Performance Path Study

Summary of Calgary Part 3 Performance Path Building Permit Submissions

Calgary, AB - Climate zone 7a

PREFACE – DATA CONTEXT

This report presents a review of Part 3 NECB performance-path energy modelling submissions associated with building permit applications in Calgary. The study aims to identify energy-performance trends reflected in submitted energy models.

The analysis is based exclusively on information contained within submitted energy modelling reports and supporting documentation. No re-modelling, recalculation, or independent verification was undertaken. Results, therefore, reflect reported design-stage performance, as submitted for permitting and compliance purposes.

DATASET OVERVIEW

The analysis is based on a compiled set of Part 3 performance-path submissions extracted from processed permit-related documentation and associated energy modelling records for projects located within Calgary.

Each submission was reviewed individually to confirm:

- Use of the NECB Part 3 performance pathway
- Availability of a clearly defined reference building
- Availability of reported proposed vs. reference performance outcomes
- Sufficient supporting information to characterize envelope and system strategies at a high level

Only submissions meeting these criteria were included in the aggregated analysis.

NECB COMPLIANCE SUMMARY

The Part 3 performance-path submissions reviewed in this study reference different editions of the National Energy Code for Buildings (NECB), consistent with the code edition in force at the time of application.

Based on the submitted energy modelling reports and supporting documentation:

- A portion of the reviewed projects explicitly references NECB 2017 as the compliance baseline
- A portion explicitly references NECB 2020, reflecting more recent permit applications
- The remaining submissions rely on the applicable NECB edition in effect at the time of permitting.

Report Structure

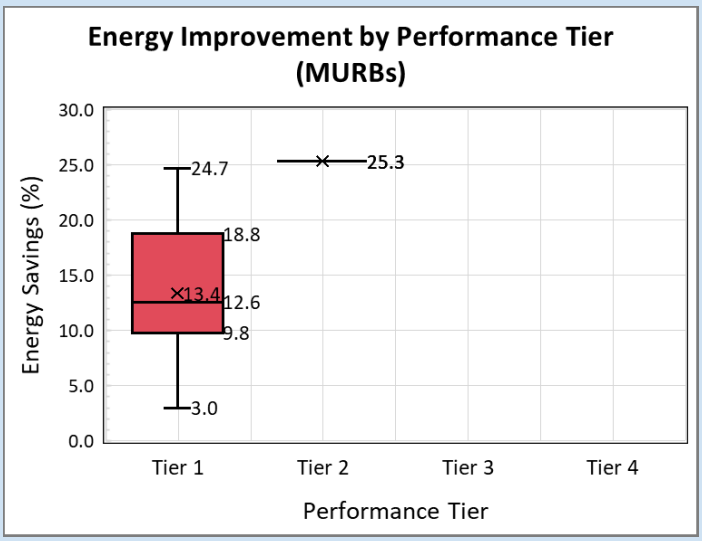
This report is broken down into parts. All the files were broken down into two groups: multi-unit residential buildings (MURBS) and Industrial, Commercial and Institutional (ICI). These two groups have different typical forms; as such, they are hard to compare.

These two groups are further divided between those evaluated under NECB 2017 and NECB 2020. NECB 2020 introduced energy performance tiers. For the NECB 2020 files, the performance is evaluated against the energy performance tiers. For the projects using NECB 2017, the performance is NOT broken down by tiers.

Multi-unit residential buildings (MURB)

Energy performance and breakdown of energy tier

Figure 1, below, shows the overall energy performance of MURBS evaluated against NECB 2020. There are 26 files in this group. Only 1 project was better than tier 1.



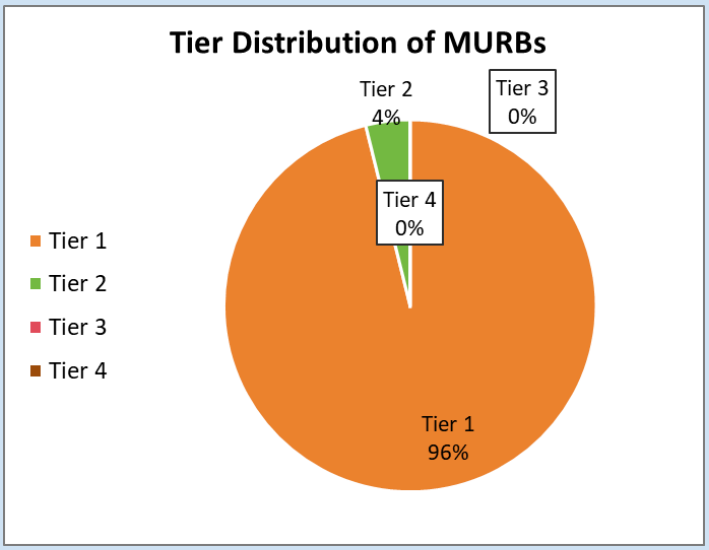


Figure 1 - Calgary Part 3 NECB 2020 MURBS, 26 buildings total.

Commentary on energy performance trends

The vast majority (96%) of MURBs are being built to the minimum energy performance tier. Within the Tier 1 buildings, the median performance is 12.6% better than the reference building.

Building envelope

Figure 2 below shows a summary of the major building envelope components.

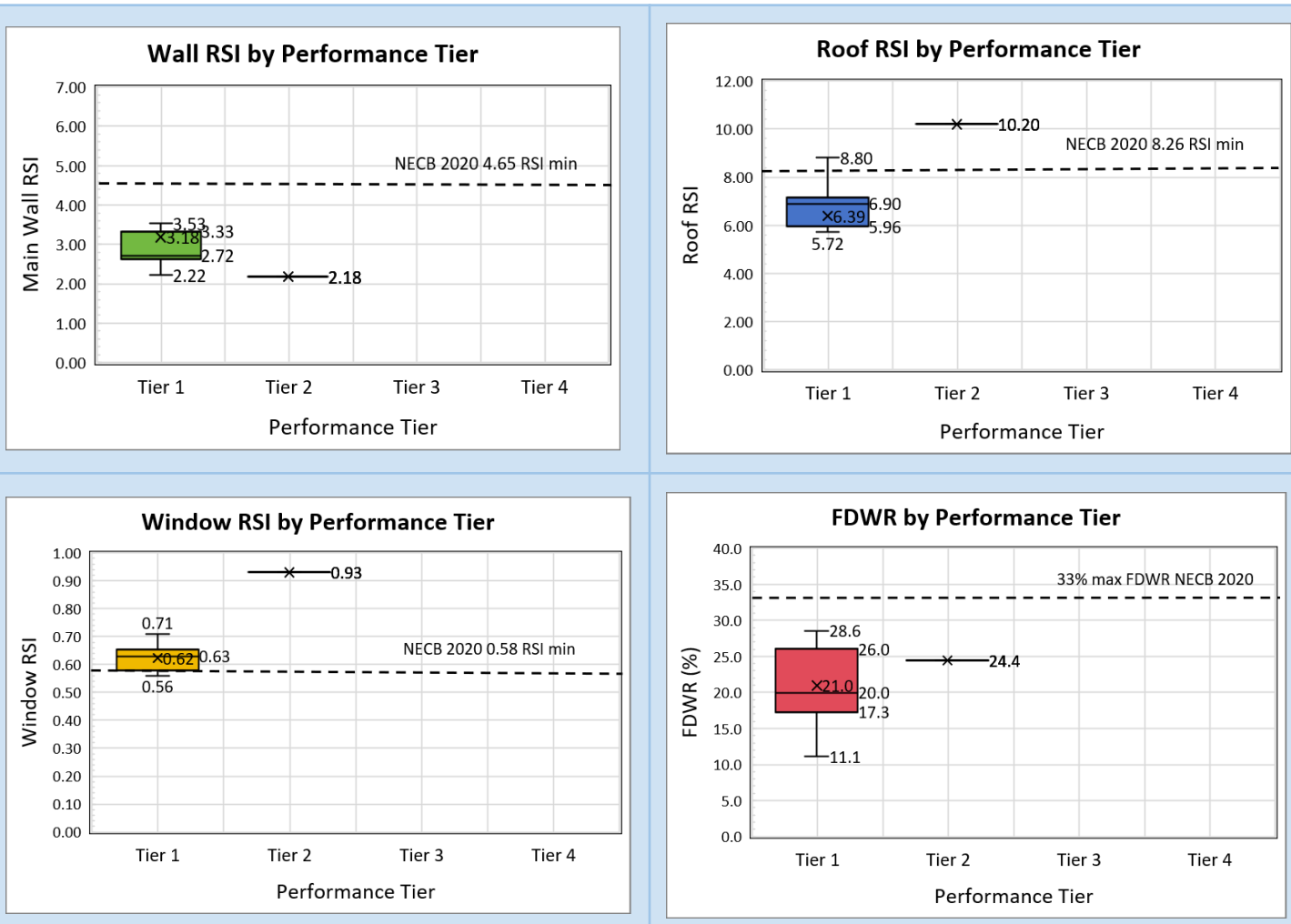


Figure 2 - Calgary, part 3 NECB 2020, building envelope major components by performance tier

Commentary on building envelope

- The wall assembly's insulating value is always below the NECB prescriptive minimum.
- Ceiling insulation exceeds the NECB prescriptive minimum in only one building, at tier 2.
- **Window thermal performance (RSI) was consistently better** than the NECB minimum.
- **The fenestration ratio (FDWR) is consistently less** than the NECB code maximum.
- **Overall,** the envelope improvements appear to be driven by better-performing windows and reduced window area.

HVAC and DHW systems

Figure 3 below shows a summary of the heating, cooling, and ventilation systems.

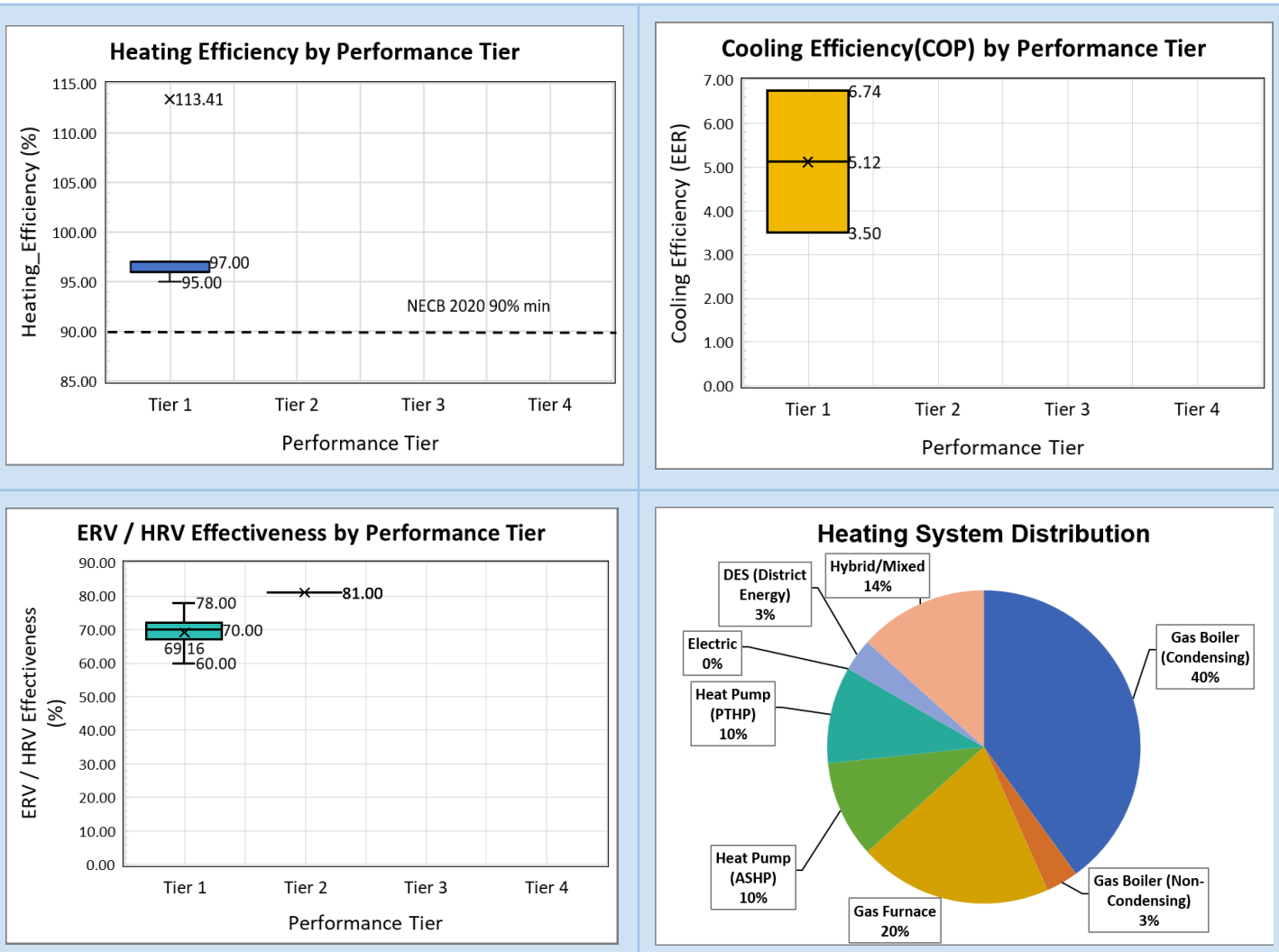


Figure 3 - Calgary, part 3 MURBS, HVAC performance summary

Commentary on mechanical systems

- Although most buildings were Tier 1, several used alternative heating systems, such as district energy systems or air-source heat pumps.

MURBs NECB 2017

Permits for MURBs were evenly split between NECB 2017 and 2020.

Although NECB 2017 has no energy performance tiers, Figure 4 shows energy savings relative to the reference building.

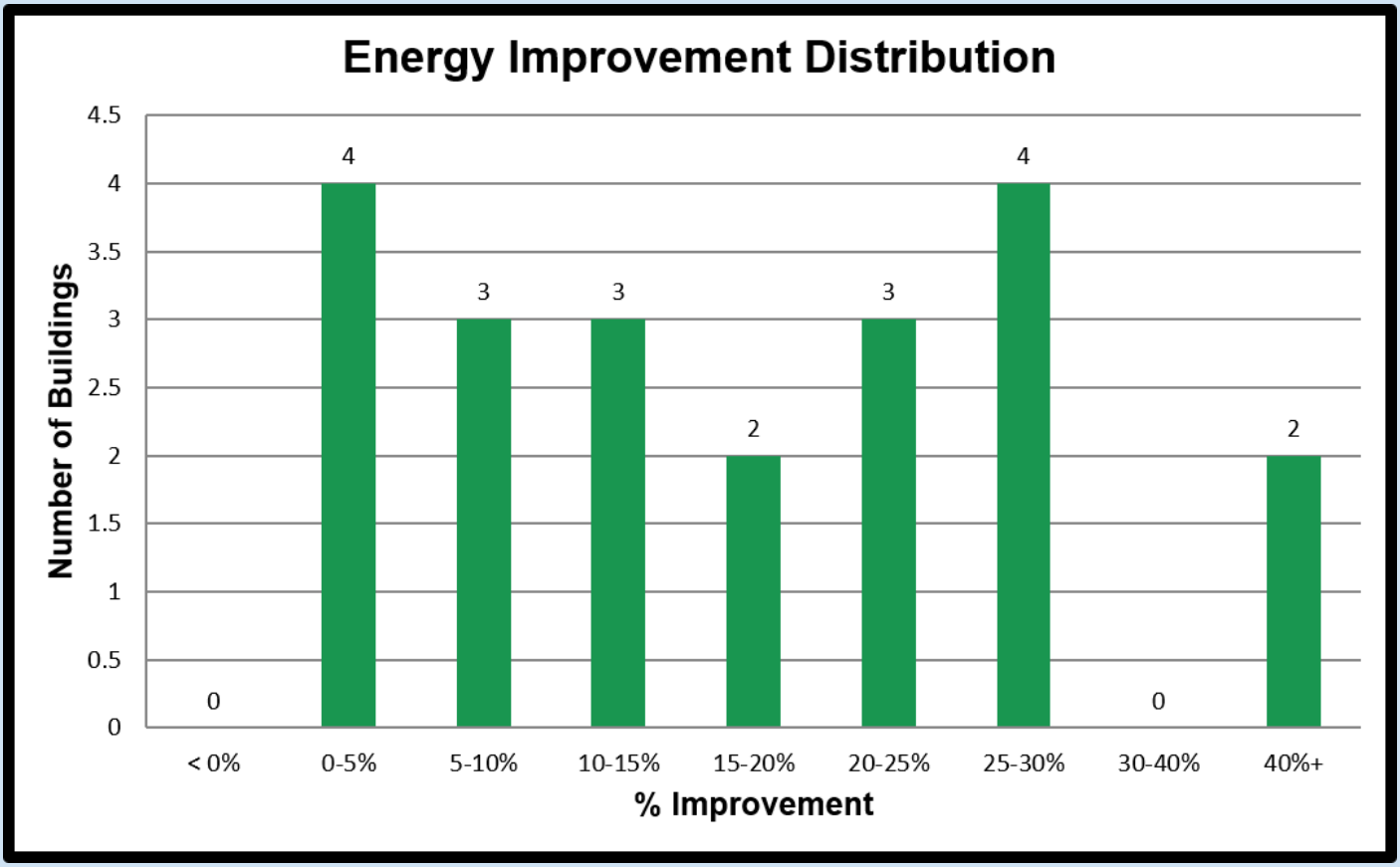


Figure 4 - Calgary, part 3 MURBS, NECB 2017, summary of energy performance.

Commentary on energy performance trends

There is no simple method for comparing the NECB 2017 improvements to the NECB 2020 improvements. All the buildings exceeded the minimum energy performance requirements.

Figure 5 shows building envelope performance. The average performance for both walls and roofs fell below the NECB minimum. This differs significantly from the trend seen in other major Alberta centres.

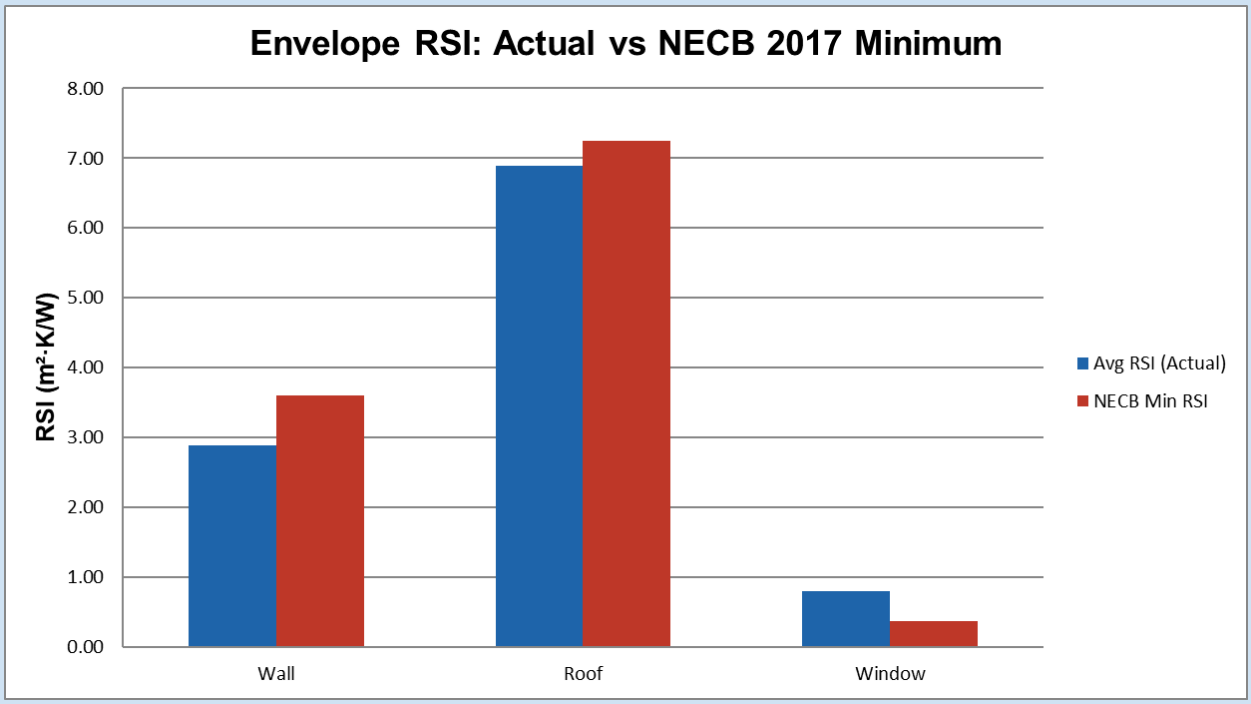


Figure 5 - Calgary, part 3 MURBS, NECB 2017, summary of envelope performance

Commentary on building envelope

Compared with the NECB 2017 analysis for MURBS in Edmonton, the trend is very different. In the Edmonton dataset, performance for both walls and roofs exceeded the NECB minimum requirement. It is unclear what drove this difference, but the Calgary NECB 2017 dataset was smaller.

The HVAC systems are summarized below. The most notable feature is the large portion of electric heating, including the use of air-source heat pumps in the larger dataset.

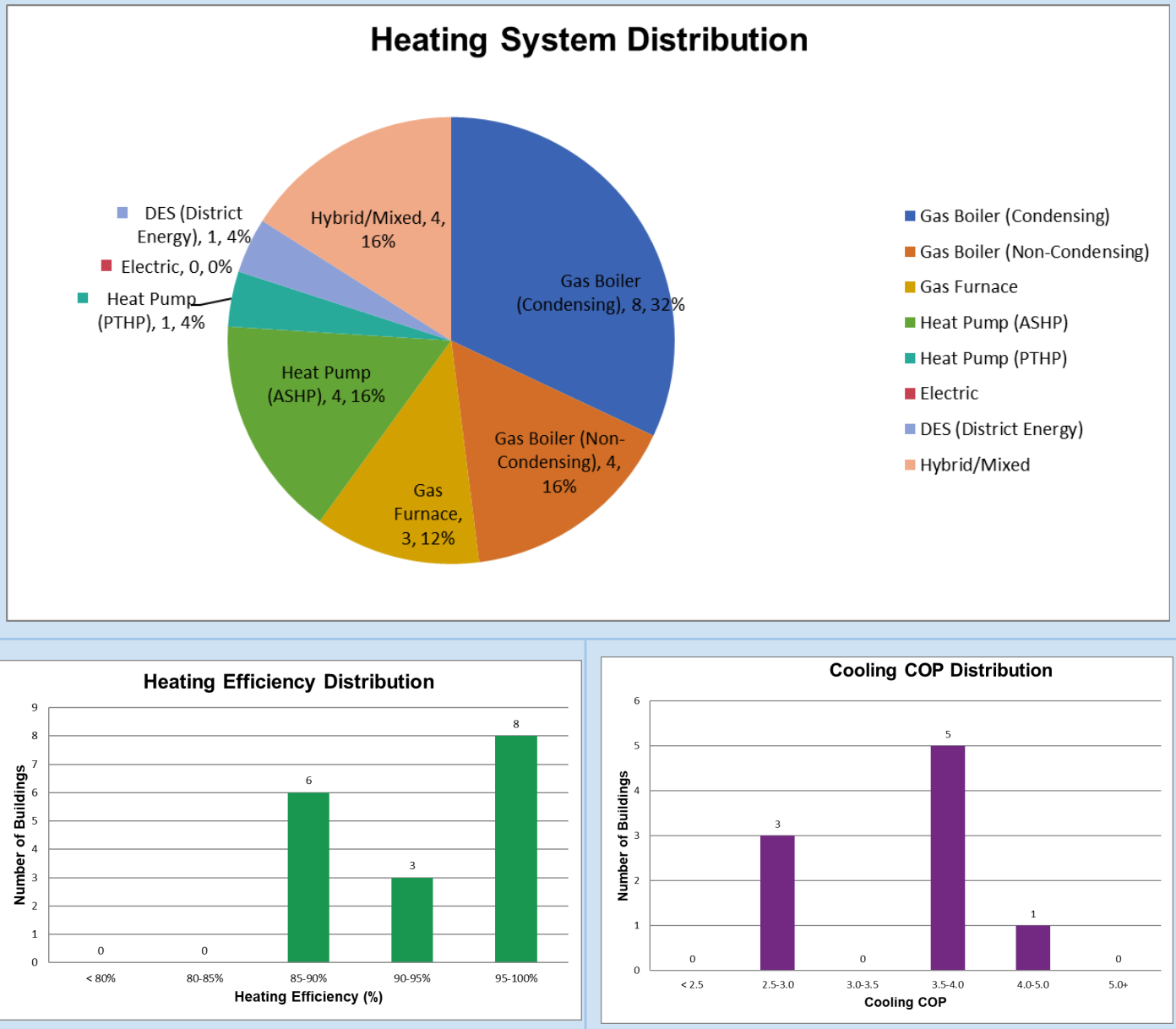


Figure 6 - Calgary, part 3 MURBS, NECB 2017, summary of HVAC systems.

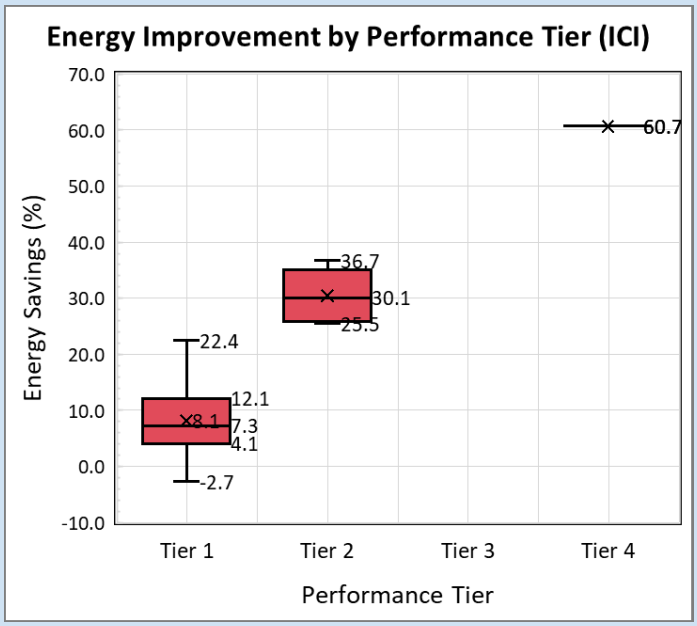
Commentary on mechanical systems

Similar to the NECB 2020 buildings, a wide variety of building heating systems are being used.

Industrial, Commercial, and Institutional (ICI)

Energy Performance / Breakdown of Energy Tier

Eighty (80) projects were in the ICI grouping and planned using NECB 2020. This category of projects covers a wide range of buildings, with commercial being the most common. Figure 7 below shows the distribution and energy savings reported.



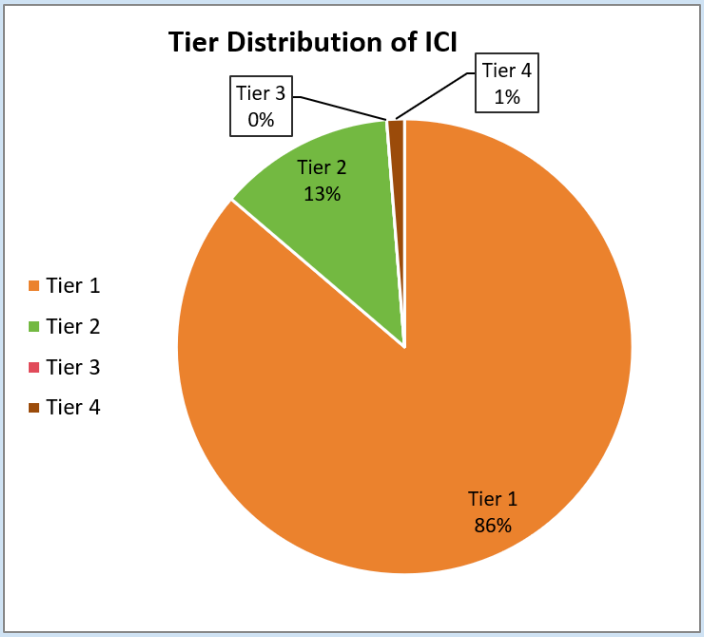


Figure 7 - Calgary, part 3 ICI, NECB 2020, energy performance summary.

Commentary on energy performance trends

The Tier 2 projects included a diverse mix of building types, including public buildings, schools, and commercial/retail buildings. The only Tier 4 project was a City of Calgary building.

Building envelope

Figure 8 summarizes the major building envelope components for ICI projects evaluated under NECB 2020.

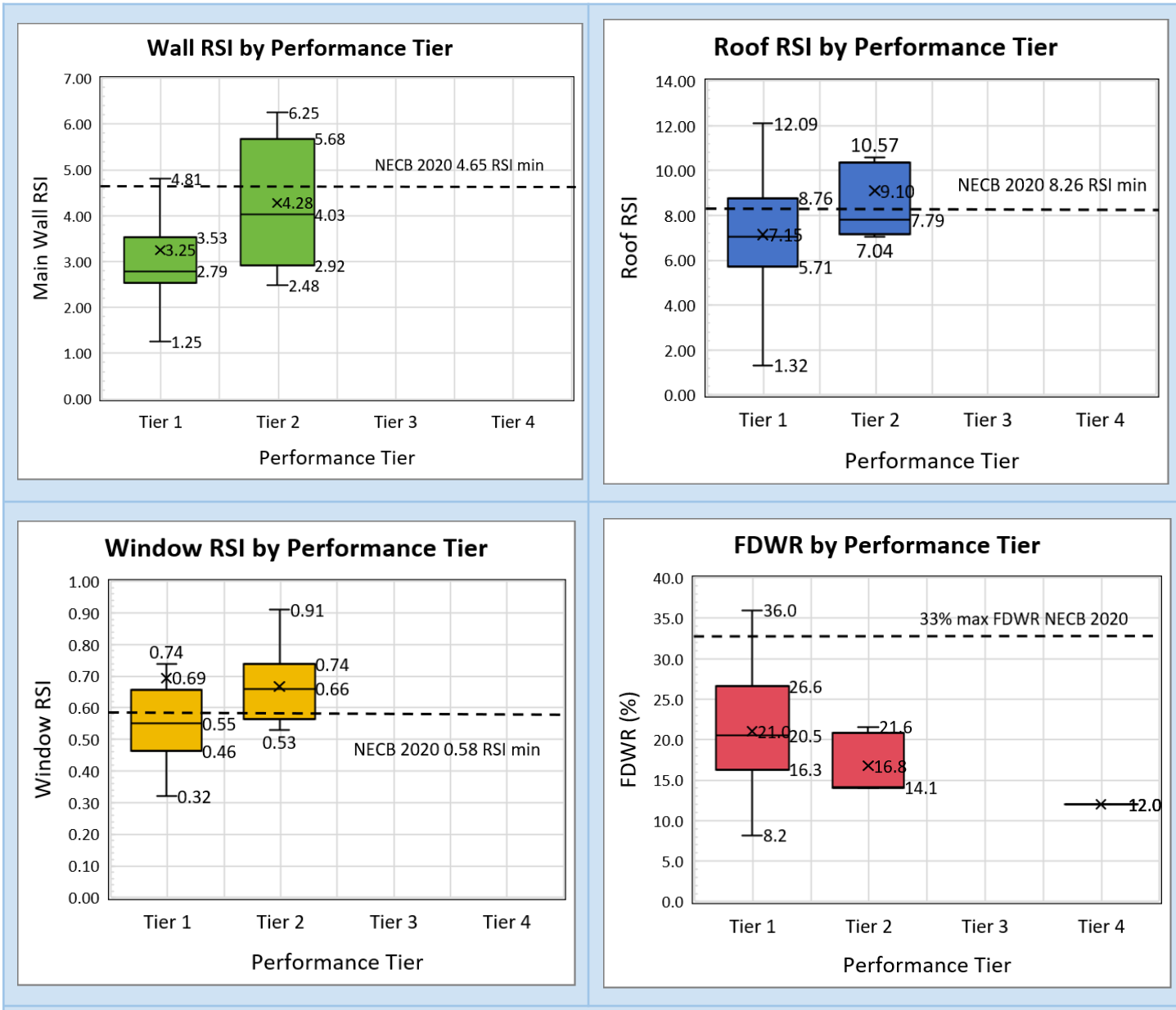


Figure 8 - Calgary, part 3 ICI, NECB 2020, building envelope.

Commentary on building envelope

The trends are a little clearer in this data set. The average performance of the walls, windows, and roof insulation all improved. The trend in window-to-wall ratio (FDWR) is also clear, with reducing ratios (i.e., fewer windows) as we move to higher performance tiers.

HVAC systems

Figure 9 below looks at the HVAC system performance.

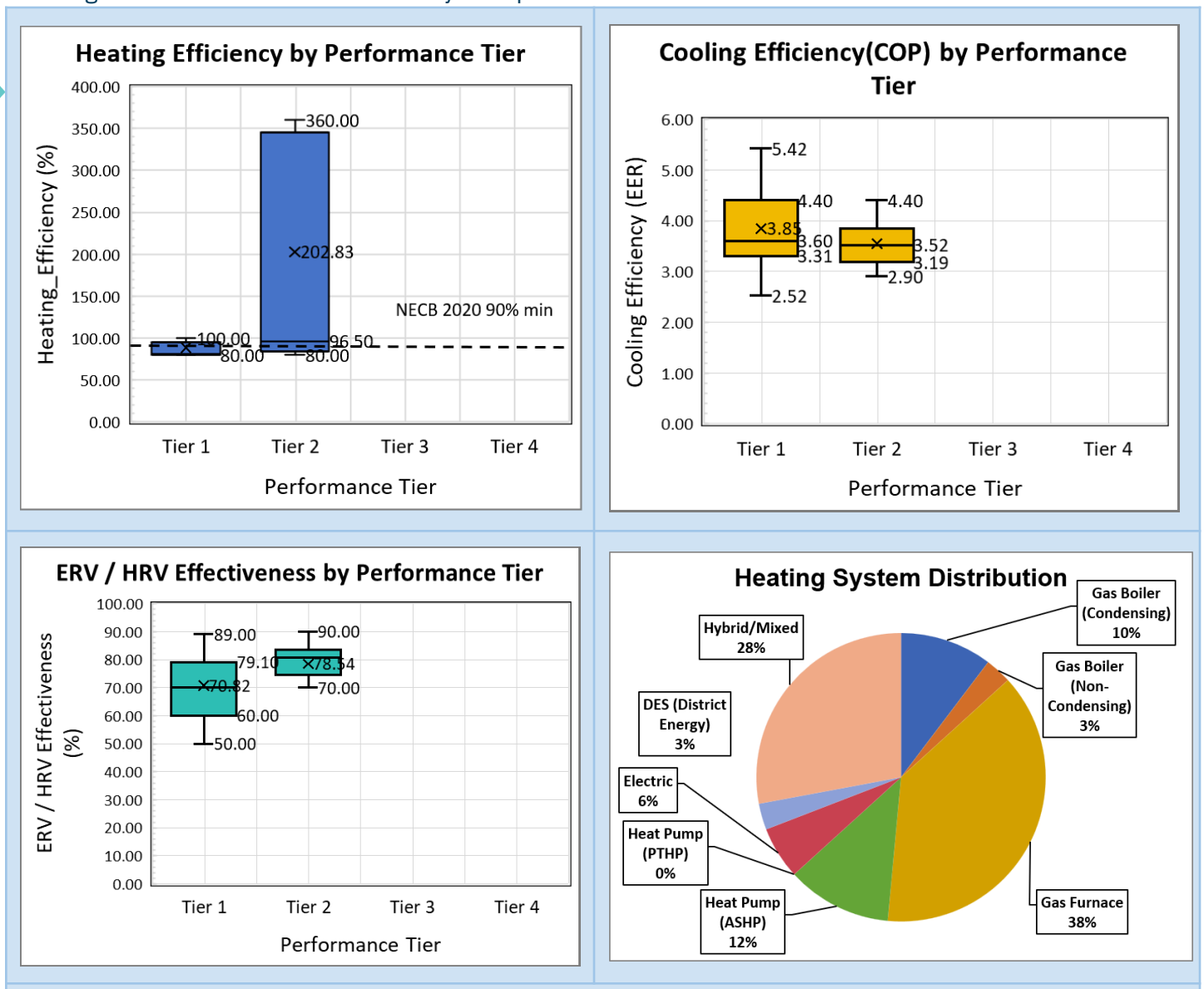


Figure 9 - Calgary, part 3 ICI, NECB 2020, HVAC performance.

Mechanical commentary

The most striking observation is the ASHP being used for significant heating; heating performance up to 360% (COP 3.6) was noted in the energy performance permitting. By contrast, cooling COP did not improve significantly from Tier 1 to Tier 2.

ICI NECB 2017

Eleven (11) permits were evaluated against NECB 2017. The majority of these spaces were warehouses. Figure 10, below, shows the breakdown of projects relative to the reference buildings.

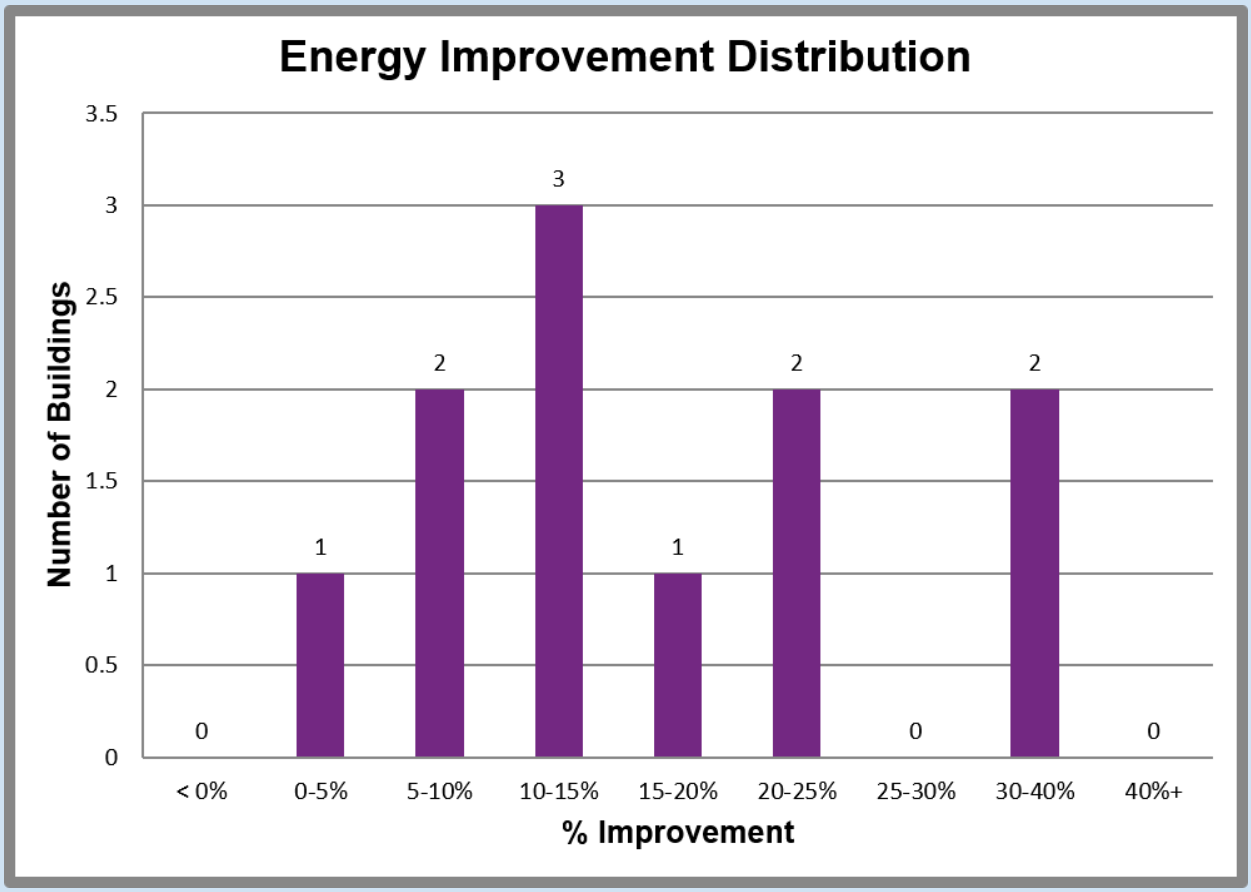


Figure 10 - Calgary, part 3 ICI, NECB 2017 - energy savings.

Commentary on energy performance trends

Similar to the MURBS, all of the buildings observed were modeled better than the minimum energy efficiency performance.

Figure 11 below shows a similar trend to the MURB results, with both wall and roof insulation performing below the minimum NECB RSI values.

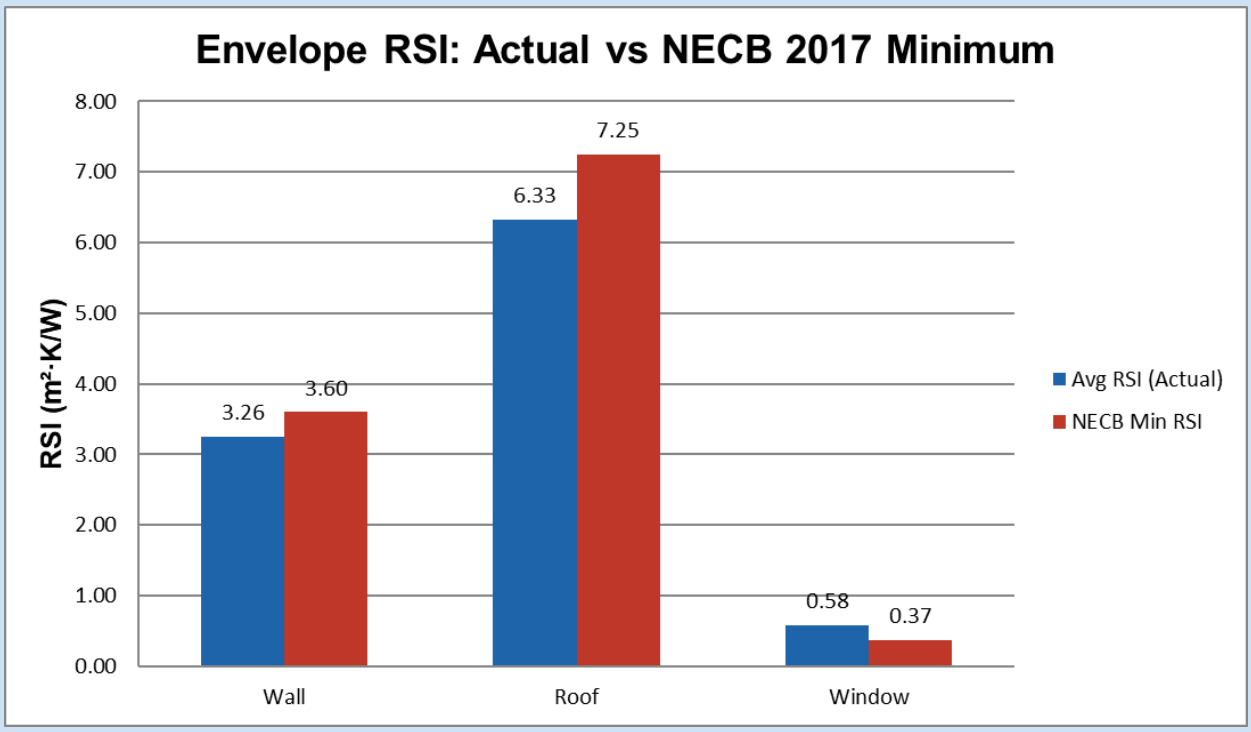
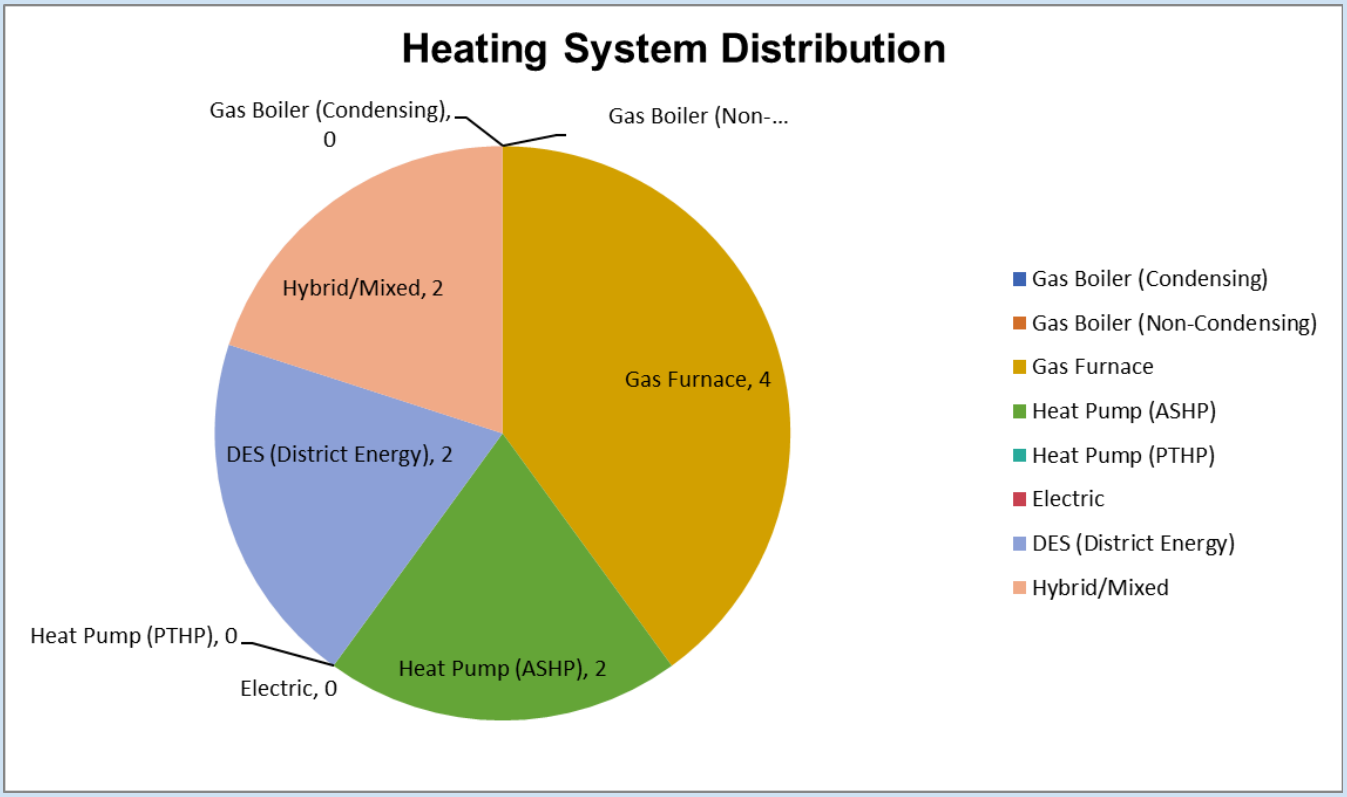


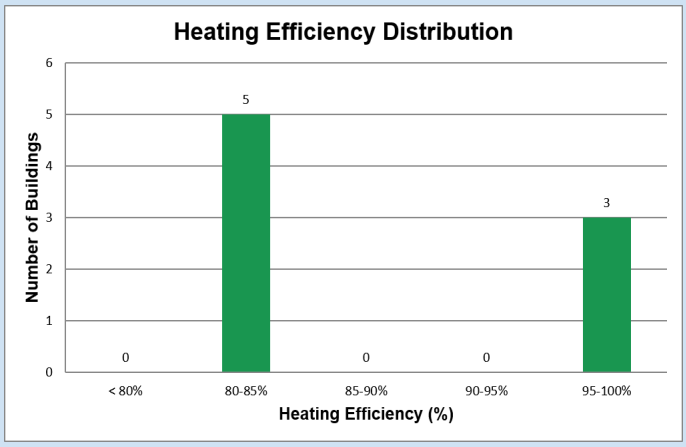
Figure 11 - Calgary, part 3 ICI, NECB 2017 - building envelope

Commentary on building envelope

The results follow a similar trend to the MURBs, with the insulation values for the wall and roof assemblies falling below the prescriptive minimum.

Figure 12 below shows heating and cooling system performance. Natural gas is the dominant heat fuel. Two locations are identified as part of a district heating system.





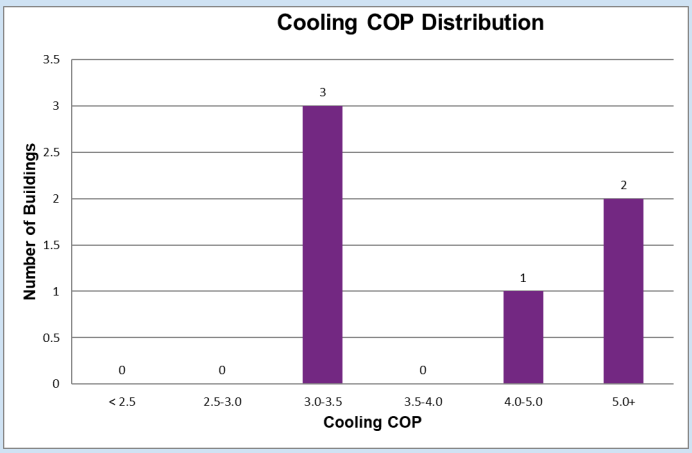


Figure 12 - Calgary, part 3 ICI, NECB 2017 - HVAC performance

Commentary on mechanical systems

Similar to the NECB 2020 ICI buildings, heating systems vary significantly.