PART 1: PROJECT DESCRIPTION FOR THE FALKLAND PROJECT

PROJECT SUMMARY

The Falkland Street Deep Retrofit transforms an 1850s timber-frame house in Halifax's North End into a high-performance office and public demonstration space. Located within a heritage conservation district, the two-storey building retains its original wood shingles, fieldstone foundation, and irregular structural geometry. Pursuing the EnerPHit Standard for Passive House retrofits, the project balances ambitious energy-efficiency goals with the preservation of historic character. Significant constraints, including the requirement to maintain the heritage façade, party walls that prevented the use of exterior insulation, geometric irregularities, and moisture risks inherent in the original wood sheathing—shaped the design approach.

To address these challenges, the retrofit incorporates continuous airtight and moisture-safe assemblies using Intello Plus air and vapour control membrane, triple-glazed Passive House windows, high-efficiency ventilation, dense-packed cellulose insulation, and low-VOC, bio-based interior materials. Modeling in PHPP informed performance decisions and ensured alignment with EnerPHit requirements. The completed project achieved substantial improvements, including an 88 percent reduction in heating energy, an 86 percent reduction in total energy use, and a 90 percent decrease in greenhouse gas emissions (GHGs). A pre-retrofit EnerGuide audit documented air leakage of 24 air changes per hour and 352 GJ per year electrical consumption with annual emissions totaling 72.4 tonnes of CO_2e, underscoring the impact of the transformation.

PART 1: MAIN PROJECT DESCRIPTION

1. STRATEGIC DECISIONS

The retrofit of the 1850s Falkland Street house began with a deep respect for the building's original form and the tight urban fabric that surrounds it. The structure sits pressed against its lot lines, its north façade meeting the street and its west wall sharing a party wall with its neighbour. These constraints shaped every design move, guiding the team toward an inward, envelope-first strategy that could elevate performance without disturbing the heritage character that anchors the home to its neighbourhood. The decision to retain the original wood shingles and board sheathing required a careful choreography of moisture-safe assemblies, designed for drying potential, while gaining the insulation and airtightness needed for EnerPHit performance.

Inside, the plan was reorganized to create a calm, healthy workplace that could also serve as a public demonstration of Passive House principles. The south elevation was opened to daylight, its glazing expanded to welcome warmth and light deep into the interior. Energy modelling shaped the final balance of insulation, window placement, and ventilation, ensuring that the building's historic envelope could support a modern, low-carbon future. The result is a structure that carries its past forward, its performance quietly transformed behind familiar materials and proportions.

2. COMMUNITY

The project strengthens its community not through grand gestures, but through the quiet generosity of opening its doors. As a demonstration project supported in part by Efficiency Nova Scotia, 24 tours were hosted during construction, inviting the public to view layers of insulation, meticulous workmanship and the building
systems that make high-performance retrofits possible. Tours continue to be offered since project completion to provide opportunities for visitors to

learn about the technical aspects of the retrofit and so they might experience a Passive House environment firsthand.

Falkland's walkable
location reduces reliance on cars and reinforces the value of compact, urban living.

By choosing to retrofit rather than rebuild, the project preserved the cultural memory of the street while demonstrating a path toward climate-resilient neighbourhoods.

3. SITE ECOLOGY

The site is modest in scale, yet its ecological considerations were significant. A mature maple tree on the south side shaped decisions about solar potential and shading, its presence both limiting rooftop photovoltaics and offering a natural buffer to summer heat. The decision to retain the existing structure and foundation avoided the environmental cost of demolition, allowing the embodied carbon of the original materials to remain stored in place.

Water management and habitat creation were subtle rather than overt, expressed through the preservation of the garden and the careful protection of the building envelope against moisture. The retrofit works within the boundaries of its small lot, demonstrating that ecological sensitivity can be woven into even the most constrained urban sites.

4. LIGHT AND AIR

Daylight and fresh air were treated as essential elements of comfort, shaping the placement of new triple-glazed windows and the expansion of south-facing openings. The building's interior now enjoys abundant daylight that shifts throughout the day, illuminating workspaces and social areas with a quiet steadiness.

Fresh air is delivered through an Alnor high-efficiency energy recovery ventilator that filters and tempers incoming air, creating a stable indoor

environment that feels both calm and invigorating. The dramatic improvement in airtightness, from a drafty 24 air changes per hour to under 4, allows the ventilation system to perform with precision, ensuring that every room receives consistent, healthy airflow. The result is a building where light and air work together, creating a sense of ease that belies the complexity of the systems behind it.

5. WELLNESS

Wellness guided the selection of materials and the shaping of interior spaces. Locally sourced plant-based paint and other plant-based finishes, and cellulose insulation create an environment free from harsh chemical smells and irritants. Natural textures, reclaimed beams, terrazzo tile, wood trim, and cork linoleum, bring warmth and tactility to the workplace, grounding occupants in a sense of calm.

Air quality is continuously monitored, with sensors tracking carbon dioxide, humidity, particulates, and volatile organic compounds. This quiet layer of intelligence ensures that the building responds to its occupants, maintaining comfort and clarity of air throughout the day. Social spaces, from the meeting room to the library, encourage collaboration and connection, supporting both the physical and psychological well-being of the people who work and gather here.

To provide data on the promise of Passive House, the team is conducting internal surveys to document comfort and wellness in different seasons and conditions.

6. WATER CONSERVATION

Water use in the building remains simple and efficient, reflecting the modest needs of a small office. While the project did not incorporate rainwater harvesting or greywater reuse, the compact program and low-flow fixtures keep consumption low. The focus of the retrofit remained on energy, comfort, and durability, allowing water systems to remain straightforward and reliable.

7. OPERATING ENERGY PRESENT AND FUTURE

The building's mechanical systems were chosen to complement the strength of its upgraded envelope. A 2-ton ducted mini-split heat pump serves the Passive House zone, delivering quiet, even heating and cooling throughout the upper floors. The basement, treated as a separate thermal zone, is conditioned by a 1-ton mini-split system. Together, they create a layered approach that respects the building's form and the differing needs of its spaces.

The building has an EUI of 76 kWh/m2 per year, with a heating demand of 56 kWh/m2 per year and cooling demand of 3 kWh/m2 per year.

The ERV works in harmony with the airtight envelope, dramatically reducing heating demand and stabilizing indoor conditions. With its all-electric systems and a new roof structure designed to support future solar panels, the building is prepared for a decarbonizing grid and a future free from fossil fuels. Its energy use has fallen to a fraction of its former levels, transforming a once leaky structure into a model of low-carbon operation.

8. MATERIALS AND RESOURCES

Material choices were guided by a desire for durability, health, and low embodied carbon. Dense-packed cellulose fills the walls and roof, storing carbon while providing excellent thermal performance. The decision to retain the original wood shingles and sheathing preserved both heritage character and the embodied carbon in the existing envelope.

Interior finishes were selected for their environmental transparency and tactile warmth, from cork linoleum to FSC-certified wood fixtures. Salvaged elements, including reclaimed beams and selected finishes were woven into the design, giving new life to materials that carry the story of the

building's past. Waste was minimized through careful deconstruction and reuse, reflecting a commitment to resource stewardship.

9. BUILDING LIFE CYCLE CONSIDERATIONS

A whole-life carbon assessment using the Building Emissions Accounting for Materials (BEAM) calculator guided the project's major decisions. Models were done comparing the impacts of a Passive House retrofit, a code-minimum retrofit, and a code-minimum new build, and quantified the carbon stored in the original structure. The analysis revealed a carbon savings of 11, 000 kg$C0_2$e retained in the existing structure. The retrofit as completed was responsible for 9,700 kg$C0_2$e, while a conventional renovation would have emitted approximately 25,000 kg$C0_2$e and the new-build scenario producing 36,000 kg$C0_2$e.

Over a 60-year horizon, the Passive House retrofit proved not only the lowest-carbon option but also the most financially resilient, offering significant savings in operating costs and long-term ownership. The project demonstrates that deep retrofits can align environmental responsibility with economic prudence, creating buildings that are both sustainable and enduring.

10. EDUCATION AND INFORMATION SHARING

Education was woven into the project from the beginning. The building became a living classroom during construction, with tours for government officials, students, builders, and community members. Visitors were invited to see the layers of insulation, the taped membranes, and the systems that make high-performance retrofits possible.

Today, the building continues to serve as a demonstration space, offering a tangible experience of Passive House comfort and performance. Through monitoring, tours, and public engagement, it contributes to a growing

culture of building literacy in Nova Scotia, helping to shift expectations and inspire future deep retrofits across the region.