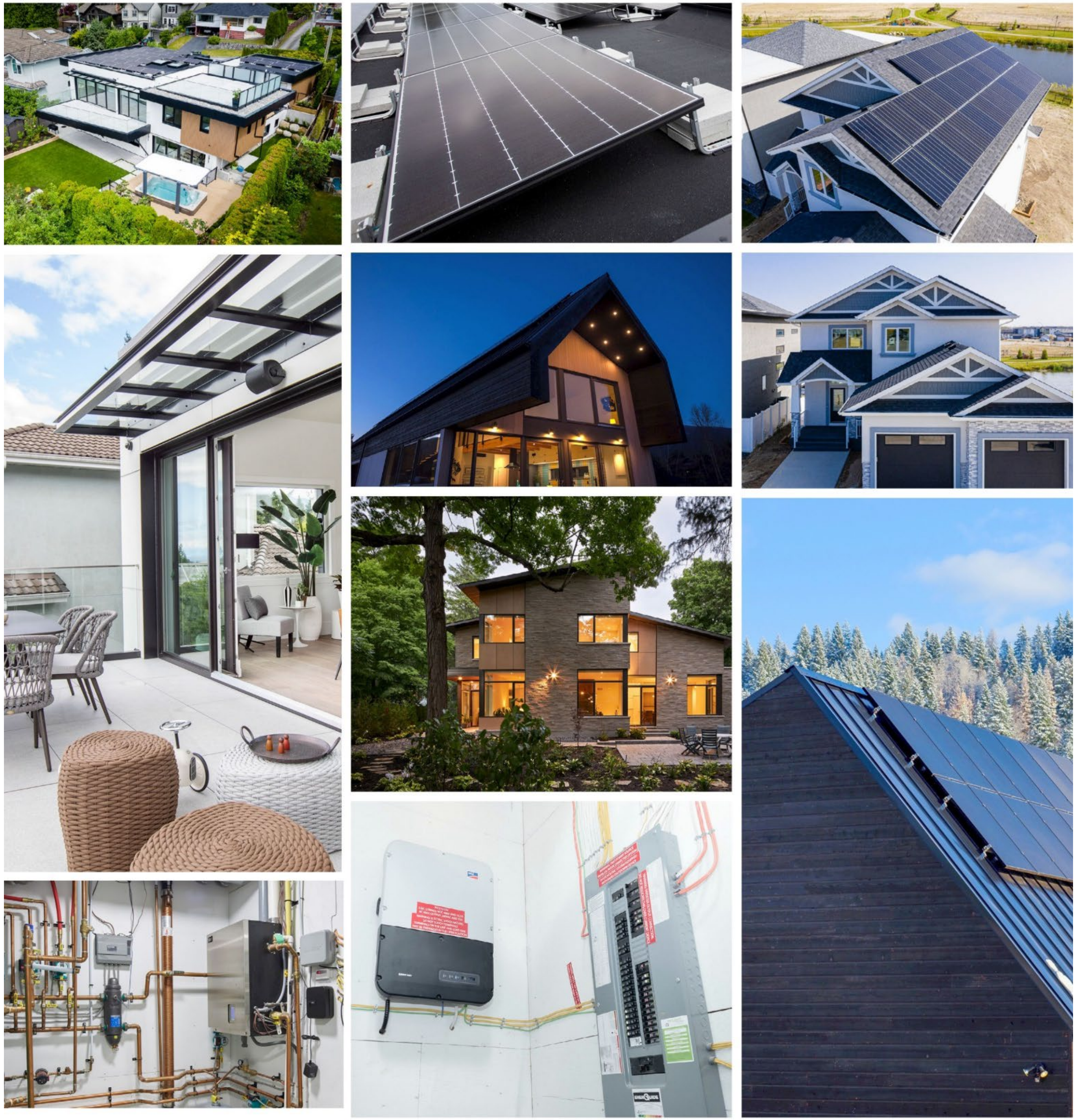

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Tiers (mis-)alignment

Tier 1 is not the status quo!
Tier 4 is Net Zero Ready Performance!

- Tier 1 does not equal the current 9.36.

- Tier 5 requirements overshoot net zero performance levels
- Net zero can be achieved faster (tier 4) and at much lower cost than tier 5

2016

Tier	Intended Alignment
1	NBC 9.36. 2015 (ERS 78)
2	R2000 (2005) (ERS 80)
3	Energy Star
4	R2000 (2012) (ERS 86)
5	**Net Zero Energy Ready**

Tiers (mis-)alignment

Target Metric	Applicable Performance Targets				
	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
1. Peak Cooling	✓	✓	✓	✓	✓
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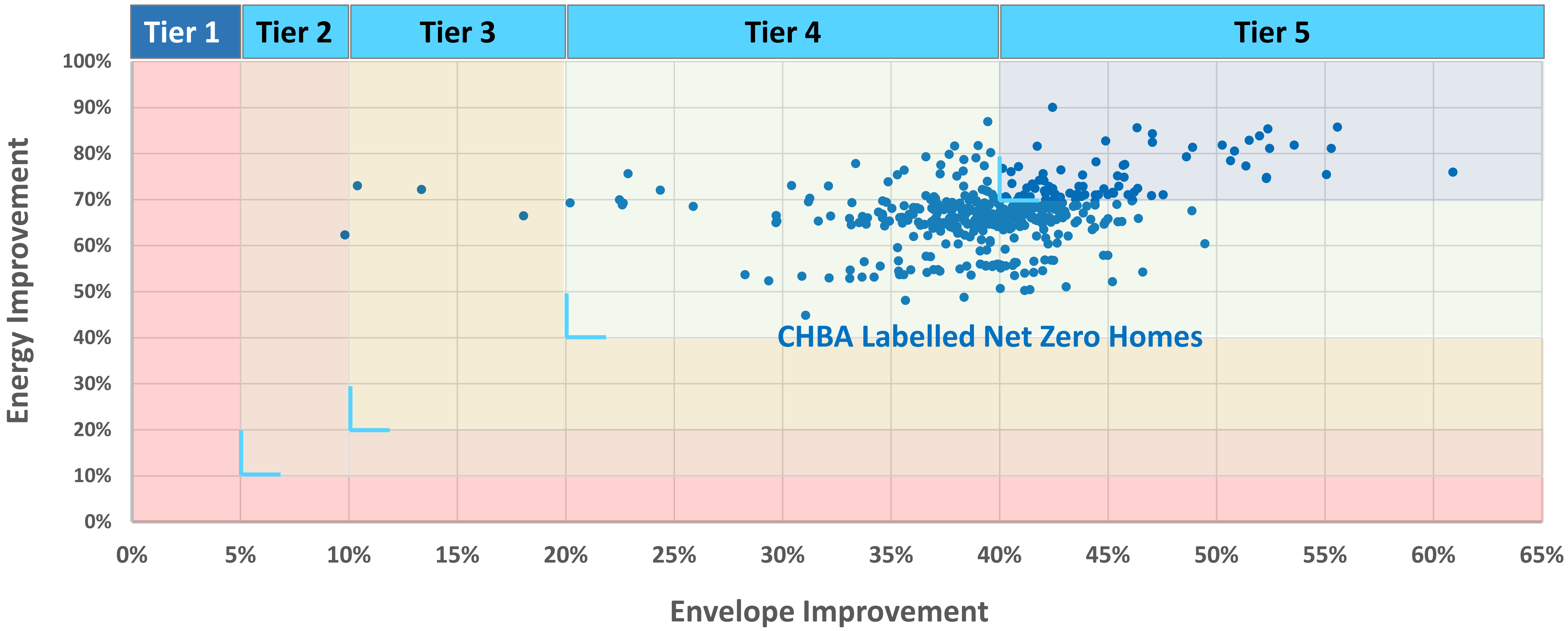
3. Envelope Improvement	0%*	≥ 5%	≥ 10%	≥ 20%	≥ 40%



Affordability

Tier 1 may not be cost-neutral or cost-saving

Average Tier 4 costs are one-third of tier 5 costs – but still high

Tier 5 cost ranges to more than $40,000

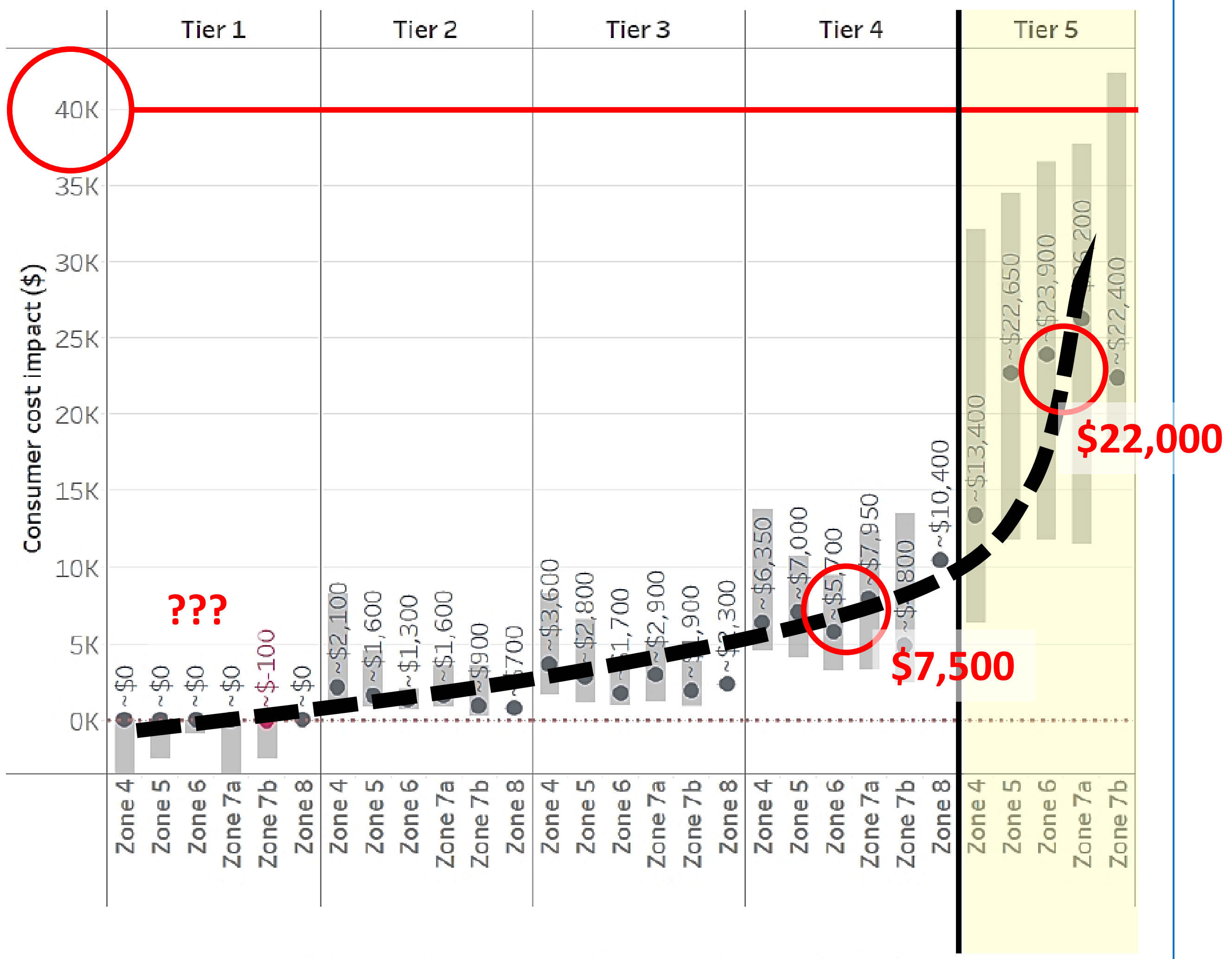


Figure 12: Upgrade costs for gas-heated single family housing, by tier and climate zone.

Excerpt of "PCF-1617 Impact Assessment" by CanMET, Page 30/31 under 5.3 Tier 4 and 5 feasibility

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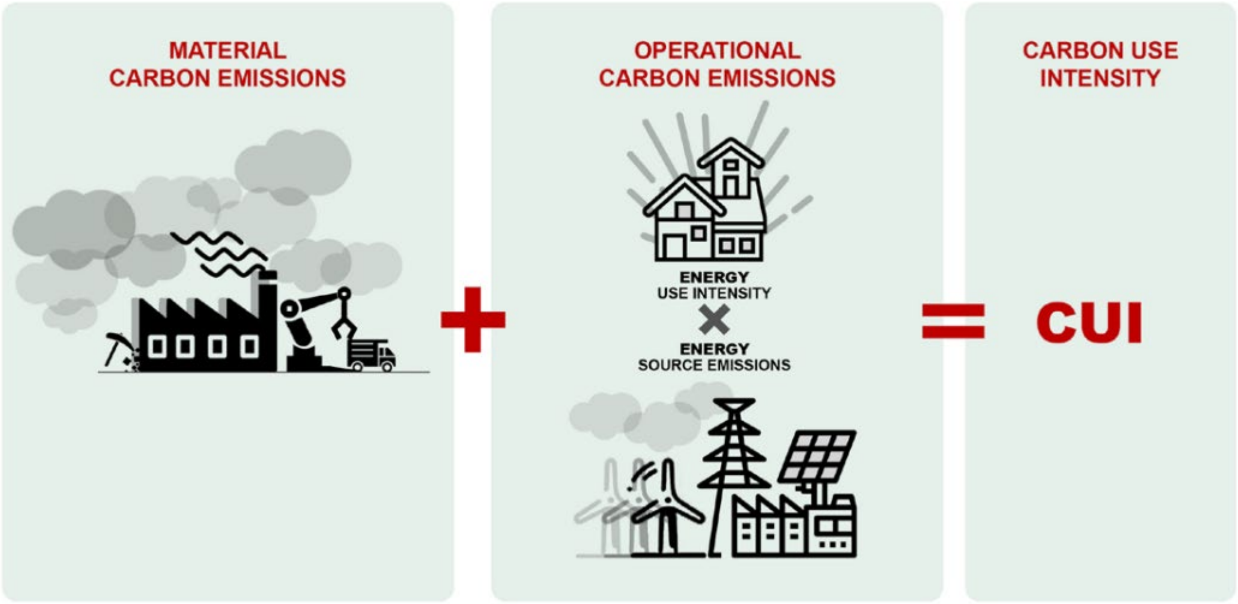
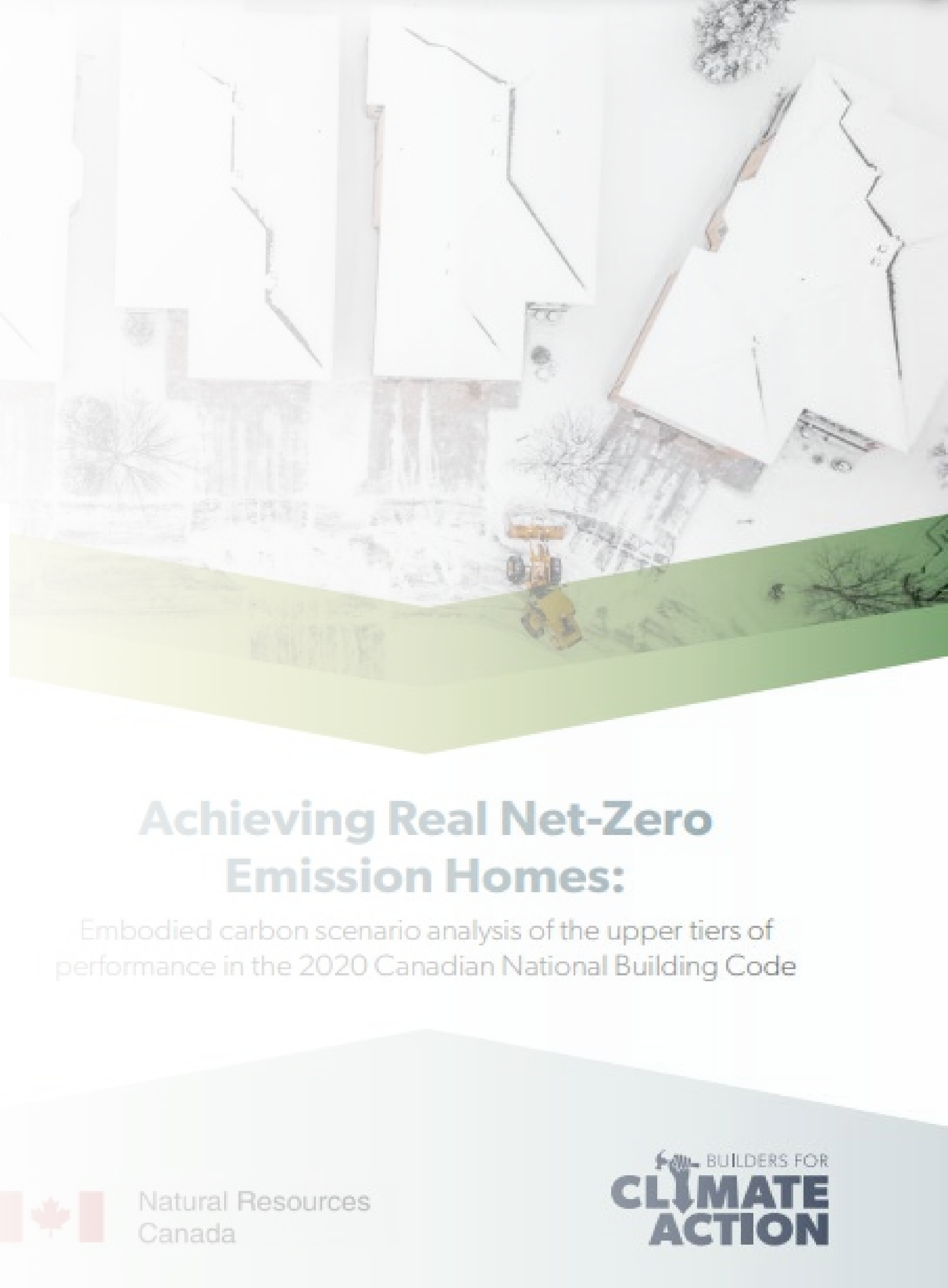
Carbon Emissions

Report by Builders for Climate Action – produced for NRCan



From: Achieving Real Net-Zero Emission Homes (2021 Natural Resources Canada & Builders for Climate Action) Figure 15 p. 31



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Carbon Emissions

Report produced for NRCan states that:

- Low-carbon **material selection can outweigh efficiency gains** of tier 4 or 5 using "typical" construction materials in regions with clean grids
- High cost of tier 5--that energy and GHG savings will never make up—for **little or no net benefit** to the environment, and a potential additional carbon burden

Tier 5 requirements may create too much embodied carbon in homes operated with energy from a clean electrical grid

> In Prince Albert, the city with the highest GHGs from grid electricity in this study, the benefits of moving up tiers in the energy code are the clearest. However, making lower-carbon material choices can outweigh the impacts of moving up the energy code tiers. A Best Available Materials (BAM) model at Tier 3 has a better CUI than a High Carbon Materials (HCM) model at Tier 4, and the same applies between Tiers 4 and 5. This implies that a builder in Prince Albert could strategically choose whether to improve material selections or energy efficiency and "tune" a home design to meet a CUI target.

> With energy source emissions reduced as low as those in the Toronto area, material selections begin to outweigh the CUI impact of energy code tiers significantly. A MCM model at Tier 3 has three times less CUI than a HCM model at Tier 5.

From: Achieving Real Net-Zero Emission Homes (2021 Natural Resources Canada & Builders for Climate Action) p. 32

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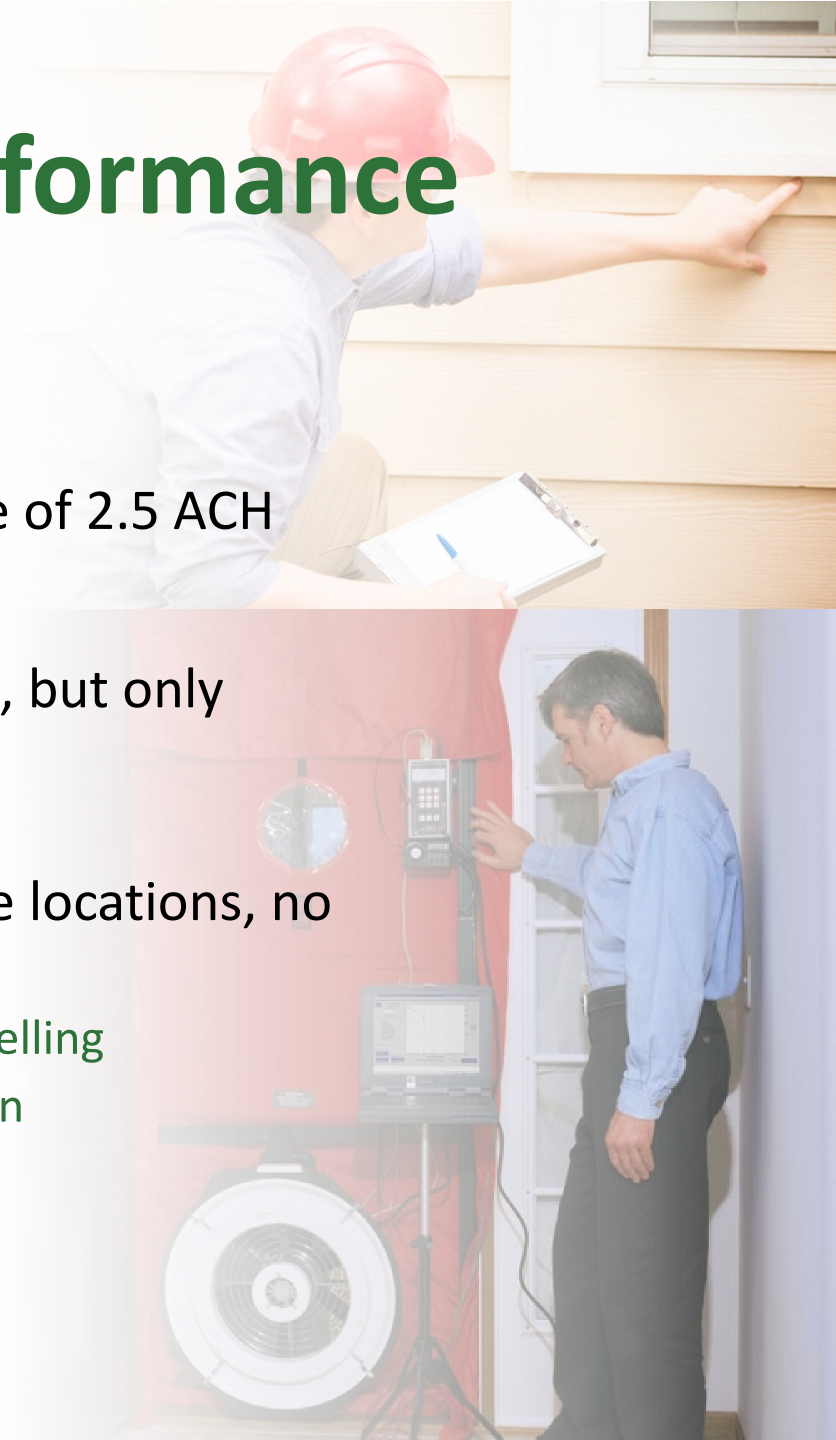
Airtightness Testing – Performance



In the 2015 NBC,

- prescriptive requirements for airtightness permitted use of 2.5 ACH

In the 2020 NBC (9.36.7.3.(9))

- builders **can** still use 2.5 ACH for proposed house model, but only
  - after meeting the prescriptive requirements, **and**
  - **if airtightness testing is conducted (regardless of results)**
- builders not able to conduct airtightness testing (remote locations, no energy advisors, or very windy conditions)
  - are forced to use a less favourable value of 3.2 ACH for modelling
  - have to make up for "performance loss" with more insulation
- reference house model stays at 2.5 ACH

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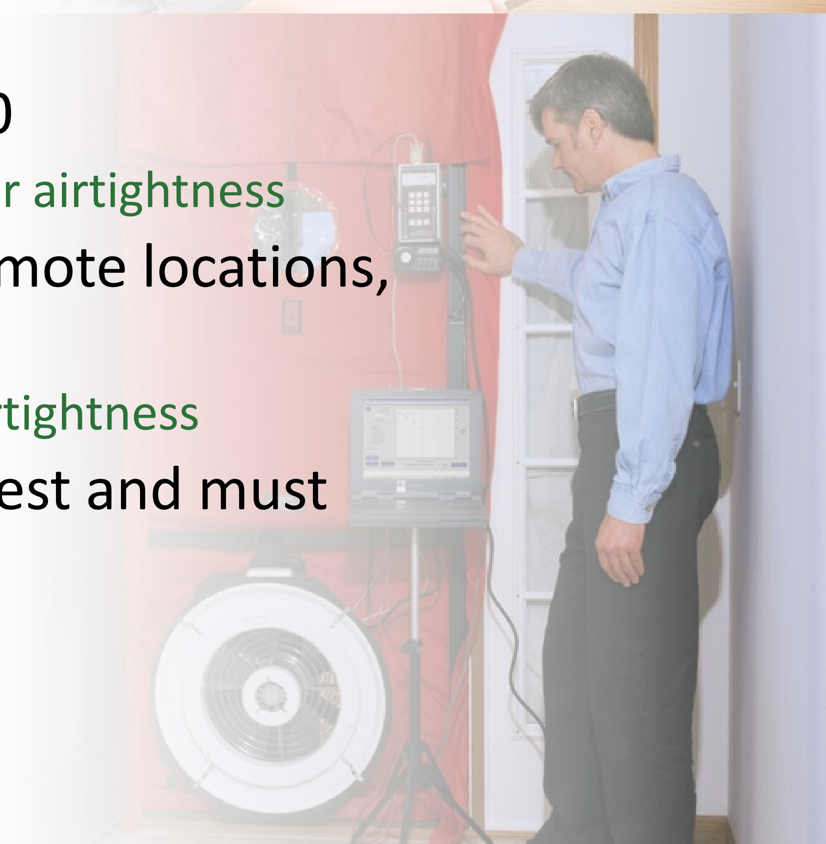
Airtightness Testing – Prescriptive



In the 2015 NBC,

- Testing was not option in 9.36.2.9. or 9.36.2.10

In the 2020 NBC (9.36.8.8. (1) and (2)),

- builders <u>**can still**</u> follow Article 9.36.2.9. or 9.36.2.10
  - but will not be able to earn energy conservation points for airtightness
- builders not able to conduct airtightness testing (remote locations, no energy advisors, or very windy conditions)
  - will not be able to earn energy conservation points for airtightness
- builders trying to achieve airtightness points must test and must achieve 2ACH for any points
  - quite challenging especially in attached homes

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Airtightness Testing – "in factory"

In the 2015 NBC,

- There was no penalty imposed if a test was not conducted, so an option for in-factory testing was not necessary

In the 2020 NBC

- In-factory airtightness testing is not addressed
- **<u>It would have to be negotiated with local site building officials!</u>**

Small House Relaxations

Small homes use less energy, but are hard harder to improve

Performance relaxations for homes <300m^3 (1324 ft^2)

Small Homes	Applicable Performance Targets				
	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
1. Peak Cooling	✓	✓	✓	✓	✓
2. Energy Improvement	0%*	0%	≥ 10%	≥ 30%	≥ 60%
3. Envelope Improvement	0%*	0%	≥ 5%	≥ 15%	≥ 25%

Prescriptive points for small Volume of detached homes

- 1 point if Volume ≤ 390 m^3 (1721 ft^2)
- Up to 10 points if ≤ 300 m^3 (1324 ft^2)

Relaxations based on dwelling unit volume in MURBs and attached homes

- 10 points if each unit ≤ 230 m^3 (1015 ft^2)

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Peak Cooling Requirement

The tiered code "peak cooling requirement"

- Comparison after modeling that:

Peak cooling load for the **proposed** house $\leq$ Peak cooling load for the **reference** house

Read CHBA's backgrounder on peak cooling

Overheating Risk

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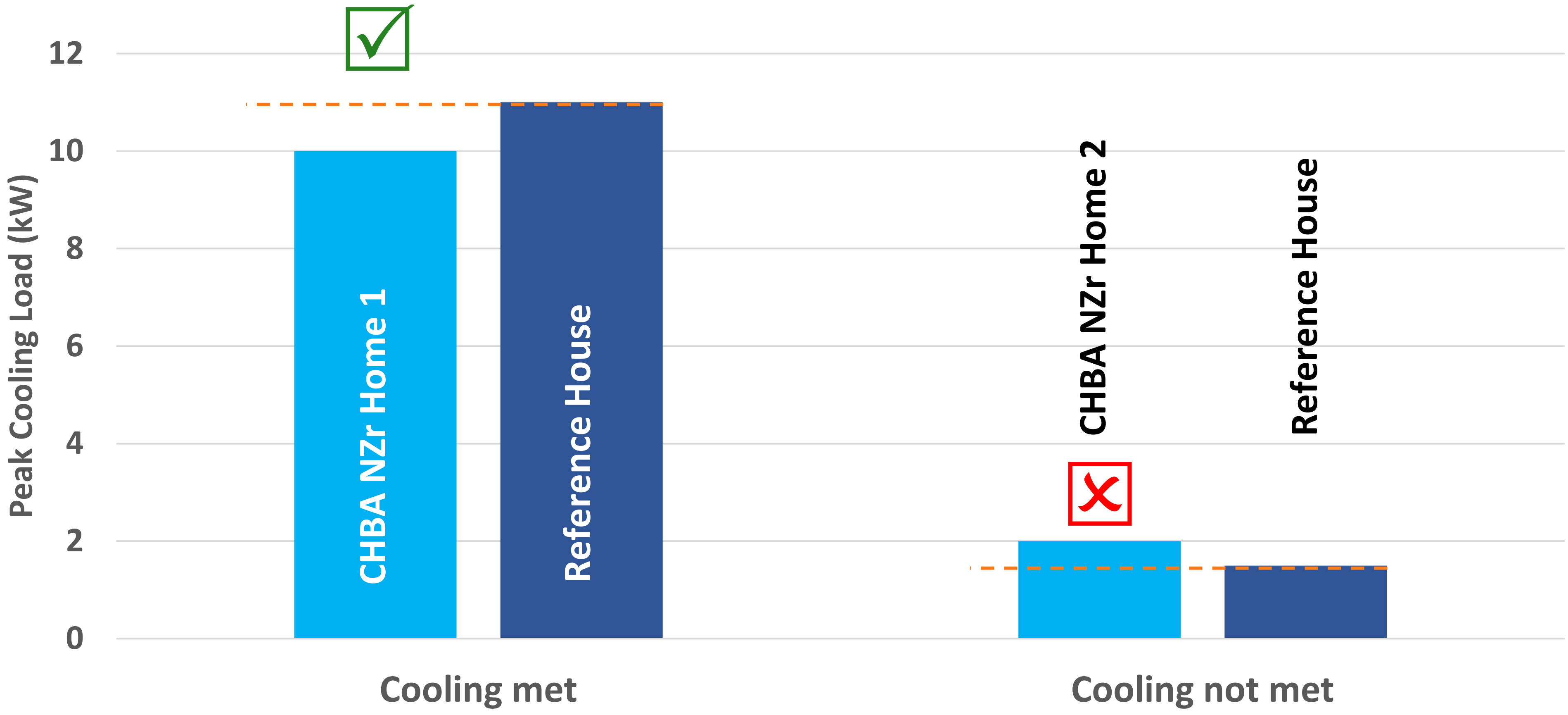
Dramatization
Do not try this at home



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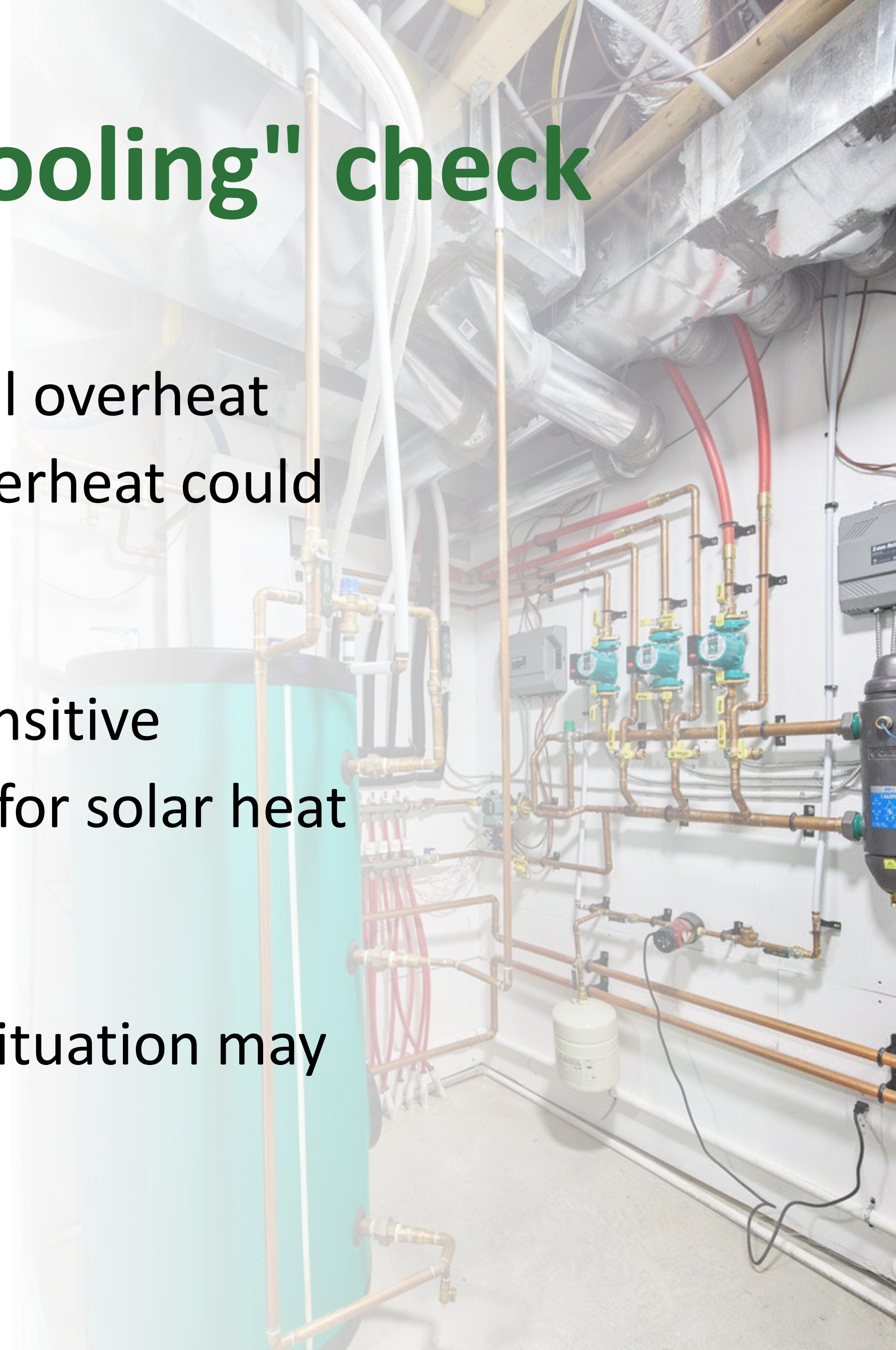
Concerns with "peak cooling" check



1. Homes that meet the requirement might still overheat
2. Well-designed homes that are unlikely to overheat could still be disqualified
3. Mechanical cooling will not help compliance
4. The pass/fail criterion is not climate zone sensitive
5. The code makes unreasonable assumptions for solar heat gain modeling
6. Passive cooling measures are not modelled
7. Implications of this criterion for the winter situation may not have been fully considered

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Capacity & Enforcement

Builder readiness / Ease of compliance and learning

- No prescriptive requirements available for Tiers 3 to 5

Building official capacity

- 9.36. performance compliance is already not well understood by officials

Energy Advisor availability

- Limited availability of airtightness testing equipment, qualified testers and energy advisors presents challenges for airtightness testing and performance modeling for higher tiers

Industry and sector-wide training needs

- lack of consistent understanding of air barrier vs vapour barrier (designers, builders, officials)
- decreased heating loads are more challenging // products unavailable (manufacturers, designers, trades)
- inconsistent application of CSA F280 for heating equipment sizing (designers, builders, HVAC contractors)
- installation of high-performance mechanical ventilation systems not well enough understood for high-end performance (designers, builders, HVAC contractors)
- operation of high-performance mechanical ventilation systems not well understood by owners and/or occupants

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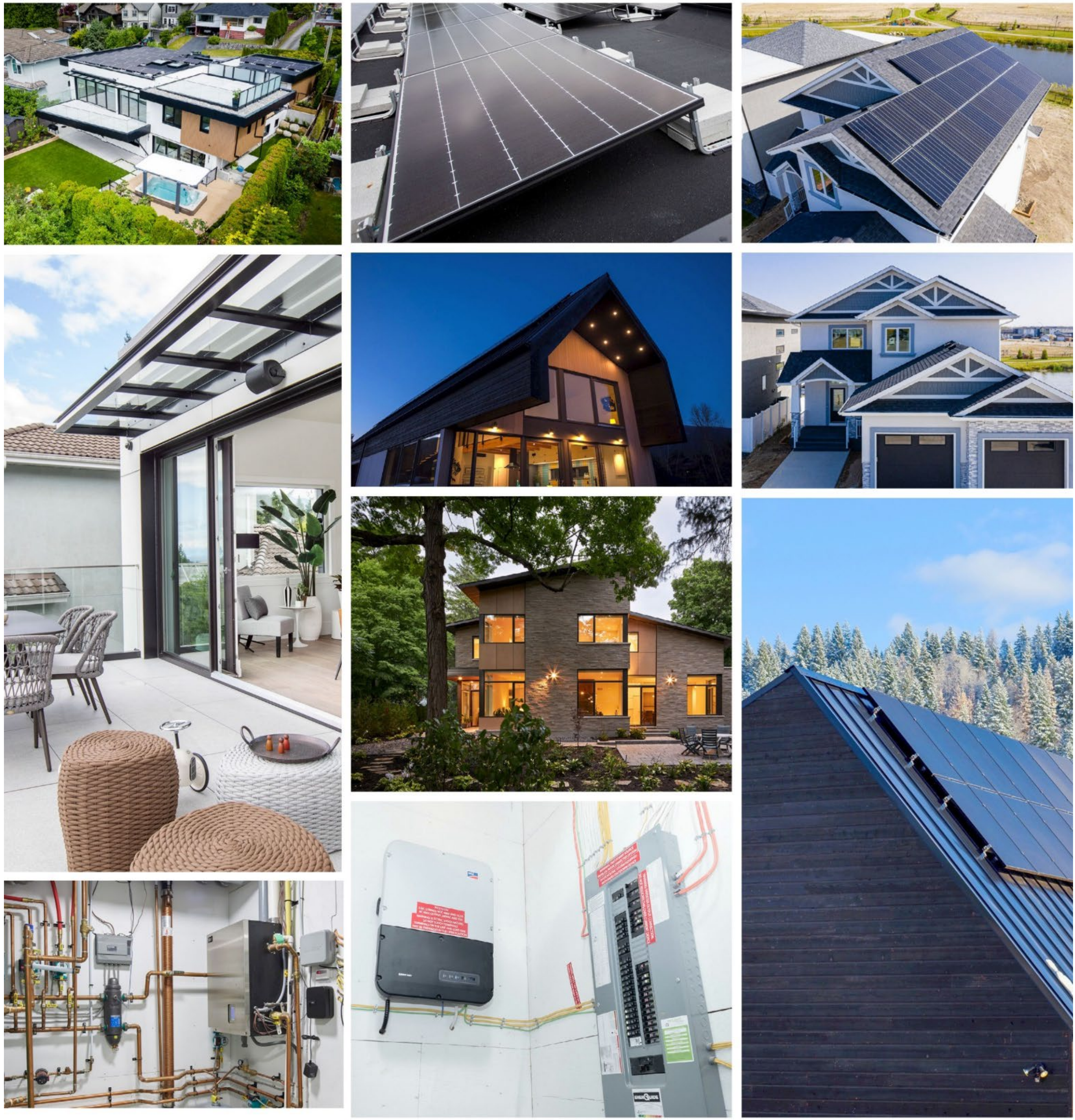

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Summary

Tier 1 ≠ Current 9.36

- ERV/HRV mandatory
- Updated equipment efficiency ratings
- Implications of airtightness testing regime

Tier 4 is net zero energy ready performance level

Start paying attention to embodied carbon

Airtightness testing

- Investigate options and study implications

Peak cooling criteria can be tricky

Small building volume relaxations

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Thank You

Are there any questions?