

Evaluation of Environmental Sustainability in the National Housing Strategy

July 2024



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Canada



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Executive Summary

Evaluation objective, scope, and methodology

- This evaluation assessed how NHS programs and initiatives are contributing to **environmental sustainability**, which is one of the National Housing Strategy's (NHS) 11 Shared Outcomes.
- The evaluation scope focused primarily on projects with signed agreements from CMHC-delivered NHS programs that create new or repair existing housing, from program inception to March 31, 2023.
- Evaluation methodologies included: interviews, literature and documentation review, administrative data analysis, and energy savings impact analysis.

Summary of key findings

- There is a **continued need** for the NHS to include environmental sustainability outcomes as buildings are the third-largest emitter of greenhouse gases (GHG) and deep energy retrofits are needed to reduce emissions. Increased extreme weather events and slower onset impacts also have potential severe impacts to buildings, occupants, and cost.
- The goals of the NHS **reflect CMHC and federal government priorities** on climate change and environmental sustainability.
- The NHS's impact is estimated to be an annual reduction in energy consumption of **~2 million gigajoules** and in **GHG emissions of ~40,000 tonnes of CO₂**.
- Overall, NHS projects committed to an average improvement of 25.6% in energy efficiency (EE) and an average reduction of 33.6% in GHG emissions. Based on the period examined in this evaluation, the NHS is **not on track to meet the overall energy efficiency (EE) target of 35%**. This is because of:
 - the **reliance on incentives** to achieve this target, as program minimum requirements are lower than 35%. Therefore, most projects exceed its program minimum requirements despite not meeting the NHS target;
 - the **impact of exempt projects** that have energy requirements waived, or no energy requirements. This lowers the overall achievement of EE targets by 6.6 percentage points and GHG reduction targets by 2.7 percentage points; and,
 - the **impact of repair/renewal projects** that target lower energy efficiency and greenhouse gas reductions compared to new construction projects.

- The NHS supply programs **focus on mitigation-based measures** for reducing the sources of greenhouse gas emissions, rather than adaptation- or resilience-based measures that adjust to or increase capacity to cope with changing climates.
- The **reliance on modelled building performance** limits the ability to determine actual progress in achieving desired NHS environmental sustainability outcomes.
- **Cost**, including the impact of increased construction costs, can be a barrier to achieving more efficient buildings.
- Meeting and implementing energy efficiency is more difficult for:
 - **non-profits** and **Indigenous** groups, who face challenges with the process and the environmental outcomes, and;
 - **repair/renewal projects** or ones in **Northern/remote regions**, which face difficulties building and repairing more efficiently.

Recommendations and Key Considerations

Based on these findings, the evaluation proposes two recommendations and two key considerations:

- Recommendation 1: Conduct a review of the options to meaningfully support energy efficiency and greenhouse gas emissions reductions in repair/renewal projects.
- Recommendation 2: Examine actual building energy performance.
- Key consideration 1: Explore opportunities to better align program requirements and incentives with broader strategic environmental objectives, including the **NHS 35% energy efficiency target and GHG reduction goals**.
- Key consideration 2: Consider exploring the inclusion of **climate resilience and adaptation** measures in future programming.

Policy considerations were shared with Housing, Infrastructure and Communities Canada's (HICC), pursuant to HICC's assumption of the leadership role in housing policy for the Government of Canada.

Introduction

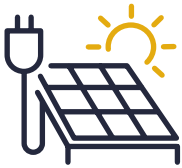
Thematic profile and context

Environmental sustainability and the National Housing Strategy

NHS shared outcomes

One of the National Housing Strategy's 11 shared outcomes is that **"affordable housing contributes to environmental sustainability"**. To achieve it, most NHS programs and initiatives that build or repair housing include requirements, targets, and incentives that are expected to contribute to environmental sustainability. The most common are:

Energy efficiency improvements



Greenhouse gas (GHG) reduction



During the period of this evaluation, the requirements were based on the 2015 or 2017 National Building Code (NBC) for Part 9 Buildings or the 2015 or 2017 National Energy Code for Buildings (NECB) for Part 3 Buildings for new construction. Repair/renewal projects have requirements based on the pre-construction baseline.

NHS expected result

The NHS expects the result whereby **"new social and affordable housing supports greenhouse gas emission avoidance through improvement on energy efficiency standards."**

As set out in the Treasury Board submission, the indicators and targets to achieve this are:

- Greenhouse gases avoided through improvement of energy efficiency standards of NHS- funded projects;
- 35% improvement above the NECB for new buildings (2015); and
- 35% improvement above baseline for repair and renewed buildings (2015).

These NHS targets are distinct from individual program requirements and targets (see table 1 for the program requirements). The NHS targets also only account for post-construction building operation and do not consider full life-cycle emissions (which would include emissions from manufacturing, construction, and disposal). The NBC and NECB versions published to date do not include operational greenhouse gas emission reduction requirements.

What is environmental sustainability?

The NHS Glossary (CMHC, 2022b) provides the following definitions:

– **Sustainable housing:** "Housing designed, built and operated using techniques, materials and technologies that result in houses that are highly energy-efficient, make efficient use of resources, have low environmental impact, are healthy to live in, are affordable, and produce as much energy as they consume on an annual basis."

– **Environmental efficiency:** "Improvements in the measurement of energy efficiency combined with reductions in greenhouse gas emissions as a result of energy efficiency measures."

There is no definition of "environmental sustainability" in the NHS Glossary. In this report, the term is used broadly to mean energy efficiency, achieving low carbon, efficient resource use, low environmental impact, and climate resilience.



Evaluation context, questions, and methodologies

Objective of the evaluation

The evaluation assessed how National Housing Strategy programs and initiatives are contributing to environmental sustainability.

Evaluations provide evidence-based insights to inform the future direction of programs. This evaluation was conducted in accordance with the Program Evaluation Standards adopted by the Canadian Evaluation Society and the Treasury Board Secretariat's *Policy on Results*.

Overview of the evaluation

Where possible, the data collection and conduct of this evaluation was combined with the Social Inclusion and the Housing Is Affordable and in Good Condition thematic evaluations that were also underway.

Evaluation methodologies

The evaluation used the following methodologies:

Interviews

- With 70 CMHC staff members, program applicants, and environmental sustainability experts
- [Annex A](#) includes a breakdown

Literature and documentation review

- Academic and grey literature
- Internal program documents

Administrative data

- Project-level data
- See page 17 for more information

Energy savings impacts analysis

- Modelled impacts and costs
- See page 26 for more information

Evaluation scope

The evaluation focused primarily on CMHC-delivered NHS programs that create new or repair existing housing (referred to as "NHS supply programs" throughout this report). It had a secondary focus on other NHS programs. The program data covers all projects with signed agreements from program inception to March 31, 2023 (unless otherwise specified).

- **Primary focus (with energy efficiency requirements):** Affordable Housing Fund, Apartment Construction Loan Program, Rapid Housing Initiative, Affordable Housing Innovation Fund (Phase 1), Federal Lands Initiative. Table 1 provides descriptions.
- **Secondary focus (programs that contribute indirectly):** Research and Data Initiatives, Housing Supply Challenge, Community Housing Transformation Centre.

Evaluation questions

Relevance

1. To what extent is there a **continued need** for housing programs to contribute to environmental sustainability?
2. Are there any **emerging or changing needs** in the housing landscape that impact conditions related to environmental sustainability?
3. To what extent is there alignment with **federal and CMHC strategic direction and priorities**?

Effectiveness and impact

4. To what extent are programs contributing to the **achievement of the environmental sustainability related outcomes** of the NHS?

Efficiency, coherence, and sustainability

5. To what extent are the **design and delivery** of programs enabling them to contribute to environmental sustainability outcomes?
6. To what extent are programs **coherently and sustainably** supporting the achievement of environmental sustainability outcomes?

Programs in scope



1,453 projects



228,940 housing units/shelter beds



~\$24 billion committed

*Reported numbers in this report may vary from reported numbers on the NHS Place to Call Home website due to exact timing of data collection, reliance on manual data manipulation, and cross-referencing with application information that was done for this evaluation.

Table 1: Programs with a primary focus for environmental sustainability evaluation

Program	Description of the program	Energy efficiency requirements (during the evaluation period)
Apartment Construction Loan Program (ACLP)	Low-cost loans encouraging the construction of rental apartments across Canada.	<p>Projects must be at minimum 15% more efficient in energy consumption and GHG emissions than the applicable reference model building codes:</p> <ul style="list-style-type: none"> • Low-rise, multi-unit buildings (as defined in Part 9 of the NBC) must demonstrate a minimum 15% improvement relative to NBC 2015. • All other multi-unit buildings (known as “Part 3 buildings” in the NBC) must demonstrate a minimum 15% improvement relative to NECB 2015. • All projects submitted on or after November 1, 2022, under Part 3 of the NBC must demonstrate a minimum 15% improvement relative to NECB 2017.

Program	Description of the program	Energy efficiency requirements (during the evaluation period)
<p>Affordable Housing Fund (AHF)</p>	<p>Low-interest and/or forgivable loans and contributions for new affordable housing and the renovation/repair of existing affordable and community housing.</p> <p>Applicant organizations are required to have partnered with other organizations or levels of government.</p>	<ul style="list-style-type: none"> • New construction projects must achieve either a 25% decrease in energy consumption and GHG emissions relative to NECB/NBC 2015; or a 15% decrease in energy consumption and GHG emissions relative to NECB 2017*. • Existing buildings must achieve a minimum 25% decrease in energy consumption and GHG emissions relative to past or pre-renewal performance levels.
<p>Affordable Housing Innovation Fund (AHIF) Phase 1</p>	<p>Funding for housing providers driving innovation across the housing continuum.</p> <p>Only AHIF projects in Phase 1 are included in the scope of this evaluation.</p>	<ul style="list-style-type: none"> • New construction projects must achieve a minimum 10% reduction in energy consumption and greenhouse gas (GHG) emissions over the same project designed to the requirements of the NECB/NBC 2015*. • Renewal or repair projects must demonstrate a minimum 10% reduction in energy consumption and GHG emissions relative to pre-repair or pre-renewal performance.
<p>Federal Lands Initiative (FLI)</p>	<p>Surplus lands and buildings available for development into affordable housing units and communities.</p>	<ul style="list-style-type: none"> • New construction projects must achieve either a 25% decrease in energy consumption and GHG emissions relative to NECB/NBC 2015; or achieve a 15% decrease relative to NECB 2017. • Renewal or repair projects must demonstrate a 25% decrease in energy use and GHG emissions relative to past performance of the property.
<p>Rapid Housing Initiative (RHI)</p>	<p>Capital contributions for the rapid construction of new housing and/or acquisition of existing buildings for rehabilitation or conversion to permanent affordable housing.</p>	<p>RHI 1 Cities stream: Modular construction projects are expected to be at or above 5% of existing energy efficiency standards relative to the NECB/NBC 2015; or meet local/regional standards, whichever is higher.</p> <p>RHI 1 Projects stream: No requirement to exceed the standards.</p> <p>RHI 2 Cities stream: New construction projects are expected to be at 5% higher or more relative to the energy efficiency standards set out in the NECB/NBC 2015.</p> <p>RHI 2 Projects stream: No requirement to exceed the standards.</p>

*NBC is the model code that applies for buildings that fall under **Part 9 of the NBC**.

NECB is the model code that applies for buildings that fall under **Part 3 of the NBC**. These buildings are larger than 600m² or taller than three storeys.

Relevance

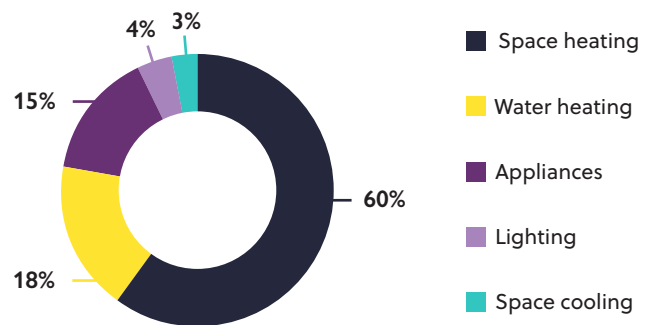
Finding 1:

There is a continued need for housing programs to include environmental sustainability outcomes, since buildings are the third-largest emitter of greenhouse gases in Canada and aging buildings are more inefficient and need deep retrofits.

Residential, commercial, and institutional buildings are the third-largest emitter of greenhouse gases in Canada (in terms of operational emissions, not including emissions from manufacturing, construction, and disposal).

Greenhouse gas (GHG) emissions affect the earth's atmosphere and change the climate, including weather, precipitation, and temperature (United Nations Environment Programme [UNEP], 2021). This leads to climate events such as natural disasters. The NHS seeks to reduce the energy used and GHGs emitted by buildings. Based on 2020 data, **buildings were (operationally) the third largest emitter** in Canada; residential buildings account for just under half of building emissions (Environment and Climate Change Canada [ECCC], 2023). Figure 1 shows that most energy consumed by residential is **from heating homes and heating water**, because the equipment uses fossil fuels (Natural Resources Canada [NRC], 2019).

Figure 1: Energy consumption in homes (NRCan, n.d. -a)



Electricity can come from **lower-emission sources** (hydro, nuclear, wind power) or from **higher-emission sources** that produce more GHGs (gas, oil, coal, diesel). Thus, provinces that generate electricity through renewable sources, like hydropower, emit less GHG than provinces that generate electricity with fossil fuels such as coal (Canada Energy Regulator, 2017). As a result, the main factor affecting household GHG emissions are (1) how **electricity is generated**, and (2) the **energy source used by the equipment** to heat water and homes.

Housing in need of repairs and older housing are less efficient.

The NHS outcome specifies that **affordable housing** should be environmentally sustainable. Older housing tends to be more affordable, and therefore more likely to be occupied by lower-income households. However, **aging buildings** that are less well-maintained or need major repairs may have poorer insulation, resulting in **higher energy consumption**, increased energy costs, and reduced affordability (Rowlands and Stephen, 2016).

- In 2021, 7.4% of households lived in units needing **major repairs** (Statistics Canada, 2022).
- Social and affordable housing provides shelter for individuals in need. **87% of these units were built before 1995** (CMHC, 2023b).

Interviewed experts noted the **significant environmental impact of existing, aging buildings**. New builds are increasingly efficient, but less-efficient buildings from the 1970s to 1990s are estimated to make up over **80%** of Canada's buildings in 2030 (Government of Canada, 2022).

As a result, retrofits of existing buildings are necessary, but face challenges.

The literature and interviewees advocated for energy retrofits to achieve Canada's emission targets (Haley & Torrie, 2021; NRCan, 2022; Canada Green Building Council, 2021). In particular, deep retrofits reduce energy demand and GHG emissions by switching from fossil fuels to electricity for home and water heating (NRCan, 2022).

The low rate of retrofits is a **constraint to lowering building emissions** (Intergovernmental Panel on Climate Change [IPCC], 2022). Key informants and literature highlighted barriers such as the **high cost and investment** required, the **complexity of implementation**, and **inconvenience to residents** (IPCC, 2022, Canada Green Building Council, 2021). Some NHS programs fund the modernization of existing buildings, and findings 6 and 12 echo some of these challenges. Since the launch of the NHS, other programs have been introduced that focus on encouraging deep retrofits (the Canada Greener Homes Initiative [including the Grant and Loan components] and the Canada Greener Affordable Housing Program).

Finding 2:

Climate events impact buildings and their occupants and add costs. The severity of these impacts differ based on geographical and individual risk factors.

Climate events affect buildings and people by pushing the housing stock to its limits, exacerbating vulnerabilities, and adding a financial cost.

Buildings are supposed to protect occupants from the outdoor environment. They should shield individuals from dangerous outdoor conditions, but climate events can make buildings unsafe and are becoming increasingly severe and frequent. Extreme and non-extreme environmental impacts from climate change include:

- Flooding (e.g. from extreme rainfall, floodplains)
- Wildfires (e.g. wildland-urban interface fires)
- Extreme heat events
- Storms (e.g. post-tropical, hailstorms)
- Coastal erosion
- Permafrost thaw

These events **impact buildings and their occupants**. For example, they can lead to building collapse and destruction, damage from impact (such as falling trees) and water, loss of durability in building materials, and loss or damage to property (UNEP, 2021). Vulnerability to climate event risks varies based on certain factors, including:

- 1. Location risks:** Known high-risk areas include floodplains and wildfire urban interface zones. Further, specific places face hazards like floods, fires, heatwaves, or melting permafrost. For example, 22% of residential properties on-reserve are at risk of a 1-in-100 year flood.
- 2. Individual (occupant) risks:** Different people experiencing the same hazard will experience different impacts. Those with limited means may not have the resources to prepare for an extreme event, or to move or adequately rebuild after it. Those living in low-quality housing are also more susceptible to risks. (UNEP, 2021; Canadian Climate Institute, 2020).

Communities most vulnerable to climate risks

- Climate change amplifies existing vulnerabilities and inequities, so some populations (Indigenous, Black, racialized, low-income, 2SLGBTQI+, and women) experience climate impacts more severely.
- People with health conditions and disabilities and the very young or older adults are particularly vulnerable to the impacts of climate change. (Government of Canada, 2023)

In recent years, Canada has faced:

- record **heat** (2021) that resulted in 90% of Lytton, BC being burned, over 600 deaths in Vancouver, and lasting economic impact across the agriculture and food sector with the deaths of more than 650,000 farm animals;
- **hurricane** Fiona (2022) in Eastern Canada that left damaged homes, cottages, piers, and roofs, and led to evacuations and three deaths; and,
- record **rains** in Quebec (2023) that led to flash floods, evacuations, flooded homes, and destroyed key infrastructure.

In addition to the impacts on buildings and their occupants, these events also have **significant financial costs** from damage to infrastructure, lost productivity, and impacts on human health (NOAA, 2024). Resilient, good quality buildings are therefore **crucial to avoid damage, protect occupants (particularly those who are most vulnerable), and mitigate costs**. By repairing older housing, the NHS lessens the impact of climate events. However, as finding 9 illustrates, the NHS requirements and incentives focus on rewarding projects for improving EE and reducing GHG emissions, rather than for increasing resilience.

More efficient, climate-resilient, and low-carbon homes offer cost savings and provide more comfortable and healthy living environments.

In addition to their greater exposure to risks, low-income households are more likely to spend more of their income on utilities (electricity, gas, or diesel fuel); higher-income households can afford energy efficiency improvements to their homes (Canada Energy Regulator, 2023).

Energy efficiency improvements have benefits such as **energy savings** (leading to lower utility bills) and **reduced maintenance costs** (Arnold, 2021). Beyond financial or environmental benefits, these improvements can enhance social outcomes through:

- **health** benefits (by reducing mould and improving indoor air quality);
- greater **comfort** (keeping occupants warm in winter and cool in the summers); improved **well-being** (tenant satisfaction) (Tsenkova, 2021; Arnold, 2021).



Finding 3:

Emerging and changing needs in the housing and regulatory landscapes, such as increased costs and changing building codes, both constrain and positively impact the inclusion of environmental sustainability in building/repairing housing.

The literature and internal stakeholders indicate that the Canadian housing landscape has significantly changed since the launch of the NHS.

Construction costs have increased due to supply chain challenges from COVID-19 and higher prices of materials from market pressures (CMHC, 2022a). Residential construction costs have increased by around 75% since the NHS's launch in 2017 (Statistics Canada, 2024). Combined with other changes, this has impacted the construction and repair of more sustainable housing. Interviewees noted other changes such as decreased affordability, labour and materials shortages, changing building codes, and COVID-19's impact on project timelines.

Canada's Northern and remote areas face unique challenges and constraints related to housing and climate change.

There have been significant labour shortages and rising costs in Northern/remote areas (CMHC, 2024) that impact the ability to build energy-efficient homes. These communities often face **limited access to materials, high transportation costs, and shorter construction periods** due to harsh weather conditions, in addition to:

- the scarce availability of rentals, which contributes to higher shelter occupancy rates (CMHC, 2022a); and
- a higher proportion of homes requiring major repairs, as well as more overcrowding. Inadequate housing is a risk factor for health conditions.

Building cost and complexity is also impacted by the design considerations required to accommodate thawing permafrost in the North. The thawing permafrost is damaging housing foundations, leading to safety issues and complicating the construction of new units (CMHC, 2022a).

Over 280 off-grid communities in Canada rely on expensive **diesel-fueled power generation** (Canada Energy Regulator, 2022). Remote communities consume diesel fuel mainly for electricity generation and home heating due to harsh environments (ECCC, 2022).

The Northern Access round of the Housing Supply Challenge seeks solutions for these issues, including supply chain, access, and climate solutions for Northern/remote areas.

There are positive changes in perception, attitudes, and awareness.

Changing perceptions and attitudes are some of the trends positively impacting sustainable building. Studies have shown positive attitudes in the public and a willingness to adopt mitigation behaviours (Government of Canada, n.d.). Interviews noted that one positive contributor to achieving more sustainable housing is the consensus that climate change is here to stay. However, the literature has shown that globally, despite a willingness to adopt low-carbon solutions, cost concerns override the willingness to pay (Mata et al., 2021).

Building codes have changed, with some programs also updating the code.

The National Energy Code of Canada for Buildings (NECB) and the National Building Code of Canada (NBC) set out **technical requirements for the energy efficient and climate resilient design and construction of new buildings**. They are considered national model codes, but provincial and territorial governments have the authority to adopt NECB or NBC standards as is or with modifications.

Following the launch of the NHS, new versions of the codes were released in 2017 and in 2020. As codes are updated and adopted, new builds will be increasingly energy-efficient and climate resilient. The IPCC (2022) notes the effective and key role played by mandatory building energy codes and standards. To implement these changes:

- AHF and FLI have options for new construction projects to model energy efficiency and greenhouse gas emissions to NECB 2017 (instead of 2015); and
- the ACLP increased its energy efficiency and greenhouse gas requirements in 2022 by changing the percentage of improvement to be based on NECB 2017 (instead of 2015).

However, with NECB 2020 in place at the time of this evaluation, NECB 2015 and 2017 are already behind the most recent national model code for new construction.

Finding 4:

NHS programs are aligned with the federal and CMHC strategic direction and priorities related to climate change and environmental sustainability.

The NHS programs demonstrate alignment with CMHC's strategic focus on climate change and environmental sustainability.

One of the key commitments in the CMHC 2022–2026 Corporate Plan is to incorporate **climate change considerations into all aspects of its operations**, promote stability in Canada's housing markets, and ensure sustainability in the housing system. CMHC's commitment extends to achieving a net-zero climate-resilient housing sector by 2050, with incremental targets for 2030. These priorities align with federal government objectives and contribute to the broader national agenda of combatting climate change. The following **CMHC measures** relate to climate change and environmental sustainability:

Outcome 3

- Canada's housing system supports sustainability and stability

Strategic result 6:

- Climate compatibility performance measures

NHS emission reduction goals align with those of the federal government.

The NHS is aligned with Canada's goal of reducing emissions. The NHS supports projects that:

- improve the performance or extend the useful life of existing buildings; and
- improve the energy efficiency and reduce the greenhouse gas emissions of new and existing buildings.

This is in line with Canada's 2030 Emission Reduction Plan, which places emphasis on reducing emissions from the building sector. Moreover, the NHS focus on energy efficiency in housing aligns with the **Canada Green Building Strategy**. This Strategy also aims to foster the use of lower-carbon construction materials and increase the climate resilience of existing buildings.

The 2030 and 2050 Emissions Reduction Plans

Released in 2022 by Environment and Climate Change Canada, the Plan aims to reduce Canada's GHG emissions by **40%** below 2005 levels by 2030 and achieve net-zero emissions by 2050. They emphasize the importance of reducing buildings sector emissions and promote the use of renewable energy as well as the implementation of building codes and standards.

Canada Green Buildings Strategy

The Strategy aims to develop a national strategy for achieving net-zero emissions in the buildings sector by 2050. It includes initiatives related to the following:

- Promoting building codes and regulations;
- Fostering the use of lower-carbon construction materials; and
- Increasing the climate resilience of existing buildings.

Effectiveness and Impact

A note on data: program-level project data

The program data presented in the following slides comes from internal project applications and program trackers. Where errors were found, they were manually corrected and verified. **The data in this section reports on projects; each project can have more than one building.**

***Note that the EE and GHG reduction targets presented here come from projections based on energy modelling at the time of the application (since energy and GHG emissions are not measured post-construction).**

Programs in scope: ACLP, AHF, AHIF Phase 1, FLI, RHI 1 and 2

Time period: Program inception until March 31, 2023

Blank data: Due to missing data, the graphs in this section note the number of valid projects where applicable (graphs will note the number with "n=" or "N=").

NECB 2017 conversion: The majority of projects report EE and GHG relative to NECB 2015. However, some projects use models that are relative to NECB 2017. Projects that report against NECB 2017 **were converted to NECB 2015**. See [annex B](#) for more details about this conversion.

RHI and GHG figures: RHI has been **excluded from all GHG figures** as proponents were not required to provide estimates for GHG emissions at the application stage. Table 2 summarizes the programs in scope, including the availability of EE/GHG data.

Table 2: Project, unit, energy efficiency and greenhouse gas numbers, by program

Program	Number of Projects	Total Number of Units or Beds across all projects	% of Program Projects with Energy Efficiency Gains Data	% of Program Projects with GHG Reduction Data
ACLP	235	41,598	90.2% (n=212)	90.2% (n=212)
AHF	623	153,782	98.4% (n=613)	97.9% (n=610)
AHIF	22	19,578	68.2% (n=15)	68.2% (n=15)
FLI	21	3,883	100.0% (n=21)	100.0% (n=21)
RHI	552	10,084	71.2% (n=393)	0.0% (n=0)
Total	1,453	228,940	86.3% (N=1254)	59.1% (N=858)

*Reported numbers in this report may vary from reported numbers on the NHS Place to Call Home website due to exact timing of data collection, reliance on manual data manipulation, and cross-referencing with application information that was done for this evaluation.

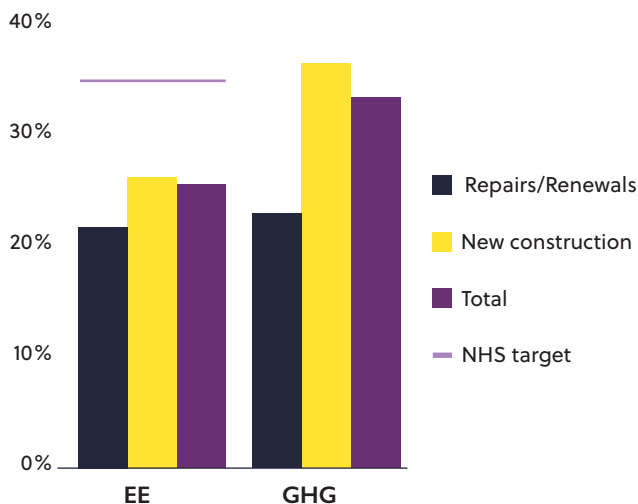
Finding 5:

While most projects exceed their program’s minimum energy efficiency and greenhouse gas reduction requirements, the overall average commitment is lower than the National Housing Strategy target of 35% energy efficiency improvement.

Overall, the NHS is not on track to meet the 35% energy efficiency target. The target does not apply to greenhouse gas reductions.

The NHS has an energy efficiency (EE) **improvement target of 35%** (above NECB/NBC 2015 at the time of this evaluation) for new buildings and a target of 35% above baseline for repaired/renewed buildings for the NHS as a whole. **The target does not apply to greenhouse gas emissions reductions.** Figure 2 shows an overall average for every project that reported EE or GHG emissions reduction targets. For EE, at 25.6%, this is almost 10 percentage points below the NHS target of 35%.

Figure 2: NHS performance on energy efficiency and greenhouse gas reductions targets, by project type



Program minimum requirements for EE are lower than the NHS 35% EE target. On average, projects exceed the program’s minimum requirements.

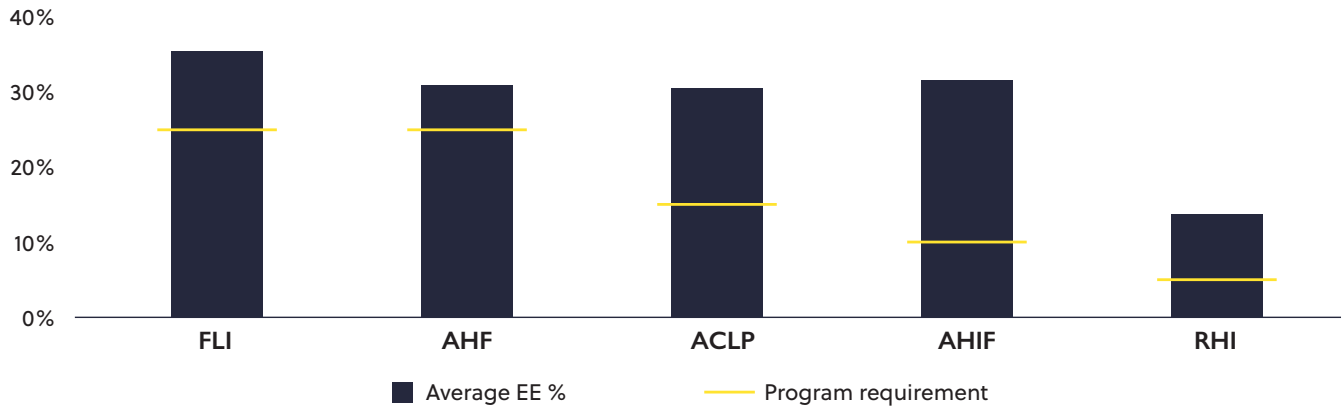
While the NHS EE 35% target is not met, the average EE% **by program** is higher than its program’s minimum requirement (see figure 3). The program requirements represent the minimum reduction that projects must achieve to be considered for funding, while the 35% NHS target is a broader goal for the entire strategy. **As table 3 shows, these minimum program requirements are all lower than the NHS target.**

Table 3: Summary of energy efficiency program requirements

Program	Program Requirement During Evaluation Period (% above NECB/ NBC for new construction or above baseline for repair/renewal)
ACLP	15%
AHF	25%
AHIF	10%
FLI	25%
RHI	5% (for construction projects under the Major Cities stream) 0% (no requirement) for all other projects

All programs have an average energy efficiency percentage target that exceeds the program’s minimum energy efficiency requirement.

Figure 3: Program performance on EE targets, relative to program requirements (N=1254)

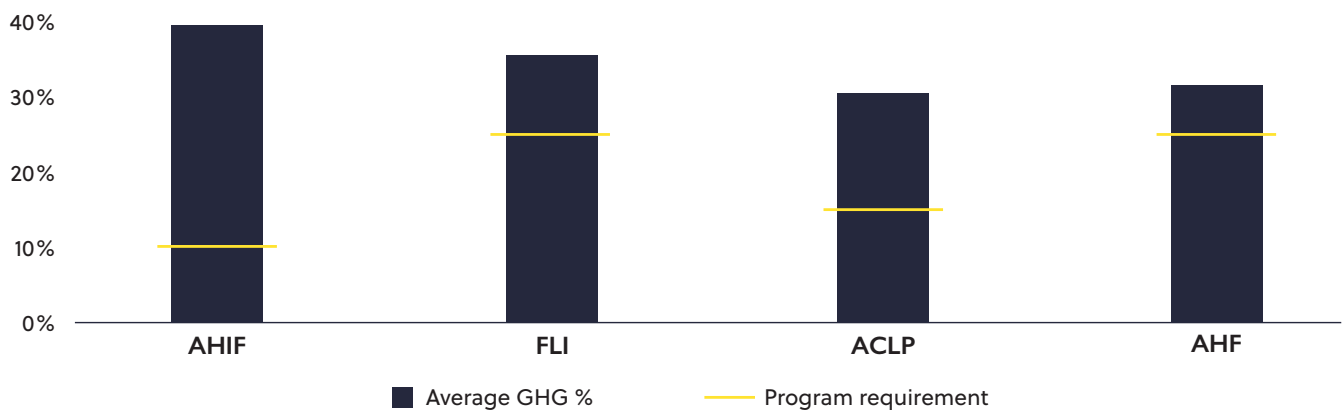


The Apartment Construction Loan Program (ACLP) and the Affordable Housing Fund (AHF) have minimum requirements of 15% and 25%, respectively. On average, projects funded by these programs have committed to 30.5% and 30.9% improvements in energy efficiency and therefore exceed their minimum requirements.

Figure 4 illustrates the average GHG percentage target by program, and echoes figure 3 on the EE percentage target. Programs have average targets that exceed the minimum requirements for GHGs. Overall, these averages are slightly higher than the averages for the EE percentage target.

All programs have an average GHG percentage target that exceeds the program’s minimum requirements.

Figure 4: Program performance on GHG targets, relative to program requirements (N=858)

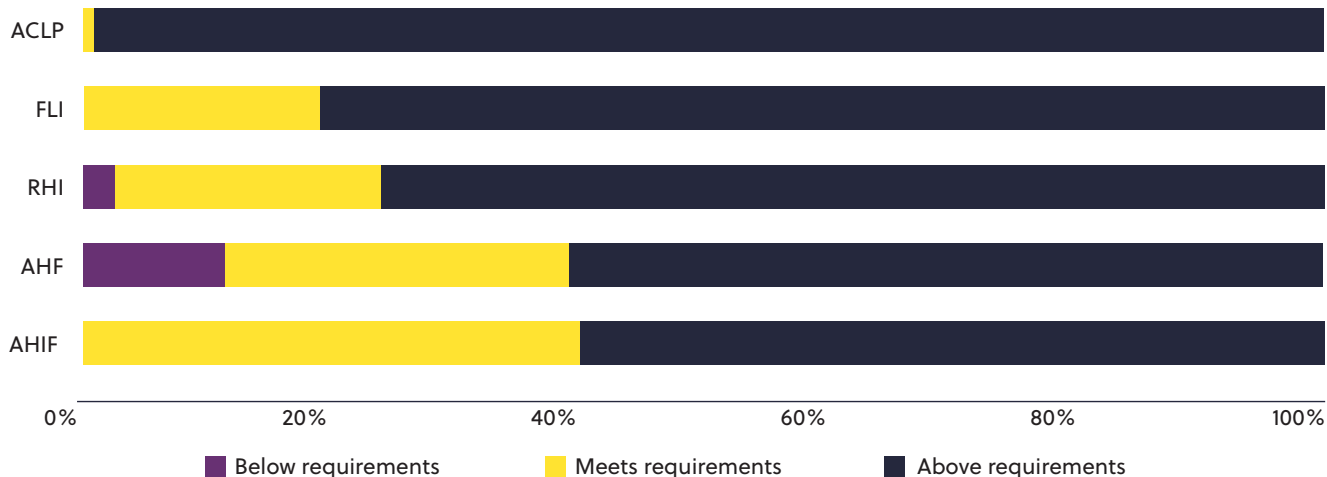


Most projects meet or exceed their individual program’s minimum EE requirements.

Figures 5 and 6 show the proportion of projects within each program that are below, at, or above the program’s requirements.

Most projects exceed their EE requirements.

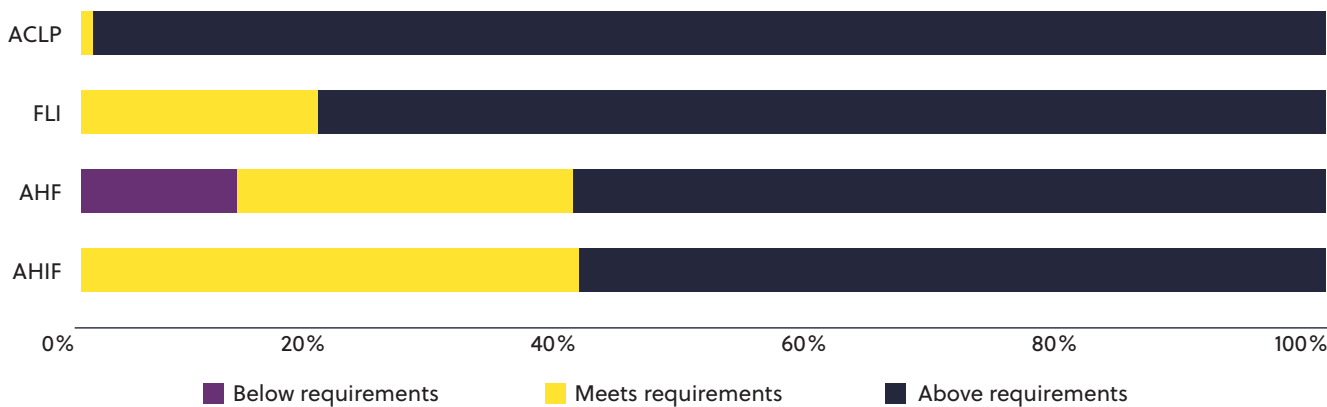
Figure 5: Proportion of projects below, meeting, or above EE requirements, by program*



*Note: Percentages don't add up to 100% due to rounding.

Most projects exceed their GHG reduction requirements.

Figure 6: Proportion of projects below, meeting, or above GHG reductions requirements, by program*



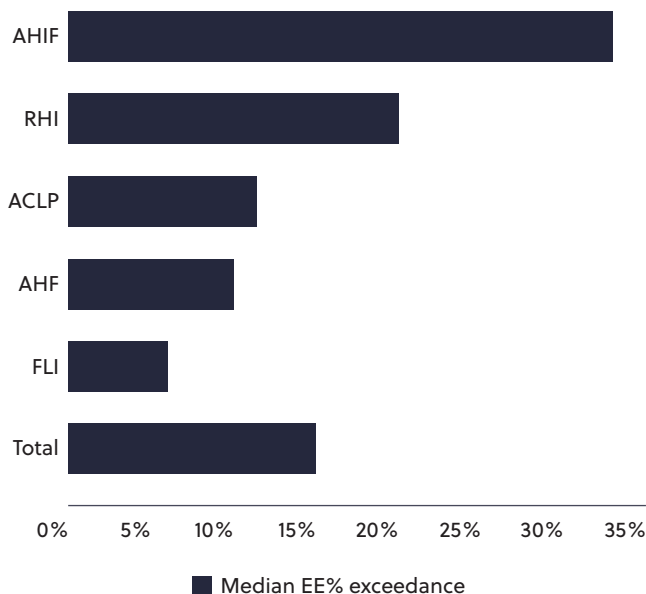
*Note: Percentages don't add up to 100% due to rounding.

Projects that exceed minimum requirements are typically about 5 to 20 percentage points above the requirement.

The high proportion of projects exceeding their requirements is likely due to the program incentives and prioritization in place for programs (finding 10 in the Efficiency section provides more information). A review of these projects shows that some do achieve 100% in energy efficiency improvement or emissions reductions, including building to net-zero or Passive House standards. However, the typical (median) project is only **around 15 percentage points more energy-efficient than the requirement** and achieves **around 12 percentage points less in greenhouse gas emissions** (figures 7 and 8). An exception is AHIF, possibly due to construction or building innovations that have led to generally greater environmental outcomes.

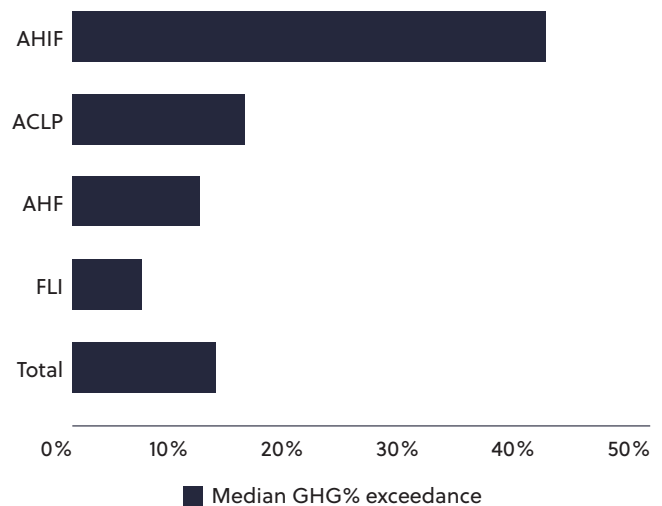
The median project exceeding EE target is 15 percentage points above the minimum requirement.

Figure 7: Variation in energy efficiency achievements beyond program requirements



The median project exceeding GHG target is 12.4 percentage points above the minimum requirement.

Figure 8: Variation in GHG reduction achievements beyond program requirements



There is a reliance on incentives/ prioritization to meet the NHS target.

In the case of ACLP, while the program requirement is 15%, most projects exceed it, but only by around 10 percentage points (median target of 26% more energy-efficient compared to NECB/NBC 2015), which is still below the NHS energy efficiency target of 35%.

Overall, this shows a mismatch between the program requirements and the NHS target. Because none of these requirements are at or above 35%, **meeting this NHS target relies on incentives and prioritization to push projects above and beyond the minimum.** Currently, incentives only push targets around 15% above the energy efficiency requirements. Incentive scoring is described in finding 10.

Finding 6:

Factors that lower the overall environmental commitments of NHS buildings include exemptions to the requirements and building type.

This evaluation defines an **exempt** project as meeting one of the following conditions:

- a. It has been granted an exemption to program EE/GHG requirements.
- b. Its program stream does not include any EE/GHG requirements.

AHF and RHI have projects that are exempt from requirements.

Under **AHF**, 11% (n=71) of **projects are exempt** from the environmental requirements (42% of these are new construction and 58% are repairs/renewals). This flexibility is in place to waive the energy efficiency requirements for **projects in circumstances** where it may be prohibitive to meet them (see table 9 in [annex C](#) for the reasons).

Under **RHI**, **only construction projects under the Major Cities** stream have an energy efficiency requirement (of 5%). Thus, most RHI projects with data are exempt from the requirements, as noted in table 4.

Table 4: RHI exemption from energy requirements (with % of projects)*

N=513	New/Modular Construction	Conversion/ Rehabilitation
Major Cities Stream	Yes – Expected to meet 5% (12.3%)	Exempt from requirements (9.6%)
Projects Stream	Exempt from requirements (69.9%)	Exempt from requirements (8.3%)

*Note: Percentages don't add up to 100% due to rounding.

That said, some exempt projects still target higher energy efficiency, due to existing project designs or to obtain points so the project is more likely to be selected for funding. The average **energy efficiency commitment is much higher in the Projects stream** (which have no requirements), at 14.3% (n=349), than the Major Cities stream, at 9.0% (n=44).

These exempt projects lower the overall NHS achievement of EE targets by 6.6 percentage points and GHG reduction targets by 2.7 percentage points.

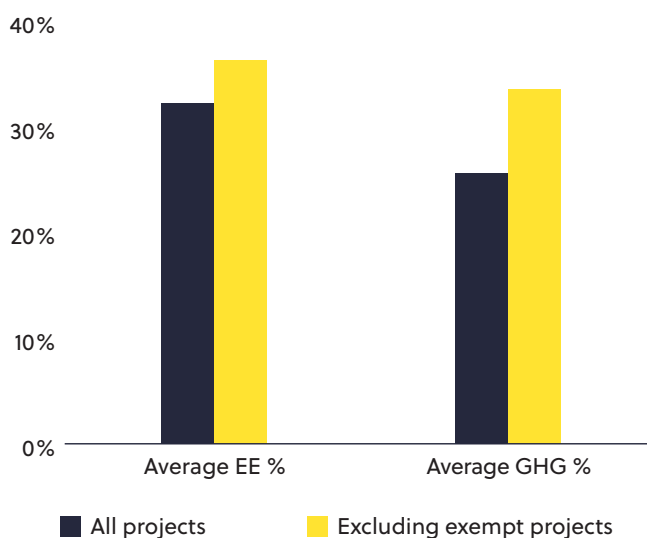
When exempt projects are excluded, the average EE/GHG percentage achievement is much greater, particularly for EE targets. However, it is still below the 35% NHS EE target.

The All projects columns in figure 9 show that for all NHS projects, there is a 25.6% target for EE (N=1254) and 33.5% for GHG reductions (N=858); taking out exempt projects raises this percentage, so it is much closer to the NHS 35% EE target. This demonstrates that exempt projects impact the NHS EE outcomes by **lowering its target achievement by ~6.6 percentage points**, and impact GHG reductions by **lowering its reductions by ~2.7 percentage points**.

This data shows that to achieve the overall NHS EE target of 35% while also accommodating exceptions and programs with lower or no requirements, **the other projects/programs need to achieve higher average EE targets than currently.**

Excluding projects with exceptions reveals an increase in the total projects' energy efficiency and greenhouse gas emissions reduction targets achievements.

Figure 9: Impact of excluding exceptions on NHS project outcomes for EE and GHG targets



Exemptions impact other factors, such as project location. When exempt projects are excluded, rural, remote, and Northern projects show higher EE targets.

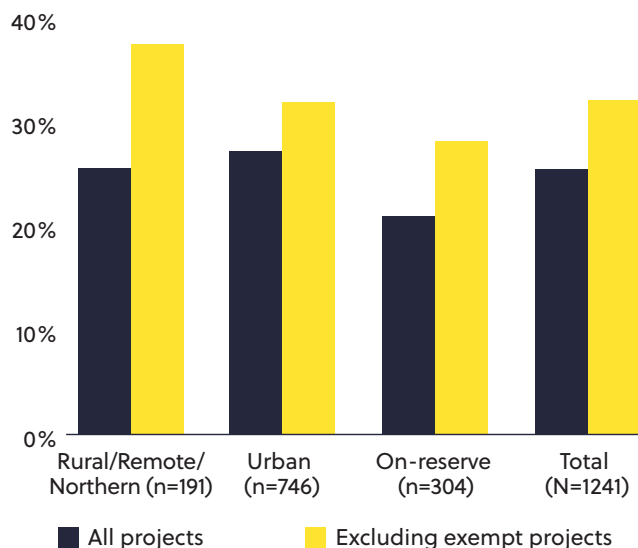
Figure 10 breaks down the average EE percentages by location. Overall, urban projects have the highest average targets, while on-reserve projects have the lowest.

- This is because **two thirds of the projects built/ repaired on-reserve** are exempt RHI and AHF projects, possibly due to specific challenges with meeting or implementing these requirements (these are discussed in finding 12).

Excluding these exceptions brings the average EE much higher for rural/remote/Northern and on-reserve projects.

Excluding exceptions reveals a significant achievement in energy efficiency target for projects in rural, remote, and Northern areas.

Figure 10: Average energy efficiency target %, by location (with number of all projects)

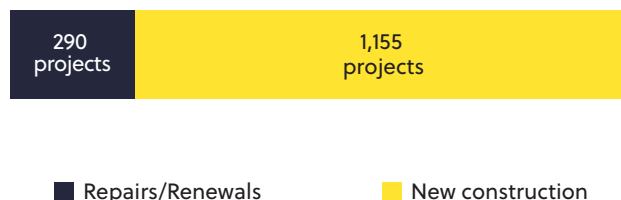


Most projects are new construction projects.

Overall, four in five (79.9%) NHS projects are new construction (see figure 11). Fewer than 300 of the federally funded NHS projects have been for the repair, renewal, or retrofitting of existing buildings (table 10 in [annex C](#) shows the disaggregation by program).

Most NHS projects are new construction projects.

Figure 11: Distribution of NHS projects by project type



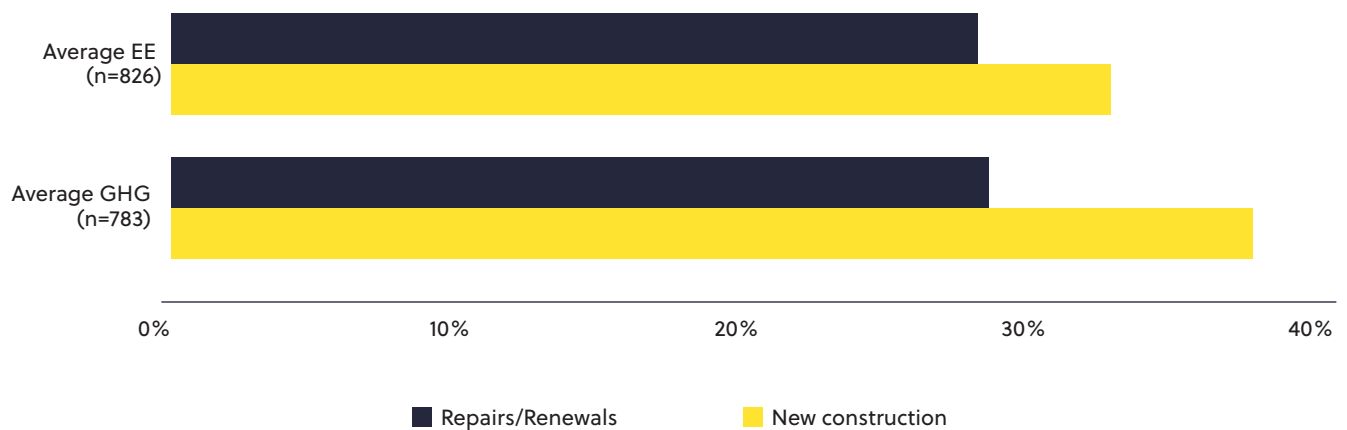
However, examining this by unit count, rather than project shows that **repairs and renewals make up almost 60% of the total units**. This is explained by several AHF-funded projects that have each repaired over 1,000 units across multiple buildings. As a result, **there are fewer overall repair projects being approved, but they represent a higher volume of units**.

Challenges with repair/renewal projects result in these projects achieving lower EE and GHG reduction targets than new construction projects on average.

Broken down by project type, **repair and renewal** projects achieve **significantly lower average targets** (even when excluding exempt projects). In other words, **new construction projects achieve higher average targets**. Figure 12 shows the EE and GHG targets of repair/renewal and new construction projects (excluding exempt projects)

On average, new construction projects have achieved higher energy efficiency and greenhouse gas emissions reduction targets.

Figure 12: EE and GHG emissions reduction targets by project type, excluding exemptions



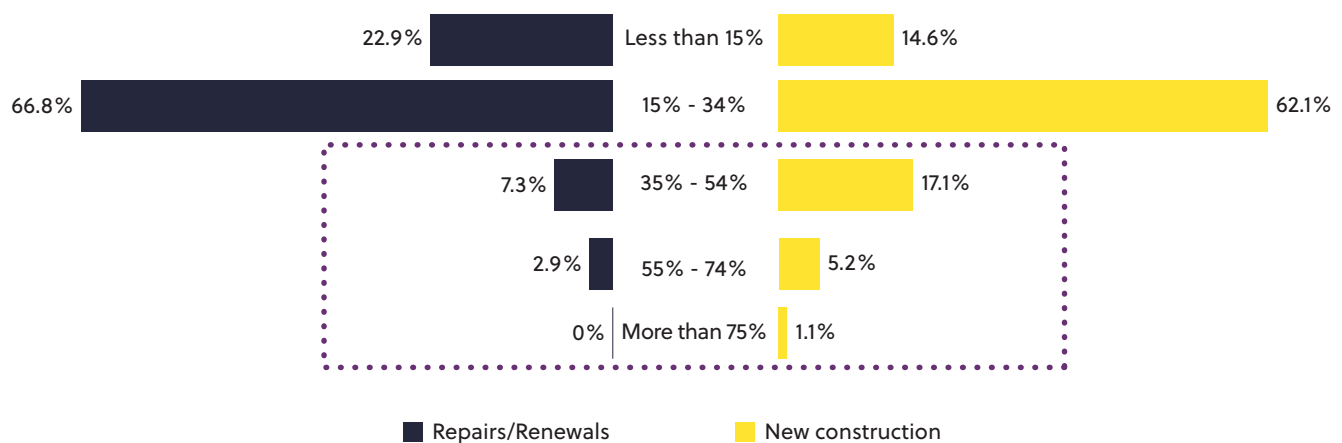
The observed discrepancy in EE/GHG commitments is partly explained by insights from interviewees. Environmental sustainability experts and internal staff highlighted that retrofitting existing buildings, especially older ones, is significantly more challenging when it comes to improving energy efficiency and reducing emissions. This may be why fewer repair/renewal proposals have been approved to date. In the case of a program like AHF, this is impacted by low demand from repair/renewal projects.

More new construction projects target higher EE and GHG.

One reason why new construction projects have **greater average** EE and GHG targets is because **more new construction projects have higher targets**. This may be influenced by factors such as improvements in building codes that apply to new construction projects, or technologies. Figure 13 shows the distribution of repair/renewal projects and new construction projects by range of energy efficiency targets. It shows that 23.6% of new construction projects target higher EE (35% or more) compared to only around 10% of repair/renewal projects. See table 11 in [annex C](#) for these GHG results.

A greater proportion of new construction projects target higher EE levels.

Figure 13: Proportion of new construction and repair/renewal projects in each category of EE targets (N=1242)*



*Note: Proportions may not add up to 100% due to rounding.

Figure 13 also shows that a greater proportion of repair/renewal projects are below an EE target of 15% improvement. Of **all repair/renewal projects, 45.5% are exempt**. They either have applied to an RHI stream with no EE requirements, or those requirements have been waived. In contrast, only 37% of new construction projects are exempt.

These findings reflect the previously noted challenges of increasing efficiencies and reducing emissions in existing buildings. The lower energy efficiency/greenhouse gas reduction targets are noteworthy to the environmental sustainability outcome because of the **need for deep energy retrofits to existing buildings**, as identified in finding 1.

However, one important caveat is that repair/renewal projects assess EE and GHG reduction against a pre-construction baseline, while new construction projects assess them against national model codes. Thus, the EE and GHG reduction targets of the two project types are not equivalent. Comparisons of these targets are not comparisons of absolute energy consumption or emissions reduced.

A note on data: modelled energy savings and greenhouse gas

The data presented in the following slides comes from the *Modelled Energy Savings Impacts Study* conducted as part of this evaluation by Posterity Group. This data reports at the **building-level**.

Study objective: This study examined the energy savings and greenhouse gas (GHG) emission reductions of NHS buildings as well as hard construction costs to assess the monetary investment required to meet energy efficiency requirements and the corresponding energy savings and GHG reduction benefits.

Programs in scope: ACLP, AHF, AHIF Phase 1, FLI, RHI 1 and 2

Time period: Program inception until March 31, 2023

Data sources:

- Program datasets
- Third-party energy modelling reports (submitted as part of NHS project applications)
- Statistics Canada (for the proportion of electricity and gas consumption by building type and region)
- Environment and Climate Change Canada (for provincial electricity and natural gas emissions factors)
- CMHC's internal study for incremental costing data

Exclusions and errors: Some buildings were excluded from this analysis due to the following:

- Building types identified as out of scope (such as shelters and tiny homes)
- Missing building type data
- Missing project location data
- Missing energy savings target data
- Erroneous datapoints (outlier data points, resulting from data entry errors).

More details about the specific calculations can be found in [annex D](#).

Finding 7:

NHS environmental commitments are estimated to reduce energy consumption by around 2 million gigajoules and greenhouse gas emissions by around 40,000 tonnes of CO₂ per year, and NHS low-rises and high-rises have lower energy use intensities.

The *Modelled Energy Savings Impacts Study* conducted as part of this evaluation examined the impacts of constructing and repairing NHS buildings.

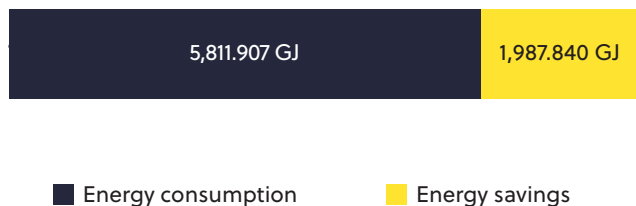
Energy consumption

Energy efficiency improvements committed across NHS projects are projected to **reduce annual energy consumption by around 2 million gigajoules (GJ), a 26% decrease compared to if the project buildings did not have targets above the building code.**

Without these energy efficiency gains, NHS buildings would consume an estimated 7.8 million GJ per year instead of the projected 5.8 million GJ.

NHS buildings are projected to reduce energy consumption by ~2 million GJ a year.

Figure 14: Annual energy consumption and savings of NHS buildings in gigajoules (GJ)



Greenhouse gas emissions

Buildings in many parts of Canada rely on energy sources that produce GHG emissions. When a building is designed to improve energy efficiency, it uses less energy and generally lowers the associated greenhouse gas emissions. Sustainable techniques used across NHS projects are estimated to **reduce emissions by around 42,000 tonnes of CO₂ per year, a saving of 23%.** This addresses the NHS indicator of "GHG avoided through improvement of energy efficiency standards of NHS-funded projects."

NHS buildings are projected to reduce annual CO₂ emissions by 23%.

Figure 15: Annual CO₂ emissions and reductions of NHS buildings (in tonnes CO₂)



Unsurprisingly, programs with more projects and units, like AHF and ACLP, report **higher absolute energy consumed** and **emissions produced** each year. Differences in the percentage savings by program reflect variations in program requirements (see tables 13 and 14 in [annex E](#)).

Differences in energy savings targets and greenhouse gas reduction targets

Projects sometimes have GHG emissions percentage reductions targets that differ (i.e.greater or lesser) than the EE savings targets.

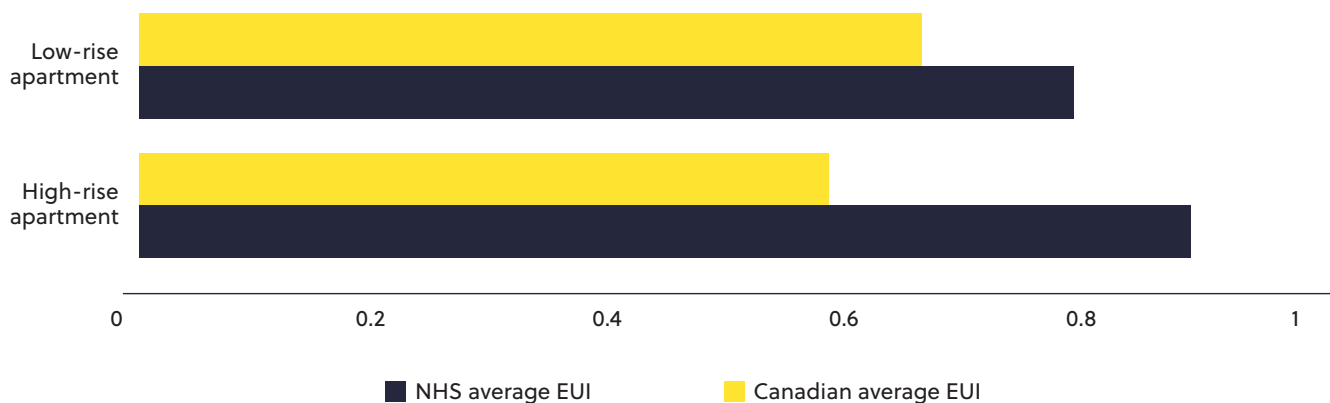
Why? This difference between energy efficiency and GHG reduction targets could be driven by the proposed design and the carbon intensity of the electricity grid. For example, electrification in low-carbon grids reduces GHG emissions more than it reduces energy consumption.

NHS low-rise and high-rise apartments have lower energy use intensity than the Canadian average (NRCan, n.d.-b).

Energy use intensity (EUI) is a measure the energy efficiency of buildings. EUI expresses a building’s total energy use per unit of floor area and is often expressed in gigajoules (GJ) per square metre (m²). **The lower the EUI, the better.** Figure 16 shows that NHS apartments have lower EUI than the Canadian average (NRCan, n.d.-b).

NHS buildings have lower EUI than the Canadian average for high- and low-rise apartments.

Figure 16: Energy use intensity (EUI) in GJ/m², by building type



Limitation of the analysis: Low-rise and high-rise buildings are the **most common NHS building types**. Low-rise buildings are typically only a few storeys tall, whereas high-rise buildings are taller. Due to the small number of other building types, analysis of the EUI of these buildings is unlikely to be accurate or reflect outcomes. These buildings were therefore excluded from the analysis.

Regional distribution partly explains differences in energy and GHG intensity.

As with EUI, high-rise apartments tend to have the lowest GHG emissions intensity while detached or semi-detached structures tend to have higher emissions intensity (see table 15 in [annex E](#)). This is partly because some building types are more prevalent in regions with higher-emission power sources. For example, NHS high-rise apartments, which have the lowest emissions intensity, are most common in Ontario and British Columbia, and these provinces use cleaner power generation methods.

NHS buildings in Nunavut, Nova Scotia, and Saskatchewan have achieved the highest GHG emissions intensity reductions.

Figure 17: Annual GHG emissions intensity reduction, by region (in kg CO₂e/m²)

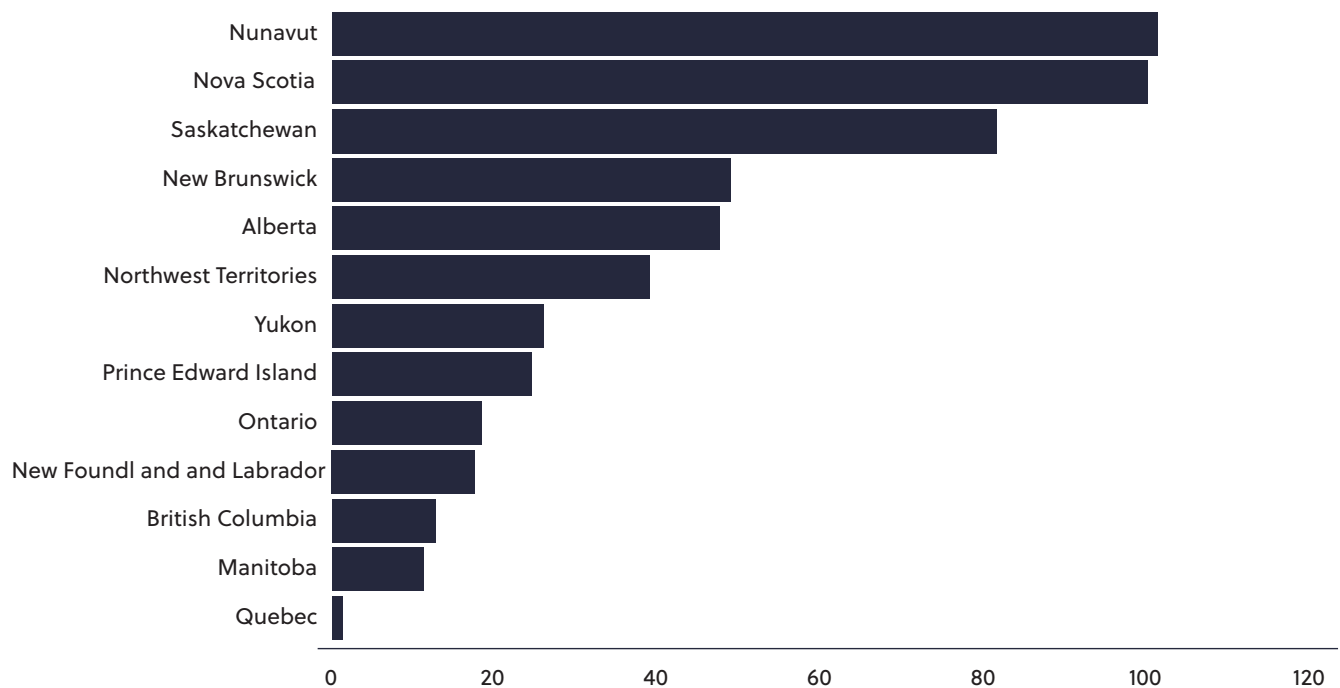


Figure 17 shows that examining annual GHG emissions intensity reductions can illustrate **trends that align with how different regions generate electricity**. Nunavut, Nova Scotia, and Saskatchewan are shown to have achieved the highest GHG emissions intensity reductions, in contrast to Quebec, Manitoba, and British Columbia, which exhibit the lowest.

- For example, despite Nova Scotia and Alberta’s reliance on fossil fuels, these regions have achieved significant emissions intensity reductions in NHS projects. This is likely because improving energy efficiency in these provinces, which have a high-carbon grid, results in the largest emissions reductions.

The Federation of Canadian Municipalities (2020) highlights that solutions to reduce emissions will differ based on whether the electrical grid is low-carbon, moderate- carbon, or high-carbon. Low-carbon provinces are recommended to focus on electrification (to use electricity instead of gas or oil), since the electrical grid is already powered by renewable sources and emits less GHG.

Finding 8:

The NHS promotes sustainability improvements and solutions through research, capacity-building, and innovation programs, but there are gaps that limit the integration of findings into the design of programs.

Research, capacity, and innovation programs are intended to encourage the implementation of more environmentally sustainable solutions.

Overall, NHS innovation and research programs support outcomes by facilitating innovation and research in and providing support for energy efficient and environmentally-sustainable housing. While outside the scope of this evaluation due to timing, it is notable that AHIF Phase 2 sets aside \$100M for climate-related housing innovations. Other programs are described below in table 5. [Annex F](#) provides examples of environmental projects under each program.

Table 5: Research, capacity, and innovation programs contributing to environmental sustainability

Program	Description
Housing Supply Challenge (Round 4)	Promotes innovative solutions to address construction-related barriers to affordable and climate compatible housing by funding activities that accelerate the use of construction processes, techniques, systems, and materials.
Demonstration Initiative	Funds the demonstration of solutions supporting NHS outcomes in the real environment, including cutting-edge, sustainable technologies and practices in housing to inspire widespread adoption and advance energy-efficient living standards.
Solutions Lab	Funds solutions to complex housing problems and challenges, including environmental sustainability, through project teams that will explore new ways of making progress on the housing challenge.
Community Housing Transformation Centre	Provides support, practices, and resources to build capacity in the community housing sector, including on green initiatives, energy efficiency and economic viability through services such as energy efficiency coaching services.

There are mixed perceptions on the success with which research findings are integrated into the NHS supply programs, with noted gaps.

“There are direct examples of where Solutions Labs can and are contributing to CO-1 [AHF] or RCFi [ACLP], for example, on how to renovate multi-storey apartments to [meet] climate criteria in CO-1, while tenants are in place.”

Internal stakeholders

Most internal interviewees generally agreed that CMHC-funded research was, at least to some extent, reflected in the design and refinement of the NHS and its programs. However, there were also gaps and limitations, as key informants noted:

- **Timeliness issues:** Research takes time to produce; however, data and information are often required by CMHC before research has been completed, creating a gap between the time of information demand and the availability of research findings.
- **Knowledge transfer gaps:** Some noted inconsistent approaches to knowledge mobilization, repeated questions and the underutilization of existing findings.
- **Organizational cohesion:** Some noted administrative, budgetary and organizational constraints, such as research not being updated on the website or lack of a budget for administrative support, which can impede research application.
- **Challenges in accessing research:** Several cited a general lack of clarity on access to CMHC research and data and their dissemination, which can hinder the effective use of research findings.

Finding 9:

NHS program requirements and indicators are limited to mitigation-based measures to improve environmental sustainability, but do not require or incentivize efforts that focus on climate resilience or adaptation.

The Intergovernmental Panel on Climate Change (2014) uses the following categories of environmental action:

Mitigation: Reducing the sources or enhancing the sinks of GHGs.

Adaptation: Adjusting to the actual or expected climate and its effects.

Resilience: The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance.



The NHS shared outcome that “affordable housing contributes to environmental sustainability” is operationalized through energy efficiency improvements and greenhouse gas reductions in NHS supply programs. **In reducing energy consumption and greenhouse gas emissions**, the NHS programs have largely focused on **mitigation**.

NHS projects also consider proximity to transit. While mostly considered alongside proximity to amenities, proximity to transit also has indirect effects on the environment by enabling a reduced reliance on personal vehicles and lowering gasoline consumption, thereby mitigating climate change (Fercovic & Gulati, 2016). Among the NHS projects with data on proximity to transit, 70% are located within 1 km of transit.¹

Environmental sustainability can be improved through adaptation and resilience measures, which are not currently part of the NHS design.

Adaptation to climate change is equally important. It includes **preventing and minimizing the adverse effects of climate change**, which has disproportionate impacts on residents based on different risk factors (as noted in finding 2). Appropriate adaptations depend on the local context. Examples include fire-resistant building material choices for houses at risk from wildfires, and backflow valves or sump pumps in areas prone to flooding.

The NHS focus on mitigation explains why interviewees noted that some sustainability features (such as biophilic wall design) were not rewarded by CMHC through the program requirements, incentives, or prioritization. While the programs in scope for this evaluation do not consider these elements, new NHS programs such as the Housing Accelerator Fund have started to include support for “low-carbon and climate-resilient communities” as part of their application prioritization. As mentioned, AHIF Phase 2 includes \$100M set aside for climate-related housing innovations.

¹ This data comes from the Evaluation of Social Inclusion in the NHS. Proximity to transit and amenities was examined as part of that evaluation.

The environmental experts who were interviewed all emphasized climate resilience. They noted that **climate resilience does not equal energy efficiency** and that it needs to be improved to **cope with potential risks and extreme events**.

New strategic directions for resilience have since emerged for the Government of Canada. Preventing the unmitigated development of new, federally-supported housing and infrastructure in high-risk areas is now a priority to maintain safety and affordability. Canada has a National Adaptation Strategy to reduce the risks that come with climate change impacts, with one key pillar being infrastructure (Government of Canada, 2023). Adaptations that could enhance climate resilience include the following:

- Exterior solar shading (blocking the sun before it enters buildings).
- Windows that open more than four inches (for natural ventilation and nighttime cooling).
- Multiple orientation units with single egress points (for crossflow of air).
- Storm-resistant roofing to minimize damage from extreme winds or hail.
- The addition of insulation to minimize heat transfer (United Nations Environmental Programme, 2021).

The location and design of new home construction (i.e. away from high-hazard areas) is an important consideration to reducing damage and ensuring insurability. Furthermore, there is now some recognition in the industry that environmental sustainability includes other environmental aspects in addition to energy efficiency (such as water consumption, embodied carbon, nature-based solutions, and lifestyle choices facilitated by the building/community). These aspects are not considered in the energy efficiency and GHG reduction targets of the NHS programs.



Efficiency and Sustainability

Finding 10:

Program design embeds energy efficiency and greenhouse gas reduction in most supply-based initiatives through program requirements, prioritization, and incentives.

The Federal Lands Initiative and the Affordable Housing Fund are the NHS programs whose minimum requirements demand the greatest reductions in energy use and GHG emissions, but both also allow for exemptions.

Program requirements inform the extent to which the environmental sustainability outcome is embedded in the program. The main federally funded supply initiatives have minimum project application requirements that dictate the energy efficiencies and greenhouse gas reductions needed for projects (see table 6). Different programs have efficiency and greenhouse gas reduction requirements:

- FLI and AHF have the most demanding requirements (but are on par with ACLP projects that applied after November 2022 and therefore use NECB 2017).
- However, FLI and AHF allow various exemptions, including for shelters and supportive housing, as well as for projects in Northern or remote areas (see table 9 for details). 11.4% (n=71) of AHF projects were exempt.

Projects that exceed minimum energy efficiency and greenhouse gas requirements are rewarded through prioritization and incentives.

Environmental gains are further embedded in program design through prioritization and incentives. The aim is to encourage projects to exceed minimum requirements to achieve greater EE and GHG reductions. Table 6 highlights the rewards offered to these projects.

- FLI, AHF, ACLP, and RHI use a **scoring grid that awards points for projects** that achieve certain social outcomes.
- Of the possible points granted for projects achieving greater social outcomes, **AHF awards a larger proportion of these points to environmental gains (compared to other programs)**, at 25%; table 5 shows this proportion in the scoring grid for environmental gains.

As finding 6 notes, the mismatch between the NHS target and the program requirements results in a reliance on incentives and prioritization to achieve the target. Excluding exempt projects still shows projects not meeting the NHS target, which means **these rewards may be insufficient in encouraging projects**. Proponents noted in interviews that the main barrier to including environmental features was the lack of incentive.

Table 6: Program requirements and prioritization/incentives

Program	Program Requirement		Prioritization/Incentives	
	Requirement	Exemptions?	% of Points for EE/GHG	Reward
ACLP	15% to 2015, then 2017 (for projects after November 2022)	N	20% (5 points of total 25 points)	Greater residential loan-to-cost
AHF	25% to 2015 or 15% to 2017 (new); 25% to baseline for renewals	Y	25% (75 points of total 300 points)	Greater contribution or forgivable loan amount (\$)
AHIF	10% to 2015	N	--	Amount invested; application prioritization
FLI	25% to 2015 or 15% to 2017 (new); 25% to baseline for repairs	Y	10% (10 points of total 100 points)	Level of discount offered on property
RHI 1 & 2	5% more efficient than 2015 NECB (construction projects in Major Cities stream only)	N	4% (5 points of total 125 points)	Application prioritization

Finding 11:

Gaps in data collection and reliance on modelled building performance limit the ability to determine actual progress toward the NHS environmental sustainability outcomes.

Data gaps result in data quality issues, posing challenges to understanding.

Prior to the NHS, environmental sustainability was not a specified outcome of most programs. While data collection and reporting needs systems have changed, there are still **gaps that affect outcome measurement**. Internal staff have noted issues such as:

- **incomplete** data fields and missing information;
- data submitted in **multiple formats**;
- manual data entry resulting in **errors**; and
- **inconsistent** data gathering and updating, for example, between programs and teams.

While energy reports (required for many programs) contain data projects' energy targets, they are submitted as PDFs that are difficult to analyze without requiring mainly manual data compilation. These data challenges echo previous evaluation reports:

- The 2022 [Evaluation of the Housing Partnership Framework](#)² found that a few provinces and territories did not have the capacity to track energy use and GHG emissions.
- The 2021 evaluations of the [Affordable Housing Fund](#)³ and the [Apartment Construction Loan Program](#)⁴ both recommended a review of data collection strategies to ensure consistent collection.

The work done by Posterity as part of this evaluation's Modelled Energy Savings Impacts Study also resulted in several recommendations regarding data, based on the experience of working with program and other datasets:

1. Implement a **proactive data collection strategy** to minimize missing data. Clearly define the scope and criteria for data collection and prioritize key information.
2. Establish a **standardized data format** for all program datasets, ensuring consistency and ease of integration. This will streamline analysis and reduce data preprocessing.

² <https://assets.cmhc-schl.gc.ca/sites/cmhc/about-cmhc/corporate-reporting/program-evaluation/2022/nhs-hpf-evaluation-report-2022-en.pdf>

³ <https://www.cmhc-schl.gc.ca/-/media/sites/cmhc/about-cmhc/corporate-reporting/program-evaluation/2021/nhs-nhcf-evaluation-report-en.pdf>

⁴ <https://assets.cmhc-schl.gc.ca/sites/cmhc/about-cmhc/corporate-reporting/program-evaluation/2021/rcfi-evaluation-report-en.pdf>

Project outcomes are based on modelled performance during design, but actual performance is not measured.

Interviewees noted that EE was only assessed at the design stage. Energy efficiency and GHG reductions for NHS building are currently assessed through third-party energy modelling of the **proposed** project (except for RHI projects from government entities, where proof such as energy reports is not required). This is what is used to determine if a proposed project will meet requirements and if it should be awarded for exceeding social outcomes. However, modelled performance can be inaccurate, as there may be an **energy performance gap**.

Energy performance gap: the difference between the predicted energy consumption during a building's design and **the actual energy it use** once operation (IPCC, 2022).

- These discrepancies between modelled and actual performance are partly due to assumptions about the building's type and use, including occupant behaviour, equipment, climate data, etc. (IPCC, 2022; Zare et al, 2022; BC Housing, 2020)

These known performance gaps **stress the importance of examining actual building performance**.

Under current guidelines, projects completed under ACLP, AHF, AHIF, FLI, and RHI require a post-completion attestation, which asks if the building is meeting energy efficiency requirements. This attestation requires confirmation that the building was constructed as planned; however, it does not require an energy assessment of the building in operation to understand the building's energy consumption and emissions. Thus, there is no validation or comprehension of actual performance.

Finding 12:

Non-profit and Indigenous organizations, Northern and remote communities, and repair and renewal projects face heightened challenges around applying to programs and implementing environmental commitments.

Challenges around processes, documentation, and environmental outcomes impact the organizations that face the most capacity constraints, such as non-profits and Indigenous organizations.

Proponents noted frustration with the **application process**, with one key challenge being the amount of **documentation required** and the re-submission of documents they had already provided. This can delay the application process and project implementation.

For many of federally funded NHS programs, the required documents include energy reports with simulation analyses by an independent third party, environmental reports (geotechnical reports, environmental site assessments), and soil test reports. This is in addition to other required financial and project documentation required.

Programs with overly bureaucratic processes can be overwhelming and expensive for applicants. Some organizations need to weigh the potential funding with the time, resources, and costs to be applied. This is especially true for **non-profit organizations**. Stakeholders have commented on the financial impact of costly applications for the non-profit sector, especially if they are unsuccessful in receiving funding.

Institutional capacity and the non-profit housing sector

Tsenkova's book *Energy Efficient Affordable Housing* (2021) notes a recurring theme on the capacity of the non-profit housing sector to effectively implement energy retrofits.

- **Larger organizations** with sizable social housing portfolios have the ability and capacity to apply to different programs. Their **institutional capacity** also helps comprehensively address energy efficiency and capital improvements across their portfolio.
- **Small, less-experienced, and lower capacity organizations** may have a **hard time with accessing funding** due to the sets of criteria and administrative processes required.

The burden and process issues and the required internal capacity also apply to **Indigenous groups**. Interviews highlighted the inequities that develop between Indigenous communities, especially when communities compete with non-Indigenous organizations for the same funding. Considering the severity of housing need in Indigenous communities, **energy efficiency is not always a priority** for the building or repair of housing. Interviewees noted that communities were often forced to choose between affordability and energy efficiency. The already higher costs of construction, paired with the fact that some communities do not charge rent, meant providing shelter was sometimes prioritized over meeting thematic outcomes.

Most projects that have exceptions to energy efficiency requirements are from non-profits and Indigenous organizations.

Due to the difficulties in meeting the EE and GHG requirements in some programs, there are exemptions granted to projects (see finding 6 for more details).

Of the 71 AHF projects that had environmental requirements waived:

- 70% were from **non-profit/co-operative** housing organizations
- 21% Were from **Indigenous** organizations, non-profits, or governing bodies.

In addition, **almost two-thirds (63.7%, n=263) of funded projects from Indigenous groups** were for the RHI, which has no energy efficiency requirements for the Project stream. This data helps illustrate the difficulties faced by non-profits and Indigenous groups in meeting energy efficiency requirements.

Misalignment of energy efficiency criteria between funders can impose additional costs on proponents.

A challenge emerges when **CMHC requirements do not align with other funding partners**. For example, the [2021 AHF Evaluation](#)⁵ found that the energy efficiency criteria of CMHC, the Province of British Columbia, and the City of Vancouver were not aligned. Such misalignment can cause pressure applicants to **incur additional costs** to meet or demonstrate multiple criteria around the same outcome in order to secure funding from all three sources.

The NHS requirement is based on NECB or NBC 2015 or 2017, the national code, but building codes are adopted by provinces or adapted to regional needs. In the case of British Columbia, it adopted a Step Code in 2017 (which NECB 2020 resembles, using set “levels” or “steps” of increasing efficiency).

Northern and remote communities face constraints in meeting environmental outcomes.

As finding 3 notes, proponents from Northern and remote communities face constraints and challenges in meeting energy efficiency requirements. These **regional constraints limit their ability to adapt conventional, efficiency-centered building designs**. A 2021 evaluation of the Affordable Housing Fund noted that projects in the North face difficulties from:

- the reliance on diesel fuel;
- the unviable nature of solar panels due weather and shorter winter daylight periods; and
- limited resources and costliness.

These factors create barriers to meeting or exceeding energy efficiency requirements. Of the 71 projects granted **exceptions under AHF, 15 (21%) were due to their Northern or remote location** (see table 9 in [annex C](#)). That said, finding 6 shows that these communities had high EE % targets, once these exempt projects were excluded.

⁵ <https://www.cmhc-schl.gc.ca/-/media/sites/cmhc/about-cmhc/corporate-reporting/program-evaluation/2021/nhs-nhcf-evaluation-report-en.pdf>

It is more difficult for existing buildings to meet energy efficiency and greenhouse gas requirements.

Stakeholders noted that achieving EE in existing buildings (through repair, renewal, or retrofit projects) is more challenging than new construction. The data from finding 6 highlights this, as new construction projects achieve higher and deeper EE targets.

- Interviews with proponents reveal difficulties in meeting energy efficiency requirements due to the **complexities and costs associated with retrofitting older existing structures**; they argued that it would be less expensive to demolish and build new (despite this being potentially more environmentally detrimental). The integration of modern sustainability features into these buildings is often hindered by structural and design limitations as well as financial constraints.
- The AHF evaluation determined that repair and renewal projects are **based on a pre- repair/pre-renewal “base case” that does not always recognize a project’s prior EE investments**. This means projects that recently invested in energy efficiency may have more difficulty in further improving their outcomes to meet requirements.

These points align with findings from the literature noted in finding 1 around the slow pace of retrofits and the technical and financial hurdles to be overcome.

As noted in some interviews, this barrier had been recognized and identified. In response, CMHC introduced **program flexibilities (exemptions)** to support projects that have trouble meeting the environmental requirements (see findings 6 and 10). However, this **compromises EE outcomes**, and deep energy retrofits of existing buildings are still needed to improve housing quality as well as energy consumption and GHG emissions from existing buildings.

“New builds and retrofits are very different. With retrofits, everything is perceived as a ‘custom solution,’ which is perceived as a hurdle.”

Environmental expert

Finding 13:

Cost can be a barrier to environmentally sustainable NHS buildings, suggesting a trade-off between NHS outcomes.

About the same proportion of interviewed proponents stated that **without NHS funding**, they **would have included** environmental sustainability commitments (exceeding the NECB) as those that stated they would not have included them.

Some proponents indicated ease with meeting the environmental outcomes.

Among those that said they **would have included** environmental commitments regardless of funding, this was primarily because:

- Environmental sustainability was part of their organization's goal or mandate; or
- they were already meeting or surpassing CMHC's requirements.

For example, one proponent stated that they would have included the environmental sustainability features regardless; however, they amplified them to exceed the minimum requirements and therefore obtain more social outcome points for their application.

Many of these proponents stated that the environmental outcomes were clear and easy to meet; a few reported that they needed clarification, but also stated that they were provided with adequate clarification and that there were no issues otherwise.

Proponents reported overall that including energy efficiency measures in their project **positively impacted their ability to source other funding or subsidies**, and that industry was moving in that direction anyway. Building more efficiently meant they had to consider and plan for these techniques, which could then be applied to future projects. This suggests broader sustainable impacts on the housing sector **beyond the NHS projects**.

"So, the fact of being forced to do it...meant that, in the end, even if I no longer had the environmental restrictions of the program, I'd probably do all the rental projects in exactly the same way."

Proponent

Cost was the main barrier to more environmentally sustainable buildings.

Although finding 10 discusses the use of incentives for environmental outcomes, in interviews, proponents who noted they would not have included environmental sustainability features without NHS funding cited **cost** as the main barrier. This is in line with literature that has noted finances as a barrier to low-carbon solutions, and the construction and incremental cost increase shown in projects that have higher energy savings targets (see Finding 18). Proponents discussed that without funds to cover these added costs, they were **unable to justify the cost of paying for environmental features**, particularly if they would have had to increase rents to do so. This suggests the trade-off, further noted in the following section.

The fact that cost is a key barrier for environmental features in projects without funding indicates that the NHS programs' design enable the achievement of these outcomes to some extent (by lessening the financial burden of implementation through financial incentives or prioritization). That said, projects can obtain exceptions through AHF and FLI, or can apply to low or no-requirement programs (such as RHI).

There are some observed trade-offs between environmental sustainability and affordability outcomes, but experts believe these trade-offs could be avoided.

In interviews, internal staff noted that when trade-offs were required, **affordability was typically prioritized over other outcomes such as environmental sustainability** and social inclusion, with energy efficiency being an easy trade-off for proponents due to its high costs. They explained that these trade-offs do not mean no energy efficiency improvements were made – just that proponents may balance maximizing affordability with only meeting (rather than exceeding) minimum energy efficiency requirements. This is consistent with the internal *Energy Efficiency Requirements Regression and Monte Carlo Analysis* study conducted by CMHC Evaluation Services and KPMG in 2021, which found there was a consistent trade-off between the energy efficiency target and the depth of affordability in AHF and ACLP projects (see details below).

“...being flexible to address affordability does run a risk of not addressing those other two areas [environmental sustainability and social inclusion]”

Internal staff

However, speaking generally about the housing landscape, environmental experts did not believe that trade-offs between environmental sustainability and other thematic outcomes (affordability and social inclusion) are needed. Their reasons for this were that smaller, affordable units were usually more energy efficient. Furthermore, climate-resilient retrofits provided opportunities to improve spaces for all users, thereby increasing occupant well-being.

About the *Energy Efficiency Requirements Regression and Monte Carlo Analysis* study:

ENERGY EFFICIENCY'S TRADEOFFS WITH OTHER OUTCOMES

Through a regression and sensitivity analysis,⁶ this study showed a statistically significant relationship between the energy efficiency target and the depth of affordability in AHF and ACLP projects. The depth of affordability is the commitment made by projects to price affordable units at a proportion of median market rent. This means that **higher energy efficiency targets were associated with units that are less affordable** (priced closer to medium market rent).

- A one-percentage-point increase in a project's EE target is associated with a **15.7% decrease in the affordability depth of units**.
- In relation to urban areas, projects located in **Northern regions** do not have an EE and depth of affordability trade-off.

While not statistically significant, the Monte Carlo sensitivity analysis shows that at higher- levels of energy efficiency targets, affordability outcomes are worse across the board (not just for depth of affordability; higher rents and a smaller number of affordable units would be included in a project).

LIMITATIONS OF THE ANALYSIS

The study only examined approved AHF and ACLP projects from program inception until December 2021. This evaluation did not update the regression and sensitivity analyses with program data covering the period of examination.

⁶ The sensitivity analysis used Monte Carlo simulation techniques to generate a new and larger dataset.

Finding 14:

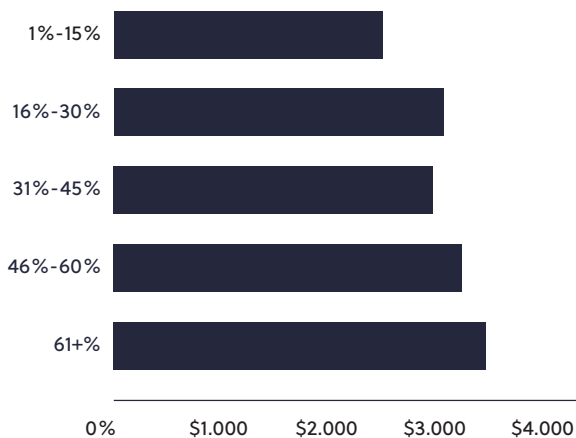
More energy efficient buildings require greater upfront investment. The payback period of these investments is estimated to be shortest for new construction projects targeting 16%–30% energy savings.

It costs more to build more energy efficiently.

Examining the costs and energy targets of NHS buildings shows that, as energy savings targets increase, construction costs also increase.⁷ This is perceived to be because to achieve higher levels of energy performance, buildings must use more costly technologies and materials. There may also be a cost premium for hiring contractors trained in these construction techniques and methods. As shown in figure 18, construction costs remain similar for buildings targeting between 16% and 60% energy savings, while buildings targeting over 61% energy savings are most expensive, at \$3511/m².

Construction costs are highest for NHS buildings with an energy target of 61%+.

Figure 18: Construction costs (\$/m²) by energy savings target

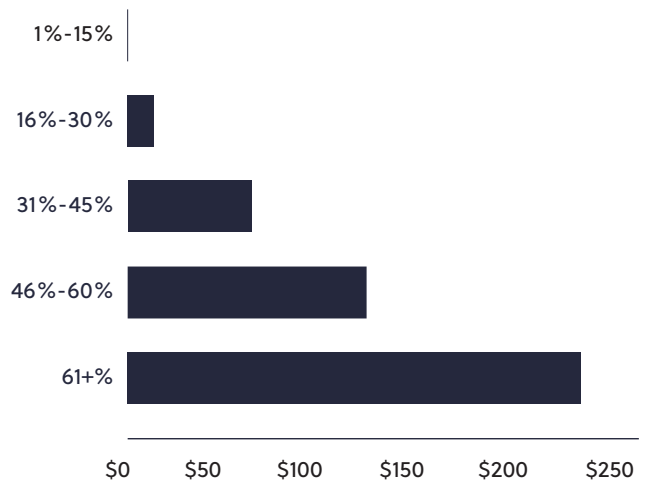


Incremental construction costs increase with greater energy savings targets

Incremental costs represent the **difference in costs between building to standard code and exceeding the standard code** to improve energy efficiency.⁸ For NHS new builds, incremental costs increase as buildings target higher levels of energy savings. High-rise buildings have lower incremental construction costs than low-rise apartment buildings.

How much more it costs to build, at each energy savings target

Figure 19: Incremental construction costs (\$/m²) by energy savings target



⁷ Calculated as part of the *Modelled Energy Savings Impacts Study*. See [annex D](#) for more information.

⁸ The incremental costs presented in this section are derived from an internal study. Costs included are for equipment and materials only and are derived from a study that had the specific goal of finding the most affordable and cost-effective ways to reach an energy efficiency target.

Greater energy savings in NHS high-rise and low-rise apartments result in annual utility cost savings, compared with the Canadian average.

Cost savings occur through decreased utility costs from energy efficiency and lowered energy consumption. Canadians pay approximately \$31/GJ. Assuming this cost per GJ and a unit size of 90m² (the average size of a two-bedroom unit⁹):

- A **high-rise apartment** would have annual energy costs of ~\$2,500.¹⁰ Given the energy savings in NHS high-rises, an NHS high-rise apartment would **save ~\$675 annually** on energy costs (compared to the Canadian average).¹¹
- A same-sized **low-rise apartment** would have annual energy costs of ~\$2,200, an NHS low-rise apartment would **save ~\$520 annually** on energy costs.¹²

Note that the true beneficiary of the cost savings will depend, as explained in Additional notes. See [annex G](#) for more information about how these energy cost savings were calculated and for further calculations by province.

The payback period estimates the length of time it takes for the cost to be recovered by the savings.

The previous finding shows how the incremental cost represents the cost and investment of implementing more energy efficient measures and achieving greater efficiencies and greenhouse gas reductions. Once in place, these technologies help reduce the cost of utilities and represent a saving (either to the resident or to the landlord or property; see the additional notes). The **break-even point** between the cost and the savings – the payback period – is estimated using this formula:

$$\text{Payback period in years} = \frac{\text{Cost of energy efficiency improvements}}{\text{Annual savings}}$$

Ranges in payback years vary significantly by energy target ranges.

The following table outlines the payback period range for each energy target range. Please note that this is an estimate and **does not reflect actual scenarios**. Additional details on the analysis and how this was calculated can be found in [annex H](#).

Table 7: Estimated payback period of energy efficiency investments for NHS high-rises and low-rises

Energy Target Range	Estimated Payback Period	
	High-Rise Apartments	Low-Rise Apartments
1%–15%	1–26 years	3–52 years
16%–30%	1–3 years	3–7 years
31%–45%	8–13 years	8–13 years
46%+*	7–17 years	12–27 years

*The 46–60% range and the 61+% range were grouped due to the low number of new construction buildings over 61% energy target.

⁹ Based on the February 2019 National Rent Report from Rentals.ca (Myers, 2019).

¹⁰ For a 90m² high-rise apartment using the national average EUI of 0.90 GJ/m² for high-rises (NRCan, 2018).

¹¹ For a 90m² high-rise apartment using the NHS energy savings of 27%.

¹² For a 90m² low-rise apartment using the national average EUI of 0.80 GJ/m², with NHS energy savings of 23%.

The ranges in payback years are wide, especially for **the lowest** (up to 52 years) **and highest energy target ranges** (up to 27 years), because of **aspects affecting the cost or the annual savings**. The 52-year recovery in payback years for low-rises targeted 1%– 15% is because a 1% energy saving results in very little monetary savings on utility costs each year.

This analysis shows that:

- payback periods are generally **shorter for high-rise buildings** than low-rise, likely due to lower incremental costs; and
- payback periods are shortest for **projects targeting the 16%–30%** energy efficiency range. This amplifies and can potentially help explain finding 6, which shows that most new construction projects fall in the range of 15%–35% range.

This analysis **only includes low-rise and high-rise new construction**, since the incremental cost analysis is based on a study that only examines new builds. Payback periods for upgrades made to existing buildings (retrofits) are also an important consideration, particularly given the importance of deep retrofits.

Additional notes

This payback period estimate **does not consider any avoided future costs** (for maintenance, and retrofitting) or any potential damage or destruction from climate impacts. It also does not consider additional benefits such as health, resiliency, etc.

While the payback period is one way of calculating when the cost will be recovered, an important factor is who the beneficiary of the cost savings is:

- If utilities are **included** in a tenant's rent, the **property benefits** from the utility savings.
- If utilities are metered individually and **paid by the tenant** directly, it is the **tenant who obtains the savings**.

Conclusions, Recommendations, and Key Considerations

Conclusions

The National Housing Strategy seeks to achieve the shared outcome whereby “affordable housing contributes to environmental sustainability.” This evaluation focused primarily on supply-based programs (ACLP, AHF, AHIF Phase 1, FLI, RHI 1 and 2), from program inception to March 31, 2023, and found the following:

- There is a **continued need** for the NHS to include environmental sustainability outcomes. Buildings are the third largest GHG emitter (with residential buildings making up just under half of this), and there is a need for deep energy retrofits to reduce emissions. Climate events also have potential severe impacts on buildings, occupants, and costs.
- The NHS is **aligned with federal and CMHC priorities** on climate change and environmental sustainability. It also promotes these outcomes through research, capacity-building and innovation programs. In requiring and incentivizing energy efficiency and greenhouse gas reductions, the NHS supply programs **focus on mitigation-based measures**, rather than adaptation- or resilience-based measures.
- Through these requirements and incentives, the NHS’s impact is estimated to be an annual **reduction in energy consumption of ~2 million gigajoules and greenhouse gas emissions of ~40,000 tonnes of CO₂ per year**.
- Overall, the NHS has an energy efficiency target of 35% and no greenhouse gas reduction target. NHS projects achieve an average energy efficiency level of 25.6% and an average greenhouse gas reduction level of 33.5%. As a result, the NHS is **not on track to meet the 35% energy target**. This is due to:
 - the **reliance on incentives** (rather than program requirements) to achieve this target, as program minimum requirements are set at a lower level;
 - the impact of **exempt** projects—which have their energy requirements waived or have no energy requirements—in lowering the overall target;
 - the impact of **renewal/repair** projects that target lower energy efficiency and greenhouse gas reductions rather than new construction projects.
- **Gaps in data collection and the reliance on modelled building performance** that limit the ability to determine actual progress toward NHS environmental sustainability outcomes.
- **Cost**—including the impact of increased construction costs—can be a barrier to more efficient buildings, as construction costs and incremental costs increase with more efficient designs. However, once built, more efficient buildings reduce the cost of utilities, with the costs and savings estimated to even out the fastest for projects targeting 16%–30% energy savings.
- Achieving and implementing energy efficiency is more difficult for **non-profits and Indigenous groups** (who face challenges with the process and the environmental outcomes) and for **repair/renewal** projects or ones in **Northern or remote** areas (where difficulties are faced in building and repairing more efficiently).

Based on these findings, this evaluation proposes two recommendations and two key considerations that are outlined below.

Finally, environmental sustainability in housing will continue to evolve, including through new regulations, innovations, trends, and national and international targets or standards. Keeping abreast of new building codes and practices will be important to push NHS projects toward achieving environmental outcomes and greater climate resilience. The NHS and the federal government represent one player – synergies between the different levels of government and different players will also be key to working closely in the same direction.

Recommendations and Key Considerations

Recommendation 1: Conduct a review of the options to meaningfully support energy efficiency and greenhouse gas emissions reductions in repair/renewal projects.

While there are fewer repair/renewal projects compared to new construction, and they face more difficulty meeting EE and GHG requirements, there is a need for existing buildings to be more energy-efficient and emit less GHG. Repair/renewal projects have lower average EE/GHG targets, and a smaller proportion of them target deeper levels of efficiency (above 35% improvement in EE or GHG) compared to new builds. With 45% of repair/renewal projects exempt from requirements, the NHS should meaningfully support these projects to ensure that the desired environmental outcomes are achieved.

Potential options may consider **better understanding pre-renewal/repair energy efficiency investments; the costs and barriers, particularly or specific communities; or stacking with other funding sources, such as the Canada Greener Affordable Housing program.**

Recommendation 2: Examine actual building energy performance.

Reliance on modelled building performance limits the NHS's ability to determine actual progress in fulfilling its funded buildings' commitments to achieve energy efficiency improvements and greenhouse gas reductions. It is why all the data reported in this evaluation relies on commitments made pre-construction rather than the post-construction realities of the building in operation, which are impacted by additional factors such as occupant behaviour and climate.

The energy performance gap represents the difference between the energy consumption predicted during the building's design and the actual energy use once the building is in operation. Information on a building's operational performance (for example, energy use, emissions, water use, etc.) is **important to help understand progress toward NHS environmental sustainability outcomes and impacts.** With this understanding, there is an opportunity to examine the difference between planned (modelled) and actual building performance.

Key consideration 1: Explore opportunities to better align program requirements and incentives with broader strategic environmental objectives, including the NHS 35% energy efficiency target and GHG reduction goals.

To achieve the expected result that “new social and affordable housing supports greenhouse gas emission avoidance through improvement on energy efficiency standards,” the NHS has the target of 35% improvement above NECB/NBC 2015 for new buildings and 35% improvement above baseline for repairs and renewals. Programs also have their own minimum requirements. While most projects exceed their program’s minimum requirements, the actual performance of federally funded supply initiatives is, on average, almost 10 percentage points below the 35% NHS target. At the time of the evaluation, none of the program requirements are at or above a 35% improvement to NECB/NBC 2015. Thus, meeting the NHS target relies on incentives to push projects above and beyond the minimum requirements toward 35%. However, these incentives are currently insufficient to do so.

Allowing exemptions to requirements lowers the overall achievement of NHS projects, even though this flexibility is needed for projects that face challenges and barriers (such as repairs, location in Northern or remote communities, etc.). To accommodate this and achieve the 35% target, the evaluation indicates that adjusting the requirements, incentives or prioritization of supply programs could contribute to better reaching this target. Conversely, the 35% targets can be assessed if they are no longer appropriate.

Key consideration 2: Consider exploring the inclusion of climate resilience and adaptation measures in future programming.

Climate events impact buildings and their occupants. As a result, good quality and resilient buildings are crucial to avoid damage, protect occupants (particularly those who are most vulnerable), and mitigate costs. This highlights the importance of resilience and adaptation measures in addressing climate change and promoting environmental sustainability.

In examining the NHS’s progress toward the environmental sustainability outcome, this evaluation focuses on mitigation-based measures. This is because energy efficiency and greenhouse gas reduction indicators are embedded in program design through targets, requirements, and incentives. However, adaptation and climate resilience measures are neither required or nor incentivized by the programs assessed in the evaluation. While energy efficiency and greenhouse gas reductions are important, they are not the only aspects of environmental sustainability.

Policy analysis and future program design may want to consider climate resilience and adaptation – in addition to energy efficiency and greenhouse gas emissions – as part of overall environmental sustainability efforts in housing.

Acronyms

ACLP	Apartment Construction Loan Program
AHF	Affordable Housing Fund
AHIF	Affordable Housing Innovation Fund
CO₂	carbon dioxide
ECCC	Environment and Climate Change Canada
EE	energy efficiency
EUI	energy use intensity
FCHI	Federal Community Housing Initiative
FLI	Federal Lands Initiative
GHG	greenhouse gas
GJ	gigajoule
IPCC	Intergovernmental Panel on Climate Change
MT	megatonne
NBC	National Building Code
NECB	National Energy Code for Buildings
NHS	National Housing Strategy
NRCan	Natural Resources Canada
RHI	Rapid Housing Initiative
TBS	Treasury Board Secretariat of Canada
UNEP	United Nations Environment Programme

Annexes

Annex A: Key Informant Interviews

The interviews for this evaluation were combined with those for the Social Inclusion and Housing is Affordable and in Good Condition thematic evaluations. The figures below provide a breakdown of the 70 interviews with 111 participants which informed this evaluation.¹³

Figure 20: Number of interviews and interview participants by stakeholder group

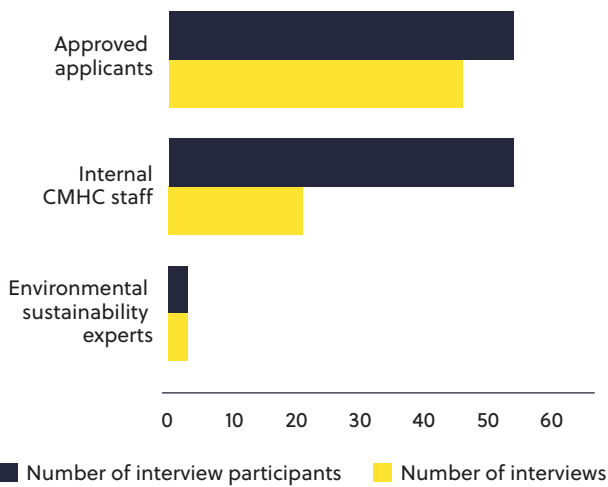
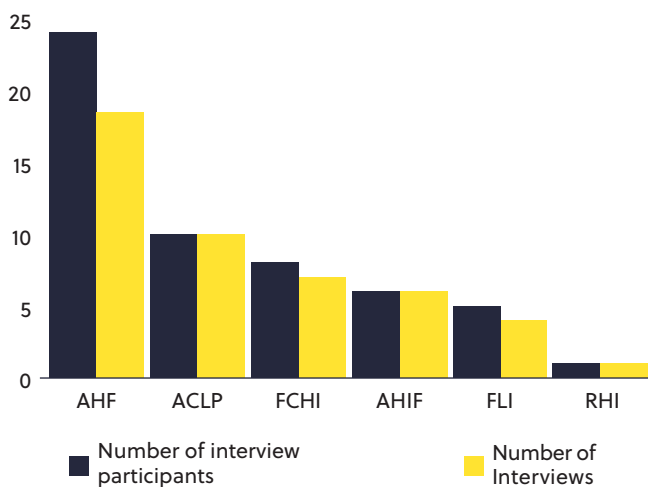


Figure 21: External interviews with approved applicants—number of interviews and interview participants



Annex B: NECB 2017 Conversion to NECB 2015

After November 2022, ACLP projects must meet minimum requirements of 15% relative to NECB 2017. AHF and FLI projects have a choice of modelling to either NECB 2015 or NECB 2017.

The evaluation used the following equation to convert projects that reported energy efficiency and greenhouse gas reduction targets from NECB 2017 into target percentages from NECB 2015.

$$2017 \text{ NECB target } \% + 10\% = 2015 \text{ NECB target } \%$$

This was determined by the information in the table below from the AHF Guidelines. Based on this, the evaluation converted the targets of projects that relied on 2017 NECB into NECB 2015.

Table 8: NECB 2015 to NECB 2017

NECB/NBC 2015	NECB 2017
Minimum 25% reduction	Minimum 15% reduction
26% to 40% reduction	16% to 30% reduction
41% to 55% reduction	31% to 45% reduction
Greater than 55% reduction	45% reduction
Net-zero	Net-zero

In total, 65 projects reported to NECB 2017. All of these were new construction, with 13 from ACLP (making up 5.5% of all ACLP projects) and 52 from AHF (making up 8.3% of all AHF projects).

¹³ FCHI approved applicants (in figure 21) were interviewed as part of the other thematic evaluations.

Annex C: Additional Program Data

Table 9: AHF project reasons for exemption to environmental requirements (N=71)*

Reason for Exception	Proportion of Exempt AHF Projects
Shelter/transitional/supportive housing	28.2%
Urgent housing repairs	26.8%
Northern/remote	21.1%
Small-scale projects	9.9%
Urban Indigenous community housing	8.5%
Other	5.6%

*Note: Proportions may not add up to 100.0% due to rounding.

Table 10: Distribution of NHS projects, by program and project type

Program	New Construction Projects	Repair/Renewal Projects
ACLP	100% (n=235)	0% (n=0)
AHF	69.2% (n=431)	30.8% (n=192)
AHIF	85.7% (n=12)	14.3% (n=2)
FLI	76.2% (n=16)	23.8% (n=5)
RHI	83.5% (n=461)	16.5% (n=91)

Table 11: Proportion of new construction and repair/renewal projects in each category of greenhouse gas targets (N=852)

GHG Target % Category	Proportion of new construction projects in GHG target % category	Proportion of repair/renewal projects in GHG target % category
<15%	3.9% (n=26)	20.6% (n=40)
15% to 34%	54.2% (n=357)	68.6% (n=133)
35% to 54%	25.8% (n=170)	5.7% (n=11)
55% to 74%	10.6% (n=70)	4.1% (n=8)
75% +	5.5% (n=36)	1.0% (n=2)

Table 12: Average EE and GHG target, by province

Province/Territory	# of Projects	EE Average Target	GHG Average Target
Alberta	113	28.8% (n=101)	36.0% (n=66)
British Columbia	284	27.4% (n=267)	35.0% (n=212)
Manitoba	70	25.9% (n=65)	39.2% (n=36)
New Brunswick	45	21.1% (n=44)	24.7% (n=29)
Newfoundland and Labrador	18	20.4% (n=17)	27.8% (n=8)
Northwest Territories	16	19.5% (n=15)	17.7% (n=13)
Nova Scotia	47	31.8% (n=40)	40.1% (n=25)
Nunavut	16	13.2% (n=16)	10.2% (n=7)
Ontario	423	28.4% (n=373)	35.5% (n=270)
Prince Edward Island	25	39.2% (n=23)	42.3% (n=20)
Quebec	319	18.5% (n=219)	28.9% (n=131)
Saskatchewan	51	19.9% (n=50)	23.9% (n=26)
Yukon	22	24.1% (n=22)	30.5% (n=13)

Annex D: Modelled Energy Savings Impacts Study

This annex outlines details on the calculation used by the *Modelled Energy Savings Impacts Study* in this evaluation for energy savings, greenhouse gas emissions reductions, and incremental cost analyses.

Energy savings calculation

$$E_{\text{savings}} = A_{\text{floor}} \times \text{EUI} \times T_E$$

Where:

- E_{savings} is the projected energy savings (GJ)
- A_{floor} is the conditioned floor area (m²)
- EUI is the energy use intensity (GJ/m²)
- T_E is the energy savings target (%)

Greenhouse gas emissions reductions calculation

$$\text{GHG}_{\text{reductions}} = A_{\text{floor}} \times \text{EUI} \times E_{\text{factor}} \times F_{\text{share}} \times T_{\text{GHG}}$$

Where:

- $\text{GHG}_{\text{reductions}}$ is the projected energy savings (GJ)
- A_{floor} is the conditioned floor area (m²)
- EUI is the energy use intensity (GJ/m²)
- E_{factor} is the emissions factor (kg CO₂e/GJ)
- F_{share} is the fuel share (%)
- T_{GHG} is the GHG emissions reduction target (%)

Incremental cost analysis

To perform the analysis, the study utilized incremental cost data obtained from an internal study, which outlines strategies for achieving high levels of energy efficiency in new multifamily buildings. For each building, we cross-referenced the building with the most similar archetype in the CMHC study based on the following criteria:

- Location
- Building type (low- or high-rise)
- Floor area
- Primary heating fuel

There are some caveats for using incremental costs in this assessment:

1. They are for equipment and materials only.
2. The baseline energy code is NECB 2017, and the study subtracts a constant cost, \$9.49/m² for low-rise apartments and \$8.06/m² for high-rise apartments, from the incremental costs of those buildings to adjust for differences in costs between the two NECB code-minimum baselines.
3. They are derived from a study that had the specific goal of finding the most affordable and cost-effective ways to reach an energy efficiency target.

Annex E: Additional Data from the *Modelled Energy Savings Impacts Study*

Table 13: Annual energy consumption and savings of NHS programs (in gigajoules)

Program	Energy Use (GJ)	Energy Savings (GJ)	Energy Savings (%)
ACLP	2,332,803	825,086	27%
AHF	2,475,832	993,998	29%
AHIF	72,552	43,451	37%
FLI	115,178	56,695	33%
RHI	815,541	68,610	8%

Table 14: Annual GHG emissions and reductions of NHS programs (in kg CO₂e)

Program	GHG Emissions (kg CO ₂ e)	GHG Reductions (kg CO ₂ e)	GHG Reductions (%)
ACLP	63,653,753	20,479,460	33%
AHF	51,349,816	16,400,283	24%
AHIF	20,479,460	333,273	46%
FLI	3,100,392	1,277,638	34%
RHI	21,876,341	3,337,493	13%

Table 15: NHS and Canadian average EUI and GHG emissions intensity, by building type

Building Type	NHS Average EUI	Canadian Average EUI	NHS Average GHG Emissions Intensity (in kg CO ₂ e)
Low-Rise Apartment	0.67	0.8	18.7
High-Rise Apartment	0.59	0.9	12.2

There was a limited sample of EUI data for some building types (single-family homes, duplexes, mobile homes, etc.) in ACLP and AHF datasets (used to extrapolate to other programs). The small sample of these building types in the ACLP and AHF data means there is low confidence in the accuracy of the extrapolated EUI data. For this reason, these building types were excluded from this report.

Annex F: Research, Innovation, and Capacity Projects Contributing to Environmental Sustainability

This annex outlines a few examples of projects supported by NHS research, innovation, and capacity programs.

Housing Supply Challenge

1. **Project:** Magnesium cement building materials manufactured from recycled waste and captured CO₂.

Organization: ZS2 Technologies Ltd.

Project description: This project produces sustainable construction materials through captured CO₂ from waste and minerals to develop cement through a formula that is cost-effective, carbon-negative, and energy efficient.

2. **Project:** Living with water: Flood-resistant construction tool kit

Organization: Architecture Sans Frontières Québec

Project description: This project aims to develop technical specifications for the installation of flood protection and resilient architectural design, alongside training programs and diagnostic tools to protect housing from flooding.

Demonstration Initiative

1. **Project:** Accelerating deep energy retrofits across multi-residential Buildings

Organization: Toronto Atmospheric Fund

Project description: This project is focused on scaling up the adoption of deep energy retrofits in multi-family buildings, including through electric baseboard space heating and a pilot on heat pumps to demonstrate the viability of retrofits focused on heat pumps.

Solutions Lab

1. **Project:** Integrating environmental performance for better housing

Organization: Intelligent Futures

Project description: This initiative examines how to integrate environmental performance into the economic model of housing projects to enhance the long-term livability and viability of affordable housing. This project identifies opportunities to combine affordability and environmental sustainability to improve the longevity of housing while reducing the environmental footprint of affordable housing. By developing and testing ideas to improve the environmental performance of affordable housing, this project seeks to share innovative solutions that can be replicated on a large scale.

Community Housing Transformation Centre

1. **Project:** Greener Co-op Microgrant

Organization: Co-operative Housing Federation of Canada

Project description: This initiative offers funding for small-scale projects with budgets ranging from \$500 to \$4,000. These projects are dedicated to mitigating environmental issues, such as reducing greenhouse gas emissions, improving air quality, and aiding co-operatives in adapting to climate change.

Annex G: Annual Utility Savings for NHS High-Rise and Low-Rise Buildings

The annual utility cost of an average building is calculated using the formula **\$ per GJ x EUI x Floor area**.

- **\$ per GJ** is the energy cost per GJ.
 - The “Energy cost per GJ” column breaks down the average cost per gigajoule of energy used in this report (\$30.93/GJ) by each Canadian province (there is insufficient data for the Northern territories). It is based on 2022.
 - **How was this calculated?** The fuel shares (proportion of gas and electricity consumed in each household) and all gas and electric utility costs were gathered for each province. The fuel share and utility rate were then multiplied to estimate the cost of each GJ of energy in that province. (Natural Resources Canada, n.d.-b; Hydro -Québec, 2022)
- **EUI** is determined using the national average.
- **Floor area** uses an assumption of 90m² for low-rise and high-rise units, for the purposes of this estimate.

The annual utility cost for NHS buildings multiplies the energy saving of the building type: (*\$ per GJ x EUI x Floor area*) x **Energy saving**.

Table 16: High-rise NHS buildings utilities cost savings

Province	Annual Energy Costs for High-Rise Buildings			
	Energy Cost per GJ	Average for Canada (EUI .90)	Average for NHS (using energy savings of 26.95%)	Energy Cost Savings for NHS Buildings
Quebec	\$21.12	\$1,710.72	\$1,249.74	\$460.98
Alberta	\$23.56	\$1,908.36	\$1,394.12	\$514.24
Manitoba	\$23.69	\$1,918.89	\$1,401.81	\$517.08
Ontario	\$25.23	\$2,043.63	\$1,492.94	\$550.69
British Columbia	\$28.71	\$2,325.51	\$1,698.86	\$626.65
Saskatchewan	\$32.07	\$2,597.67	\$1,897.69	\$699.98
New Brunswick	\$33.56	\$2,718.36	\$1,985.86	\$732.50
Newfoundland and Labrador	\$34.28	\$2,776.68	\$2,028.46	\$748.22
Prince Edward Island	\$40.34	\$3,267.54	\$2,387.05	\$880.49
Nova Scotia	\$46.73	\$3,785.13	\$2,765.17	\$1,019.96
Canadian Average	\$30.93	\$2,505.33	\$1,830.23	\$675.10

Table 17: Low-rise NHS buildings utilities cost savings

Province	Annual Energy Costs for Low-Rise Buildings			
	Energy Cost per GJ	Average for Canada (EUI .80)	Average for NHS (using energy savings of 23.37%)	Energy Cost Savings for NHS Buildings
Quebec	\$21.12	\$1,520.64	\$1,165.27	\$355.37
Alberta	\$23.56	\$1,696.32	\$1,299.89	\$396.43
Manitoba	\$23.69	\$1,705.68	\$1,307.06	\$398.62
Ontario	\$25.23	\$1,816.56	\$1,392.03	\$424.53
British Columbia	\$28.71	\$2,067.12	\$1,584.04	\$483.08
Saskatchewan	\$32.07	\$2,309.04	\$1,769.42	\$539.62
New Brunswick	\$33.56	\$2,416.32	\$1,851.63	\$564.69
Newfoundland and Labrador	\$34.28	\$2,468.16	\$1,891.35	\$576.81
Prince Edward Island	\$40.34	\$2,904.48	\$2,225.71	\$678.77
Nova Scotia	\$46.73	\$3,364.56	\$2,578.27	\$786.29
Canadian Average	\$30.93	\$2,226.96	\$1,706.52	\$520.44

Annex H: Payback Period Analysis

This annex details how the payback periods for energy efficiency improvements are determined. Costs and savings vary based on the targeted energy savings, so this calculation is done for each energy savings range.

Step 1: Determine the cost of energy efficiency improvements

Data on the **incremental cost** from the *Modelled Energy Savings Impacts Study* is used here. Note that this study and the incremental cost rely on an internal CMHC study.

- The average incremental cost percentage by energy target range was calculated and then applied to the average construction cost for the building type.

Step 2: Estimate annual utilities savings

Average annual utilities cost for an average Canadian building is determined using the formula
\$ per GJ x EUI x Floor area

- To determine the annual utilities savings, the average annual Canadian utilities cost is multiplied by the lower and upper bounds of the energy target range.

Step 3: Calculate the payback period

Payback period in years = Incremental cost / Annual utilities savings

- Due to the range in savings depending on the energy target, this is provided as a range using the upper/lower bounds of the utilities savings.
- The longer recovery in payback years for lower energy target ranges (1%-15%) is because a 1% energy saving is very little monetary savings to utility costs each year.

Limitations to note: This analysis relies on available NHS new construction projects and buildings.

Table 18: NHS high-rise apartment payback period

Average construction cost (rounded)		\$60M	
Average floor area (rounded)		17,000 m²	
Average annual Canadian utility cost		\$473,229.00	
Energy Target Range	Annual Utilities Savings	Incremental Cost	Payback Period
1%–15%	\$4,732.29 to \$70,984.35	\$119,646.46	1–26 years
16%–30%	\$75,716.64 to \$141,968.70	\$179,509.52	1–3 years
31%–45%	\$146,700.99 to \$212,953.05	\$1,827,743.52	8–13 years
46%+ ¹⁴	\$217,685.34 to \$473,229.00	\$3,623,581.37	7–17 years

Table 19: NHS low-rise apartment payback period

Average construction cost (rounded)		\$13M	
Average floor area (rounded)		5,000 m²	
Average annual Canadian utility cost		\$123,720.00	
Energy Target Range	Annual Utilities Savings	Incremental Cost	Payback Period
1%–15%	\$1,237.20 to \$18,558.00	\$63,401.32	3–52 years
16%–30%	\$19,795.20 to \$37,116.00	\$129,077.69	3–7 years
31%–45%	\$38,353.20 to \$55,674.00	\$472,102.98	8–13 years
46%+ ¹⁵	\$56,911.20 to \$123,720.00	\$1,465,708.72	12–27 years

¹⁴ The 46%–60% range and the 61+% range were grouped due to the small number of funded new construction buildings with an energy target of more than 61%.

¹⁵ The 46%–60% range and the 61+% range were grouped due to the small number of funded new construction buildings with an energy target of more than 61%.

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Alternative text and data for figures

Figure 1: Energy consumption in homes (NRCan, n.d. -a)

Space heating	60%
Water heating	18%
Appliances	15%
Lighting	4%
Space cooling	3%

Figure 2: NHS performance on energy efficiency and greenhouse gas reductions targets, by project type

	Repairs/Renewals	New construction	Total	NHS target
Average EE %	21.8%	26.3%	25.6%	35%
Average GHG %	23%	36.6%	33.5%	

Figure 3: Program performance on EE targets, relative to program requirements (N=1254)

	Average EE %	Program requirement
FLI	35.4%	25%
AHF	30.9%	25%
ACLP	30.5%	15%
AHIF	31.5%	10%
RHI	13.7%	5%

Figure 4: Program performance on GHG targets, relative to program requirements (N=858)

	Average GHG %	Program requirement
AHIF	39.3%	10%
FLI	35.4%	25%
ACLCP	35.7%	15%
AHF	32.5%	25%

Figure 5: Proportion of projects below, meeting, or above EE requirements, by program*

Program	Below requirements	Meets requirements	Above requirements
AHIF	0%	40%	60%
AHF	11.4%	27.7%	60.8%
RHI	2.5%	21.4%	76.1%
FLI	0%	19%	81%
ACLCP	0%	1.4%	98.6%

*Note: Percentages don't add up to 100% due to rounding.

Figure 6: Proportion of projects below, meeting, or above GHG reductions requirements, by program*

Program	Below requirements	Meets requirements	Above requirements
AHIF	0%	40%	60%
AHF	12.5%	27%	60.5%
FLI	0%	19%	81%
ACLCP	0%	0.9%	99.1%

*Note: Percentages don't add up to 100% due to rounding.

Figure 7: Variation in Energy Efficiency Achievements Beyond Program Requirements

Program	Median EE% exceedance
ACLP	11.4%
AHF	10%
RHI	20%
FLI	6%
AHIF	33%
Total	15%

Figure 8: Variation in GHG reduction achievements beyond program requirements

Program	Median GHG% exceedance
AHIF	41%
ACLP	14.9%
AHF	11%
FLI	6%
Total	12.4%

Figure 9: Impact of excluding exceptions on NHS project outcomes for EE and GHG targets

	Excluding exempt projects	All projects
Average EE %	32.2%	25.6%
Average GHG %	36.2%	33.5%

Figure 10: Average energy efficiency target %, by location (with number of all projects)

Location	Excluding exempt projects	All projects
Rural/Remote/Northern (n=191)	37.5%	25.6%
On-reserve (n=304)	28.2%	21%
Urban (n=746)	31.9%	27.2%
Total (N=1241)	32.1%	25.5%

Figure 11: Distribution of NHS projects by project lower case type

Project Type	Number of Projects	Percentage
Repairs/Renewals	290	20%
New construction	1155	80%

Figure 12: EE and GHG emissions reduction targets by project type, excluding exemptions

Project Type	Repairs/Renewals	New construction
Average GHG (n=783)	28.8%	38.1%
Average EE (n=826)	28.4%	33.1%

Figure 13: Proportion of new construction and repair/renewal projects in each category of EE targets (N=1242)

EE Target	New construction	Repairs/Renewals
More than 75%	1.1%	0%
55% - 74%	5.2%	2.9%
35% - 54%	17.1%	7.3%
15% - 34%	17.1%	66.8%
Less than 15%	14.6%	22.9%

Figure 14: Annual energy consumption and savings of NHS buildings in gigajoules (GJ)

Energy consumption	5,811,907 GJ
Energy savings	1,987,840 GJ

Figure 15: Annual CO2 emissions and reductions of NHS buildings (in tonnes CO2)

GHG emissions	140,378 tonnes
GHG reductions	41,828 tonnes

Figure 16: Energy use intensity (EUI) in GJ/m², by building type

Type of building	NHS average EUI	Canadian average EUI
Low-rise apartment	0.67	0.8
High-rise apartment	0.59	0.9

Figure 17: Annual GHG emissions intensity reduction, by region (in kg CO₂e/m²)

Province	Annual GHG emissions intensity reduction (kgCO ₂ e/m ²)
Nunavut	101.0
Nova Scotia	99.8
Saskatchewan	81.3
New Brunswick	48.8
Alberta	47.4
Northwest Territories	38.9
Yukon	25.9
Prince Edward Island	24.2
Ontario	18.3

Province	Annual GHG emissions intensity reduction (kgCO ₂ e/m ²)
Newfoundland and Labrador	17.5
British Columbia	12.7
Manitoba	11.2
Quebec	1.0

Figure 18: Construction costs (\$/m²) by energy savings target

Energy Savings Target	Average of Construction Cost/Unit Area
1%-15%	\$2,533
16%-30%	\$3,111
31%-45%	\$3,010
46%-60%	\$3,283
61+%	\$3,511

Figure 19: Incremental construction costs (\$/m²) by energy savings target

Energy Savings Target	Incremental construction costs
1%-15%	\$2.06
16%-30%	\$12.98
31%-45%	\$60.31
46%-60%	\$116.39
61+%	\$220.93

Figure 20: Number of interviews and interview participants by stakeholder group

Stakeholder group	Number of interviews	Number of interview participants
Approved applicants	46	54
New construction	21	54
Environmental sustainability experts	3	3

Figure 21: External interviews with approved applicants—number of interviews and interview participants

Program	Number of interviews	Number of interview participants
AHF	18	24
ACLP	10	10
FCHI	7	8
AHIF	6	6
FLI	4	5
RHI	1	1