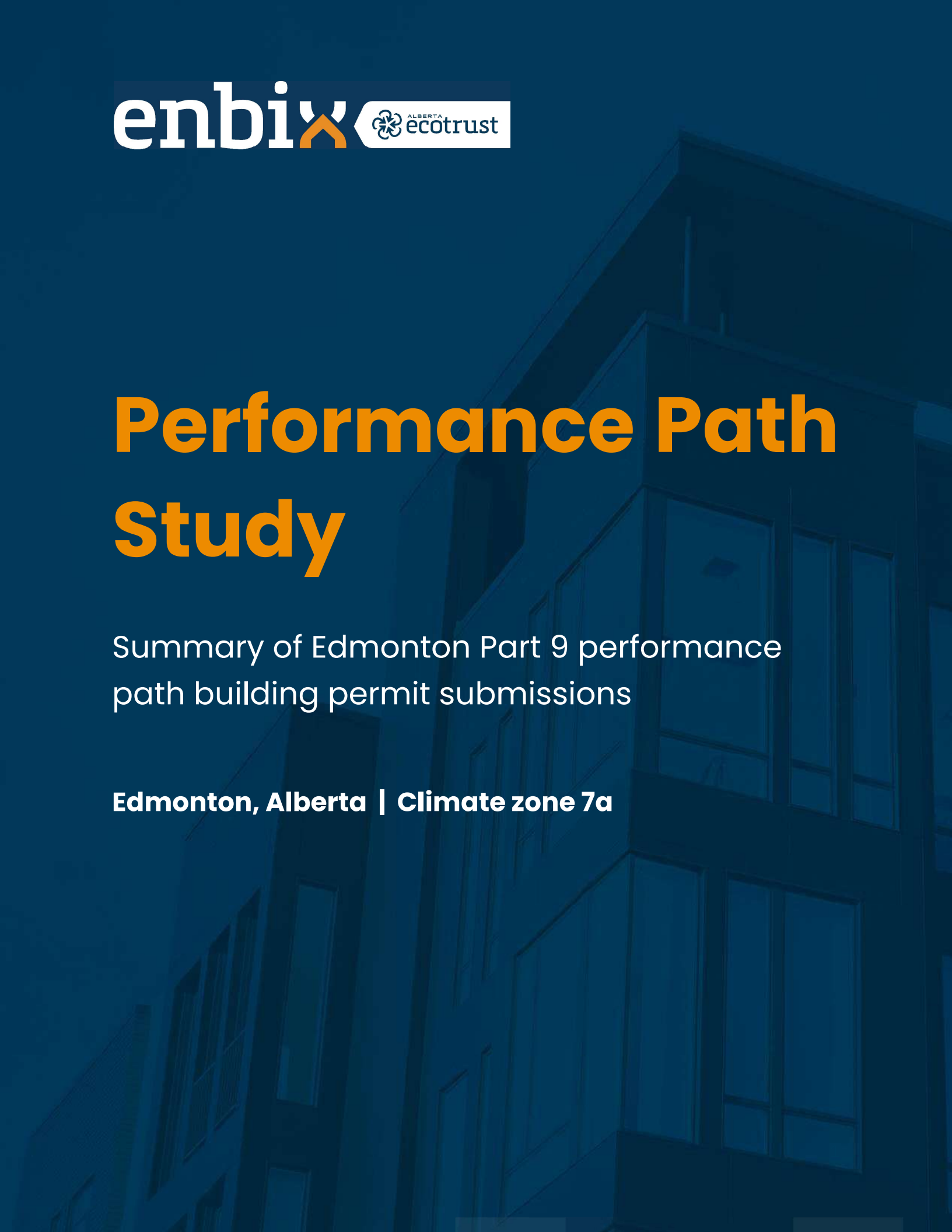

Performance Path Study

Summary of Edmonton Part 9 performance path building permit submissions

Edmonton, Alberta | Climate zone 7a

Preface

Data context for Edmonton

This report is based on 2024 residential building permit data submitted to the City of Edmonton. The dataset includes information derived from energy compliance documentation, mechanical schedules, and design-stage energy modelling, which were used to demonstrate compliance with the National Energy Code of Canada for Buildings (NECB) and Section 9.36 of the Alberta Building Code.

It is important to note that this dataset:

- Reflects design-intent performance based on submitted documentation rather than verified post-construction testing.
- Represents new housing projects for which detailed energy modelling or performance documentation was required as part of the permitting process.
- Provides a snapshot of building permit data of typical building envelope characteristics and equipment efficiencies for Edmonton's 2024 new residential sector.

While not based on field-verified results, the permit data offers a credible and conservative representation of the energy performance built into Edmonton's residential designs under current minimum Tier compliance pathways.

Single detached houses

Energy performance and breakdown of energy tier

Below is a summary of energy performance and a breakdown of the energy tier of single detached houses, with a sample size of 252 entries:

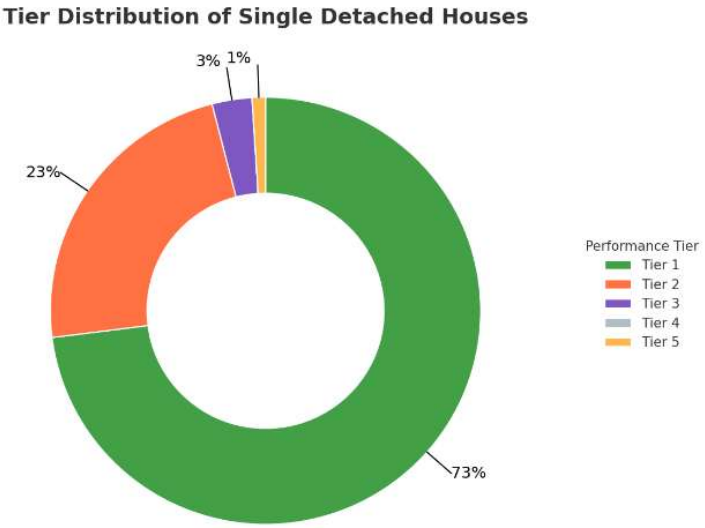

Figure 1 - Distribution and Savings by Performance Tier

Commentary on energy performance trends

- Tier distribution shows that most homes (73%) fall within the minimum Tier 1, code-level energy compliance.
- Higher tiers (2–5) together represent 27%, showing increasing adoption of enhanced energy-efficiency measures.
- A breakdown of the design of the buildings for each Tier follows to understand the typical makeup of energy savings.

Building envelope

Below is a summary of the significant building envelope characteristics.

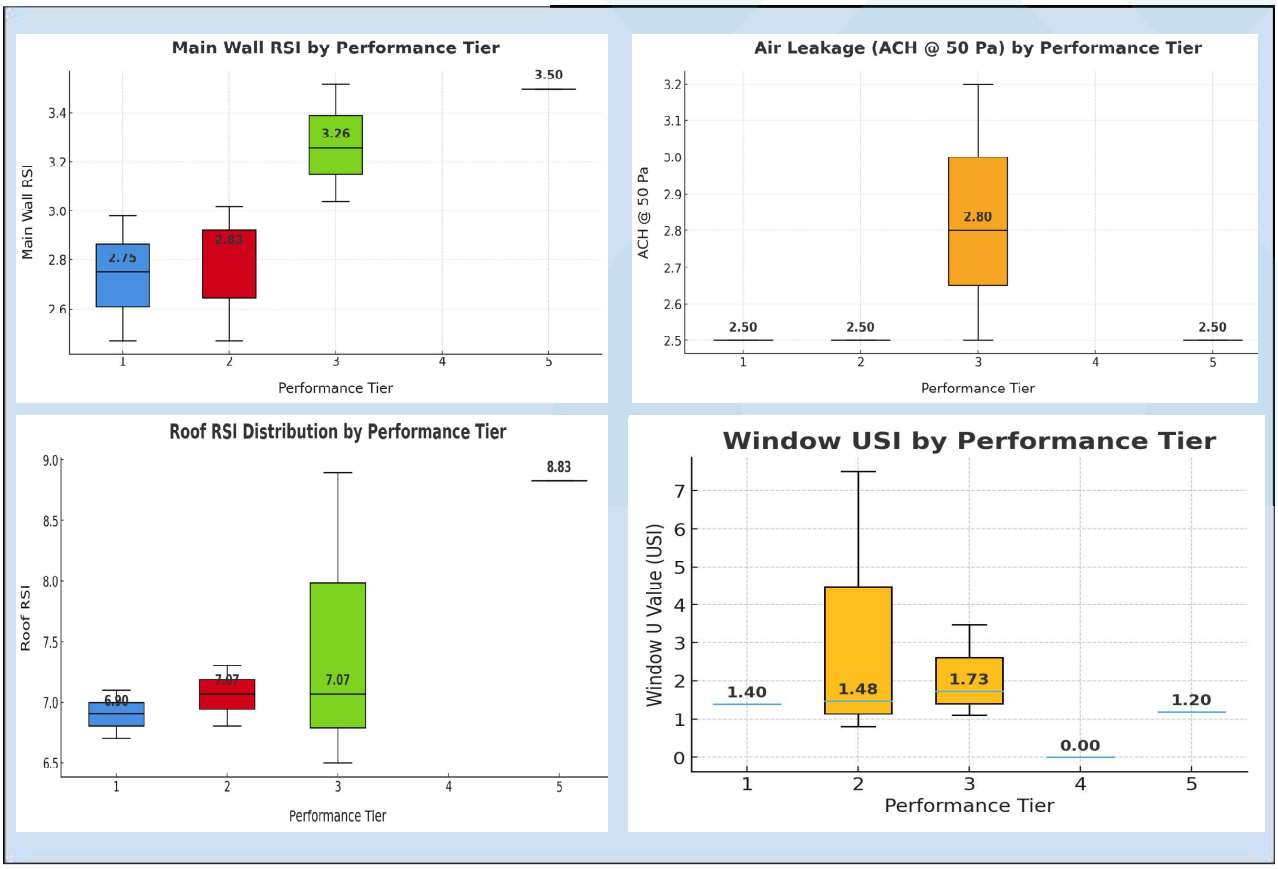

Figure 2 - Building Envelope

Commentary on building envelope

- **Wall and roof insulation levels improve with higher tiers**, with median RSI values increasing from ~2.75 to 3.26 (walls) and ~6.9 to 7.07 (roofs) as Tiers increase, indicating slight improvements in wall and roof design and stronger thermal resistance in advanced designs.
- **Airtightness levels remain similar across tiers** (ACH@50Pa ≈ 2.5), reflecting a lack of blower-door testing for code compliance. Some blower door tests were conducted on Tier 3 applications, but we are not better than the reference building. This is an area that could help achieve higher tiers but requires training and understanding of how permit processing would be impacted.
- **Window performance shows a large spread in U-values**, with U-values dropping from 1.7 to 1.2, demonstrating the use of high-efficiency glazing in top-tier homes. In Tier 1 homes, the windows' performance is helping achieve energy savings. In Tiers 2 and 3, their impact is reduced as wall and roof R-values increase.

- **Overall**, envelope performance slightly increases as the Tier's performance requirement increases. There are some areas that could be focused on to achieve a greater impact, such as airtightness or wall insulation values. However, as energy modelling calculates the house as a system, we need to review this with the mechanical design in the following section.

HVAC and DHW systems

Below is a summary of the significant building HVAC and DHW characteristics:

Figure 3 – HVAC and DHW Systems

Mechanical commentary

- **Heating systems maintain consistently high efficiency** (~95–96%) across all tiers, indicating widespread adoption of condensing furnaces or equivalent high-performance systems. This is the highest level of performance from these systems and the maximum efficiencies that can be produced. The next step up is to look at heat pump installation.
- **Heat recovery performance improvement** from ~0.66 in Tier 1 to 0.74 in Tier 3, demonstrating greater deployment of efficient HRVs/ERVs in higher-tier homes.

- **Domestic hot water systems show rising energy factors** from a median of ~0.79 in Tier 1 to 0.96 in Tier 5, reflecting increased use of high-efficiency hot water heating to make up annual energy savings.
- **System type distribution confirms this shift**, with Tier 1 dominated by direct-vent units while higher tiers adopt integrated heat pumps and condensing systems, marking a clear technology transition.

Row Houses

Energy performance and breakdown of energy tier

Below is a summary of energy performance and a breakdown of the energy tier of houses with a sample size of 415 entries:

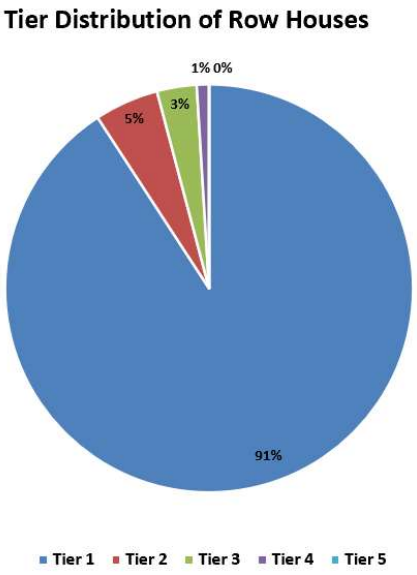

Figure 4 - Distribution and Savings by Performance Tier

Commentary on energy performance trends

- The majority of sampled row houses achieve Tier 1 (91%), indicating that most projects are designed to meet baseline energy code requirements with limited performance enhancement beyond compliance.
- A small proportion of row houses achieve Tier 2 (5%) and Tier 3 (approximately 4%), demonstrating that higher-tier performance is technically achievable within this building typology, though it remains relatively uncommon.
- A very limited share of projects achieve Tier 4 (approximately 1%), indicating that advanced energy performance is possible for row houses, but is rarely pursued under current market and cost conditions.
- The limited representation in higher tiers suggests that energy performance in rowhouses with similar designs to single-family homes is different from that based on the energy modelling.

- Despite mainly low-tier results, the compact form and reduced exposed envelope area of row houses may contribute to lower absolute energy use and operating emissions per-unit compared to larger residential building types.

Building envelope

Below is a summary of the significant building envelope characteristics:

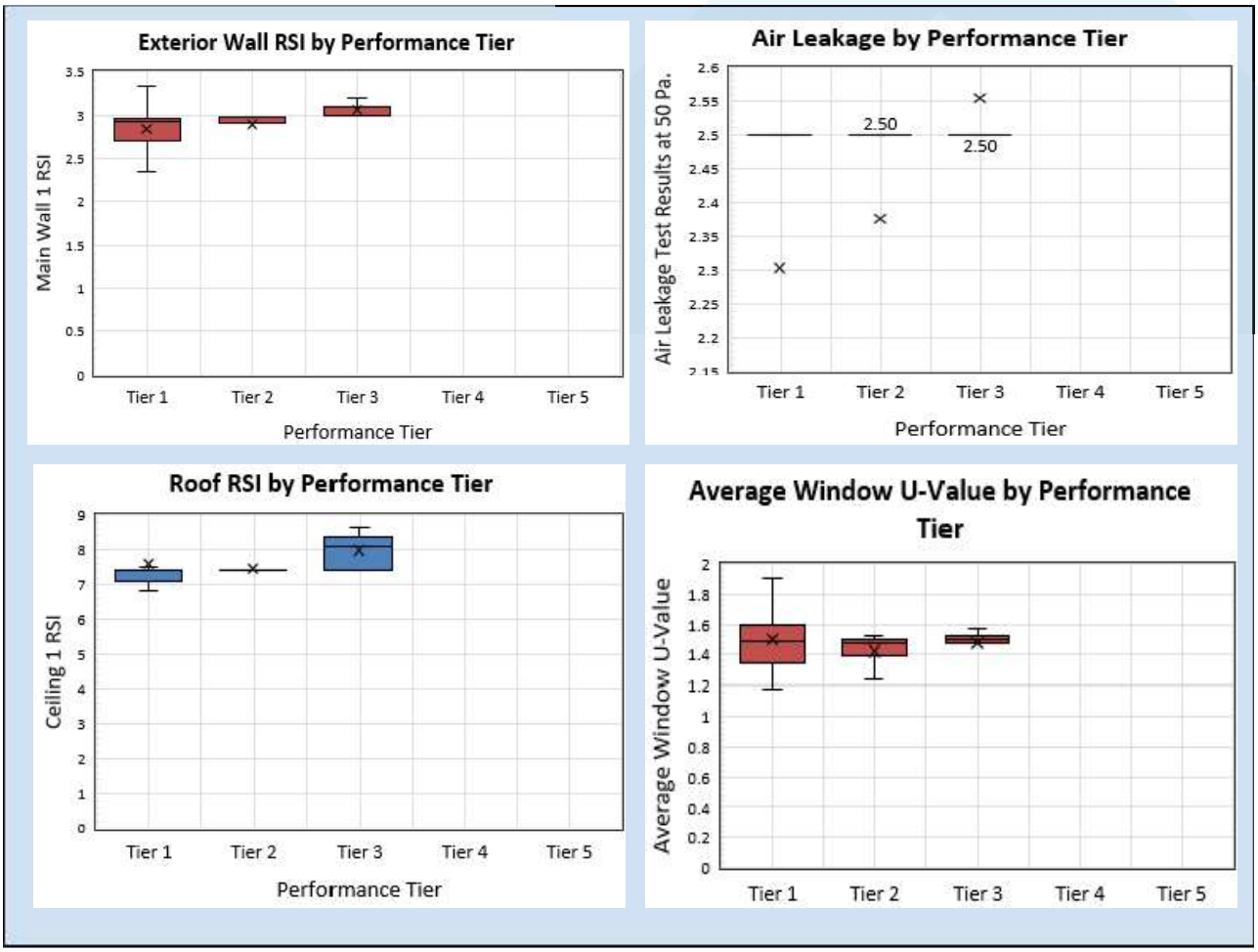

Figure 5 - Building Envelope

Commentary on building envelope

- Exterior wall insulation is relatively consistent across the sampled projects, with median RSI values clustered around Tier 1 baseline levels. Limited variation between tiers suggests that wall assemblies are generally designed to meet minimum code requirements rather than to drive higher-tier performance.

- Airtightness performance is uniform across the dataset, with air leakage results concentrated around approximately 2.5 ACH at 50 Pa. Similar to single-family homes, reflecting a lack of blower door tests being used for code compliance.
- Roof insulation demonstrates stronger thermal performance compared to wall assemblies, with median RSI values in the higher range. Because there is less wall area to achieve energy savings, the roof insulation is an area that can help reduce heat loss through the modelling.
- Window thermal performance remains modest and tightly clustered, with average U-values consistent with standard double-glazed assemblies. The limited variation across tiers suggests that glazing selection is aligned with baseline envelope practice, with minimal uptake of higher-performance window systems.
- Overall, the envelope data indicate a design approach focused on consistent baseline compliance, with limited differentiation between tiers. While roof insulation provides comparatively strong thermal resistance, opportunities remain for improved wall performance, tighter airtightness, and higher-performance glazing to support advancement to higher energy performance tiers.

HVAC and DHW systems

Below is a summary of the significant building HVAC and DHW characteristics:

Figure 6 – HVAC and DHW Systems

Mechanical commentary

- **Heating systems** exhibit consistently high efficiency across all performance tiers, with median values clustered around **95%.** This indicates widespread adoption of modern high-efficiency or condensing heating equipment and suggests that space-heating efficiency is treated as a baseline requirement rather than a differentiating factor between tiers.
- **HRV/ERV effectiveness** shows moderate and relatively consistent performance, with median effectiveness in the **mid-60% range** and only modest improvement at higher tiers. This indicates common use of standard HRV systems, with limited adoption of higher-effectiveness energy recovery ventilation as a primary performance strategy.
- **Domestic hot water (DHW) systems** demonstrate moderate to moderately high performance, with median energy factors around **0.75–0.80**. Tier 3 projects show

slightly higher and more consistent DHW performance, while Tier 1 results exhibit greater variability. Lower reported efficiencies in some Tier 1 cases may reflect system configuration and modelling assumptions rather than inferior equipment performance.

- **Overall system selection trends** indicate a continued predominance of conventional and sealed direct-vent DHW and space-heating systems, with limited uptake of advanced technologies such as heat-pump-based or fully integrated high-performance systems.

Semi-detached houses

Energy performance and breakdown of energy tier

Below is a summary of energy performance and a breakdown of the energy tier of houses, with a sample size of 210 entries:

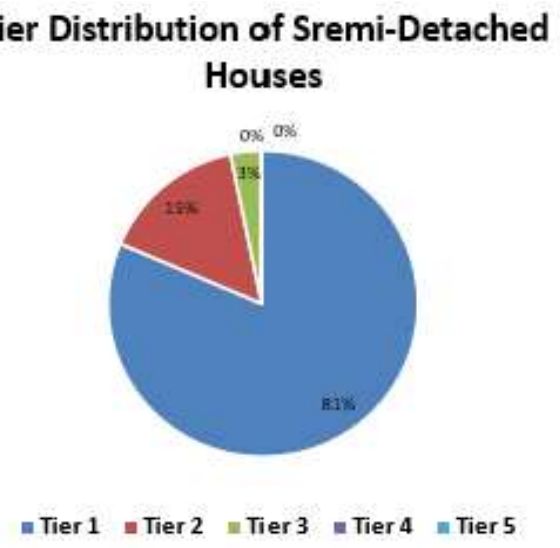

Figure 7 - Distribution and Savings by Performance Tier

Commentary on energy performance trends

- The majority of semi-detached homes achieve Tier 1 (81%), indicating broad and consistent compliance with baseline energy code requirements across the housing stock.
- A meaningful subset of projects achieves Tier 2 (15%), demonstrating that incremental performance improvements beyond minimum compliance are being realized within this building typology.
- A small proportion of homes reach Tier 3 (3%), confirming that higher-tier performance is technically achievable for semi-detached housing, although it remains uncommon with an absence of Tier 4 and Tier 5 projects.
- Overall, the distribution reflects consistent construction practices with emerging examples of enhanced envelope and system performance, providing a foundation for future improvement toward higher energy tiers.

Building envelope

Below is a summary of the significant building envelope characteristics:

Figure 8 - Building Envelope

Commentary on building envelope

- **Exterior wall insulation** is generally consistent across performance tiers, with moderate effective RSI values aligned with baseline 9.36 compliance. While higher-tier projects show marginal improvements, overall variation is limited, indicating that wall assemblies are primarily designed to meet minimum requirements rather than to drive higher-tier performance.
- **Airtightness performance** is uniform across all tiers, with air leakage results clustered at similar levels. Again, reflecting a lack of blower door tests being used for code compliance.
- **Roof insulation** provides higher thermal resistance than walls and shows a modest increase with higher tiers. However, the narrow range of roof RSI values indicates that

roof insulation is treated as a standard cold-climate requirement rather than a key differentiator between performance tiers.

- **Window thermal performance** improves incrementally with higher tiers. Tier 1 projects typically use standard double-glazed assemblies, while Tier 2 and Tier 3 projects show lower average U-values and reduced variability, indicating selective adoption of improved glazing.
- **Overall, the envelope results reflect a design approach focused on consistent baseline compliance**, with incremental improvements in roof and window performance at higher tiers. Airtightness and wall insulation remain largely uniform, highlighting opportunities for enhanced envelope strategies to support higher energy performance outcomes.

HVAC and DHW Systems

Below is a summary of the significant building HVAC and DHW characteristics:

Figure 9 – HVAC and DHW systems

Mechanical Commentary

- Heating system efficiency is consistently high across all performance tiers, with median values clustered in the mid- to high-90% range. This reflects widespread use of modern high-efficiency and condensing heating equipment, indicating that space-heating efficiency is largely treated as a baseline requirement rather than a differentiating factor between tiers.
- Heat recovery ventilation (HRV) efficiency shows moderate performance across tiers, with median effectiveness in the mid-60% range and only modest increases at higher tiers. This suggests that while HRV systems are commonly provided, higher-effectiveness ERVs are not yet widely adopted as a primary performance strategy.
- Domestic hot water (DHW) system performance remains relatively consistent across tiers, with energy factors generally clustered in the mid-0.6 to low-0.7 range. This indicates continued reliance on conventional high-efficiency storage-based DHW systems, with limited penetration of advanced or alternative technologies.
- Overall mechanical system trends indicate that efficiency gains between tiers are incremental rather than transformative. Heating efficiency is already near practical limits, while ventilation and DHW systems present the greatest opportunity for further performance improvement through adoption of higher-efficiency equipment and integrated system strategies.