Community Energy Association

LEEP10 Home Energy Pilot Project

Partnerships to accelerate aggregated, community-scale deep energy retrofits.

March 2026

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Acknowledgments

The LEEP10 pilot project was made possible through the leadership, funding, and collaboration of a diverse group of partners, public, private and not-for-profit, all committed to accelerating deep energy retrofits in Canada. Together, these organizations spanning local, provincial, and national mandates demonstrated how coordinated partnerships can test scalable, market-ready solutions to the urgent challenge of retrofitting Canada's existing housing stock.

City Green Solutions played a foundational role in conceiving and shaping the pilot, bringing a community-scale lens and nonprofit leadership to the initiative, while thinkBright Homes Ltd. provided initial thought leadership in conceiving of this pilot, and on-the-ground expertise and stewardship as the managing general contractor and long-time advocate for deep energy retrofits.

The project gratefully acknowledges funding support from Natural Resources Canada through the Local Energy Efficiency Partnerships (LEEP) program (administered in BC by City Green Solutions), BC Hydro, whose flexibility enabled this innovative aggregated approach, and the Canadian Home Builders' Association (CHBA) National, through its Net Zero initiatives, strengthening the project's ambition and alignment with national goals in scaling industry capacity for deep energy retrofits.

The Community Energy Association (CEA), through its Retrofit Assist Concierge Program, provided critical project management for LEEP10, and administered homeowner coordination support in the Regional District of East Kootenay, helping translate technical planning into practical action. In addition, Wildsight Invermere and the Columbia Valley Economic Development Commissions played an instrumental role in finding homeowners to participate in the program by advertising and hosting a webinar for local to learn about and apply to join this pilot project. Bernhardt Contracting Ltd. provided Net Zero energy advising and analysis throughout the project.

1. Executive Summary

Canada's climate targets require a structural shift in how residential retrofits are planned, financed, and delivered. More than 12 million existing low-rise houses must be upgraded by 2050 to align with national emissions commitments. That is equivalent to roughly 480,000 homes per year. Incremental, one-off retrofits supported by unstable rebate programs will not achieve this scale.

The LEEP10 Pilot Project was designed to test a scalable alternative that substantially reduces energy demand and greenhouse gas (GHG) emissions while building a business case that enables replication. LEEP10 project partners wanted to evaluate and test an aggregation approach that gathers retrofits into a single project with one general contractor leading an Integrated Design Process (IDP) and supported by a coordinated team of technical sub-trades.

The LEEP10 project was made possible by an innovative collaboration between key industry partners and organizations. This collaboration was essential to achieving efficiency results within the pilot homes while also building a shared understanding of how this approach could be scaled, adapted, and replicated.

Between January 2025 and December 2025, the LEEP10 pilot consisted of ten homes in the communities of Invermere and Windermere within the Regional District of East Kootenay (RDEK) in British Columbia. These homes met LEEP, CHBA, and Retrofit Assist criteria most effectively.

There were two stages of involvement for homeowners and while homeowners did not need to commit to Stage 2, implementing retrofit measures, they did commit to the planning process in Stage 1.

Stage One: Planning Using an Integrated Design Process (IDP)

Following a house-as-a-system approach, each home had a pre-retrofit EnerGuide energy audit, electrical site assessment, HVAC assessment, heat loss/gain assessment using the F280-12 standard, solar assessment and assessment for radon.

This data allowed the project team to develop a fully costed, two-phase retrofit roadmap for each home. ***Phase one*** included measures to meet immediate or urgent needs related to human health and safety and a 5-year plan to meet energy and emissions targets (50% reduction in energy use and 50% reduction in GHG emissions). ***Phase two*** included sequenced recommendations that put the home on a path to net zero.

ABOUT LEEP

Natural Resources Canada's (NRCan) Local Energy Efficiency Partnerships (LEEP) initiative is a proven innovation and technology accelerator that has a record of engaging key stakeholders, providing support and bridging RD&D and program delivery for the building industry.

LEEP10 PROJECT PARTNERS

BC Hydro

Canadian Home Builders' Association

City Green Solutions

Community Energy Association

Natural Resources Canada (LEEP Initiative)

Retrofit Assist

thinkBright Homes

Stage Two: Retrofit Implementation

Homeowners were supported to access loans and rebates and proceed with an energy retrofit themselves, or led by the IDP contractor, thinkBright Homes.

Analysis of modelling results and cost estimates revealed a clear pattern: the cost per unit of energy saved increases significantly as retrofit depth increases beyond the 50% reduction threshold.

The average cost per GJ saved for phase 1 retrofits was $1,575, and for phase 2 retrofits was $42,303.

The pilot offers a clear direction: fund the planning, stabilize the financing environment, aggregate delivery, and anchor programs around measurable performance targets.

Based on the evidence available at the conclusion of the design phase, the pilot has achieved its deep energy retrofit planning goals. All ten homes received comprehensive, house-as-a-system retrofit plans grounded in robust technical assessments and aligned with clear performance targets.

LEEP10 Key Learnings

1. **Retrofit planning must be target-driven and collaborative.**
2. **Homeowners understand the technical but not the financial value of Integrated Design Processes.**
3. **Energuide assessments and all-trades site visits are essential.**
4. **Fifty percent energy reduction are more cost-effective than 50% to net zero retrofits.**
5. **Ventilation is universally required but underrepresented.**
6. **Program management and rebate navigation are critical.**
7. **Major air sealing is rarely a standalone retrofit strategy.**
8. **Variable-speed heat pumps enable phased retrofit strategies.**
9. **Exterior insulation should be combined with asset renewal.**
10. **Electrification does not always require panel upgrades and electrical load assessments can be unnecessary.**
11. **Aggregation and compensation improve the retrofit outcomes.**
12. **Implementation special considerations – Hot water heat pumps, cellulose, solar, and radon and hazmat.**

2. Background and Rationale

National Retrofit Imperative

Canada’s pathway to achieving its 2050 climate targets depends heavily on transforming the existing housing stock. More than 12 million low-rise residential buildings must undergo significant upgrades to reduce operational greenhouse gas (GHG) emissions and energy demand. At current retrofit rates, Canada is not on track to meet this objective.

Historically, residential retrofits have been:

- Homeowner-initiated
- Fragmented across trades
- Driven by equipment failure or aesthetic renovation
- Dependent on short-term rebate programs

This approach results in incremental improvements rather than deep, performance-based energy reductions. It also fails to address houses as integrated systems, often leading to missed opportunities, sequencing errors, or upgrades that complicate future decarbonization efforts.

The LEEP10 pilot was conceived in response to this structural gap. The core idea was simple but ambitious:

Could multiple homes be aggregated into a single, coordinated retrofit planning process under one General Contractor, using an Integrated Design Process (IDP), to improve efficiency, outcomes, and scalability?

Core Hypothesis

LEEP10 was structured around three interrelated hypotheses:

Aggregation	Integrated Design	Scalability
Bundling multiple homes within a defined geographic area under a single General Contractor improves efficiency, reduce transaction costs, and streamline coordination between trades.	A fully compensated Integrated Design Process (IDP), grounded in modelling and house-as-a-system principles, produces higher quality cost-optimized retrofit plans with an accessible starting point for homeowners than a conventional quote based approaches.	If deep energy retrofit planning can be systematized and streamlined, it may offer a replicable model capable of supporting community-scale retrofit deployment.

The pilot aimed to test whether deep energy retrofits targeting approximately 50% energy and GHG reductions alongside establishing credible pathways to net zero could be delivered in the range of $100,000 - $150,000 per single-family dwelling (excluding externalized program administration costs).

Geographic and Community Context

The pilot was implemented in the Invermere and Windermere communities within the Regional District of East Kootenay (RDEK), British Columbia.

Key contextual factors included:

- No natural gas distribution system; homes rely primarily on electricity, wood, or propane
- Cold climate conditions with significant heating demand
- Detached single-family housing stock built primarily between 1948 and 1990
- Short travel distances between participating homes (maximum ~15 minutes)

The tight geographic clustering was intentional because travel time and coordination inefficiencies are major barriers to trade productivity in rural and small-town contexts. Aggregation within a compact area was essential to testing whether efficiency gains could be realized.

This area also had several foundational characteristics that made it an ideal place to evaluate the hypotheses:

Skilled and Experienced General Contractor

The General Contractor and project lead for the LEEP10 pilot, thinkBright Homes, is an Invermere-based Home Performance Council Network (HPCN) registered General Contractor with a long track record in high performance energy-efficient building and deep energy retrofits.

thinkBright Homes coordinated all aspects of retrofit planning and delivery, including scheduling, budgeting, homeowner engagement, sub-trade integration, development and costing of the IDP process. As an established builder with deep expertise and commitment to the climate objectives of LEEP10, thinkBright was a key contributor to the design of the pilot and was able to leverage existing relationships with partners and local trades across the pilot timeline.

Existing retrofit concierge service

Retrofit Assist had been available to residents in the region since December 2024. Therefore, the retrofit concierge team was trained and engaged in the region prior to the pilot's launch with knowledge and expertise of the local context and grant landscape. The team also had existing relationships with the GC and many local trades.

Grassroots support

The pilot project had an ambitious timeline to identify and onboard homeowners to the project. Awareness and outreach to potential participants was significantly bolstered with the support of staff from the Invermere branch of Wildsight as well as from the Chamber of Commerce. Without local, on-the-ground activities to build awareness and interest this project would have found it more difficult to onboard ten homes to the project within the timeline.

Additionally, having messengers from well-known and respected local organizations increased the trust participants had in the pilot.

History of capacity building and trades engagement

Core project partners had been active convenor in the region for several years, with previous collaborations building and delivering home energy efficiency programs. In addition, starting in 2018, CEA had been delivering local training and education activities to builders and tradespeople, with many opportunities to collaborate with thinkBright Homes. For a pilot project, this existing capacity and expertise contributed to program partners having momentum to build from; there was knowledge and relationship capital in the pilot region that had been cultivated over many years.

Why Integrated Design Process (IDP)?

Deep energy retrofits require coordinated decision-making across building envelope, mechanical systems, electrical capacity, ventilation, and renewable energy integration. Traditional retrofit delivery is characterized by homeowners gathering independent quotes from separate trades; this approach does not achieve optimal sequencing or system-level performance.

IDP is a foundational step in delivering deep energy retrofits under both the Local Energy Efficiency Partnerships (LEEP) for Renovations and the CHBA Toward Net Zero Renovations program. IDP ensures that technical decisions are based on whole-home performance modeling, accurate assessments, and cost-optimized planning.

The IDP model used in LEEP10:

- Brought the General Contractor, sub-trades, energy advisors, and homeowner together as a first step
- Anchored decisions in modelling (EnerGuide, F280-12, HEET optimization)
- Sequenced upgrades to avoid unintended building science consequences
- Identified cost-effective pathways to performance targets
- Produced fully costed, phased retrofit roadmaps

Unlike new construction, where design fees are expected, it is uncommon in the retrofit world to pay for design. LEEP10 explicitly funded IDP to test whether compensated planning would improve outcomes and reduce downstream risk. The funding model is discussed more in section 3.

INTEGRATED DESIGN PROCESS is a holistic, multi-disciplinary collaborative approach used in the construction industry that brings together all key stakeholders to maximize project objectives, efficiency and cost. The IDP team included the General Contractor, Energy Advisor, and subtrades like an electrical contractor and HVAC contractor.

Toward Net Zero Pathways

LEEP funding required a 50% energy and GHG reduction. With the addition of CHBA Toward Net Zero Renovations funding, the pilot was able to develop toward net zero roadmap for each home. Retrofit plans were phased as follows:

- A Phase 1 retrofit plan to achieve approximately 50% reductions.
- A Phase 2 retrofit plan to achieve net zero performance.

This two-phased structure allowed the pilot to test both immediate, high-return on investment energy reductions and long-term, capital-intensive envelope and solar strategies. The pilot thereby bridged short-term programmatic goals with long-term decarbonization objectives.

Rationale for Community-Scale Aggregation

Scaling deep energy retrofits will require more than improved technology. It will require new delivery models.

Aggregation offers several theoretical advantages:

- Attracts General Contractor professionalism and experience
- Reduced per home transaction costs
- Collaborative mobilization of trades
- Improved learning transfer between trades and across homes
- Pipeline stability for contractors
- Potential bulk procurement efficiencies
- Enhanced community engagement

However, aggregation also introduces complexity, including the need for centralized program management, homeowner coordination, and consistent financing support.

3. Program Design and Governance

Partnership Structure

LEEP10 was delivered through a multi-partner collaboration that combined federal, utility, industry, non-profit, and local contractor expertise. The program and governance design reflected the team's understanding that deep energy retrofit delivery is not a single-actor activity; it requires strategic funding partners, coordinated technical leadership, program oversight and management, and homeowner support.

Strategic Funding Partners

City Green's LEEP Trial Homes for Renovation Program via Natural Resources Canada's (NRCan) LEEP program provided pilot funding and the framework requiring participating homes to explore approximately 50% energy and GHG reductions. This established the performance benchmark that anchored the project.

Canadian Home Builders' Association (CHBA), through the Toward Net Zero Renovations program, expanded the pilot's scope to include the development of net zero pathways. This introduced a second performance lens beyond the 50% reduction target.

BC Hydro aligned the pilot with utility objectives and provided funding to support project management and administration.

These strategic funding partners defined the performance architecture within which local delivery occurred.

Technical and Coordinated Leadership

LEEP10 was led by thinkBright Homes, a local HPCN[1] registered General Contractor with a track record in high performance energy-efficient building and deep energy retrofits, based in Invermere, BC.

As the central project lead and General Contractor (GC), thinkBright Homes coordinated all aspects of retrofit planning and delivery, including scheduling, budgeting, homeowner engagement, sub-trade integration, development and costing of the IDP process. Centralizing coordination under the GC significantly improved communication between the homeowner and the trades and streamlined scheduling.

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[1] The Home Performance Contractor Network (HPCN) is British Columbia's vetted database of retrofit professionals. By requiring contractors to meet trade, training, and ongoing quality-assurance standards, the HPCN ensures homeowners can confidently access rebates and work with qualified providers across insulation, windows and doors, heat pumps, energy advising, and general retrofit contracting. For the LEEP10 pilot, participation by the General Contractor and relevant sub-trades in the HPCN was essential to maintain eligibility for provincial and utility rebates and to ensure minimum standards of training, education, and experience.

As the GC, thinkBright also carried the liability for delivery of the project to CHBA, and thereafter to homeowners engaging in retrofit work.

Coordinated IDP Team

A key success factor in the pilot was having a qualified GC supported by technically proficient sub-trades. This integrated, single-point-of-coordination model enabled the team to manage the complexity of aggregated deep energy retrofits while delivering high quality work and capturing project efficiencies.

The GC coordinated comprehensive assessments as part of the IDP process to ensure retrofit plans were appropriate and optimized to meet GHG and energy targets. Assessments, all funded through the project, included a pre-retrofit EnerGuide evaluation, electrical site assessment, HVAC assessment, heat loss/gain assessment using the F28-12 standard, solar assessment and assessment for radon. Five 5 homes also underwent hazardous materials assessment.

To deliver a robust, credible, data-driven plan to homeowners, the IDP team included expertise in the following areas:

- General contracting
- Project management
- Communications, client and partner relations
- EnerGuide assessments
- Building envelopes including airtightness, moisture and vapour management
- Fenestration
- Vapour open insulation
- Mechanical ventilation
- Heat pump technologies
- Natural gas propane
- Balance point calculations
- Electrical load assessment
- Electrical load management
- Solar
- Energy audits
- F280-12
- Residential energy modelling and cost optimization

Program Oversight and Management

Community Energy Association (CEA) led project oversight and management. CEA was a natural partner to assume this role given the organization's presence in the region, relationships with strategic partners and funders, and experience building and delivering energy efficiency and retrofit programs. This function was intentionally separated from the GC to ensure the IDP team could focus on their core expertise—retrofits.

Aggregation requires centralized coordination. Without separating program management from technical delivery and coordination, the administrative complexity of ten concurrent IDP processes would have undermined efficiency gains.

Homeowner Support and Engagement

Attracting and registering homeowners, conducting program communications, and helping homeowners navigate rebates was facilitated by CEA and CEA's Retrofit Assist program. Similar to program oversight and management, this function and responsibility was independent from the GC and IDP team to 1) ensure the technical team could focus on the complex IDP process and retrofit recommendations, and 2) provide homeowners with third party validation and oversight, and customized support for rebates and loans.

Alongside the marketing and outreach efforts that were in progress as part of Retrofit Assist, trusted, local community groups played a critical role in socializing the pilot in the community. The on-the-ground networking and communications by the GC as well as both the Invermere Branch of Wildsight and the Columbia Valley Chamber of Commerce were key to the team receiving enough applications to ultimately accept ten homes into the pilot. Recruiting and screening participating homeowners was supported by thinkBright Homes and CEA's Retrofit Assist program. Retrofit Assist also providing rebate and loan navigation assistance.

Funding Model

All trades and the general contractor were compensated for the time they invested in the IDP. This holistic compensation is critical to ensure their fulsome engagement in the IDP process, and it builds the capacity and expertise of businesses that provide local jobs. In new home construction, this work is commonly understood as "design" and is a considered as a normal, expected fee-for-service component of the build. In the retrofit world, this culture does not exist, which helps explain why house-as-a-system, building-science-based approaches have struggled to gain traction.

Given the lack of culture in the retrofit world of paying for design, funding from public sources was necessary to ensure application of a building science-based approach to IDP, including house-as-a-system.

Funding sources and total budget

Funding from strategic partners allowed the pilot to develop individualized, cost-optimized retrofit road maps using IDP while aligning with national programs and targets.

Amount	Source	Project Activity
$35,000	City Green Solutions' LEEP Trial Homes for Renovation Program via the Natural Resources Canada's Local Energy Efficiency Program (LEEP).	IDP
$78,940	Canadian Home Builders' Association (CHBA) Net Zero Renovation Program.[2]	IDP and case studies
$65,000	BC Hydro	Project management

Retrofit Financing

While the IDP was funded, retrofit implementation was not subsidized through the pilot itself. Homeowners relied on local and provincial rebate programs, federal grants (where applicable), the Canada Greener Homes Loan (until its abrupt closure during the pilot period), and personal financing.

The mid-pilot suspension of the Canada Greener Homes Loan (September 2025) created uncertainty and delays for several participants. This real-time policy shift provided insight into how the instability of financing and grant programs directly affects retrofit uptake; both homeowners and businesses are affected when funding programs end. It also revealed the benefits and value of giving homeowners quick access to energy retrofit experts. By integrating Retrofit Assist's concierge service into the pilot, homeowners were alerted that the Greener Homes Loan was closing and given one-on-one support to complete their applications before the deadline. At the time of writing, it is not known how many homeowners will be approved for the $40,000 loan. This will likely influence their implementation plans, although it did not deter them from continuing to participate in the IDP.

[2] The CHBA funding supported integration of the pilot project into the national Toward Net Zero Renovations (TNZR) program. Funded by NRCan, the objective of the TNZR program is to support 100-150 deep energy retrofits or Net Zero home upgrades through professional guidance to achieve deep energy retrofits with 50% energy consumption reduction and use of CHBA's Net Zero Home Labelling Program.

Design and Governance Lessons

The design of LEEP10 revealed key insights that can inform the design and governance of future community-scale retrofit programs:

Leverage expertise from diverse partners.

Multi-partner coordination with clear delineation of roles and scope allows partners to invest their time effectively and in line with their core skills and expertise. It also creates space for complex problem solving.

Furthermore, separating program management from technical and construction activities increases credibility.

Compensate all aspects of planning, if possible.

Funding IDPs creates high-quality, actionable retrofit plans that homeowners can trust, and yet funding this planning is difficult to replicate. This pilot secured federal and industry funding up front which eliminated barriers for homeowner participation[3] and ensured all trades and sub-trades could contribute their expertise.

Aggregate to find efficiencies, but centralized coordination is critical.

A key success factor in the pilot was having a qualified and connected General Contractor as the central project lead and single-point-of-coordination. thinkBright Homes had existing relationships with many of the project partners including the project management team at CEA. As such, they were able to coordinate all aspects of retrofit planning and delivery including scheduling, budgeting, homeowner engagement, sub-trade integration, and development and costing of the IDP process.

The rural context of the LEEP10 pilot required the team to select homes that minimized travel inefficiencies. These micro details and considerations are important for aggregation to build efficiencies. For example, the LEEP10 IDP team was able to conduct all ten on-site assessments in just four days.

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[3] CEA completed debrief meetings with eight of the ten homeowners after they received their costed plans. None said they would have paid $7,000 for a retrofit IDP, yet all confirmed that they found it very valuable, helpful, and clarifying.

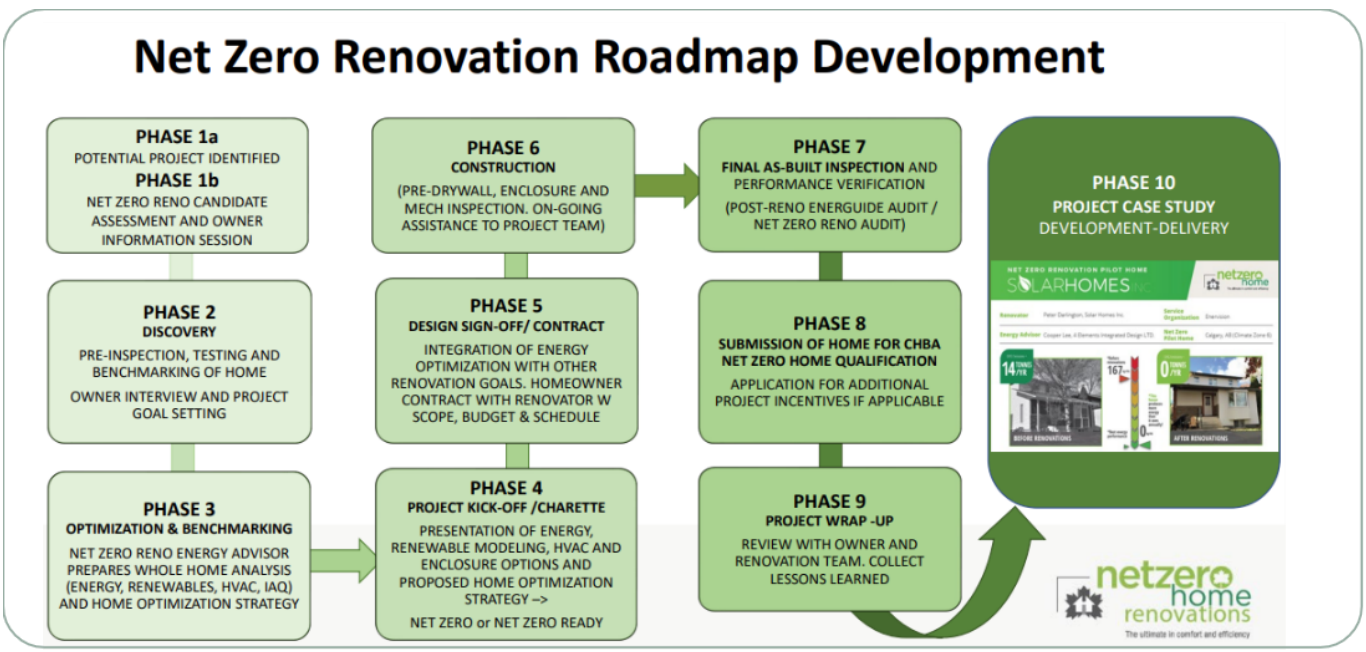
4. Integrated Design Process Model

Overview of the IDP Framework

The LEEP10 pilot used an Integrated Design Process (IDP) to develop retrofit roadmaps for each participating home. IDP is a collaborative planning approach that brings together the general contractor, trades, energy advisors, and homeowners early in the design process to evaluate the house as an integrated system.

IDP is a foundational step in delivering deep energy retrofits under both the Local Energy Efficiency Partnerships (LEEP) for Renovations and the CHBA Toward Net Zero Renovations program. IDP ensures that technical decisions are based on whole-home performance modeling, accurate assessments, and cost-optimized planning. The following diagram shows the phases of the deep energy retrofit path to net zero, as defined by CHBA.

Figure 1: CHBA Net Zero Renovation Roadmap



House-as-a-System Approach

The IDP framework was used to ensure that retrofit recommendations were developed using a house-as-a-system (HAAS) approach. Rather than generating isolated upgrade recommendations, the process evaluated how combinations of measures could work together to achieve defined performance targets. This integrated perspective ensured that recommended upgrades improved performance without introducing unintended building science risks.

For each participating home, the IDP team completed comprehensive phases of discovery and modelling to develop a structured two-phase retrofit pathway:

> Phase 1: Measures capable of achieving approximately 50% energy and greenhouse gas reductions.
>
> Phase 2: Additional upgrades required to achieve net zero performance over time.

This structure allowed the team to balance cost-effectiveness, technical feasibility, and long-term decarbonization objectives.

The IDP process integrated modelling results, contractor expertise, homeowner priorities, and program performance targets into a single planning framework.

THE HOUSE-AS-A-SYSTEM APPROACH is grounded in the concept that homes function as interconnected systems rather than isolated components. Out-of-sequence changes to one element of a building, such as insulation, air sealing, or mechanical equipment, can significantly affect other systems including ventilation, moisture management, and indoor air quality.

IDP Process

Discovery and Site Assessment

The IDP process began with a comprehensive discovery phase designed to gather technical information about each home and homeowner priorities. The GC coordinated with trades and the homeowners to conduct efficient and standardized on-site home assessments.

Each home underwent:

- **Pre-retrofit EnerGuide evaluation** to establish baseline energy consumption and GHGs. The Energy Advisor visited each home before the onsite meeting with all trades and the homeowner, so that the EnerGuide reports would be available to inform discussions.
- **Mechanical design and load calculations** using CSA F280-12 methodology to determine heating requirements and appropriate mechanical sizing.
- **Electrical service assessment** to evaluate panel capacity and potential constraints for electrification.
- **Mechanical system review** of heating, cooling, and domestic hot water equipment.
- **Ventilation assessment** to evaluate existing air exchange and indoor air quality considerations.

- **Solar feasibility review** to assess roof orientation, shading, and structural suitability.
- **Digital building capture,** including LiDAR scans and 3D modelling tools, to generate accurate geometry and support rapid estimating of mechanical design, windows and door, siding, and roofing take-offs.

These assessments provided the technical foundation for subsequent modelling and optimization.

Homeowners also contributed data during this phase by completing a homeowner questionnaire and providing historical data.

Electrical Load Optimization

One of the technical goals of the pilot was to demonstrate how deep energy retrofits can optimize electrical loads, particularly as homes transition from fossil fuels to electric heating. Using demonstrated load calculations, smart switching technologies, and efficient mechanical equipment (including HRVs), the team sought to avoid costly electrical panel upgrades by designing systems that fit within existing capacity wherever possible. This approach supports broader electrification goals by making Deep Energy Retrofits (DERs) more cost-effective and technically feasible for more homes.

All-Trades On-Site Meeting

The need for team meetings was minimized as far as possible by effective forward planning by the GC who coordinated with the trades and homeowner. Meetings were tightly controlled within the scheduled timeframe to stay within budget.

One of the defining features of the pilot was the all-trades discovery meeting conducted at each home. After an initial team meeting to introduce the trade team to each other, the homeowner, general contractor, energy advisor, and relevant sub-trades met simultaneously on site.

Participants typically included:

- General contractor
- HVAC contractor
- Electrical contractor
- Energy advisor
- Homeowner

The purpose of this initial discover meeting was to:

- Establish a shared understanding of the house as a system
- Hear first-hand from the homeowner about needs, concerns, budget, priorities
- Discuss sequencing considerations
- Identify constructability challenges

- Build a shared real-world understanding of the opportunities identified in the EnerGuide assessment and any implementation constraints (e.g., finishing, occupancy conditions, physical impediments, etc.)

Conducting this discussion collaboratively allowed the team to resolve potential issues in real time rather than through multiple rounds of independent consultations. Trades were able to assess elements of the home and discuss opportunities and challenges for implementing what they felt were the most effective energy conservation measures based on the EnerGuide assessment.

Trades spent maximum one hour on site whereas the GC spent up to two hours with the homeowner and trades. The GC contributed to the technical discussions with the trades but also worked with the homeowners to ensure they felt heard in the process of developing recommendations. This ultimately contributed to building homeowner trust and buy-in of the IDP and the team in general.

> *"Being on site all at the same time has been incredibly informative, and I think will result in a much smoother process of producing recommendations that make sense for each home"* - HVAC contractor

> *"Now I get what you are talking about when you say IDP and House as a System"* - Electrician

> *"The homeowner quickly became educated on the reasons for the issues that they have, and the potential ways in which each problem could be resolved. **This was a 'huge' trust building exercise**, with on-the-spot (reciprocal) learning and credibility building between the homeowner and the trades."* - General Contractor

> *"Having the general contractor and all the trades in the home at the same time to talk about the problems and how they can be resolved helped them to think collaboratively about what needed to be done. **It made it very clear to the homeowner that everyone was working toward a functional HAAS outcome**."* - General Contractor

> *"Going to the site for onsite discussions and problem solving is the best route."* - General Contractor

> *"Doing IDP on paper first and **then** visiting the homes would have been a waste of time."* - General Contractor

> *"It's all about the context."*- General Contractor

Homeowner goal setting

The onsite meeting with the whole team, including the homeowner, proved critical in building homeowner trust. It provided the GC with the opportunity to discuss the clients' expectations and goals and those of the pilot project:

- Project Scope, expectations, requirements and budget
- Homeowners' "Must-Have's", "Wish-List" and "Deal Breakers"
- Goals (e.g., energy, GHG reduction targets and Air Changes per Hour (ACH) targets)
- Vision of the project and its outcomes

Modelling and optimization

Following the discovery phase, energy modelling was conducted to evaluate retrofit scenarios and identify strategies that would achieve the program's performance targets.

The modelling process incorporated several analytical tools:

- HOT2000 modelling based on EnerGuide baseline data to evaluate energy performance
- F280-12 heat loss calculations to determine appropriate mechanical system sizing
- HEET optimization software to analyze combinations of energy conservation measures and evaluate cost-effectiveness

Multiple retrofit scenarios were modelled for each home to evaluate how combinations of envelope upgrades, mechanical systems, and renewable energy options could affect overall performance.

Optimization focused on identifying strategies capable of delivering the largest energy and GHG reductions at the lowest cost. Measures were then allocated between phases according to building science, their ability to achieve the biggest energy reductions, cost-effectiveness, disruption level, and alignment with long-term renovation opportunities.

Throughout the modelling process, homeowner priorities were incorporated into scenario development. This ensured that the recommended pathways reflected both performance targets and the homeowner's budget, comfort goals, and renovation plans.

HEET Software in the LEEP10 Pilot

Modelled energy demand for each home informed IDP discussions. The team discussed each home, reviewing the outcomes of the HEET model to identify the specific combination of retrofits that would achieve 50% reductions and a path to net zero.

The HEET model identified the specific issues each house had (i.e., where specifically most heat was being lost, optimal insulation addition, and MEUI implications of combinations of recommendations. This allowed the team to allocate retrofit actions (energy conservation measures) into two phases with confidence, following the metrics and building science. It also avoided dogmatic or "in my experience" type of decisions about which actions could generate sufficient energy outcomes for each phase. The modelling subsequently identified the lowest cost solution to achieve the energy reduction targets of each phase.

The GC excluded some options such as spray foam insulation (to avoid embodied emissions and toxic volatile compounds), above-grade Styrofoam insulations (to avoid embodied emissions), and slider and double hung windows (which are energy in-efficient because they do not seal effectively). Where the HEET modelling suggested that dual pane windows would suffice, the GC opted to quote triple pane, while advising the homeowner that dual might be adequate. This recommendation reflects a capital investment perspective given the long lifespan of windows.

IDP Meeting Structure

The IDP involved several structured meetings that progressively refined the two-tiered retrofit plan for each home. Meetings were held over a 3-month period between April and June, 2025.

IDP Meeting 1 (3 hours): Opportunities and Constraints

Following the discovery phase, the first IDP meeting brought together the technical team to review the home's baseline performance and identify potential retrofit strategies. The overarching objective was to understand the opportunities, challenges, and red flags for each LEEP10 home to attain 50% and net zero energy reduction targets. The EnerGuide assessements and the all-trade site visit findings were discussed by the GC and all-trades team. Key questions the team explored about each home were:

- What is the one thing this home needs right now?
- What are the recommendations/possible energy conservation measures for each home to achieve pilot targets?
- Is there enough power at each home to electrify? If not, is there a solution to avoid electrical system upgrades?
- What solar opportunity exists for the home to support targets?

Energy Conservation Measure (ECM) Meeting (2 hours): Optimization Review

Once modelling was completed, the GC, Energy Advisor and Bernhardt contracting met to review the outcomes of the EnerGuide assessments and HEET model to evaluate and discuss how combinations of ECMs could achieve the desired performance targets compared their relative cost-effectiveness.

Measures were then categorized into Phase 1 and Phase 2 according to their performance impact and financial feasibility. These ECMs were then presented to the IDP team for consideration and refinement at the 2nd IDP meeting.

IDP Meeting 2 (3 hours): Refinement and Constructability

The second IDP meeting focused on reviewing the data for each home and refining it into coherent house-as-a-system recommendations that address the homeowner's priorities, pain points, and budget constraints. The IDP team reviewed the most challenging homes first, allowing for in-depth discussion on six of the ten homes.

Homeowner priorities and constructablity were mixed into the data analysis to ensure that the Phase 1 recommendations best positioned to achieve 50% energy/GHG savings were *also* practical for trades to implement and realistic for homeowners. Where the proposed ECMs might not be the most implementable solutions, alternate paths were co-developed by the team.

In order to confirm retrofit pathways that were both technically sound and practically achievable, the IDP team identified "good enough" solutions. For example, opting to recommend installing ductless Lumnos HRV pair as an incremental step to improve indoor air quality and moisture management immediately, as opposed to fully ducting an HRV into the home with enormous cost and disturbance.

The final outcome of the IDP process was a customized retrofit roadmap for each participating home, including projected energy savings, greenhouse gas reductions, and tiered implementation strategies.

These roadmaps served as both decision-making tools for homeowners and analytical inputs for evaluating the broader outcomes of the LEEP10 pilot.

5. Retrofit Roadmaps

The IDP described in Section 4 produced individualized, detailed plans rooted in the homeowners' lived experiences, budget constraints, and best-available technologies and building science practices. While the specific measures varied depending on building condition, homeowner priorities, and technical constraints, several consistent strategies emerged across the cohort.

To support both immediate performance improvements and long-term decarbonization, retrofit recommendations were organized into a two-phased framework. This structure allowed homeowners to implement cost-effective upgrades in the near term while preserving a clear pathway toward net zero performance over time.

Sequencing and Asset Renewal

A key principle of the retrofit strategy framework was sequencing upgrades to align with asset renewal cycles. Certain measures, particularly exterior envelope improvements, are most financially viable when combined with planned renovations such as siding replacement, roof replacement, or major window upgrades.

By integrating energy upgrades with asset renewal events, homeowners can significantly reduce the marginal cost of performance improvements. The two-phase retrofit plans developed through the IDP process made these sequencing opportunities visible to homeowners, enabling them to plan improvements strategically over time.

Phase 1 – Achieving 50% Energy and GHG Reductions

Across the ten participating homes, Phase 1 strategies consistently prioritized measures that delivered the strongest return on investment and achieved the biggest energy savings.

Common Phase 1 recommendations included ventilation improvements, attic insulation upgrades, targeted window/exterior doee replacement, foundation insulation, cold-climate variable speed heat pumps, and electrical optimization.

Ventilation improvements

Ventilation upgrades were recommended in every participating home. All homes lacked adequate mechanical ventilation or relied on outdated systems that did not provide consistent air exchange. This made it the single most important action each home needed first to address several objectives simultaneously:

- Improved indoor air quality
- Moisture control
- Occupant comfort
- Compatibility with increased airtightness from envelope improvements

Attic insulation upgrades

Where homes had an attic, blown cellulose insulation was identified as one of the most cost-effective energy conservation measures. Increasing insulation levels significantly reduced heat loss with relatively low cost and construction complexity.

Targeted window/exterior door replacement

Rather than recommending full window replacement packages, the design team prioritized replacement of the least efficient or most problematic windows and exterior doors. This targeted strategy improved performance while controlling costs.

Foundation insulation

Where homes were loosing most heat through their foundation, foundation insulation was incorporated into phase 1. In homes with accessible foundations, insulating foundation walls or slabs offered additional opportunities to reduce heat loss.

Cold-climate variable-speed heat pumps

Electrification of space heating represented one of the most significant opportunities for emissions reduction. Variable-speed heat pumps were recommended in all homes due to their ability to operate efficiently across a wide range of heating loads.

These systems also provide flexibility for future envelope improvements because their output adjusts as building performance changes. Their ability to operate at variable speeds avoids frequent on/off cycling of an improperly sized traditional heat-pump, saving energy and reducing operating costs. Variable speed heat pump soft start technology has a lower amperage draw at start-up than traditional single-stage heat pumps, reducing the need for electrical panel upgrades and making them much easier to run on solar and battery systems.

Electrical optimization

Electrical load calculations were conducted to determine whether service upgrades were necessary to support electrification. In many cases, careful equipment selection and load management allowed heat pumps to be installed without upgrading the electrical panel.

Together, these measures provided substantial reductions in both energy use and emissions while maintaining manageable implementation costs.

Table 1: ECM by Phase

Energy Conservation Measure	50%/50% (Phase 1)	Net zero pathway (Phase 2)
Heat Pump	10	0
Ventilation	10	0
Windows/Doors	10	5
Other	8	0
Insulation - roof/attic/ceiling	6	4
Insulation - foundation	4	7
Solar	3	7
Hot water	2	0
Insulation - exterior walls	2	8
Electrical service upgrade potential	2	0
Air Sealing - stand alone[4]	1	0

Phase 2 – Pathway to Net Zero

Phase 2 strategies outlined the additional upgrades required to achieve net zero performance over time. These measures typically involved more extensive envelope improvements and renewable energy integration.

Because of their cost, Phase 2 measures were framed as long-term opportunities at asset renewal stage, rather than immediate requirements. Once Phase 1 retofits are complete, these measures have an opportunity to be funded through capitalization.

Common Phase 2 recommendations included exterior wall over-insulation, founation inslation, comprehensive window upgrades, and solar PV.

Exterior wall over-insulation

Adding continuous exterior insulation significantly improves thermal performance by reducing thermal bridging and increasing wall R-values. However, this measure is most cost-effective when combined with siding replacement or other exterior renovations.Exterior insualtion also provides for climate resilience – more consistent inside temparatures and fire smart insulation.

Foundation insulation

In homes with accessible foundations, insulating foundation walls or slabs offered additional opportunities to reduce heat loss.

Where foundations were not a substantial heat sink, foundation insulation was incorporated into phase 2 retrofits.

[4] The IDP only recommended standalone air-sealing in one home. This home had natural well-maintained cedar siding in excellent condition which may never be replaced. The home interior is very tidy and un-cluttered so aerobarrier was recommended (an inside application).

Comprehensive window upgrades

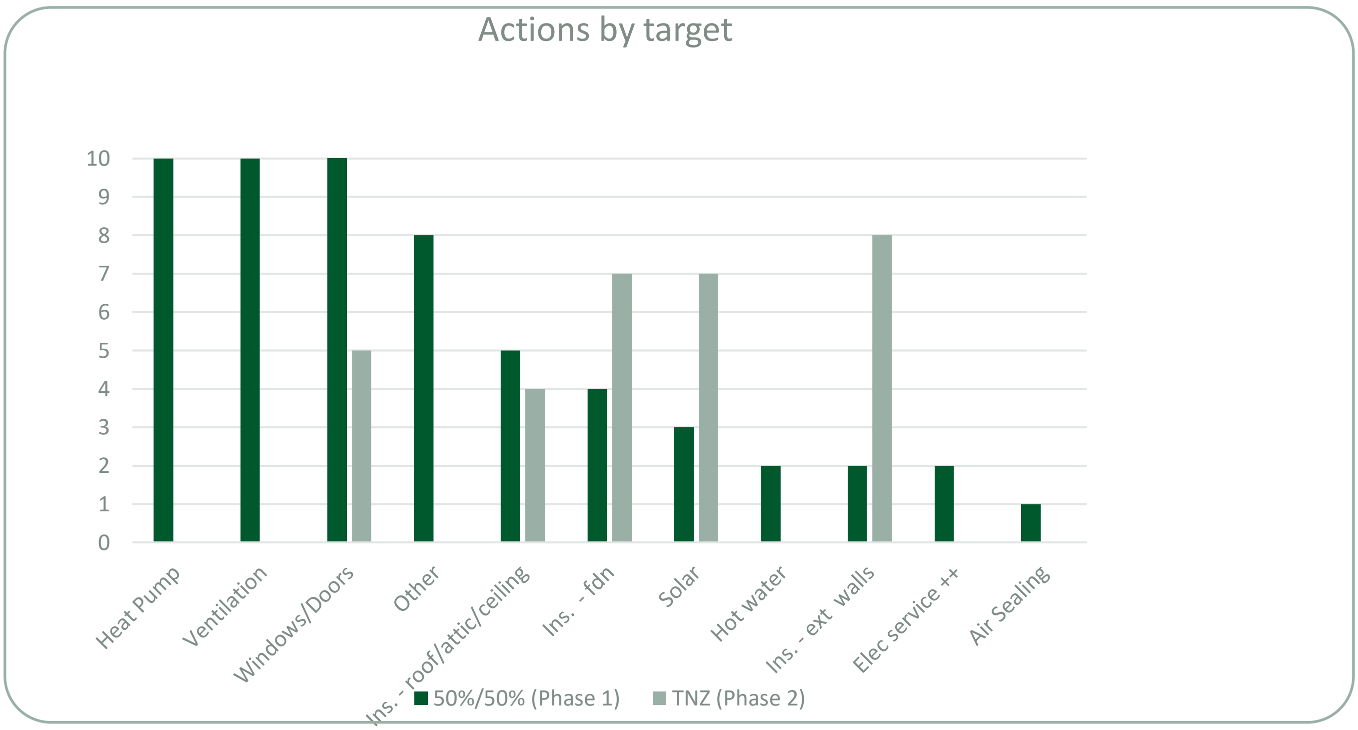
Full replacement with high-performance units was recommended as part of the long-term pathway.

Solar photovoltaic (PV) systems

Solar PV systems were included in many phase 2 plans to offset remaining electricity demand and enable net zero energy performance.

These measures were sequenced to align with future renovation cycles based on asset condition and the need to replace siding material or a roof, allowing homeowners to integrate energy upgrades with necessary asset renewal stages, planned maintenance or aesthetic improvements.

Figure 2: Retrofit Actions Recommended by Phase



Electrical Load Optimization

Electrification often raises concerns about electrical service capacity. Many homeowners assume that switching to heat pumps will require expensive panel upgrades.

As part of the IDP process, electrical load calculations were performed to evaluate this assumption.

Electrical panels in two of the ten were assessed for load capacity. This was because both panels were 100 amps and it was necessary to check that the panel could accommodate the operation of a heat pump. Both did have enough capacity to power a heat pump and did not need to be upgraded to increase their capacity.[5]

Demonstrated peak electrical load assessment may be assumed to be unnecessary for homes of 200 amps+ that are already all electric. Homes that are at 100-150 amps with fossil fuel burning heating and/or hot water can be assumed to need this assessment prior to fully electrifying.

Homes with 100 amp service were able to accommodate heat pump installations without requiring panel upgrades. This was achieved through:

- Demonstrated load calculations
- Proper equipment sizing
- Load management strategies

These findings suggest that electrification barriers may be overstated in some retrofit contexts, particularly when careful planning is undertaken.

Comparing ECMs recommended by the EnerGuide Assessments with those recommended by the IDP process

The EnerGuide assessment reports:

- Do not recommend ventilation as an ECM retrofit measure. This is because ventilation is not considered to be an energy conservation measure and is instead classified as a non-energy benefit. This is a fundamental gap in the EnerGuide assessment process which could be solved with the simple addition of a humidity or moisture test.
- Recommend seven homes get supplementary roof/attic/ceiling insulation and seven homes insulate their exterior walls.
- Did not evaluate the electrical panel size and its capacity to service additional equipment like a heat pump.

In comparison IDP recommends:

- Adding ventilation to all ten homes,with ventilation considered the single most important critical action each home needs first.
- Installing variable speed heat pumps in all ten homes.
- Gradual air sealing planned in conjunction with other actions such as window/door replacement, over insulation, attic insulation, roof repair, replacement, etc.
- Five homes get supplementary roof/attic/ceiling insulation and two homes insulate their exterior walls.
- Investigating panel capacity at each home identifying two homes with 100 amp services.

[5] One homeowner chose to upgrade their service for discretionary uses only – the future addition of a hot tub, RV connection, they would not have needed for the home itself.

Strategic Insights from the Retrofit Roadmaps

Across the ten participating homes, several strategic insights emerged from the retrofit planning process:

- Achieving approximately 50% energy reduction is technically feasible and financially rational
- Moving from 50% reduction to net zero requires significantly greater investment and careful sequencing
- Ventilation improvements are universally required in existing homes
- Electrification barriers are often lower than expected when electrical capacity is properly assessed
- Asset renewal timing strongly influences the cost-effectiveness of envelope upgrades

These insights informed both the financial analysis presented in the next section and the broader strategic learnings discussed later in the report.

6. Financial Analysis and Cost Outcomes

IDP Costs

One of the key features of the LEEP10 pilot was that the IDP was fully funded. Approximately $6,800 per home supported the technical planning required to develop two-phase performance-based retrofit plans.

This funding covered:

- Pre-retrofit EnerGuide evaluations
- F280-12 heat loss calculations
- Electrical load analysis
- Digital building capture and modelling preparation
- Energy modelling and scenario development
- All-trades site visits and IDP design meetings
- Development of phased and costed retrofit roadmaps
- Homeowner consultation and plan refinement

The pilot demonstrated that this level of funding was sufficient to support a rigorous, collaborative planning process involving multiple technical disciplines.

At the same time, while participants consistently reported that the retrofit roadmaps were valuable and informative, none indicated that they would have voluntarily paid the full cost of the IDP process. This suggests that public or utility funding for retrofit planning is likely necessary if deep energy retrofits are to scale beyond early adopters.

Retrofit Implementation Costs

It is significantly cheaper and more cost effective to undertake phase 1 retrofits to 50% energy and GHG reduction, than to implement phase 2 retrofits that move from 50% energy reductions to net zero. This is largely because majority of phase 1 measures could be implemented without major structural changes to the building envelope, helping control costs and minimize disruption for homeowners. This also provided homeowners with an easy entry starting point for their energy retrofits.

Across ten homes, the average projected cost of phase 1 retrofits was $104,350 while the average cost of phase 2 retrofits was $251,444.

Analysis of modelling results and cost estimates revealed a clear pattern: the cost per unit of energy saved increases significantly as retrofit depth increases beyond the 50% reduction threshold.

The average cost per GJ saved for phase 1 retrofits was $1,575, and for phase 2 retrofits was $42,303.

Table 2: Implementation Cost

	Phase 1 50% GHG/energy sav.	Phase 2 50% to NZ incremental	Total NZ total
Min	$42,513	$74,085	$166,920
Avg	$104,350	$251,444	$326,012
Max	$143,378	$485,000	$512,412

Table 3: Cost $ Per GJ saved

	Phase 1 50% GHG/energy sav.	Phase 2 50% to NZ incremental	Total NZ total
Min	$774	$3,798	$1,899
Avg	$1,578	$42,303	$8,303
max	$2,477	$130,917	$ 23,038

Comparing The Value of Energy Conservation Measures

Phase 1 strategies provided the strongest return on investment when evaluated in terms of energy savings per dollar spent. As a result, they represent a practical milestone for homeowners seeking meaningful reductions in energy use and emissions without undertaking extensive exterior renovations.

Mechanical Energy Use Intensity (MEUI) measures the annual energy consumption of a building's mechanical system, per unit of floor area (m^2). MEUI can be used to understand the potential value of a proposed retrofit by comparing the dollars ($) per MEUI saved.

The data shows that Phase 1 retrofits to reach 50% energy and 50% GHG reductions is very cost effective when comparing the MEUI ($2,081 per MEUI saved).

This is because Phase 1 aims to achieve 50% energy reductions using cost optimized ECMs with the highest return on investment (ROI). The most cost-effective retrofits to achieve 50% energy reductions are:

- Blown-in attic insulation
- Installation of an HRV
- Foundation Insulation
- Installation of a variable speed heat pump
- Targeted fenestration of the very worst performing windows and exterior doors (i.e., not the whole window/door package)

These measures delivered substantial reductions in energy use and emissions while remaining financially achievable for homeowners.

Conversely, Phase 2 retrofits that take a house from 50% energy reductions to net zero are a significantly greater investment with lower ROI — $11,850 per MEUI saved.

Table 4: Cost ($) per MEUI Saved

Phase	$ to reach each phase (averaged across 10 homes)	$ per MEUI saved (averaged across 10 homes)
Phase 1 – 50%/50%	$104,350	$2,081
Phase 2 – 50% to Net Zero	$251,444	$11,850
Total net zero cost - Phase 1 + Phase 2	$326,012	$6,311

Table 5: cost ($) per KWH & GJ Saved

Phase	$ to reach each phase (averaged across 10 homes)	$ per kWH and GJ Saved (averaged across 10 homes)	Average GJ Reduction
Phase 1 – 50%/50%	$104,350	$1,578	70
Phase 2 – 50% to Net Zero	$251,444	$42,303	14
Total net zero cost - Phase 1 + Phase 2	$326,012	$8,303	85

7. Implementation Status and Early Performance

This section summarizes the implementation status at the time of reporting and highlights early performance observations from homes that completed Phase 1 retrofits. While the number of completed retrofits remains limited, these early results provide important insights into both technical outcomes and market barriers.

At the completion of the planning phase, all ten participating homes had received detailed retrofit roadmaps outlining Phase 1 and Phase 2 measures.

However, implementation varied significantly across participants. Of the ten participating homeowners:

- Nine intend to proceed with retrofits
- Two decided to immediately proceed with a deep energy retrofit in October and November 2025
- Two are considering moving ahead with a deep energy retrofit in the spring of 2026
- Five are proceeding with the work themselves because they have family members with construction experience and are choosing to proceed alone with the recommended scope of work

Although homeowners expressed strong interest in the retrofit plans, the transition from planning to construction depended heavily on access to loans and rebates.

Case Example: House #7

There were no Phase 1 recommendation for this home because this homeowner was already planning to replace their siding material this year. Retrofits undertaken in 2025 included:

- + R32 cellulose insulation to the attic (total R53)
- + R12 woodfiber over-insulation under new cladding (total R24)
- + a triple pane entry door (USI1.02)
- + ductless ventilation in the main and rental suite
- Roughed-in ductless heat pump for the rental suite
- Roughed-in solar

Total Change in Energy Consumption (modelled & measured)					Total GHG Reductions (EnerGuide vs. Actual)				
Projected Change			Measured Change*		Projected GHG Reductions – pre-retrofit			Actual GHG Reductions – post retrofit**	
Current GJ	Potential GJ	Reduction %	GJ	%Reduction	Current GHG tonnes/yr	Potential GHG tonnes/yr	% Reduction	GHG tonnes/yr	Reduction %
82	43	52	80	3%	0.4	0.2	50	0.4	0%

**A mudroom was added during the retrofit which added 8% floor space to the property. This prevented like for like comparisons on the pre- and post-EnerGuide assessment.*

*** This house was already fully electrified at the beginning of the process.*

The pre-Energuide assessment and post-EnerGuide assessments are not directly comparable as the homeowner added a mudroom to the home, creating an additional 8% floor space. Major energy savings will be realized when the roughed-in rental suite heat pump and solar are installed.

Modelled energy intensity reduction for the completed scope of work was 12% with a second heat pump.

Achieved energy intensity reduction for the completed scope of work was 10% without a second heat pump, and with the addition of 8% more square footage (mudroom) between the pre- and post-energy audits.

Homeowner Benefits:

- Already experienced warmer in winter – looking forward to being cooler in summer!
- Quieter inside the home.
- Fresher indoor air quality
- Temperature stability and comfort vastly improved.

Case Example: House #10

Phase 1 recommended retrofits undertaken in 2025:

- Replace existing undersized 58 cfm HRV with a 75% SRE HRV, right sized
- Add UV treatment to HRV for health reasons
- Add insulation to the basement cubby
- Replace all doors and windows
- Add cellulose insulation to the attic +R30
- Add 3 head ductless heat pump
- No electrical service upgrades
- Change and decommission propane hot water to standard electric resistance
- Solar and exterior over insulation deferred to a future time

Total Change in Energy Consumption (modelled & measured)					Total GHG Reductions (EnerGuide vs. Actual)				
Projected Change			Measured Change*		Projected GHG Reductions – pre-retrofit			Actual GHG Reductions – post retrofit**	
Current GJ	Potential GJ	Reduction %	GJ	% Reduction	Current GHG tonnes/yr	Potential GHG tonnes/yr	% Reduction	GHG tonnes/yr	% Reduction
121	52	43	79	45	2.4	0.6	25	0.7	24

Post retrofit audit results match the modelled outcomes: 45% energy savings and 100% GHG reduction as a result of the transition to electric heating. The total cost of retrofits is less than $80,000 representing approximately $1,900/GJ.

Homeowner benefits:

- Focus for this home is energy, comfort, and HEALTH
- Temperature stability and comfort vastly improved
- Increased comfort, aesthetics and health outcomes. This family has respiratory illnesses and are loving the fresh clean indoor air quality
- Improved indoor air quality

This case provides early validation that the Integrated Design Process can produce technically sound retrofit pathways capable of achieving performance improvements while meeting homeowner goals such as improved health and comfort.

8. Key Learnings and Insights

The LEEP10 pilot generated a range of technical, market, and program design insights that extend beyond the ten participating homes. These findings reflect both the modelling outcomes produced through the Integrated Design Process and the real-world experience of homeowners, the general contractor, energy advisors, tradespeople, and program partners working within the pilot framework.

1. Retrofit Planning Must Be Target-Driven and Collaborative

One of the clearest lessons from the pilot was that retrofit planning becomes significantly more effective when it begins with clearly defined performance targets.

In the LEEP10 pilot, the design process was anchored around two specific objectives:

- Achieving approximately 50% reductions in energy use and greenhouse gas emissions
- Establishing a credible pathway toward net zero performance

There needs to be up-front agreement between the homeowner, funders, and the GC that the costed retrofit plan be structured toward achievement of specific energy/GHG targets. This creates the conditions for a more efficient process, and development of clearer recommendations. Through the targets lens, future renovations will be informed by retrofit actions, rather than retrofit actions being squeezed into renovations. This approach supports the integration of four factors:

- Homeowner energy efficiency and comfort priorities/pain points
- Energy modelling data
- House-as-a-system risks and opportunities
- Homeowner budget/financial capacity to implement

> ***"We were previously thinking about new windows and doors but realized that wasn't the best return on investment."***

A plan to net zero is essential. This provides a road map on how the home can most cost effectively reach net zero following House-as-a-System (HAAS), working toward net zero as budgetary conditions allow. This plan should stay with the house informing the retrofit process until net zero is achieved.

This outcome-focus must also be balanced with flexibility, with program partners empowered to effectively collaborate and contribute to how goals are achieved.

The LEEP10 pilot would not have progressed without early inter-sectoral collaboration, a commitment to the cause, and shared willingness to pivot to overcome barriers and obstacles together. The pilot combines the funding, technical capacity and commitment to act of public, private and non-profit organizations.

2. Homeowners Will Not Pay for Integrated Design Process

Having a costed roadmap on the specific and necessary steps to take to achieve 50%/50% energy and GHG savings is a valuable and empowering document with the potential to save homeowners significant operational costs and extending the lifespan of their home. However, even as homeowners consistently reported that the retrofit roadmaps produced through the IDP were valuable, the pilot revealed that the market currently does not support homeowner-funded planning at the depth required for deep energy retrofits.

The IDP process required approximately $6,800 per home to support modelling, trade coordination, and development of phased retrofit strategies.

This suggests that if governments or utilities wish to encourage deep energy retrofits, funding for retrofit planning will likely remain necessary, at least in the near term.

Without such support, planning processes may revert to simplified quote-based approaches that lack the technical rigor needed for high-performance outcomes.

3. EnerGuide Assessments and All-Trades Site Visits Are Essential

An EnerGuide assessment is basic and essential to the retrofit IDP process and must serve as the starting point. It is needed to:

- Understand how the house operates as a system and specifically where energy and heat is being lost
- Enable F280-12 heat loss and gain calculations, which in turn informs HEET software, which cost-optimizes the outcome ECM recommendations to identify the specific items (ECMs) that need to be retrofitted (e.g., specific windows instead of the whole window package, recommended by EnerGuide).

The all-trades discovery meeting conducted at each home proved to be one of the most valuable elements of the pilot; a virtual equivalent is not adequate to the task. Bringing the homeowner, general contractor, energy advisor, and key trades together in the home allowed the group to:

- Create efficiency in the process through scheduling demands
- Build trust within the team and with the homeowner by forcing unscripted discussion and multi-party assessment of the home in the presence of the homeowner
- Efficiently build a shared understanding of the home between trades and avoid unintended consequences
- Identify technical constraints early in the process
- Discuss sequencing considerations
- Resolve potential conflicts between different upgrade strategies

This collaborative format significantly reduced the risk of conflicting recommendations and improved communication across the pilot project team and the IDP and technical team. It also strengthened homeowner confidence in the process by allowing them to interact directly with the professionals involved in designing the retrofit plan.

4. Fifty Percent Energy Reduction Is the Most Cost-Effective Milestone

LEEP10 demonstrated that reaching 50% energy and 50% GHG reductions is very cost effective compared to reaching net zero. Retrofit pathways for each pilot home recommended ECMS that would deliver substantial reductions in energy use and emissions while remaining financially achievable for homeowners.

Measures required to reach this level typically included:

- Heat pump installation
- Ventilation upgrades
- Attic insulation improvements
- Targeted window replacement
- Foundation insulation

Moving beyond the 50% threshold toward net zero performance required significantly greater investment, particularly in envelope improvements.

A 50% target can be a blunt instrument and scheduling the retrofits into two stages could discourage progress past 50% reductions. This can be avoided by simply listing all ECMs in prioritized sequence and not referencing a specific target at the half away stage. The above analysis is useful to demonstrate the benefits of cost optimization, front-loading ECMs into Phase 1 that are within financial reach of homeowners with 0% or limited loan support.

5. Ventilation Is Universally Required but Underrepresented

Across the ten participating homes, ventilation improvements were recommended in every case. This was determined with a combination of the EnerGuide airtightness assessment, visual and olfactory assessment on site (see moisture, smell moisture), and discussion with homeowner about their experience of their home. The presence of mechanical ventilation does necessarily mean adequate ventilation.

Many homes either lacked mechanical ventilation systems or relied on systems that were no longer providing adequate air exchange.

Inadequate ventilation can be more difficult to solve than heating and cooling issues for a number of reasons:

- New ducting is expensive and disruptive
- The risks of poor ventilation and benefits of proper ventilation are not well understood by consumers or even by some GCs and trades
- There are no standards in the building code for ventilation in existing buildings
- Ductless ventilation is not well understood or commonly implemented in Canada, despite prevalence in Europe

Given these challenges, a good enough or incremental solution may be the only approach to ensure that some form of ventilation is agreed to and implemented by the homeowner.

Despite its importance, ventilation is not consistently emphasized within current retrofit programs or EnerGuide upgrade recommendations. The pilot highlighted ventilation as a systemic gap within many existing retrofit frameworks.

6. Program Management and Rebate Navigation Are Critical

The pilot also demonstrated that aggregated retrofit initiatives require dedicated program management.

Responsibilities shared by the program manager and the concierge team (Retrofit Assist) included:

- recruiting and coordinating homeowners
- coordinating and ensuring accountability across teams
- creating and sharing supporting documentation and reporting
- assisting homeowners with rebate and financing applications

Separating this administrative role from the contractor helped maintain trust and allowed the technical team to focus on design and construction.

7. Major Air Sealing Is Rarely a Standalone Retrofit Strategy

Contrary to the retrofit golden rule of an envelope-first approach with mechanical systems installed as a secondary measure, the pilot revealed that extensive air sealing is not effective as a standalone retrofit measure in occupied homes (achieving only 10% air change reductions).

The LEEP10 team determined that air sealing could be most effectively implemented as part of other major envelop upgrades such as fenestration replacement, attic insulation, and exterior over insulation. Even when minor air sealing improvements were incorporated alongside other upgrades, large reductions in air leakage were rarely achievable without more comprehensive envelope renovations.

This approach makes it vital that heat pumps are sized appropriately to balance current and future expected heat loss/gain, based on the most likely energy conservation measures, which is why a variable speed heat pump is essential to energy retrofits undertaken over time.

8. Variable-Speed Heat Pumps Enable Phased Retrofit Strategies

Cold-climate variable-speed heat pumps were recommended in all ten participating homes.

These systems offered several advantages within the retrofit context:

- they can operate efficiently across a wide range of heating loads
- they adapt well as envelope performance improves over time
- they support electrification without requiring immediate envelope upgrades

Because their output can modulate as building conditions change, variable-speed heat pumps are particularly well suited to phased retrofit strategies where envelope improvements may occur later at asset renewal stage.

9. Exterior Insulation Is Most Effective When Combined with Asset Renewal

Exterior wall insulation emerged as one of the most powerful envelope improvements for reducing heat loss. However, it is also one of the most expensive measures when undertaken independently.

The pilot demonstrated that exterior insulation becomes far more financially viable when combined with asset renewal events such as siding replacement. By aligning energy upgrades with asset renewal, planned maintenance or renovation activities, homeowners can reduce the marginal cost of improving building performance.

This reinforces the importance of sequencing retrofit measures rather than attempting to achieve maximum performance in a single renovation.

10. Electrification Does Not Always Require Panel Upgrades and electrical load assessments can be unnecessary

Electrification is often assumed to require major electrical infrastructure upgrades, particularly in older homes. However, electrical load analysis conducted during the pilot demonstrated that several homes were able to install heat pumps without upgrading their electrical panels. Through careful load calculations and appropriate equipment sizing, homes with 100-amp electrical service were still able to accommodate electrified heating systems.

Electrical load assessments can be assumed to be unnecessary for homes of 200 amps+ that are already all electric. Whereas, homes that have 100-150 amp capacity with fossil fuel burning heating and/or hot water still need this assessment prior to fully electrifying.

11. Aggregation and Compensation Improve the Retrofit Outcomes

Finally, the pilot demonstrated that aggregating multiple homes within a defined geographic area can improve the efficiency of retrofit delivery. The GC and IDP team noted that the LEEP10 IDP process was time and cost efficient, generated more comprehensive and viable retrofit recommendations, supported positive homeowner relations, and improved the business model for retrofits.

The financial analysis of the business model benefits will take up to one year to review, however, it is already clear that the paid-IDP model reduced risk for GCs and trades by eliminating the free quote model and replacing it with a data-robust ECM analysis, planning, and quoting process. It ensured that the entire team was engaged throughout the IDP process by properly compensating them for their time and expertise. It also induced buy-in and engagement from the homeowner because the known cost was understood to equate to value.

Benefits observed through the aggregated and compensated model applied in LEEP10 include:

- reduced travel time for contractors
- improved coordination and collaboration between trades
- shared learning across projects
- more efficient scheduling of site visits and design meetings
- homeowner buy-in and support

Aggregation also allowed the GC to approach retrofit planning as a structured design process rather than a series of independent renovation quotes. However, aggregation also requires centralized coordination and stable financing support to sustain implementation across multiple homes.

Governments seeking to reduce energy demand and GHGs must be willing to pay for the cost of credible IDP retrofit plans. Based on the LEEP10 pilot it seems viable to cap the per home allowance for IDP, thereby avoiding the price escalation commonly seen when rebate programs are introduced.

12. Implementation Special Consideration – Hot Water Heat Pumps, Cellulose, Solar, and Radon and Hazmat

Hot Water Heat Pumps

Heat pump hot water did not surface as a priority. Only 1 home had a practical location for a heat pump tank within the conditioned living area of the home. In no case did our analysis indicate that a heat pump hot water tank would be a better investment than other higher homeowner prioritized items.

Switching to heat pump hot water was perceived to draw available funds away from other actions that would directly resolve homeowner pain points. In short, in homes that are already all-electric and in a community that is already largely all electric, there are no strong drivers for switching to heat pump hot water.

Even in the two homes with 100amp services, there was no need to explore heat pump hot water, in order to allow for installation of heat pump heating and cooling. Heat pump hot water could be part of a path to net zero to avoid panel upgrades, where there is an appropriate space inside a home to accommodate one.

Blown-in Cellulose

All homes with attics (6 of 10 homes) received recommendations to add blown in cellulose insulation in Phase 1. It is very effective and very cost-effective, providing a high return on investment.

The remaining 4 homes had cathedral ceilings, and so roof/ceiling insulation recommendations were deferred to Phase 2. This was due to prohibitive cost or lack of timeliness for undertaking a major home upgrade (e.g., roof was recently replaced, re-clad, etc.).

Solar PV

In 9 of 10 homes, solar was recommended to be implemented after other major energy efficiency upgrades, usually in Phase 2. Only one home had a Phase 1 solar recommendation and even then only in conjunction with other upgrades.

Priority was put on lowering energy demand first, then offsetting that demand with PV solar. Since the LEEP10 pilot took place in a predominantly all-electric community with no natural gas service, the GHG reduction from PV is nominal at best with the primary benefit being energy bill reduction.

Radon & Hazmat

While they are likely beneficial for homeowners and part of a home safety inspection, radon testing and hazardous materials assessments are not critical elements of a retrofit IDP. Hazmat assessment is governed in BC by WorkSafe BC regulations and must be implemented by any GC or trade prior to commencement of construction. A reputable GC will include comment in their proposal about materials that may need to be tested prior to starting home energy renovation.

9. Conclusion

The LEEP10 pilot was intentionally designed to test whether an aggregated, neighbourhood-scale approach led by a single general contractor and supported by an IDP could offer a credible pathway to scaling deep energy retrofits while also creating a viable business case for industry. The pilot offers a clear direction: fund the planning, stabilize the financing environment, aggregate delivery, and anchor programs around measurable performance targets.

Based on the evidence available at the conclusion of the design phase, the pilot has largely achieved its deep energy retrofit planning goals. All ten homes received comprehensive, house-as-a-system retrofit plans grounded in robust technical assessments and aligned with clear performance targets.

LEEP10 provides credible evidence that aggregated, performance-targeted retrofit planning is technically sound, operationally efficient, and replicable at community scale. However, without stable financing mechanisms and public support for planning costs, deep energy retrofits will not scale at the pace required to meet Canada's 2050 climate objectives.

Cost-optimized Phase 1 pathways demonstrated that achieving approximately 50% energy and GHG reductions (where fuel switching) is technically feasible and comparatively cost-effective, while Phase 2 pathways established credible, sequenced roadmaps to net zero. The consistent finding that Phase 1 measures deliver the strongest value reinforces the importance of target-driven programs paired with long-term planning horizons. While full performance validation will occur during the two-year monitoring period, the quality, consistency, and rigor of the retrofit plans indicate that the pilot successfully met its core technical and climate objectives.

The pilot also delivered meaningful, if more nuanced, results with respect to the business case goal. From a contractor perspective, aggregating ten homes within a tight geographic area and managing them under a single project structure demonstrated clear efficiencies in coordination, travel time, trade engagement, and knowledge transfer.

This validates the premise that an aggregated model can reduce delivery friction and create a more attractive, repeatable workflow for builders. However, the pilot also surfaced a critical barrier to scalability: homeowners do not yet recognize the value of an IDP and are unwilling to pay for it without external support. This confirms that, under current market conditions, IDP and program management must be externally funded if deep energy retrofits are to scale at the pace required.