Appendix 2: Literature Review

This section analyzes several papers, documents, and reports and it is organized in the following way:

1. Introduction

2. Jobs Losses and Gains

3. Training Requirements & Annual Investment

4. Equity strategies and partnerships

5. What key initiatives exist in other places that are seeing success?

1. Introduction

Purpose of the Literature Review

This Literature Review aims to identify key areas and knowledge gaps related to the Ecology Action Centre's "Skills for Net-Zero Initiative". This initiative focuses primarily on energy-efficiency –including operational and embodied energy in buildings– and conservation work on Nova Scotia's buildings to transition the province's energy system and economy away from fossil fuels.

Some of the key areas of the research are:

1. The impact of the green-energy transition on the provincial job market, including new opportunities and job losses.

2. Barriers and opportunities for equity-deserving communities.

3. Resources needed for inclusive workspaces.

4. Identifying available educational training assets.

5. Identifying skills needed for net-zero energy building construction and retrofits, including areas where further training is needed

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To develop a knowledge base on the areas mentioned above, this report will use existing data, a survey, and key informant interviews to develop a broader understanding of the complex and different perspectives on the green-energy transition of Nova Scotia. Special attention will be given to address the needs of each unique group and how to address their needs effectively. The existing data consulted originated from studies, governmental, institutional, and company reports, Statistics Canada data, and grey literature documents.

The document review insights contributed to identifying knowledge gaps and key areas of focus, which were later used as focal points during interviews. These were also important areas that were considered during the survey design process.

2. Job Losses and Gains

Background on Nova Scotia's Energy Efficiency

The province of Nova Scotia set emission targets of achieving 80% renewable energy by 2030 and becoming net zero by 2035 - this is for electricity generation (NSPower). These targets were set by the provincial government and align with Canada's commitment as a country to achieve net-zero emissions by 2050 (Canada Gov). This research examines the dynamics of demand and supply in the green jobs market to support Nova Scotia's goal of achieving greater energy efficiency.

To achieve net-zero by 2035 there are two key pathways that Nova Scotia must follow. First, phasing out the generation of electricity through fossil fuels and moving towards renewable energy such as wind and solar energy produced in Nova Scotia, or as part of a shared inter-jurisdictional grid.

Second, improving energy efficiency in homes and buildings, as well as factories, to minimize the strain they place on the electric grid with their heating, cooling, and other electrical demands (NSPower). Using energy more efficiently and creating it through more sustainable mechanisms will play a crucial role in pushing forward the province's net-zero objectives.

One big area that has tremendous potential to advance the province's energy efficiency, and is the primary focus of this project, is improving the energy usage of buildings. According to the Government of Nova Scotia, the third largest source of greenhouse gas emissions in the province is buildings (NS Gov, 2023).

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Improvement in energy efficiency is achieved through retrofits. The Government of Canada officially defines energy-efficiency retrofitting as any upgrade of the building's energy-consuming systems which might involve replacing lighting fixtures, ventilation systems, or windows and doors, or adding insulation where it makes economic sense, in addition to including energy efficiency measures in all the renovation and repair activities (Natural Resources Canada).

In Nova Scotia, where many buildings still rely on heating oil, it is also essential that we electrify our buildings as part of the green transition. Often this will mean installing heat pumps to replace oil furnaces. In summary, these retrofits are meant to reduce the building's operational costs by reducing its energy usage. Retrofits are most often in older buildings, as newer ones tend to follow more efficient energy usage guidelines. To implement these solutions, the government and several agencies have set up a series of incentives and guidelines.

Energy-efficiency retrofits are broken into three main categories: minor, major, and deep retrofits. Minor retrofits can be viewed as easy wins, and include low-cost modifications with a high return on investment by substantially reducing the building's energy consumption. They can include sealing with caulking or spray foam, adding insulation, or upgrading lighting systems.

Major retrofits involve a more holistic approach as they focus on replacing window glazing and doors, updating inefficient heating and cooling systems, installing low-flow faucets with sensors and automatic shut-offs, or installing sub-metering. Although it is a step up from the last category, they are still minimally disruptive to the building's occupants (Natural Resources Canada).

Lastly, deep retrofits involve an extensive overhaul of a building's system and are more disruptive to the occupants, but often generate as much as 60% in energy-cost savings. Alterations can include significantly reconfiguring the interior, replacing the roof, adding or rearranging windows for increased daylight, and replacing the heating, ventilation, and air conditioning system with an efficient technology like a ground-source heat pump (Natural Resources Canada).

Jobs Gained

According to various studies, powering a Green Nova Scotia will generate significant new employment opportunities for the province, as well as hurdles that will have to be overcome to achieve net zero by 2035. The green economy will demand technical expertise for the construction of new energy infrastructure and to provide services like improving home energy efficiency and adopting green transportation technologies (NSPower). We will start by analyzing the potential jobs gained from the green energy transition, followed by the potential job losses.

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As indicated before, buildings have climbed from being the fourth to the third largest emissions source from 2021 to 2023 (Atlantic Economic Council, 2024, and NS Gov). This is largely why it is a focal point for achieving emission reductions, requiring a large number of green building trade workers to implement the solutions. This change in the workforce needs will result in an elevated demand across all renewable energy sector and clean tech sector workers. Ultimately, these efforts will help reduce emissions from this sector and facilitate the transition to a greener economy and improved energy efficiency.

To address the high emission levels from the building sector, both new constructions and the existing building stock will require a significant number of skilled green building trade workers. Many of these workers will come from the traditional trades but will need additional expertise in retrofitting buildings to meet green energy and efficiency standards.

One challenge this presents is the recruitment of sufficient green trade workers to be able to support this expanded workload (Atlantic Economic Council, 2024). Provincial investments in renewable energy projects are expected to help sustain the increasing demand for non-residential construction workers from Nova Scotia, and projects will keep contributing to the growth of jobs in the sector (BuildForce Canada, 2024).

According to projections from BuildForce Canada, by 2033 the construction industry in Nova Scotia will need to recruit and retain as many as 10,600 additional workers to keep pace with expansion and replacement demands. This takes into consideration the expected 8,200 workers, about 22% of the 2023 construction labour force, who are expected to retire, and the 7,400 new entrants to the industry (BuildForce Canada, 2024). The trend is caused in part due to the aging population of Nova Scotia representing a higher percentage compared to some of the other provinces. Nova Scotia's population of age 65 or older increased to 22.2% in 2021, from 17.1% in 2016 (Government of Nova Scotia, 2022). The increased demand from the workforce of the construction industry is fueled by a higher demand for housing as well as the retrofitting of buildings to achieve higher energy efficiency.

In Canada, the clean energy workforce employed around 430,500 people. This number is projected to reach 639,200 by 2030, which represents an addition of about 200,000 jobs (Clark, A. and Matthews, M., Clean energy and pathways to net-zero, 2023). The substantial projected growth in clean energy employment can be interpreted as the market being considerably robust and likely to become a key driver in Canada's net-zero transition throughout the next decade.

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According to a study conducted by the Information and Communications Technology Council (ICTC) in 2023, the clean energy labour demand is growing at an estimated 4% annually, with rapid expansion to be expected in renewable energy projects and energy efficiency roles (Clark, A. and Matthews, M., Clean energy and pathways to net-zero, 2023). A lot of this growth is driven by projects like the Point Tupper Green Ammonia Project in Nova Scotia, which focuses on producing green hydrogen energy. These types of projects are driving an increased demand for skilled workers in clean energy both at the provincial and national levels.

This trend of increased demand for clean energy professionals is seen across Canada, including Nova Scotia, and will be materialized in some of the following ways. A study by ECO Canada estimates that the province of Nova Scotia is projected to require approximately 3,190 new green jobs by 2033, with a further 11,720 job openings expected due to retirements and sector growth (ECO Canada, 2024). The data points to an increasing regional reliance on green jobs, particularly in renewable energy and retrofitting. As these two sectors become more essential, they are generating a pathway in which strong employment drives forward environmental goals and regional and national economic growth.

The changes that the workforce from Nova Scotia is experiencing are part of a recent trend caused by shifts in green-energy objectives. According to research by the Canadian Climate Institute from 2020, which focused exclusively on analyzing the province of Nova Scotia, they found that the province provides a tangible example of what clean growth means in practice. The study found that the clean tech and energy efficiency sectors in the province saw a 27% job increase from 2012 to 2018, providing stability in these industries and offsetting the declines in traditional energy roles. This showcases the long-term potential for these fields to generate steady employment and is partly driven by Nova Scotia's ambitious climate targets (Canadian Climate Institute, 2020).

Job Losses

Although the clean energy sector has been experiencing recent growth, driven by provincial and federal net-zero emissions targets, the workforce of traditional energy industries and resource-based sectors have been negatively impacted. One of these industries is the fossil-fuel sector, which has been experiencing a decline in employment levels.

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According to the Information and Communications Technology Council (ICTC), approximately 81% of Canada's greenhouse gas emissions can be attributed to the generating of energy, primarily from fossil fuels such as oil, gas, and coal. Because its consumption levels are decreasing due to the phasing out of fossil fuels, employment in the industry is projected to decrease by up to 9% by 2030. By 2050 about 50-70% of oil and gas jobs, approximately 312,000 to 450,000 Canadians, are at risk of being eliminated (Clark, A. and Matthews, M., Clean energy and pathways to net-zero, 2023).

These projections highlight the other side of the green energy transition and emphasize the need to proactively develop workforce planning and re-skilling programs for these heavily affected sectors where the economy is heavily dependent on fossil fuels.

In Nova Scotia, this change has also been felt by the good-producing sector, particularly emission-intensive industries. The province has experienced a gradual shift from emissions-intensive goods towards services, which has facilitated the province's drop in emission levels.

According to a report by the Canadian Climate Institute, between 2005-2018 most of Nova Scotia's growth in GDP and jobs was in the services sector. This sector is generally less emissions-intensive.

Meanwhile, in the same timeframe, the province's goods-producing sectors steadily contracted, the oil-and-gas sector fell by 87%, coal mining by 84%, and forestry and logging by 42% (Canadian Climate Institute, 2020). The economic shift, characterized by the sharp decline in GDP from traditional industries, reinforces the importance that green industry jobs have to provide stability for urban and rural communities.

An aging workforce will be another factor that will present some challenges to the green transition. The Canadian Coalition of Women In Engineering, Science, Trades, and Technology (CCWESTT) has highlighted that around 40% of Canada's workforce is over 55 years of age, which poses a big labour challenge in traditional and green sectors as large numbers of workers retire. This could generate labour shortages in green-building trades, and friction in the transition of the workforce towards clean energy (CCWESTT, N/A).

As a lot of the skilled trades professionals are exiting the workforce it will generate a gap that has the potential to be exacerbated by the increasing demand for green sector jobs. This challenge raises the urgency to implement retraining initiatives to bring younger workers into energy transition roles, particularly in the skilled trades sector.

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Other resource-intensive industries are also forecasted to experience job declines in upcoming years. Sectors such as mining, quarrying, and oil and gas extraction, have been negatively impacted by policy initiatives that increasingly prioritize renewable energy (ECO Canada, 2024). The decline will be driven to a lesser degree by the automation of some processes. It will be important to ensure clear education and upskilling pathways are available to displaced workers so that they can be reabsorbed into different sectors of the economy.

3. Training Requirements & Annual Investment

Training Requirements

The transition to a green economy will require the development of new skills, while also increasing the demand for some skills that are currently present in the workforce. In Nova Scotia, the provincial government's implementation of higher energy efficiency standards is a big driver of the demand for high skilled workers. A skillful workforce will be in charge of implementing Nova Scotia's ambitious 2030 and 2035 climate targets.

To achieve this, construction workers and even government staff will have to go through training to upgrade their skill sets. The provincial and federal governments have taken the initial steps to deliver and develop the right training pathways for a green transition. Nevertheless, updated building codes and other energy-efficiency legislation will drive the demand for specialized workers higher (Atlantic Economic Council, 2024).

The training pathways developed must offer efficient and accessible learning solutions. Some of the programs being implemented focus on preparing the construction industry for the green-energy transition. They offer flexible solutions with a wide array of education options to accommodate the busy schedules of individuals who want to upgrade their skills.

Some of these upskilling solutions are offered through college and building trade union partnerships in the form of micro-credentials. Training flexibility is needed to accommodate workers who are already employed full-time, as a big portion of the job gap will be filled by full-time workers already in the workforce (Atlantic Economic Council, 2024).

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An important consideration is that training solutions must address the decline in apprenticeship rates that Nova Scotia experienced post-pandemic. The pandemic brought significant challenges to apprenticeship in the province, which is a key source of labour for the construction industry. New registrations in 2020 were about 25% lower than 2010 levels and have seen a faster decline than overall trade employment. However, completions have had an upward trend over the last decade driven partly by the increase in construction activity (BuildForce Canada, 2024).

From 2021 onwards, new registrations have rebounded and completion has also increased. Despite this, reduced registration levels during the pandemic could result in an insufficient number of newly certified journeypersons to sustain long-term requirements. This is why it is important to develop accessible programs, encourage new apprenticeship entries, and boost completion rates to maintain a skilled pipeline of skilled tradespeople in Nova Scotia.

The adoption of more inclusive training and workplaces for women, historically marginalized individuals, Indigenous peoples, New Canadians, 2SLGBTQIA+ workers, and people with disabilities will be crucial to mitigating labour shortages in the skilled trades. . These initiatives start from making sure equipment is available that fits all different body shapes and sizes, the workplace accommodates all genders in washroom facilities, and anti-harassment and respectful workplace policies are in place(CCWESTT, N/A).

Smaller, rural communities with high unemployment rates, specifically Indigenous populations, can greatly benefit from targeted retraining for net-zero building projects. Eskasoni First Nation in Cape Breton had the highest unemployment rate in Nova Scotia in 2016, at 26%. The same year in the Atlantic Region, the unemployment rate of Indigenous peoples was over 18% compared to 15% nationally (Canadian Climate Institute, 2020). By providing the right training, Nova Scotia can support these communities to increase their employment levels, and it can bring labour to remote projects.

The green energy transition offers a unique opportunity to make positive change by bridging community needs with green job demands. Addressing this structural unemployment won't be easy, and it will depend on whether the low-carbon economy can maintain the demand for this type of worker as the green economy transition advances for the training to achieve its full potential.

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Annual Investment Needs

Some of the costs associated with the green energy transition have been estimated by the Atlantic Economic Council in a 2024 report focusing on the net-zero building sector. They identified that about 41,000 residential units and about 2 million square metres of commercial space in Atlantic Canada will have to be retrofitted annually until 2040 to meet net-zero targets. All of these renovations will add up to almost $1.5 billion per year. Although the data available on the progress is not extensive, it has been identified that the region is falling short of this need ([Atlantic Economic Council, 2024](#)). To address these elevated costs, joint efforts between the public and private sectors will be instrumental in achieving the net-zero targets.

The Maritime provinces have an older housing stock compared to the rest of Canada. This means more energy-efficient retrofitting efforts will be required. Older homes are notably less energy efficient, and more complex and costly to retrofit ([Atlantic Economic Council, 2024](#)).

The projected investment in non-residential construction is another important factor driving high demand for construction-sector workers. BuildForce Canada predicts that non-residential construction investment will peak in 2025 ([BuildForce Canada, 2024](#)). It is important to be aware of this strong upward trend as there is a clear increased demand for construction workers, and they must be presented with clear pathways to learn or upskill into green-energy-required skills. If left unchecked, the region risks growing a labour force that is not qualified for the green transition.

The Nova Scotia Construction sector must attract, train, and retain about 10,600 workers over the next decade to replace retiring workers and meet new project demands ([BuildForce Canada, 2024](#)). Achieving this will require a significant amount of investment to develop recruitment and training programs. These should have a dedicated focus to encourage diverse hiring, as this gap will be even harder to close if traditionally underrepresented groups are not supported.

Furthermore, considerable efforts have to be made in the construction sector, a male-dominated sector, to bring long-term changes in the workspace culture to attract a broader labour base ([CCWESTT, N/A](#)). This can be achieved by Equity, Diversity, Inclusion & Accessibility (EDIA)-focused initiatives and investments that will hopefully create a better workplace culture for everyone.

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4. Equity strategies and partnerships

Equity Strategies

As we highlighted before, it will be crucial to support traditionally underrepresented groups in joining the construction workforce in order to meet the net-zero targets in Nova Scotia and Canada. It is estimated that to meet the demand, there will be around 7,400 first-time new entrants in the construction sector under the age of 30, and there will still be a gap of about 3,200 workers that will need to be recruited from outside the local construction labour force ([BuildForce Canada, 2024](#)). This problem will require a combination of strategies to increase the share of traditionally underrepresented groups in the construction sector by training workers from other industries and the recruitment of newcomers who have some foundational knowledge.

The development of tailored programming through a public-private collaboration approach will be necessary to improve inclusivity and secure the shift in participation ratios of traditionally underrepresented groups. These types of solutions should be specific to each community, such as Mi'kmaq, women in trades, Newcomers to Canada, etc ([CCWESTT, N/A](#)). They will not only promote equity but also empower these communities to actively engage and have a say in the green transition. The key informants who will be driving this shift will be federal and provincial governments, industry leaders, and educational providers, which all have to work together to develop strategies for diversifying and upskilling the construction labour force ([Atlantic Economic Council, 2024](#)). The end result should provide clear pathways for all these groups to succeed in the skilled trades.

An important challenge that must be addressed is ensuring fair wages for these traditionally underrepresented groups as they enter the construction sector. African Nova Scotian communities still face wage gaps and lower representation ([Road to Economic Prosperity, 2024](#)). At the same time as we develop training initiatives, it will be important to prioritize communication with African Nova Scotian communities to address their local needs and challenges, some of which include lower employment rates, historically lower wages, and education levels. This is the only way to promote equitable economic growth, foster trust within these communities, and make sure that the workforce enjoys long-term engagement levels.

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Another important step is making sure traditionally underrepresented groups can access leadership roles. The Urban Alliance on Race Relations highlights some of the barriers, especially for Black and Muslim youth to access leadership roles. Several systemic, societal, organizational, and individual barriers have to be addressed to foster leadership opportunities. Some of these can be partly solved through an emphasis on programs that promote mentorship, networking, and support for youth-led initiatives both by the government and other organizations (Urban Alliance, 2023).

Partnerships

To solve the challenges of the green energy transition, partnerships will have to be formed to divide the work among different organizations. One key partnership will be at the Federal-Provincial level to establish green building standards. These play a critical role in advancing Nova Scotia's net zero objectives. The Energy Efficiency Hub's 2023 annual report highlighted progress at the federal level to harmonize building codes and advance net-zero standards across Canada (Energy Management Action Network, 2023). This benefits regional programs by ensuring alignment between resources and policies to maximize impact. Another way to increase support is through federal investments in infrastructure and energy-efficiency retrofitting programs.

Collaboration with workforce development agencies, governments, industry, and academic institutions will be needed to develop an equitable clean-energy transition. International cooperation is also needed, for example, with countries like Germany and South Korea, to enhance training of the Canadian workforce in green energy (Clark, A. and Matthews, M., Clean energy and pathways to net-zero, 2023). This type of international partnership supplements local workforce development efforts by importing advanced technologies and best practices and ensuring workers from all groups are trained equitably.

A diverse labour force in Nova Scotia should be pursued as the region transitions to a greener economy. Provincial and federal governments must partner with labour organizations and educational institutions to deliver tailored programming that supports traditionally underrepresented communities (BuildForce Canada, 2024). The training has to be inclusive and accessible to all, with special considerations for the systemic barriers to entry for those outside the traditionally male-dominated trades (Parahoo, 2023 [CCWESTT]). Although this will be quite challenging, it presents a unique opportunity to uplift underrepresented communities while building a sustainable future.

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5. What key initiatives exist in other places that are seeing success?

Across Canada and around the world some successful green initiatives have often been powered by strong public-private partnerships targeting workforce training programs. One example is Alberta's Iron and Earth Initiative, a non-profit led by former oil sands workers, which focuses on helping fossil fuel and Indigenous workers transition into clean energy. The organization helps workers re-skill for roles in renewable energy, using existing experience.

EDGE UP is another program, developed by Calgary Economic Development (CED) and the Information and Communications Technology Council, which focuses on providing pathways for oil and gas workers to transition into the digital economy. In Toronto, Build Up is a nonprofit social enterprise with some public funding, which works to "improve Toronto's environmental efficiency and affordable housing stock to give people experiencing barriers to employment paths to successful careers in the trades." These programs highlight the value and importance of coordinated efforts in workforce initiatives that are quick to respond to local labour shifts and economic demand changes (Clark, A. and Matthews, M., Clean energy and pathways to net-zero, 2023).

At a national level, Canada's Green Building Strategy represents an impactful government-led approach to advancing net zero infrastructure and promoting growth in green jobs. This strategy includes several programs such as the Greener Homes Program, and initiatives such as the Deep Retrofit Accelerator, all of which collectively support the retrofitting of existing buildings and the development of standards for net-zero and climate-resilient buildings.

Creating nationwide regulatory frameworks and data disclosure practices is a task that the federal government has to undertake to ease the green energy and infrastructure transition.These initiatives showcase how policy-driven infrastructure investments can accelerate green transition, especially when they adapt to address the needs of small and medium-sized enterprises (Energy Management Action Network, 2023).

Some international partnerships have notably contributed to green economy goals by supporting equality and standardization policy adoption. Canada's partnership with the European Union helps to drive climate-oriented infrastructure investments while encouraging gender equality in the workforce by drawing inspiration from some of the European Nations. For instance, Lithuania's legislation mandates gender equality compliance across all employers.

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All of these collaborations provide Nova Scotia with blueprints to institute equitable policy reforms and ensure an equitable workforce transition to a greener economy (Parahoo, 2023 [CCWESTT]).

Lastly, we will highlight the importance of academic institutions in advancing the green transition through industry collaboration. Some notable partnerships like Dalhousie University and Tesla developing battery storage technologies or the Tidal Energy Institute at Acadia University advancing tidal energy harnessing, showcase the potential of university-led research in driving innovation. Through the integration of private sector support, these institutions have been able to create a model for rapid development and deployment of green technologies, and support the readiness of the workforce in the green energy transition (Canadian Climate Institute, 2020).

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