Appendix 4: Pathways to Education

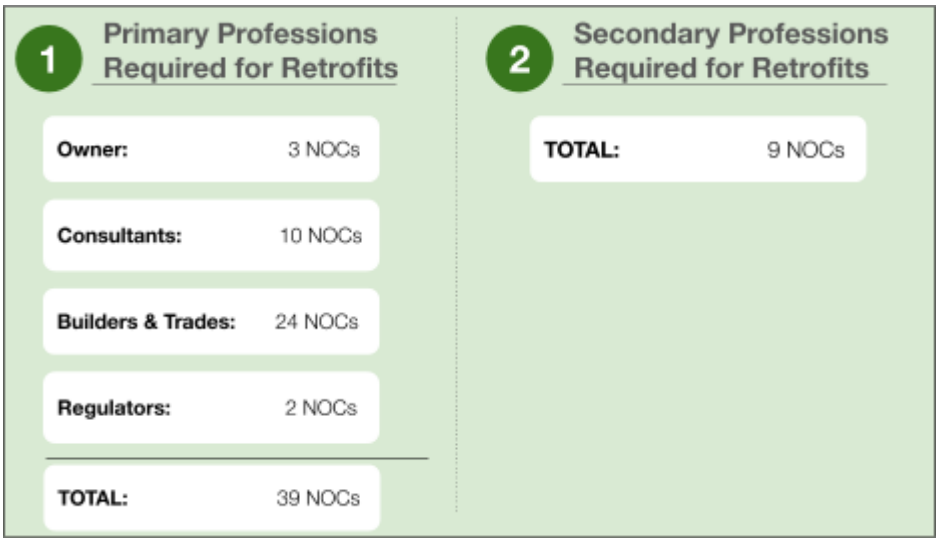
This section explores the education and upskilling opportunities for each one of the Key NOCs we identified in the previous sections. The list is broken down into two main groups: primary and secondary professions required for retrofits. The primary professions category is further subdivided into four categories, Owner, Consultants, Builders & Trades, and Regulators. An outline for this organization is provided below in **Figure 17.**

For each unique NOC, we provide the following information, which was compiled through consultations of the Government of Canada's NOC system, job posting descriptions, Nova Scotia Works and the Canada Job Bank.

- Typical education background needed to work in that occupation.
- What are the key competences required?
- Educational organizations that support the development of key competences.
- Some of the responsible organizations that oversee the specific sectors of workforce & industry.

We also provide information about Considerations on Workforce Capacity & Skills, and Micro Credentials available for upskilling. However, this analysis is not available for each NOC rather at the group level (Owners, Consultants, Builders & Trades, Regulators, and Secondary Professions)

Figure 17: Categorization of Key NOCs



1. Availability of Services/Education For Each NOC

Table of Institutions that offer these types of credentials

The analysis identified and categorized relevant NOCs into primary and secondary professions associated with energy-efficient retrofits. We profiled, for each NOC, the base-level qualifications required for entry and advancement in

the occupation, including diplomas, degrees, certifications, apprenticeships, as well as specialized training and microcredentials responding to green job demands, such as energy efficiency retrofits.

This detailed breakdown outlined the integration of green job competencies within each NOC, putting into perspective the required skills to support Canada's transition toward a sustainable, low-carbon economy. Using electricians as an example (NOC 7241), they would require traditional trade certifications but also new credentials in areas such as photovoltaic system installation and Building Automation Systems. Similarly, the core NOC 7313 of HVAC technicians will also be supplemented with knowledge in heat pumps and energy-efficient systems. The emphasis will be on green jobs, ensuring that each profession is adequately prepared for the technical and sustainability needs of today's energy-efficient retrofitting, cultivating a workforce ready for the green transition.

2. PRIMARY PROFESSIONS REQUIRED FOR RETROFITS

This section highlights the NOCs that are almost always needed when undertaking an energy efficiency retrofit. The Primary professions section is divided into four groups, **Owners, Consultants, Builders & Trades, Regulators**. Each group has a general commentary section on Considerations on Workforce Capacity & Skills, and Micro Credentials available for upskilling, which apply to all NOCs within that group.

To identify the National Occupational Classifications (NOCs) relevant to energy-efficient retrofits and their associated educational requirements, we conducted a comprehensive review using the Government of Canada's NOC system, supplemented by job postings and insights from Nova Scotia Works and the Canada Job Bank.

1. OWNER

1.1. ADVERTISING, MARKETING AND PUBLIC RELATIONS MANAGERS

NOC 10022- Advertising, marketing and public relations managers

Advertising, marketing, public relations and e-business managers plan, organize, direct, control and evaluate the activities of establishments and departments involved in commercial, industrial and e-business advertising, marketing and public relations. They are employed by commercial and industrial establishments, government departments, and advertising, marketing and public relations firms or consulting businesses.

Typical education background:

Advertising and Public Relations Managers

- A university degree or college diploma in communications, public relations, marketing, journalism or in a related field and several years of experience in an advertising, public relations or communications officer position or in a related occupation are required.

Marketing Managers

- A university degree or college diploma in business administration or in a related field with a specialization in sales or marketing and several years of experience as a sales, marketing or public relations representative or in a related occupation are required.

E-business Managers

- A university degree or college diploma in a field related to electronic commerce, website content development, or Internet and mobile services and experience in website design, interactive media development, data administration or information systems analysis or experience related to website content are usually required.

Key Competencies for Retrofits

- Development of communication strategies to promote energy-efficient retrofits in Nova Scotia.
- Designing campaigns to educate homeowners, businesses, and municipalities about benefits and incentives for retrofits.
- Building partnerships with energy organizations, contractors, and government bodies to amplify awareness of retrofit programs.
- Conducting market research to understand consumer attitudes and barriers to green retrofit adoption.
- Utilizing digital platforms (SEO, paid social media, Google Ads) and traditional media to target diverse audiences.
- Soft Skills: Demonstrating strong leadership, interpersonal, and communication skills to manage teams and build trust.

Support for Key Competencies	
	Acadia University • Business Administration, Bachelor • Marketing, Bachelor **Cape Breton University** • Business Administration, Bachelor • Communication, Bachelor • Marketing, Bachelor **Dalhousie University** • Business Administration, Master • Commerce, Bachelor • Digital Business, Graduate Certificate • Digital Innovation, Master • Intercultural Communication, Advanced Certificate • Journalism Studies (minor), Bachelor • Marketing Management, Bachelor, Advanced Certificate • Professional Communications, Certificate • Technical Writing, Certificate **Nova Scotia Community College** • Business Administration, Diploma • Business Fundamentals, Certificate • Digital Marketing, Advanced Certificate • IT Web Programming, Diploma • Public Relations, Advanced Certificate

Responsible Organizations	• Efficiency Nova Scotia: A key partner in promoting retrofit incentives and energy efficiency programs. • Nova Scotia Power: Offers energy-saving programs and rebates for residential and commercial retrofits. • Atlantic Canada Opportunities Agency (ACOA): Supports green initiatives and provides funding opportunities. • Canada Green Building Council – Atlantic Chapter: Promotes green building practices and collaboration. • Nova Scotia Home Builders' Association (NSHBA): Engages with retrofit and residential construction markets. • Local municipalities and community groups advocating for sustainable housing and energy efficiency.

1.2. CONSTRUCTION MANAGERS

NOC 70010 – *Construction managers*

Construction managers plan, organize, direct, control and evaluate the activities of a construction company or a construction department within a company, under the direction of a general manager or other senior manager. They are employed by residential, commercial and industrial construction companies and by construction departments of companies outside the construction industry.

Typical education background:

- A university degree in civil engineering or a college diploma in construction technology is usually required.
- A master's degree in project management may be required.
- Several years of experience in the construction industry, including experience as a Construction Supervisor or Field Superintendent, are usually required.
- Extensive experience in the construction industry may substitute for post-secondary education requirements.
- Professional engineering status or construction trade certification may be required by some employers.

Key Competencies for Retrofits

- Overseeing the planning, coordination, and execution of green retrofit projects to ensure they meet energy efficiency and sustainability standards.
- Managing budgets, schedules, and resource allocation for retrofit projects while adhering to environmental compliance requirements.
- Ensuring proper integration of low-carbon materials, energy-efficient systems, and renewable energy solutions into building retrofits.
- collaboration with engineers, contractors, and energy specialists to implement innovative technologies such as heat pumps, photovoltaic systems, and Building Automation Systems (BAS).
- Monitoring and ensuring compliance with building codes, safety regulations, and green building certification standards, such as LEED.
- Soft Skills: Demonstrating strong communication, leadership, and conflict-resolution skills to effectively manage diverse teams.

Responsible Organizations	• Efficiency Nova Scotia: Provides technical and financial support for energy-efficient retrofit projects. • Nova Scotia Power: Collaborates on electrification initiatives and energy-saving measures. • Construction Association of Nova Scotia (CANS): Offers resources and networking opportunities for construction managers involved in retrofits. • Canada Green Building Council – Atlantic Chapter: Provides education and resources on green building certifications and practices. • Nova Scotia Community College (NSCC): Supports workforce development with relevant training programs for construction professionals.
Support for Key Competencies	Dalhousie University • Civil Engineering Bachelor • Construction Management Certificate • Project Management Certificate

1.3. FACILITY OPERATION AND MAINTENANCE MANAGERS

NOC 70012 – *Facility operation and maintenance managers*

Facility operation managers plan, organize, direct, control and evaluate the operations of commercial, transportation and recreational facilities and the included real estate. Facility operation managers are employed by a wide range of establishments, such as airports, harbours, canals, shopping centres, convention centres, warehouses and recreational facilities. Maintenance managers plan, organize, direct, control and evaluate the maintenance department within commercial, industrial, institutional, recreational and other facilities. Maintenance managers are employed by a wide range of establishments, such as office buildings, shopping centres, airports, harbours, warehouses, grain terminals, universities, schools and sports facilities, and by the maintenance and mechanical engineering departments of manufacturing and other industrial establishments.

Typical Educational Background:

Facility Operation Managers require completion of a college or university program in business administration or in a discipline related to facility operation and maintenance or an equivalent combination of technical training and experience in administration or maintenance.

Key Competencies for Retrofits

- **Managing the operation and maintenance of energy-efficient systems** in retrofitted buildings, including HVAC, lighting, photovoltaic systems, heat pumps, energy storage solutions, and renewable energy technologies.
- Implementing energy-saving strategies and monitoring Building Automation Systems (BAS) to optimize energy use.
- Assessing existing building systems, conducting energy audits, and identifying areas for improvement, including embodied carbon and efficiency.
- Understanding building science fundamentals and integrating low-carbon materials and technologies into building operations.
- Demonstrating strong business acumen for creating cost-effective retrofit proposals and managing budgets.
- Leveraging digital literacy to operate automated systems and optimize energy management.
- **Soft Skills:** Managing teams effectively, engaging tenants, negotiating with contractors, and solving problems to ensure smooth facility operations.

Responsible Organizations	• Efficiency Nova Scotia: Offers programs for the maintenance and optimization of energy-efficient building systems. • Nova Scotia Power: Provides expertise in energy management and renewable energy

	systems. • Canada Green Building Council – Atlantic Chapter: Promotes green building certifications and sustainable operations in retrofitted facilities. • Nova Scotia Community College (NSCC): Provides training in sustainable facility management and energy efficiency.
Support for Key Competencies	**Acadia University** • Applied Science Bachelor • Business Administration Bachelor **Cape Breton University** • Business Administration Bachelor • Business Management Advanced Diploma • Engineering Advanced Diploma **Dalhousie University** • Commerce Bachelor • Engineering Bachelor, Master, Doctorate • Maintenance Management Certificate • Managing People and Organizations Bachelor • Mechanical Engineering Bachelor **Nova Scotia Community College** • Business Administration Diploma • Business Fundamentals Certificate • Mechanical Engineering Technology Diploma

1.4 . Considerations on Workforce Capacity & Skills for Owners

- Knowledge gaps & Work Shortages:
    - Low knowledge in low-carbon technologies and with integrating sustainability principles into asset and project management may slow down the adoption of energy efficient practices.
    - Need for enhanced training in life cycle cost analysis, sustainability reporting, and performance tracking to support retrofit projects effectively.
    - Workforce shortages in experienced property and facility managers with expertise in energy efficiency could slow retrofit implementation.
    - Increasing updates of digital tools and technical skills (e.g., Building Automation Systems, green technology and energy monitoring platforms) requires upskilling in technology use and data interpretation.
- Financial Constraints and Complexity of Retrofits

    - Financial constraints and extended project timelines associated with retrofits may deter owners from undertaking such projects without clear cost-benefit analyses and incentives.
    - Navigating complex government incentives, and preparing for new building code adoptions for green retrofits can be challenging, requiring specialized knowledge to maximize funding opportunities.

- Low Awareness of Opportunities in Workforce
    - A widespread lack of green literacy, including understanding sustainability principles, net-zero construction strategies, and the urgency to implement them, limits the ability to identify and implement retrofit solutions at a larger scale.
    - Lack of awareness of financial and environmental benefits of retrofits will require tailored campaigns to reach diverse and rural communities.
    - Marketing managers must align messaging with federal and provincial retrofit programs, grants, and rebates.

1.5 Microcredentials for Owners

Nova Scotia Community College:

1. Introduction to Construction Management
Mode (online)

- **Course Objective:** Develop a framework for monitoring and evaluating construction projects using industry methodologies and sustainable practices.
- **Target Audience:** Individuals with experience in the construction sector, but open to all.
- **Key Learning Outcomes**: Understanding project phases, financial management, environmental impacts, and safety regulations.
- **Greenhouse Gas Emissions:** Buildings account for 18% of Canada's national greenhouse gas emissions.
- **National Retrofit Code:** By 2030, Canadians can expect a national retrofit code for existing buildings.
- **Green Building Workforce:** The green building workforce needs to triple by 2030 to meet the demand for sustainable building construction and renovation.

2. Climate Literacy for Construction

Mode (Online)

- **Course Focus:** Explores the role of the construction industry in climate change, focusing on carbon emissions, energy efficiency, and lifecycle carbon.
- **Target Audience:** Designed for individuals working in the construction industry, although no prior experience is required.
- **Learning Outcomes:** Students will understand climate change impacts, the construction industry's role, adaptation strategies, and climate change mitigation and adaptation in the context of Nova Scotia's future climate.

3. Introduction to Solar Photovoltaic Systems

Mode(online)

- **Course Objective:** To provide foundational knowledge on solar photovoltaic (PV) technology and systems, including the science behind solar energy conversion, system operation, and component characteristics.
- **Learning Outcomes**: Students will be able to explain solar PV system fundamentals, describe electricity concepts in solar PV design, explain solar PV panels and system operation, and assess the characteristics and applications of solar PV components.
- **Career Path:** This course serves as a pathway to becoming a solar PV installer, a crucial role in Canada's transition to a low-carbon economy.

2. CONSULTANTS

2.1. ARCHITECTS

NOC 21200 – *Architects*

Architects conceptualize, plan and develop designs for the construction and renovation of commercial, institutional and residential buildings. They are employed by architectural firms, private corporations and governments, or they may be self-employed.

Typical Educational Background:

- A bachelor's degree from an accredited school of architecture or completion of the syllabus of studies from the Royal Architectural Institute of Canada (RAIC) is required.
- A master's degree in architecture may be required.
- Completion of a three-year internship under the supervision of a registered architect is required.
- Completion of the architect registration examination is required.
- Registration with a provincial regulatory body is required in all provinces and the Northwest Territories.
- Leadership in Energy and Environmental Design (LEED) certification is offered by the Canada Green Building Council and may be required by some employers.

Key Competencies for Retrofits

- Designing energy-efficient, sustainable buildings and retrofits, ensuring adherence to green building standards and energy codes.
- Assessing existing buildings, conducting energy audits, and identifying opportunities for improvement, including embodied carbon analysis and energy efficiency.
- Integrating legacy systems with high-performance systems, including mechanical, passive systems, and on-site renewable energy solutions.
- Applying building science principles (Building-as-a-System) to ensure optimal integration of all systems and energy efficiency.
- Utilizing digital tools like CAD, laser scanning (LIDAR), and photogrammetry for accurate building assessments and design.
- Incorporating low-carbon materials and performing Life Cycle Assessment (LCA) to reduce environmental impacts in retrofit designs.
- Utilizing adaptive and resilient design strategies to ensure that retrofits are energy-efficient and able to withstand environmental changes.
- **Soft Skills:** Such as communication, negotiation, problem-solving, and project coordination for managing client expectations and working with contractors.

Responsible Organizations	• Canada Green Building Council – Atlantic Chapter: Provides resources on green building practices and certifications such as LEED. • Efficiency Nova Scotia: Offers programs to support energy-efficient retrofits and sustainable design. • Nova Scotia Power: Collaborates on energy efficiency and renewable energy initiatives for retrofitted buildings. • Nova Scotia Association of Architects (NSAA): Provides professional development, training, and advocacy for sustainable architecture. • The Royal Architectural Institute of Canada (RAIC): Supports architects with resources on sustainable architecture and green building certifications.

Support for Key Competencies	**Dalhousie University** • Architecture Master

2.2. CIVIL ENGINEERS

NOC 21300 – *Civil Engineers*

Civil engineers plan, design, develop and manage projects for the construction or repair of buildings, earth structures, powerhouses, roads, airports, railways, rapid transit facilities, bridges, tunnels, canals, dams, ports and coastal installations and systems related to highway and transportation services, water distribution and sanitation. Civil engineers may also specialize in foundation analysis, building and structural inspection, surveying, geomatics and municipal planning. They are employed by engineering consulting companies, in all levels of government, by construction firms and in many other industries, or they may be self-employed.

Typical Educational Background:

- A bachelor's degree in civil engineering or in a related engineering discipline is required.
- A master's degree or doctorate in a related engineering discipline may be required.
- Licensing by a provincial or territorial association of professional engineers is required to approve engineering drawings and reports and to practice as a Professional Engineer (P.Eng.).
- Engineers are eligible for registration following graduation from an accredited educational program, and after three or four years of supervised work experience in engineering and passing a professional practice examination.
- Leadership in Energy and Environmental Design (LEED) certification is offered by the Canada Green Building Council and may be required by some employers.

Key Competencies for Retrofits

- Designing and implementing sustainable civil infrastructure for green retrofits, such as stormwater management, drainage, and site preparation.
- Conducting assessments of existing civil infrastructure to identify energy-efficient and low-carbon opportunities for retrofitting.
- Integrating renewable energy solutions like geothermal, solar panels, and wind into civil engineering designs for retrofits.
- Utilizing building science principles (Building-as-a-System).
- Using digital tools such as CAD, GIS, and energy modeling software for planning and designing.
- Ensuring retrofitted infrastructure meets sustainability standards, including compliance with environmental, energy efficiency, and building codes.
- Soft Skills: Demonstrating strong project management, communication, and collaboration skills to work with multidisciplinary teams.

Responsible Organizations	• Engineers Nova Scotia: Provides professional resources and support for civil engineers working on sustainable infrastructure. • Canadian Society for Civil Engineering (CSCE): Promotes sustainable civil engineering practices and training. • Canada Green Building Council – Atlantic Chapter: Supports civil engineers with resources on green building certifications and sustainable retrofitting practices. • Efficiency Nova Scotia: Offers guidance and programs to support energy-efficient infrastructure retrofits. • Nova Scotia Power: Collaborates with civil engineers on energy management and renewable energy initiatives in retrofitted buildings.

Support for Key Competencies	**Acadia University** ● Engineering and Applied Science Bachelor **Dalhousie University** ● Civil and Resource Engineering, Master, Doctorate ● Civil Engineering Bachelor, Master ● Engineering Bachelor, Master, Doctorate

2.3. ELECTRICAL ENGINEERS

NOC 21310 – *Electronic and Electrical engineers*

Electrical and electronics engineers design, plan, research, evaluate, and test electrical and electronic equipment and systems. They are employed by electrical utilities, communications companies, manufacturers of electrical and electronic equipment, consulting firms, and a wide range of manufacturing, processing,g and transportation industries and government.

Typical Educational Background:

- A bachelor's degree in electrical or electronics engineering or in an appropriate related engineering discipline is required.
- A master's or doctoral degree in a related engineering discipline may be required.
- Licensing by a provincial or territorial association of professional engineers is required to approve engineering drawings and reports and to practice as a Professional Engineer (P.Eng.).
- Engineers are eligible for registration following graduation from an accredited educational program, and after three or four years of supervised work experience in engineering and passing a professional practice examination.
- Leadership in Energy and Environmental Design (LEED) certification is offered by the Canada Green Building Council and may be required by some employers.

NOC 22301- *Mechanical engineer technologists and engineers*

Mechanical engineering technologists and technicians provide technical support and services or may work independently in mechanical engineering fields such as the design, development, maintenance, and testing of machines, components, tools, heating, and ventilating systems, geothermal power plants, power generation and power conversion plants, manufacturing plants and equipment. They are employed by consulting engineering, manufacturing, and processing companies, institutions and government departments.

Typical Educational Background:

- Completion of a two- or three-year college program in mechanical engineering technology is usually required for Mechanical Engineering Technologists.
- Completion of a one- or two-year college program in mechanical engineering technology is usually required for Mechanical Engineering Technicians.
- Certification in mechanical engineering technology or in a related field is available through provincial associations of Engineering/Applied Science Technologists and Technicians and may be required for some positions.
- A period of supervised work experience, usually two years, is required before certification.

Key Competencies for Retrofits

- Conducting thorough assessments of existing buildings, including energy audits, evaluating current electrical systems, and identifying opportunities for improving energy efficiency and reducing embodied carbon.
- Integrating legacy electrical systems with high-performance solutions, including renewable energy systems (e.g., solar panels) and energy storage.
- Designing and implementing energy-efficient electrical systems, such as LED lighting, HVAC integration, and energy

automation, while maintaining system compatibility.
- Applying building science fundamentals (Building-as-a-System) to ensure seamless integration of electrical and mechanical systems for energy optimization.
- Utilizing green building construction strategies such as improving water and energy efficiency, enhancing indoor environmental quality, and reducing electrical consumption.
- Applying Life Cycle Assessment (LCA) to evaluate low-carbon materials and the embodied carbon in electrical system components.
- Developing adaptive and resilient systems that ensure retrofits are energy-efficient and climate-resilient.
- Soft Skills: such as communication, negotiation, problem-solving, and project coordination when collaborating with architects, contractors, and other professionals involved in green retrofits.

Responsible Organizations	• Nova Scotia Power: Provides expertise in energy management, electrical system integration, and renewable energy solutions. • Engineers Nova Scotia: Supports electrical engineers with training and resources for energy-efficient systems in retrofitted buildings. • Canadian Electrical Contractors Association (CECA): Represents electrical contractors implementing energy-efficient solutions and renewable energy systems. • Canada Green Building Council – Atlantic Chapter: Provides resources on green building practices, certifications, and energy-efficient systems. • Efficiency Nova Scotia: Offers support for energy-efficient retrofits, including optimizing electrical systems for reduced consumption.
Support for Key Competencies	**Acadia University** • Engineering and Applied Science Bachelor **Dalhousie University** • Electrical and Computer Engineering Bachelor, Master, Doctorate • Engineering Bachelor, Master, Doctorate

2.4. COMPUTER ENGINEERS

NOC 21311 – *Computer engineers (except software engineers and designers)*

Computer engineers (except software engineers and designers) research, plan, design, develop, modify, evaluate and integrate computer and telecommunications hardware and related equipment, and information and communication system networks including mainframe systems, local and wide area networks, fiber-optic networks, wireless communication networks, intranets, the Internet and other data communications systems. They are employed by computer and telecommunication hardware manufacturers, by engineering, manufacturing and telecommunications firms, in information technology consulting firms, by governmental, educational and research institutions and in information technology units throughout the private and public sectors.

Typical Educational Background:

- Computer Engineers require a bachelor's degree in computer engineering, electrical or electronics engineering, engineering physics or computer science.
- A master's or doctoral degree in a related engineering discipline may be required.
- Licensing by a provincial or territorial association of professional engineers is required to approve engineering drawings and reports and to practice as a Professional Engineer (P.Eng.).
- Engineers are eligible for registration following graduation from an accredited educational program, three or four years of supervised work experience in engineering and passing a professional practice examination.

Key Competencies for Retrofits

- Designing and implementing smart building technologies, such as building automation systems (BAS) and energy management systems (EMS) to optimize energy efficiency in green retrofits.
- Integrating renewable energy solutions, such as solar power and energy storage, into smart building designs.
- Conducting energy audits and system assessments to identify opportunities for improving energy efficiency through automation and advanced control systems.
- Applying building science principles (Building-as-a-System) to ensure seamless integration of digital systems with mechanical, electrical, and architectural systems in retrofitted buildings.
- Utilizing digital tools and technologies such as sensors, IoT devices, and real-time monitoring systems to enhance the energy performance of retrofitted buildings.
- Implementing low-carbon technologies, such as energy-efficient lighting systems, electric vehicle (EV) charging stations, and smart grid systems, within retrofit projects.
- Ensuring that all integrated systems are adaptable and resilient to future energy needs and climate change impacts.
- Soft Skills: Demonstrating strong problem-solving, communication, and project management skills to collaborate with engineers, architects, and others involved in green retrofit projects.

Responsible Organizations	• Nova Scotia Power: Provides expertise in integrating smart grid systems, energy storage, and renewable energy solutions in retrofit projects. • Engineers Nova Scotia: Offers resources and training for computer engineers involved in energy-efficient system design and implementation. • Canada Green Building Council – Atlantic Chapter: Promotes green building standards, certifications, and smart building technologies for retrofitting projects. • Efficiency Nova Scotia: Offers support for energy-efficient retrofit programs, including those that leverage smart building and automation technologies. • Canadian Energy Efficiency Alliance (CEEA): Supports engineers in the development and deployment of energy-efficient technologies for building retrofits.
Support for Key Competencies	**Acadia University** • Engineering and Applied Science Bachelor **Dalhousie University** • Artificial Intelligence and Intelligent Systems Advanced Certificate • Electrical and Computer Engineering Bachelor, Master, Doctorate • Engineering Bachelor, Master, Doctorate **St. Francis Xavier University** • Artificial Intelligence Graduate Diploma

2.5. INDUSTRIAL AND MANUFACTURING ENGINEERS

NOC 21321 – *Industrial and Manufacturing engineers*

Industrial and manufacturing engineers conduct studies and develop and supervise programs to achieve the best use of equipment, human resources, technology, materials and procedures to enhance efficiency and productivity. They are employed in consulting firms, manufacturing and processing companies, in government, financial, health care and other institutions, or they may be self-employed.

Typical Educational Background:

- A bachelor's degree in industrial engineering or in a related engineering discipline is required.
- A master's degree or doctorate in a related engineering discipline may be required.

- Licensing by a provincial or territorial association of professional engineers is required to approve engineering drawings and reports and to practice as a Professional Engineer (P.Eng.).
- Engineers are eligible for registration following graduation from an accredited educational program, and after three or four years of supervised work experience in engineering and passing a professional practice examination.

Key Competencies for Retrofits

- Optimizing manufacturing processes for low-carbon building materials and components used in green retrofits.
- Assessing and designing energy-efficient systems to reduce operational energy consumption in retrofitted buildings.
- Applying life-cycle assessment (LCA) to evaluate the environmental impact of materials and processes in green retrofits.
- Integrating automation and digital tools to improve the efficiency of manufacturing and installation processes for retrofit projects.
- Implementing adaptive and resilient design strategies for materials and systems to enhance durability and sustainability.
- **Soft Skills:** Strong communication, problem-solving, and collaboration skills to coordinate with architects, contractors, and material suppliers.

Responsible Organizations	• Engineers Nova Scotia: Provides training, certification, and resources for industrial engineers focusing on sustainable practices in retrofitting. • Canadian Manufacturers & Exporters (CME): Offers resources on integrating sustainable manufacturing practices to support green building initiatives. • Canada Green Building Council – Atlantic Chapter: Supports the adoption of green materials and technologies in manufacturing processes for retrofits. • Efficiency Nova Scotia: Provides guidance on energy-efficient systems and sustainable practices relevant to manufacturing and installation in retrofit projects.
Support for Key Competencies	**Acadia University** • Engineering and Applied Science, Bachelor **Dalhousie University** • Engineering, Bachelor, Master, Doctorate • Industrial Engineering, Bachelor, Master, Doctorate • Materials Engineering, Master, Doctorate • Mechanical Engineering, Bachelor, Master, Doctorate

2.6. METALLURGICAL AND MATERIAL ENGINEERS

NOC 21322 – *Metallurgical and Material Engineers*

Metallurgical and materials engineers conduct studies of the properties and characteristics of metals and other non-metallic materials and plan, design and develop machinery and processes to concentrate, extract, refine and process metals, alloys and other materials such as ceramics, semiconductors and composite materials. They are employed in consulting engineering firms, mining, metal processing and manufacturing companies, and in government, research and educational institutions.

Typical Educational Background:

- A bachelor's degree in metallurgical, materials, ceramic or chemical engineering or in a related engineering discipline is required.
- A master's degree or doctorate in a related engineering discipline may be required.
- Licensing by a provincial or territorial association of professional engineers is required to approve engineering drawings and reports and to practice as a Professional Engineer (P.Eng.).
- Engineers are eligible for registration following graduation from an accredited educational program, and after three or four years of supervised work experience in engineering and passing a professional practice examination.

Key Competencies for Retrofits

- Evaluating and selecting sustainable and low-carbon materials for use in green retrofit projects.
- Developing advanced materials with enhanced durability and performance for energy-efficient and climate-resilient retrofits.
- Conducting life-cycle assessments (LCA) to analyze the environmental impact of materials used in retrofit construction.
- Researching and applying techniques to minimize embodied carbon in materials, including recycling and reuse strategies.
- Ensuring compliance with environmental standards and certifications related to materials in retrofits.
- **Soft Skills:** Strong communication, problem-solving, and collaboration skills to coordinate with architects, contractors, and manufacturers.

Responsible Organizations	• Engineers Nova Scotia: Offers professional development and certification for metallurgical and materials engineers in sustainable practices. • Canadian Institute of Mining, Metallurgy and Petroleum (CIM): Provides resources for sustainable material development and recycling processes. • Canada Green Building Council – Atlantic Chapter: Promotes sustainable material use and certification for green retrofit projects. • Efficiency Nova Scotia: Supports material selection and energy-efficient strategies for retrofits.
Support for Key Competencies	**Acadia University** • Engineering and Applied Science, Bachelor **Dalhousie University** • Engineering, Bachelor, Master, Doctorate • Materials Engineering, Master, Doctorate

2.7. INDUSTRIAL DESIGNERS

NOC 22211- *Industrial Designers*

Industrial designers conceptualize and produce designs for manufactured products. They are employed by manufacturing industries and private design firms or they may be self-employed.

Typical Educational Background:

- A university degree in industrial design, architecture, or engineering or a college diploma in industrial design is required.
- Creative ability, as demonstrated by a portfolio of work, is required.

Key Competencies for Retrofits

- Designing sustainable products and systems for green retrofits, including energy-efficient materials, low-carbon construction components, and eco-friendly finishes.
- collaboration with architects and engineers to integrate industrial design solutions into retrofit projects, such as furniture, fixtures, and custom components that enhance energy efficiency and sustainability.
- Applying building science principles (Building-as-a-System) to ensure that all design elements contribute to the overall energy performance of the building.
- Understanding the environmental impact of materials and designing for circularity, using materials with low embodied carbon and promoting reuse and recycling.
- Utilizing advanced design tools such as CAD, 3D modeling, and rapid prototyping to create efficient, sustainable design solutions for retrofits.
- Contributing to green building construction strategies, including improving indoor environmental quality, energy efficiency, and resource conservation in retrofitted spaces.
- Ensuring designs are adaptable and resilient to future environmental and energy needs, enhancing the long-term sustainability of retrofitted buildings.
- Soft Skills: Demonstrating strong communication, problem-solving, and project coordination skills to work with architects, engineers, and contractors on complex retrofit projects.

Responsible Organizations	• Nova Scotia Design and Manufacturing Association: Supports industrial designers in sustainable design practices and green manufacturing techniques. • Canada Green Building Council – Atlantic Chapter: Provides guidance on integrating sustainable industrial design into green building projects and retrofits. • Canadian Industrial Designers Association (CIDA): Offers resources and training to industrial designers focused on sustainability and energy-efficient design practices. • Efficiency Nova Scotia: Supports industrial design projects focused on reducing energy consumption and promoting sustainability. • Green Building Council of Canada: Provides certification programs and resources for industrial designers to implement green solutions in retrofit projects.
Support for Key Competencies	**Dalhousie University** • Environmental Design Master • Environmental Engineering Master • Mechanical Engineering Bachelor

2.8. TECHNICAL OCCUPATIONS IN GEOMATICS AND METEOROLOGY

NOC 22214- *Technical occupations in Geomatics and Meteorology*

Technical occupations in geomatics include aerial survey, remote sensing, geographic information systems, cartographic and photogrammetric technologists and technicians, who gather, analyze, interpret and use geospatial information for applications in natural resources, geology, environmental research and land use planning. Meteorological technologists and technicians observe weather and atmospheric conditions, record, interpret, transmit and report on meteorological data, and provide weather information to the agricultural, natural resources and transportation industries and the public. Geomatics technologists and technicians are employed by all levels of government, utilities, mapping, computer software, forestry, architectural, engineering and consulting firms and other related establishments. Meteorological technologists and technicians are employed by all levels of government, the media, natural resources, utilities and transportation companies and consulting firms.

Typical Educational Background:

- Completion of secondary school is required.
- Geomatics Technologists require completion of a two- to three-year college program in cartography, photogrammetry, aerial survey, remote sensing, geographic information systems or geomatics.
- Meteorological Technicians require completion of a one-year meteorological technician program provided by the Meteorological Service of Canada.
- Further specialized training is available for Meteorological Technicians and may be required by some employers.
- Further specialized training is available for Meteorological Technicians and may be required by some employers

Key Competencies in Retrofits

- Conducting site assessments using geomatics technologies (e.g., GPS, GIS) to map and analyze building sites for green retrofit projects, optimizing energy efficiency and sustainability.
- Using remote sensing and meteorological data to support climate-resilient building designs by assessing environmental conditions and weather patterns.
- Integrating environmental data with building information modeling (BIM) to improve the accuracy of energy audits, site preparation, and performance simulations in retrofits.
- Performing geospatial analysis to assess potential impacts of green retrofits on the surrounding environment and identifying sustainable land use practices.
- Assisting in the planning and implementation of renewable energy systems (e.g., solar energy) by providing data on optimal site locations, solar exposure, and environmental factors.
- Contributing to climate-adaptive strategies by using weather and climate data to design retrofits that are resilient to climate change and extreme weather events.
- Ensuring compliance with environmental standards and regulations, including land conservation, water management, and carbon emissions reductions, during the retrofit process.
- Soft Skills: Demonstrating strong problem-solving, communication, and collaboration skills when working with architects, engineers, and others involved in green retrofit projects.

Responsible Organizations	• Geomatics Association of Nova Scotia: Provides professional development, resources, and support for geomatics professionals, focusing on sustainable practices in land and building assessment. • Engineers Nova Scotia: Offers training and resources for professionals working on energy-efficient systems and climate-resilient building strategies in green retrofits. • Canadian Meteorological and Oceanographic Society: Provides expertise on meteorological data and its integration into green building and retrofit projects, particularly in assessing environmental impacts. • Canada Green Building Council – Atlantic Chapter: Promotes green building standards and practices, offering resources on integrating environmental data into building retrofit projects. • Efficiency Nova Scotia: Supports energy-efficient retrofits and sustainable building practices, providing resources for site and environmental assessments.
Support for Key Competencies	**Acadia University** • Applied Geomatics Master **Dalhousie University** • Geographic Information Science (GIS) Advanced Certificate • Meteorology Advanced Diploma **St. Francis Xavier University** • Geography Bachelor, Master

	Nova Scotia Community College (NSCC) • Geographic Information Systems Advanced Certificate • Geographic Information Systems - Cartography and Geovisualization Diploma • Geographic Information Systems Technician Diploma • Geomatic Engineering Technology Diploma • Geospatial Data Analytics Advanced Certificate • Marine Geomatics Advanced Certificate • Remote Sensing Advanced Certificate

2.9. CONSTRUCTION ESTIMATORS

NOC 22303- *Construction Estimators*

Construction estimators analyze costs of and prepare estimates on civil engineering, architectural, structural, electrical and mechanical construction projects. They are employed by residential, commercial and industrial construction companies and major electrical, mechanical and trade contractors, or they may be self-employed.

Typical Educational Background:

- Completion of a three-year college program in civil or construction engineering technology or several years of experience as a qualified tradesperson in a construction trade such as plumbing, carpentry or electrical, are required.
- Certification by the Canadian Institute of Quantity Surveyors is usually required.

Key Competencies for Retrofits

- Assessing existing building systems, including auditing current energy efficiency, and embodied carbon, and checking the suitability of prefabrication for retrofitting.
- Understanding the preparation required for demolition, service disconnections, and materials remediation during green retrofits.
- Strong business acumen to optimize cost and performance while ensuring green retrofit goals are met.
- Applying building science fundamentals (Building-as-a-System) to ensure comprehensive energy-saving solutions.
- Familiarity with green building construction strategies, including water and energy efficiency, and improving indoor environmental quality.
- Knowledge of high-performance, low-carbon equipment, and materials, including sustainable alternatives for retrofitting projects.
- Performing life-cycle assessments (LCA) to evaluate environmental impacts, including calculating embodied carbon in retrofit projects.
- Understanding adaptive and resilient building strategies to make retrofitted buildings more sustainable in the long term.
- Soft Skills: Strong communication, negotiation, problem-solving, and project coordination skills to collaborate effectively with multidisciplinary teams.

Responsible Organizations	• Construction Association of Nova Scotia: Supports construction estimators with resources and professional development for green building practices and retrofitting. • Canadian Construction Association: Provides guidelines and best practices for green retrofit projects, including estimating costs for sustainable technologies. • Canada Green Building Council – Atlantic Chapter: Offers resources for

	construction estimators to integrate green building standards and certifications into their cost assessments. • Efficiency Nova Scotia: Offers tools and programs that help estimators evaluate energy-efficient solutions and sustainable materials for retrofits.
Support Key Competencies	**Nova Scotia Community College** • Architectural Engineering Technician, Diploma • Construction Management Technology, Diploma **Nova Scotia Apprenticeship Agency** • Carpenter - Apprenticeship, Certificate of Qualification • Carpenter - Trade Qualifier, Certificate of Qualification • Construction Electrician - Apprenticeship, Certificate of Qualification • Construction Electrician - Trade Qualifier, Certificate of Qualification • Industrial Electrician - Apprenticeship, Certificate of Qualification • Industrial Electrician - Trade Qualifier, Certificate of Qualification • Plumber - Apprenticeship, Certificate of Qualification • Plumber - Trade Qualifier, Certificate of Qualification

2.10. Considerations on Workforce Capacity & Skills for Consultants

- Limited knowledge of energy efficiency, green energy, and sustainability
    - Limited expertise in integrating advanced energy modeling and simulation tools into the design process for retrofits can slow down achieving net-zero energy goals.
    - Limited experience with life-cycle assessments (LCA) and embodied carbon calculations may impact the accuracy of cost estimates.
    - Lack of familiarity with innovative materials, such as low-carbon or adaptive materials, and their lifecycle impacts can restrict the adoption and implementation and scalability of sustainable design solutions.
    - Limited experience in integrating advanced technologies, such as automation and digital tools, in retrofit-specific manufacturing processes could delay project timelines.
- Difficulty coordinating across disciplines to implement energy efficiency
    - Professionals often face challenges in coordinating across disciplines to ensure seamless integration of mechanical, electrical, and structural systems in retrofitted buildings.

    - Collaboration between geomatics professionals and other building disciplines (e.g., architects, and engineers) is essential, which may require additional coordination and project management skills.
    - The integration of sustainable design principles with mechanical and architectural systems requires close collaboration, which may challenge coordination and timelines.
- Complexity of permits and changing codes for energy-efficiency retrofits
    - Navigating evolving codes, standards, and certification requirements for sustainable construction requires continuous professional development.
- Financial challenges due to high retrofitting costs
    - Difficulty in justifying the upfront costs of high-performance building systems to clients, despite long-term savings, poses a barrier to implementing energy-efficient retrofits.

2.11. Micro-credentials for Consultants

1. Calculating the Zero Carbon Balance (Canada Green Building Council)

This course, part of the Zero Carbon Building Micro-Credential, teaches participants about the Zero Carbon Balance and its role in achieving zero-carbon buildings. It covers carbon accounting, embodied and operational carbon, avoided emissions, and renewable energy.

2. Introduction to Embodied Carbon in Buildings (Canada Green Building Council)

This course provides building sector professionals with knowledge of embodied carbon emissions in construction projects. It covers understanding embodied carbon, calculating it through Life Cycle Assessments, and strategies to reduce emissions.

3. Fundamentals of Zero Carbon Transition Planning (Canada Green Building Council)

This course focuses on eliminating onsite combustion from building operations to achieve zero-carbon performance. Participants will learn how to develop Transition Plans, including fuel switching, energy efficiency upgrades, and capital planning.

4. Environmental Engineering Technology – Water Resources (Nova Scotia Community College)

The Environmental Engineering Technology - Water Resources program prepares students to address environmental issues and protect natural resources. The program covers groundwater exploration, water treatment, soil analysis, and more, with a focus on practical application through field experience and work-integrated learning opportunities. Graduates may be eligible for membership with TechNova and are prepared to work safely in the industry.

5. Energy Sustainability Engineering Technology (ESET) (Nova Scotia Community College)

This program prepares students for careers in alternative energy, sustainability, and energy systems management. Students learn about energy auditing, modeling, and improving energy efficiency in buildings.

6. The Sustainability in Energy (by Geologic)

The Sustainability in Energy Micro-Credential program is designed for professionals in the energy industry, offering in-demand skills and career advancement opportunities. The program, developed through industry consultation and expert insights, covers sustainability and ESG concepts, environmental, social, and governance issues, and provides practical knowledge for navigating the evolving energy sector. Employers can benefit from attracting talent, equipping their teams for the future, and retaining their workforce through this program**.**

- **Target Audience:** New graduates, early to mid-career energy professionals, engineers, geoscientists, technical professionals, operations and maintenance specialists, and corporate services employees.
- **Career Fields:** Engineering, geoscience, operations and maintenance, and corporate services.
- **Specific Roles:** Business development and sales professionals.

7. Construction Estimating, Contracts and Project Management (NSCC)

This certificate program teaches construction estimating, contracting, and project management. It includes three courses that can be taken individually or together for a certificate.

3. BUILDERS & TRADES

3.1. ELECTRONIC SERVICE TECHNICIANS

NOC 22311- *Electronic service technicians (household and business equipment)*

Electronic Service Technicians service and repair household and business electronic equipment like audio and video systems, computers, servers, photocopiers, printers, and other office equipment. Alarm and Security Technicians install and maintain electronic security alarm systems of 50V or less for homes and businesses, but this does not include fire alarm systems. They work for electronic service and retail companies, wholesale distributors, and within service departments of electronic manufacturing companies.

Typical Educational Background:

- A two-to-three-year college program in electronics or completion of high school or college courses in electronics and on-the-job training is required.
- Trade Qualifier option, 8,100 hours, and other criteria.
- Certification for Alarm and Security Technicians is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Nova Scotia Provincial Certification Exam for Alarm and Security Technicians as a trade qualifier.

Key Competencies for Retrofits

- Setting up energy efficient systems, such as LED lighting, Energy Star-rated appliances and HVAC controls.
- Replace the outdated electronic components with advanced energy-efficient alternatives.
- Implement smart home or office technologies that allow automated and optimized energy use.
- Soft Skills- independence, collaboration adaptability, analytical thinking, active learning and attention to detail.

Responsible Organizations	• Tech Nova -This is the organization for the professional technicians, certifies and regulates the use of designations • Efficiency Nova Scotia -providing rebates for energy efficiency upgrades including those involving in electronic systems
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • Alarm and Security Technician - Trade Qualifier *Certificate of Qualification* **Nova Scotia Community College** • Information Technology Technician *Diploma* • *Electrical Engineering Technology (pre-apprenticeship) Diploma*

3.2. CONTRACTORS AND SUPERVISORS

NOC 72014-*Contractors and supervisors, other construction trades, installers, repairers and servicers*

Contractors and supervisors, other construction trades, installers, repairers and servicers supervise and coordinate the activities of various tradespersons, installers, repairers and servicers classified in the following minor groups: Bricklayers and Insulators, Concrete finishers, tile setters and plasterers, Roofers, Glaziers, Painters, decorators and floor covering installers, and Building maintenance installers, servicers and repairers. They are employed by a wide range of establishments; places of employment are indicated in the

unit group descriptions. Contractors may be self-employed. This unit group also includes prefabricated product installation and service contractors and proprietors of some repair and service establishments.

Typical Educational Background:

- Completion of secondary school is usually required.
- Several years of experience in the trade or in the work area supervised are usually required.
- Journeyman/Woman trade certification may be required for some occupations in this unit group.

Key Competencies for Retrofits

- Expanded knowledge of supply chains for energy efficient and low carbon equipment, materials, and technology
- Interdisciplinary skills in mechanical, electrical, and plumbing systems, as well as digital technology
- Assessment of existing building, including understanding of existing systems; auditing current energy efficiency and embodied carbon; checking prefabrication suitability.
- Understanding the amount of building preparation required, for demolition, services disconnect and materials remediation.
- Building science fundamentals (Building-as-a-system)
- Green building construction strategies such as water efficiency, energy efficiency, indoor environmental quality
- Low carbon materials, embodied carbon in construction and performing Life Cycle Assessment (LCA)
- Adaptive and resilient building strategies
- Soft skills such as communication, negotiation, problem-solving, and project coordination

Responsible Organizations	• Construction Association of Nova Scotia -CANS supports contractors, supervisors, and construction professionals through training programs, networking events, and industry advocacy.
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • Concrete Finisher - Trade Qualifier, Certificate of Qualification • Drywall Finisher and Plasterer - Trade Qualifier, Certificate of Qualification • Floor Covering Installer - Trade Qualifier, Certificate of Qualification • Glazier - Trade Qualifier, Certificate of Qualification • Insulator (Heat and Frost) - Apprenticeship, Certificate of Qualification • Insulator (Heat and Frost) - Trade Qualifier, Certificate of Qualification • Lather (Interior Systems Mechanic) - Trade Qualifier, Certificate of Qualification • Painter and Decorator - Trade Qualifier, Certificate of Qualification • Roofer - Apprenticeship, Certificate of Qualification • Roofer - Trade Qualifier, Certificate of Qualification • Tile Setter - Trade Qualifier, Certificate of Qualification

3.3. SHEET METAL WORKERS

NOC 72102-*Sheet Metal Workers*

Sheet Metal Workers fabricate, assemble, install and repair sheet metal products. They are employed by sheet metal fabrication shops, sheet metal products manufacturing companies, sheet metal work contractors and various industrial sectors.

Typical Educational Background:

- High school or equivalent (usually).
- Training through a 7,200-hour apprenticeship program with four apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option: 10,800 hours and other criteria.
- Certification for Sheet Metal Workers is compulsory in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Sheet Metal Workers.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Crafting custom ductwork and HVAC elements to optimize airflow and minimize energy loss, thereby enhancing system efficiency.
- Operating CNC machines and other digital fabrication equipment to produce precise components that meet energy efficiency standards.
- Ensuring compliance with green building certifications like LEED by following best practices in material selection and installation methods.
- Soft skills- Communication, problem-solving, attention to detail, creativity, collaboration.

Responsible Organizations	• Sheet metal workers and roofer local 409- Representing over 340 sheet metal workers and roofers across mainland Nova Scotia • Nova Scotia Apprenticeship Agency -Training and trade certification for sheet metal workers • **Sheet Metal Workers' International Association (SMWIA**) – Provides training programs and certifications for energy-efficient and sustainable HVAC and sheet metal work. • **Canadian Council of Sheet Metal Workers and Roofers** – Represents sheet metal workers and offers apprenticeship and continuing education opportunities for green building skills. • **ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) –** Offers guidelines and standards on energy-efficient HVAC systems relevant to sheet metal workers.
Support for Key Competencies	**Nova Scotia Community College** • Sheet Metal Systems (pre-apprenticeship) Certificate **Nova Scotia Apprenticeship Agency** • Sheet Metal Worker - Apprenticeship (Certificate of Qualification) • Sheet Metal Worker - Trade Qualifier (Certificate of Qualification)

3.4. BOILERMAKERS

NOC 72103-Boilermakers

Boilermakers build, test and repair air-tight and liquid-tight containers like boilers and storage tanks. The name originated from workers who would make boilers, but they may work on projects as diverse as bridges to blast furnaces to the construction of mining equipment. Boilermakers work for boiler manufacturing, metal fabricating, shipbuilding, construction, electric power generation, rail transport, petrochemical and coal products, and similar industrial companies. Apprentices are included in this group.

Typical Educational Background:

- High school or equivalent.
- Training through a 5,400-hour apprenticeship program with three apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 8,100 hours and other criteria.
- Certification for Boilermakers is compulsory in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for boilermakers.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for the Retrofits

- Designing and constructing boilers, tanks, and pressure vessels optimized for energy efficiency.
- Inspecting boilers and pressure vessels to identify inefficiencies and recommend upgrades to meet modern energy standards.
- Designing systems that are durable and adaptable to changing energy requirements and environmental conditions.
- Communicating effectively with team members, contractors, and clients. Demonstrating problem-solving and leadership skills during complex retrofit projects.

Responsible Organizations	• International Brotherhood of Boilermakers (IBB) – Offers training and certifications focused on energy-efficient systems and sustainable practices. • Canadian Welding Bureau (CWB) – Provides certifications and resources for advanced welding techniques required in green retrofits. • National Association of Power Engineers (NAPE) – Offers resources and certifications on energy-efficient power systems relevant to boilermakers. • Canadian Standards Association (CSA) – Sets standards for boilers and pressure vessels, ensuring adherence to energy-efficient and green building practices.
Support for Key Competencies	**Nova Scotia Community College** • Metal Fabrication (pre-apprenticeship) *Diploma (NSCC)* • *Welding (pre-apprenticeship) Diploma* **Nova Scotia Apprenticeship Agency** • Boilermaker - Apprenticeship *Certificate of Qualification* • *Boilermaker - Trade Qualifier Certificate of Qualification*

3.5. IRONWORKERS

NOC 72105-*Ironworkers*

Ironworkers fabricate, construct, and join scaffolding, structural steel buildings, bridges, ornamental ironwork, and precast structures. They work for construction ironwork contractors.

Typical Educational Background:

- High school or equivalent (usually).
- Reinforcing: training through a 3,600-hour apprenticeship program with two apprenticeship levels.
- Structural/Ornamental: training through a 5,400-hour apprenticeship program with three apprenticeship levels.
- To become an apprentice, you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier Generalist option, 8,100 hours, and other criteria.
- Trade Qualifier Reinforcing option, 5,400 hours, and other criteria.
- Trade Qualifier Structural/Ornamental option, 8,100 hours, and other criteria.
- Certification for Ironworkers (generalist, reinforcing, and structural/ornamental) is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for appropriate trade.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Retrofitting Techniques include Modifying existing steel structures to improve energy performance, such as integrating thermal breaks or insulation materials.
- Enhance building frameworks to support energy-efficient upgrades, such as solar panels and green roofs.
- Knowledge of efficient building practices includes familiarity with the building codes and standards related to energy efficiency.
- Soft skills such as communication, team collaboration, Problem-solving

Responsible Organizations	• **Nova Scotia Apprenticeship agency offers** apprenticeship training and certification for ironworkers. • **Iron Works Local 752-union** local delivers apprenticeship-level training for ironworkers in Nova Scotia.

Support for Key Competencies	**Nova Scotia Apprenticeship Agency:** ● Ironworker (Generalist) - Trade Qualifier ● *Certificate of Qualification* ● Ironworker (Reinforcing) - Apprenticeship ● *Certificate of Qualification* ● Ironworker (Reinforcing) - Trade Qualifier ● *Certificate of Qualification* ● Ironworker (Structural/Ornamental) - Apprenticeship ● *Certificate of Qualification* ● Ironworker (Structural/Ornamental) - Trade Qualifier ● *Certificate of Qualification*

3.6. WELDERS

NOC 72106-*Welders and related machine operators*

Welders join, cut or shape metal using a variety of welding processes and equipment. This group also includes machine operators who use previously set up production welding, brazing, and soldering equipment. They work for companies that manufacture structural steel and platework, boilers, heavy machinery, aircraft and ships and other metal products, and by welding contractors and welding shops, or they may be self-employed.

Typical Educational Background:

- High school or equivalent (usually).
- Training through a 5,400-hour apprenticeship program with three apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option: 8,100 hours and other criteria.
- Certification for welders is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for welders.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.
- High pressure welding requires a licence.

Welding, Brazing and Soldering Machine Operators:

- Some high school education.
- Several months of on-the-job training.
- Experience as a machine operator helper may be required.
- Experience with robotics may be required.

Key Competencies for Retrofits

- Welding and fabrication of structural reinforcements for energy-efficient building upgrades, such as insulated panels and steel supports.
- Retrofitting and repairing existing metal structures to support renewable energy systems (e.g., solar panels, wind turbine mounts).
- Precision welding for the installation of heat exchangers, high-efficiency HVAC systems, and piping for geothermal systems.
- Use of sustainable and low-carbon metals to reduce the embodied carbon in retrofit projects.
- Adapting welding techniques for materials used in green retrofits, including lightweight alloys and advanced composites.
- Ensuring welded components align with energy performance goals, including airtightness and thermal efficiency standards.
- Soft skills such as teamwork, adaptability, and problem-solving for integration with multidisciplinary retrofit teams.

Responsible Organizations	• Nova Scotia Apprenticeship Agency (Certifies welders and related trades in the province). • Nova Scotia Construction Sector Council (Supports training and workforce development for sustainable construction).
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • Welder - Apprenticeship *Certificate of Qualification* • Welder - Trade Qualifier *Certificate of Qualification* ***Nova Scotia Community College*** • Metal Fabrication (pre-apprenticeship) *Diploma* • Welding (pre-apprenticeship) *Diploma*

3.7. CONSTRUCTION ELECTRICIANS

NOC 72400- *Construction Electricians*

Construction Electricians install, repair, and maintain electrical systems that are designed to provide heat, light, power, control, signals, or fire alarms for all types of buildings, structures, and premises. Construction electricians may work for electrical contractors and maintenance departments of buildings and other institutions, or they may be self-employed. Apprentices are included in this group.

Typical Educational Background:

- High school or equivalent.
- Training through a 7,200-hour apprenticeship program with four apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 10,800 hours and other criteria.
- Certification for Construction Electricians is compulsory in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for construction electricians.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Assessment of existing building, including understanding of existing systems; auditing current energy efficiency and embodied carbon; checking prefabrication suitability.
- Understanding the amount of building preparation required, for demolition, services disconnect and materials remediation.
- Business acumen, including business case for optimizing cost and performance.
- Building science fundamentals (Building-as-a-system)
- Green building construction strategies such as water efficiency, energy efficiency, indoor environmental quality
- Knowledge on high performance and low carbon equipment, and materials.
- Performing life-cycle assessment (LCA) and calculating embodied carbon
- Adaptive and resilient building strategies
- Soft skills such as communication, negotiation, problem solving, project coordination

Responsible Organizations	• Nova Scotia Apprenticeship Agency (Certifies electricians and oversees training programs in the province). • International Brotherhood of Electrical Workers (IBEW Local Chapters in Nova Scotia support training and advocacy).
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • *Industrial Mechanic (Millwright) - Apprenticeship Certificate of Qualification* • *Industrial Mechanic (Millwright) - Trade Qualifier Certificate of Qualification* ***Nova Scotia Community College*** • Electro-Mechanical Technician (pre-apprenticeship) Diploma • Industrial Mechanical (pre-apprenticeship) *Certificate*

3.8. INDUSTRIAL ELECTRICIANS

NOC 72201- *Industrial Electricians*

Industrial electricians install, maintain, test, troubleshoot and repair industrial electrical equipment and associated electrical and electronic controls. They are employed by electrical contractors and maintenance departments of factories, plants, mines, shipyards and other industrial establishments. Apprentices are also included in this unit group.

Typical Educational Background:

- High school or equivalent (usually).
- Training through a 7,200-hour apprenticeship program with three apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating

from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.

- Trade Qualifier option, 10,800 hours, and other criteria.
- Certification for Industrial Electricians is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Industrial Electricians.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.
- Additional Construction Electrician Certification may be required for Industrial Electricians when the employers are not owners of the industrial electrical equipment.

Key Competencies for Retrofits

- Installation, retrofitting, and maintenance of energy-efficient industrial electrical systems in retrofits.
- Integration of renewable energy systems, including solar panels, wind turbines, and industrial-scale battery storage.
- Commissioning and maintaining energy management systems for industrial facilities to optimize energy usage.
- Electrification of industrial processes, including converting fossil fuel-driven systems to electric alternatives
- Installation of EV charging infrastructure and power distribution upgrades for industrial sites.
- Use of low-carbon, energy-efficient electrical components to support green retrofits in industrial settings.
- Soft skills such as problem-solving, project management, and communication to effectively collaborate on retrofit projects.

Responsible Organizations	• Nova Scotia Apprenticeship Agency (Certifies industrial electricians and oversees training). • International Brotherhood of Electrical Workers (IBEW Local Chapters in Nova Scotia provide advocacy and training) •
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • Industrial Electrician - Apprenticeship *Certificate of Qualification* • *Industrial Electrician - Trade Qualifier Certificate of Qualification* ***Nova Scotia Community College*** • Electrical - Industrial Maintenance and Controls (pre-apprenticeship) *Diploma* • *Electrical Construction and Industrial (pre-apprenticeship) Certificate* • *Electro-Mechanical Technician (pre-apprenticeship) Diploma* ***Building trade advancement college of nova scotia*** • *Electrical Construction and Industrial Pre-Employment (pre-apprenticeship) Certificate*

3.9. ELECTRICAL POWERLINE AND CABLE WORKERS

NOC 72203- *Electrical Powerline and Cable Workers*

Electrical power line and cable workers construct, maintain and repair overhead and underground electrical power transmission and distribution systems. They are employed by electric power generation, transmission and distribution companies, electrical contractors and public utility commissions. Apprentices are also included in this unit group.

Typical Educational Background:

- High school or equivalent (usually).
- Training through a 7,200-hour apprenticeship program with four apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 10,800 hours, and other criteria.
- Certification for Powerline Technicians is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Powerline Technicians.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Upgrading powerline and cable systems to support renewable energy integration, including solar, wind, and battery storage.
- Installation of energy-efficient transmission and distribution infrastructure to reduce power losses.
- Retrofitting power grids to accommodate electric vehicle (EV) charging networks and electrified building systems.
- Maintenance and optimization of grid connections for retrofitted buildings with distributed energy systems (e.g., microgrids).
- Expertise in working with advanced, low-carbon materials for powerline and cable installations.
- Ensuring retrofitted systems meet safety and energy performance standards for green retrofit projects.
- Soft skills such as problem-solving, adaptability, and communication for effective collaboration on complex retrofit projects.

Responsible Organizations	• Nova Scotia Apprenticeship Agency (Certifies powerline and cable workers in the province). • Canadian Electrical Contractors Association (Supports electrical trades nationally). • International Brotherhood of Electrical Workers (IBEW Local Chapters in Nova Scotia provide training and advocacy). • NETCO (Promotes training for green and energy-efficient practices in electrical trades).
Support for Key Competencies	***Nova Scotia Community College*** • *Power and Utility Line Work (pre-apprenticeship) Certificate* **Nova Scotia Apprenticeship Agency** • Powerline Technician - Apprenticeship *Certificate of Qualification*

3.10. MECHANICAL SYSTEMS AND TRADES

NOC 72300- *Plumbers*

Plumbers plan, install and repair piping and other equipment used to move, store or dispose of water, gas and sewage. They work for maintenance departments of factories, plants, and similar businesses, for plumbing contractors, or they may be self-employed.

Typical Educational Background:

- High school or equivalent.
- Training through a 7,200-hour apprenticeship program with four apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 10,800 hours and other criteria.
- Certification for Plumbers is compulsory in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for plumbers.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

NOC 72301- *Steamfitters, pipefitters and sprinkler system installers*

Steamfitters and Pipefitters install piping, equipment, and controls for hot water, steam, process and chemical piping. Sprinkler Fitters install and maintain permanent fire extinguishing systems. Steamfitters and Pipefitters and Sprinkler Fitters work for maintenance departments of factories and plants and similar work sites, for pipefitting or sprinkler system contractors, or may be self-employed.

Typical Educational Background:

- High school or equivalent (usually).
- Training through a 7,200-hour apprenticeship program with four apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 10,800 hours and other criteria.
- Certification for Steamfitter-Pipefitters is compulsory in Nova Scotia.
- Certification for Sprinkler Fitters is compulsory in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Sprinkler Fitters or Steamfitter-Pipefitter.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.
- Petroleum Storage Tank Installers must complete industry training and then apply for certification from Nova Scotia Environment and Climate Change.

NOC 72302- *Gas Fitters*

Gas Fitters (Gas Technicians) install, service and maintain gas-utilizing appliances, piping and equipment. There are two classes of Gas Fitter – Gas Fitter A and Gas Fitter B. Gas Fitter A installs, services and maintains any size of gas-utilizing appliances, piping and equipment. Gas Fitter B installs, services and maintains any size of gas-utilizing appliances, piping and equipment with an input rate of 400,000 Btu/h or less. They work for gas utility companies and gas servicing companies.

Typical Educational Background:

- High school or equivalent (usually).
- Training through a one-level Class A, 1,800-hour or two-level Class B, 3,600-hour apprenticeship program: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 2,700 hours Class A or 5,400 hours Class B and other criteria.
- Certification for Gas Fitters is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Gas Fitters.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.
- Obtain a Fuel Safety Technician license from Technical Safety. A Gas Fitter A or Gas Fitter B Certificate of Qualification is required to apply for a license.

NOC 72402-*Heating, refrigeration and air conditioning mechanics*

Heating, refrigeration and air conditioning mechanics install, maintain, repair and overhaul residential central air conditioning systems, commercial and industrial refrigeration and air conditioning systems and combined heating, ventilation and cooling systems. They are employed by heating, refrigeration and air conditioning installation contractors, various industrial settings, food wholesalers, engineering firms and retail and servicing establishments. Transport refrigeration mechanics are included in this unit group. Apprentices are also included in this unit group.

Typical Educational Background:

- High school or equivalent (usually).
- Training through a 7,200-hour apprenticeship program with four apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 10,800 hours and other criteria.
- Certification for refrigeration and air conditioning mechanics is compulsory in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for refrigeration and air conditioning mechanics.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Knowledge on high performance mechanical systems, including efficient heating, cooling, ventilation and domestic hot water technologies, equipment, and associated distribution solutions
- Knowledge on heat recovery systems including heat recovery ventilators, heat scavengers and wastewater heat extractors
- Knowledge of renewable solutions such as solar hot water heating and photovoltaic systems
- Understanding of air flow in mechanical and ventilation systems.
- Building science fundamentals (Building-as-a-system)
- Green building construction strategies such as water efficiency, energy efficiency, indoor environmental quality
- Soft skills such as communication, negotiation, problem solving, project coordination

Responsible Organizations	• **Nova Scotia Apprenticeship Agency** (Certifies HVAC professionals, gas fitters,steamfitters, pipefitters, and sprinkler installers, plumbers and overseas training).
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • Plumber - Apprenticeship *Certificate of Qualification* • *Plumber - Trade Qualifier Certificate of Qualification* • *Sprinkler Fitter - Apprenticeship Certificate of Qualification* • *Refrigeration and Air Conditioning Mechanic - Apprenticeship Certificate of Qualification* ***Nova Scotia Community College*** • *Pipe Trades (pre-apprenticeship) Diploma* • *Gas Technician (pre-apprenticeship) Certificate* • *Building Systems Technician (HVAC&R) (pre-apprenticeship) Diploma* • *Refrigeration and Air Conditioning - Geothermal (pre-apprenticeship) Certificate* ***UA 56 Pipe Trades Career College Ltd.*** • *PipeSteamfitting/Pipefitting (pre-apprenticeship) Certificate Trades (pre-apprenticeship) Diploma*

3.11. CARPENTERS
NOC 72310- *Carpenters*

Carpenters build, install, renovate, maintain, and repair structures and components of structures made of wood, wood substitutes, lightweight steel, concrete, and other materials. They work for construction companies, carpentry contractors, and maintenance departments of factories, plants and other businesses, or they may be self-employed. Boat builders build, assemble and repair small commercial vessels used to navigate in, on through or above water using any method of propulsion. They work for boat building companies and repair shops.

Typical Educational Background:

High school or equivalent (usually).

- Training through a 7,200-hour apprenticeship program with four apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 10,800 hours and other criteria.
- Certification for Carpenters is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Carpenters.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Boat Builders:

- High school or equivalent (usually).
- Training through a 5,400-hour apprenticeship program with three apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after completing industry training; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 9,450 hours and other criteria.
- Certification for Boat Builders is voluntary in Nova Scotia.

Key Competencies for Retrofits

- Knowledge on Passive House airtightness levels and air/vapor barrier systems
- Understanding of building envelope and thermal bridges
- Knowledge on low carbon building materials and embodied carbon
- Building science fundamentals (Building-as-a-system)
- Green building construction strategies such as energy efficiency, indoor environmental quality
- Soft skills such as communication, problem solving, project coordination

Responsible Organizations	• Nova Scotia Apprenticeship Agency (Certifies carpenters and oversees their training). • Nova Scotia Construction Sector Council (Supports skills development for sustainable construction practices). • Carpenters' Union Local (Supports workforce development and advocacy for carpenters in Nova Scotia).
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • Carpenter - Apprenticeship *Certificate of Qualification* **Nova Scotia Boat Builders Association** • Boat Builder - Apprenticeship*Certificate of Qualification* • Boat Builder - Trade Qualifier *Certificate of Qualification*

3.12. BRICKLAYERS

NOC 72320- *Bricklayers*

Bricklayers build and repair walls, floors, fireplaces, and walkways with bricks, blocks and stones. Restoration stone masons build and repair structures using stone. Bricklayers work for construction companies, landscaping companies, bricklaying or masonry contractors or they may be self-employed. Apprentices are included in this group.

Typical Educational Background:

- High school or equivalent.
- Training through a 5,400-hour apprenticeship program with three apprenticeship levels: to become an apprentice first you need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.

- Trade qualifier option, 8,100 hours and other criteria.
- Trade certification for Bricklayers is compulsory in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for bricklayers.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Restoration Stone Mason:

- High school or equivalent.
- Trade qualifier option, 10,800 hours and other criteria.
- Trade certification for Restoration StoneMasons is available, but voluntary, in Nova Scotia.
- Write and score a minimum of 70% on the certification exam for Restoration Stone Masons.

Key Competencies for Retrofits

- Retrofitting masonry walls and facades to improve thermal efficiency and reduce energy loss in buildings.
- Installing and repairing high-performance building envelopes, including insulated masonry systems and energy-efficient cladding.
- Working with low-carbon, sustainable building materials, such as recycled bricks, permeable masonry, and insulating mortars.
- Incorporating advanced masonry techniques to enhance airtightness and thermal insulation.
- Constructing masonry supports for renewable energy systems, such as solar panel mounts and green roofs.
- Application of building science principles to ensure masonry retrofits align with overall building energy performance goals.
- Soft skills such as problem-solving, teamwork, and communication to collaborate effectively with other trades in retrofit projects.

Responsible Organizations	• Nova Scotia Apprenticeship Agency (Certifies bricklayers and supports training). • Nova Scotia Construction Sector Council (Promotes sustainable construction practices and workforce development).
Support for Key Competencies	**Building Trades Advancement College of Nova Scotia** • Bricklayer (pre-apprenticeship) *Certificate* **Nova Scotia Apprenticeship Agency** • Bricklayer - Apprenticeship *Certificate of Qualification* • *Bricklayer - Trade Qualifier Certificate of Qualification* • *Restoration Stone Mason - Trade Qualifier Certificate of Qualification* ***Nova Scotia Community College*** • Brick and Stone Masonry *Certificate* • Bricklayer (pre-apprenticeship) *Certificate*

3.13. INSULATORS

NOC 72321- *Insulators*

Insulators (heat and frost) install insulating materials in commercial and industrial structures and remove existing insulating materials like asbestos. They work for construction companies and insulation contractors, or they may be self-employed.

Typical Educational Background:

- High school or equivalent (usually).
- Training through a 7,200-hour apprenticeship program with four apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 10,800 hours, and other criteria.
- Certification for Insulators (heat and frost) is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Insulators (heat and frost).
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Installing high-performance insulation systems to improve building energy efficiency and reduce heat loss.
- Retrofitting walls, roofs, and floors with advanced insulation materials, including spray foam, rigid panels, and blown-in insulation.
- Ensuring airtightness and vapour barrier integrity in retrofit projects to enhance thermal performance.
- Working with sustainable and low-carbon insulation materials, such as recycled or bio-based products.
- Installing insulation for HVAC ductwork and piping systems to optimize energy use in retrofitted buildings.
- Understanding building science principles to ensure insulation aligns with "building-as-a-system" energy goals.
- Soft skills such as communication, problem-solving, and teamwork to collaborate effectively with other trades on retrofit projects.

Responsible Organizations	Nova Scotia Apprenticeship Agency (Certifies insulators and oversees their training). • Nova Scotia Construction Sector Council (Supports skills development in sustainable and energy-efficient practices). • Insulators Local 116 (Nova Scotia): This represents heat and frost insulators in Nova Scotia and promotes training and best practices. • Efficiency Nova Scotia: Advocates for energy-efficient practices and supports programs that may involve insulation retrofits.
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • *Insulator (Heat and Frost) - Apprenticeship Certificate of Qualification* • Insulator (Heat and Frost) - Trade Qualifier *Certificate of Qualification*

3.14. CRANE OPERATORS

NOC 72500-Crane Operators

Crane Operators operate cranes or draglines to lift, move, position or place machinery, materials, equipment and other large things at construction or industrial sites, ports, railway yards, surface mines and other similar locations. They work for construction, industrial, ship building, transport sector, mining, cargo handling and railway companies and public utilities.

Typical Educational Background:

- High school or equivalent (usually).
- High school, college or industry courses in crane operating (usually).
- Certification for Mobile Crane Operators is voluntary in Nova Scotia.
- Certification for Tower Crane Operators is voluntary in Nova Scotia.
- Mobile Crane Operators may require a provincial license to drive mobile cranes on public roads.
- Internal company certification as a Crane Operator may be required by some employers.
- Trade Qualifier option: write and score a minimum of 70% on the Red Seal exam for either Mobile Crane or Tower Crane Operators.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.
- A license is required from the Technical Safety Division to work in the mobile or tower crane operator trades.

Key Competencies for Retrofits

- Operating cranes to support the installation of renewable energy systems, such as solar panels, wind turbines, and energy storage units.
- Lifting and placing prefabricated energy-efficient building components, such as insulated panels and modular systems.
- Assisting in retrofits of high-performance building envelopes by hoisting heavy materials, such as low-carbon cladding or glazing systems.
- Handling specialized equipment and materials for green construction, including sustainable and low-carbon building elements.
- Ensuring safe operation and adherence to environmental standards during retrofitting projects.
- Coordinating with multidisciplinary teams to align crane operations with project timelines and energy performance goals.
- Soft skills such as communication, adaptability, and teamwork to integrate crane operations seamlessly into retrofit projects.

Responsible Organizations	• **International Union of Operating Engineers (IUOE)** – Offers training and certifications for crane operators, including green construction practices. • **Construction Safety Association of Ontario (CSAO)** – Provides resources and guidelines on safety in crane operations for retrofits. • **Canadian Hoisting & Rigging Safety Council (CHRSC)** – Offers resources and best practices for handling materials safely during retrofitting projects.
Support for Key Competencies	**Operation Engineers Training Institute of Nova Scotia** • Mobile Crane Operation *Certificate* **Nova Scotia Apprenticeship Agency** • Mobile Crane Operator - Trade Qualifier *Certificate of Qualification* • Tower Crane Operator - Trade Qualifier *Certificate of Qualification*

3.15. CONCRETE FINISHERS

NOC 73100-Concrete Finishers

Concrete Finishers place, finish, cut, and repair concrete floors, driveways, sidewalks, curbs, bridge decks, and other concrete structures. They work for construction companies, cement and concrete contractors, and manufacturers of precast concrete products, or they may be self-employed.

Typical Educational Background:

- High school or equivalent (usually).
- Over three years of work experience in the trade and some high school, college, or industry courses in cement finishing.
- Trade Qualifier option, 5,400 hours, and other criteria.
- Certification for Concrete Finishers is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Concrete Finishers.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Applying advanced finishing techniques to enhance the energy efficiency of concrete surfaces, such as polished or thermally reflective finishes.
- Retrofitting concrete floors and structures to support energy-efficient systems, including radiant heating and cooling systems.
- Repairing and upgrading existing concrete elements to reduce thermal bridging and improve energy performance.
- Using sustainable, low-carbon concrete materials, including recycled aggregates and carbon-reducing additives.
- Assisting in retrofitting building foundations for renewable energy systems, such as wind turbine bases or solar panel supports.
- Ensuring concrete finishing aligns with energy performance and sustainability goals, including airtightness and thermal mass optimization.
- Soft skills such as teamwork, problem-solving, and adaptability to collaborate with multidisciplinary teams in green retrofits.

Responsible Organizations	• Nova Scotia Apprenticeship Agency: Oversees certification and training for concrete finishers in the province. • Nova Scotia Construction Sector Council: Provides training and development resources for green construction practices. • Concrete Association of Nova Scotia (CANS): Promotes best practices in concrete use and sustainability. • Nova Scotia Community College (NSCC): Offers programs related to sustainable construction and advanced concrete techniques.
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • Concrete Finisher - Trade Qualifier *Certificate of Qualification*

3.16. TILESETTERS

NOC 73101-Tile Setters

Tilesetters cover interior and exterior walls, floors and ceilings with ceramic, marble and quarry tile, mosaics or terrazzo. They are employed by construction companies and masonry contractors, or they may be self-employed.

Typical Educational Background:

- High school or equivalent (usually).
- A combination of over three years of work experience in the trade and some high school or college courses in tile setting.

- Trade Qualifier option, 8,100 hours, and other criteria.
- Certification for Tilesetters is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Tilesetters.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Installing energy-efficient and sustainable tile systems, including thermal and radiant flooring compatible tiles.
- Retrofitting surfaces with tiles that improve thermal mass and contribute to energy efficiency in retrofitted buildings.
- Using sustainable, low-carbon, or recycled tile materials to reduce environmental impact in green retrofits.
- Applying advanced waterproofing and insulation techniques to tiled surfaces, enhancing airtightness and thermal performance.
- Coordinating with HVAC specialists for integrating tiles with underfloor heating and cooling systems.
- Restoring and reusing existing tiles where possible to align with sustainable practices and waste reduction goals.
- Soft skills such as teamwork, attention to detail, and communication to collaborate with other trades in retrofit projects.

Responsible Organizations	• Nova Scotia Apprenticeship Agency: Overseas training and certification for tile setters in the province. • Tilesetters' Local (Nova Scotia): Represents tile setters and supports training and advocacy in the trade.
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • Tile Setter - Trade Qualifier *Certificate of Qualification*

3.17. PLASTERS, DRYWALL INSTALLERS AND FINISHERS AND LATHERS

NOC 73102- Plasterers, drywall installers and finishers and lathers

Plasterers apply, finish, and maintain and restore plaster or similar materials, on interior and exterior walls, ceilings and building partitions to produce plain or decorative surfaces. Drywall Installers and Finishers install and finish drywall sheets and various types of ceiling systems. Lathers install support framework for ceiling systems, interior and exterior walls and building partitions. They are employed by construction companies and by plastering, drywalling and lathing contractors, or they may be self-employed.

Typical Educational Background:

- High school or equivalent (usually).
- A combination of over three years of work experience and some high school, college, or industry courses in plastering, drywalling, or lathing.
- Trade Qualifier option for Drywall Finisher and Plasterer, 8,100 hours, and other criteria.
- Trade Qualifier option for Lather (interior systems mechanic), 8,100 hours, and other criteria.
- Certification for Drywall Finishers and Plasterers is voluntary in Nova Scotia.
- Certification for Lathers (interior systems mechanics) is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Drywall Finisher and Plasterer or Lathers.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Installing energy-efficient drywall systems, including insulated and moisture-resistant drywall for high-performance building envelopes.
- Retrofitting walls and ceilings to improve thermal performance and airtightness, contributing to energy efficiency goals.
- Applying advanced plastering techniques to support airtightness and thermal insulation in green retrofits.
- Using sustainable and low-carbon materials, such as recycled drywall or environmentally friendly plaster products.
- Repairing and upgrading interior surfaces to integrate with other energy-efficient systems, such as HVAC or radiant heating.
- Constructing durable and airtight lath and plaster systems in retrofits to reduce heat loss and improve energy performance.
- Soft skills such as teamwork, problem-solving, and communication to collaborate effectively with multidisciplinary retrofit teams.

Responsible Organizations	• Nova Scotia Apprenticeship Agency: Certifies plasterers, drywall installers, and finishers, ensuring industry standards. • Nova Scotia Construction Sector Council • United Brotherhood of Carpenters Local (Nova Scotia): Represents tradespeople involved in drywall installation and finishing. • Nova Scotia Community college
Support for Key Competencies	**Carpenter Millwright College (CMC) Inc.** • Drywall Applications *Certificate* **Nova Scotia Apprenticeship Agency** • Drywall Finisher and Plasterer - Trade Qualifier *Certificate of Qualification* • Lather (Interior Systems Mechanic) -Trade Qualifier *Certificate of Qualification*

3.18. ROOFERS AND SHINGLERS

NOC 73110-Roofers and Shinglers

Roofers install, repair or replace flat roofs as well as shingles, shakes or other roofing tiles on sloped roofs. Shinglers install and replace shingles, tiles and similar coverings on sloped roofs. They are employed by roofing and general contractors, or they may be self-employed. Apprentices are also included in this unit group.

Typical Educational Background:

- High school or equivalent (usually).

Roofers

- Training through a 5,400-hour apprenticeship program with three apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 8,100 hours, and other criteria.
- Certification for Roofers is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Roofers.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Shinglers

- Shinglers require one to two years of on-the-job training.

Key Competencies for Retrofits

- Retrofitting roofs to improve energy efficiency, including the installation of reflective roofing materials and green roofs.
- Installing and maintaining photovoltaic (solar) panel systems and their integration with existing roofing structures.
- Working with advanced roofing materials, such as sustainable shingles and low-carbon membranes, to reduce embodied carbon.
- Enhancing thermal performance through airtight roofing systems and additional insulation layers.
- Waterproofing and weatherproofing retrofitted roofs to align with energy-efficient building envelope standards.
- Installing roof-based rainwater harvesting systems and other sustainable water management solutions.
- Soft skills such as problem-solving, teamwork, and communication to collaborate effectively with other trades in retrofit projects.

Responsible Organizations	• Nova Scotia Apprenticeship Agency • Nova Scotia Construction Sector Council • Roofers Local 409 (Nova Scotia) • Nova Scotia Community College (NSCC)
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • Roofer - Apprenticeship *Certificate of Qualification* • Roofer - Trade Qualifier *Certificate of Qualification*

3.19. GLAZIERS

NOC 73111-Glaziers

Glaziers prepare, install and replace glass. They work for construction glass installation contractors, retail service and repair shops and glass fabrication shops, or they may be self-employed.

Typical Educational Background:

- High school or equivalent (usually).
- Training through a 7,200-hour apprenticeship program with four apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 10,800 hours and other criteria.
- Certification for Glaziers is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Glaziers.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Installing high-performance energy-efficient windows and glazing systems to improve building thermal performance.
- Retrofitting older buildings with advanced glazing technologies, such as double or triple-glazed units and low-emissivity (Low-E) coatings.
- Replacing or upgrading glass façades with systems designed to reduce heat transfer and energy loss.
- Integrating glazing systems with renewable energy components, such as building-integrated photovoltaics (BIPV).
- Utilizing sustainable and low-carbon glass products to reduce the environmental impact of retrofits.
- Applying airtight installation techniques to enhance building envelope performance and reduce energy consumption.
- Soft skills such as attention to detail, problem-solving, and teamwork to coordinate effectively with other trades in retrofit projects.

Responsible Organizations	• Nova Scotia Apprenticeship Agency • Nova Scotia Construction Sector Council • Nova Scotia Community College (NSCC)
Support for Key Competencies	**Nova Scotia Apprenticeship Agency** • Glazier - Apprenticeship *Certificate of Qualification* • Glazier - Trade Qualifier *Certificate of Qualification*

3.20. RESIDENTIAL AND COMMERCIAL INSTALLERS AND SERVICES

NOC 73200-Residential and commercial installers and servicers

Residential and commercial installers and servicers install and service a wide variety of interior and exterior prefabricated products such as windows, doors, electrical appliances, water heaters, fences, play structures and septic and irrigation systems at residential, commercial or institutional properties. They are employed by companies specializing in specific product installation and service.

Typical Educational Background:

- Some secondary school education is usually required.
- On-the-job training and several months of related installing, repairing or servicing experience are usually required.
- A driver's licence may be required.

Key Competencies for Retrofits

- Knowledge in digitization, and automation including Building Automation System (BAS).
- Installation and maintenance of photovoltaic systems
- Knowledge on low carbon building materials and embodied carbon
- Building science fundamentals (Building-as-a-system)
- Green building construction strategies such as water efficiency, energy efficiency
- Soft skills such as communication, problem solving, negotiation, project coordination

Responsible Organizations	• Nova Scotia Department of Environment and Climate Change
Support for Key Competencies	**Nova Scotia Department of Environment and Climate Change** • Septic Installers Compulsory Certification (Mandatory) • Septic Selectors/Designers Compulsory Certification (Mandatory)

3.21. MATERIAL HANDLERS

NOC 75101-Material Handlers

Material handlers handle, move, load and unload materials by hand or using a variety of material handling equipment. They are employed by transportation, storage and moving companies, and by a variety of manufacturing and processing companies and retail and wholesale warehouses.

Typical Educational Background:

- Some secondary school education may be required.
- Physical strength is required for manual material handlers who work with heavy materials.

Key Competencies for Retrofits

- Handling and transporting sustainable and energy-efficient building materials for retrofitting projects.
- Supporting logistics for the delivery and storage of low-carbon materials, such as recycled or bio-based components.
- Organizing and managing materials required for the installation of renewable energy systems, such as solar panels and energy storage units.
- Assisting with waste management practices by separating recyclable materials and reducing landfill contributions.
- Operating equipment safely to move heavy or fragile energy-efficient components, including glazing, insulation, and HVAC units.
- Ensuring materials are stored and handled to maintain quality and performance, especially for sensitive green building products.
- Soft skills such as communication, organization, and teamwork to coordinate effectively with multiple trades on retrofit sites.

Responsible Organizations	• **Nova Scotia Apprenticeship Agency** • **Nova Scotia Construction Sector Council** • **Nova Scotia Trucking Safety Association** • **Labourers' International Union of North America (LiUNA)** – Provides training and certifications for safe and efficient material handling practices. • **Workplace Safety and Prevention Services (WSPS)** – Offers resources on safe handling of materials in construction and retrofit environments. • **Canadian Green Building Council (CaGBC)** – Promotes sustainability guidelines for handling and storing eco-friendly building materials. • **Canadian Standards Association (CSA)** – Establishes standards for handling and managing construction materials with a focus on sustainability.

Support for Key Competencies	**Nova Scotia Community College** • Adult Learning Program Nova Scotia High School Graduation Diploma for Adults

3.22. Considerations on Workforce Capacity & Skills for Builders and Trades

- Low green literacy levels and knowledge on energy efficiency and sustainability
    - Limited understanding of green construction principles, including embodied carbon, energy efficiency, and sustainable building systems, inhibits trades people's ability to align with green retrofit goals.
    - There is some degree of resistance from skilled trades professionals to adopt new sustainable techniques and materials due to long-standing practices and skepticism toward unproven methods creates friction in retrofit projects.
- Challenge to keep up with technology advancements and energy efficiency development
    - Increasing reliance on advanced technology, such as Building Automation Systems (BAS), renewable energy installations, and smart systems, demands digital upskilling for effective implementation.
    - Limited awareness and training in handling new, high-performance materials and low-carbon technologies can hinder the quality and efficiency of retrofits.
- Difficulties in coordinating across disciplines to implement energy efficiency
    - Inadequate coordination between trades, engineers, and architects in retrofit projects can lead to delays and inefficiencies, underscoring the need for collaboration and communication.
- Complexity of permits and changing codes for energy efficient retrofits
    - Navigating complex incentive programs and meeting the stringent requirements for energy-efficient retrofits require better literacy in policy frameworks and compliance standards.
- Difficulty to meet high demand for homes while still prioritizing implementation of energy efficiency
    - There is a challenge between meeting the growing demand for homes, while still maintaining energy efficiency standards as a guiding principle.

3.23. Microcredentials for Builders & Trades

1. Electrical Technician (Nova Scotia Community College)

This program provides practical and theoretical training in electrical construction and industrial electricity, with a focus on alternative energy systems. Graduates gain skills in green energy systems, including solar photovoltaic, wind, and smart grid technologies. The program includes field experience and optional cooperative education opportunities.

2. Gas Technician (Nova Scotia Community College)

This program prepares students for Gas Fitter B Level 1 certification through theory and hands-on training. Students gain practical experience through a mandatory field experience course.

3. Electrical – Industrial Maintenance and Controls (NSCC)

Program Focus: Provides practical experience and deeper insights into electrical motors, controls, transformers, solid-state technologies, and automation.

Skill Development: Emphasizes troubleshooting, problem-solving, and managing transistors for various circuits.

Work Experience: Mandatory field experience course (unpaid, approximately 5 weeks) to apply knowledge and skills.

4. Electro Mechanical Technician (NSCC)

Program Focus: This program provides training in both electrical and mechanical trades, preparing students for careers in construction and manufacturing.

Skills Developed: Students learn to operate industrial hydraulic and pneumatic systems, weld, install wiring, design motor control circuits, and work in industrial mechanics, electrical, electronic, and computer controls.

Work Experience: Mandatory field experience (unpaid, 5 weeks) and optional cooperative education (paid, full-time, 12 weeks) provide hands-on experience and industry connections.

Physical Demands: Requires adequate vision and colour perception for safe operation.

5. Carpentry Certificate (NSCC)

Develop essential skills in the carpentry trade, from construction techniques to adherence to building codes and safety standards.

Program Duration: 6.5 months (accelerated version)

- Program Focus: Provides comprehensive carpentry skills, including wood construction techniques, building codes, and problem-solving, for individuals interested in hands-on work in building and construction.
- Work Experience: Mandatory, unpaid, 5-week field experience course to apply knowledge and skills in a workplace setting.

6. Metal Fabrication (NSCC)

This program provides the knowledge and skills to enter the metal fabrication industry, including reading blueprints, using tools and techniques to cut, bend, and join metal, and applying metallurgy knowledge.

7. Power and Utility Line Work (NSCC)

Build knowledge of the systems and computer controls, safety training and environmental awareness needed to work as

a powerline technician.The Powerline Technician program prepares students for careers in power generation, transmission, and distribution. The program emphasizes safety, electrical technology, and hands-on field experience.

8. Building It Green (Canada's Building Trades Union)

Building It Green is a free national training program for the construction industry, developed by tradespeople. The program provides foundational knowledge for delivering high-performance, green construction projects.

9. Building Envelope Science: Principle and Practices (RRC Polytech)

This microcredential teaches building science, focusing on the building envelope and its interaction with the environment. It covers topics like energy efficiency, sustainability, and building codes, preparing learners for the low-carbon economy.

10. Supervising Net Zero and Passive House Construction (quick train Canada) Online

The Supervising Net-Zero and Passive House Construction microcredential is for construction industry professionals seeking skills to manage Net-Zero, Net-Zero-Ready, or Passive House projects. Learners will gain knowledge of BC Energy Step Code and Passive House standards, practical construction details, and tools for site supervision.

11. Heat Pump Installation Advance Hybrid (quick train canada)

The Advanced Heat Pump Installation course builds upon basic knowledge, focusing on complex heat pump systems for experienced technicians and engineers. It covers advanced topics like system design, troubleshooting, and energy efficiency optimization.

4. REGULATORS

4.1. ENGINEERING INSPECTORS AND REGULATORY OFFICERS

NOC 22231- Engineering inspectors and regulatory officers

Engineering inspectors and regulatory officers inspect transportation vehicles such as aircraft, watercraft, automobiles and trucks and weighing and measuring devices such as scales and meters as well as industrial instruments, processes and equipment for conformity to government and industry standards and regulations. They are employed by government agencies and in the private sector.

Typical Educational Background:

- University degree or college diploma in an appropriate engineering field or trade qualifications and extensive related work experience are required.
- Appropriate professional engineering or engineering technology certification and license may be required.

Key Competencies for Retrofits

- Inspecting retrofitted systems and materials to ensure compliance with energy efficiency and green building standards.
- Verifying that retrofits meet local and national codes, including environmental regulations and safety standards.
- Assessing the performance of renewable energy installations, such as photovoltaic panels, wind turbines, and battery systems.
- Reviewing designs and construction methods for adherence to sustainability principles, such as low-carbon construction practices.
- Monitoring the use of sustainable materials, ensuring they meet quality and performance criteria for retrofitting projects.
- Conducting energy audits and performance evaluations to certify retrofits meet energy efficiency benchmarks.

Responsible Organizations	• Nova Scotia Department of Labour, Skills, and Immigration • Efficiency Nova Scotia • Nova Scotia Building Officials Association (NSBOA) • Nova Scotia Community College (NSCC)
Support for Key Competencies	**Acadia University** • Engineering and Applied Science *Bachelor* **Saint Mary's University** • Engineering *Advanced Diploma* **Dalhousie University** • Engineering *Bachelor* **Dalhousie University Faculty of Agriculture** • Engineering *Advanced Diploma* **Cape Breton University** • Engineering *Advanced Diploma* **St. Francis University** • Engineering *Advanced Diploma*

4.2. EDUCATION POLICY RESEARCHERS, CONSULTANTS AND PROGRAM OFFICERS

NOC 41405- Education policy researchers, consultants and program officers

Education policy researchers, consultants and program officers conduct research, produce reports and administer elementary, secondary and post-secondary education policies and programs. They are employed by government departments, school boards, research institutes, professional associations and educational and other organizations throughout the public and private sectors, or they may be self-employed.

Typical Educational Background:

- A bachelor's degree in education or in a discipline such as social science or business administration is required.
- A master's degree in education may be required.
- Specialized training or certification may be required.
- Several years of experience as a school teacher are usually required.
- A teacher's certificate for the province of employment is usually required when employed by provincial education ministries.

Key Competencies for Retrofits

- Designing and developing education policies to address workforce needs in energy-efficient retrofitting projects.
- Conducting research on skills gaps and labour market trends to align education programs with green retrofit demands.
- Collaboration with government, industry, and educational institutions to develop curriculum focused on sustainability and energy efficiency.
- Evaluating the impact of policies and programs designed to support green retrofit workforce development.
- Advocating for funding and resources to support education and training initiatives in energy efficiency and sustainability.
- Soft skills such as strategic planning, public engagement, communication, and data-driven decision-making for effective program development.

Responsible Organizations	• Nova Scotia Department of Education & Early Childhood Development, Office of Teacher Certification
Support for Key Competencies	**Acadia University** • Business Administration *Bachelor* • Education *Bachelor, Master, Doctorate* **Cape Breton University** • Business Administration *Bachelor* • Education *Bachelor, Graduate Diploma* **Dalhousie University** • Adult Learning and Teaching *Certificate* • Public Administration *Graduate Diploma, Master* **Mount Saint Vincent University** • Business Administration *Bachelor* • Education *Bachelor, Master, Doctorate* • Management *Bachelor* **Saint Mary's University** • Linguistics - Post-Graduate Certificate for Teachers *Graduate Certificate* • *Management Bachelor* **St. Francis Xavier University** • Adult Education *Advanced Diploma, Master* • *Business Administration Bachelor* • *Education Bachelor, Master, Doctorate* • *Management and Leadership Bachelor*

	Université Sainte-Anne • *Business Administration Bachelor* • *Education Bachelor*

4.3. Considerations on Workforce Capacity & Skills for **Regulators**

- Low green literacy levels and knowledge on energy efficiency and sustainability
    - Limited knowledge of energy-efficient retrofit technologies and practices among building officials and municipal staff can result in slow decision-making.
    - A lack of green literacy and training on sustainable construction principles, such as embodied carbon and lifecycle assessments, can impact the effectiveness of policy enforcement.
- Complexity of permits and changing codes for energy efficient retrofits
    - Time lags in approving permits arise due to insufficient familiarity with retrofit-specific requirements among both applicants and approvers, delaying project timelines.
    - Challenges in interpreting and applying evolving codes and standards for retrofits often result in confusion or errors in approvals, requiring continuous professional development.
- Difficulties in coordinating across disciplines to implement energy efficiency
    - Limited interdepartmental collaboration and coordination between planners, building officials, and sustainability staff can create bottlenecks in managing retrofit projects efficiently.

4.4. Microcredentials for Regulators

1. GIS and Data Collection Technologies (Seneca Polytechnic) Online (Quick Train Canada)

This microcredential covers Geographic Positioning System (GPS) and Real Time Kinetic (RTK) data collection, editing, integration, and visualization. It prepares students for careers in Geographic Information Systems (GIS), drone piloting, and environmental analysis. The program is part of a suite of GIS microcredentials, focusing on data collection and analysis for a low-carbon economy.

2. Introduction to Construction Management Mode (online) NSCC

- **Course Objective:** Develop a framework for monitoring and evaluating construction projects using industry methodologies and sustainable practices.
- **Target Audience:** Individuals with experience in the construction sector, but open to all.
- **Key Learning Outcomes**: Understanding project phases, financial management, environmental impacts, and safety regulations.
- **Greenhouse Gas Emissions:** Buildings account for 18% of Canada's national greenhouse gas emissions.
- **National Retrofit Code:** By 2030, Canadians can expect a national retrofit code for existing buildings.
- **Green Building Workforce:** The green building workforce needs to triple by 2030 to meet demand for sustainable building construction and renovation.

3. The Consulting Process (The RRC polytech) Online (Quick Train canada)

This microcredential teaches participants how to effectively communicate with Indigenous communities and navigate the consultation process. Participants will learn to identify key people, compile initial assessments, negotiate budgets, and present final reports. This prepares learners for the low-carbon economy by equipping them with skills to navigate consultation processes in industries transitioning to sustainable practices.

4. Measurement, Monitoring and Verification Online (quick train Canada)

This 60-hour online course, Measurement, Monitoring & Verification (MMV), explores carbon sequestration, focusing on CO2 characteristics, regulations, and technologies. It prepares students for Canada's low-carbon workforce by providing practical knowledge and insights for immediate application.

SECONDARY PROFESSIONS REQUIRED FOR RETROFITS

1. PUBLIC AND ENVIRONMENTAL HEALTH AND SAFETY PROFESSIONALS

NOC 21120-Public and environmental health and safety professionals

Public and environmental health and safety professionals review, evaluate and monitor public health and environmental safety hazards and develop strategies to prevent, control and eliminate disease and environmental impact caused by biological and chemical factors. They inspect restaurants, industrial establishments, municipal water systems, public facilities and institutions to ensure compliance with government regulations regarding sanitation, pollution control and the handling and storage of hazardous substances. They are employed throughout the public and private sectors.

Typical Educational Background:

- A bachelor's degree in a discipline such as food science, environmental studies, chemistry or health and safety is usually required.
- Public health inspectors employed outside Quebec require certification with the Canadian Institute of Public Health Inspectors.
- Environmental health and safety professionals may require certification with the Board of Canadian Registered Safety Professionals (BCRSP).

Key Competencies for Retrofits

- Conducting environmental impact assessments to evaluate the sustainability of retrofitting projects.
- Ensuring compliance with health and safety regulations during retrofits, particularly for hazardous materials like asbestos and lead.
- Implementing best practices in air quality management, waste reduction, and water conservation in retrofit projects.
- Advising on indoor environmental quality (IEQ) to ensure healthy living conditions post-retrofit.
- Knowledge of building codes and green certifications (e.g., LEED, BREEAM) to guide retrofit project compliance.
- **Soft Skills:** Strong communication, problem-solving, and project coordination skills to collaborate with construction teams and partners.

Responsible Organizations	• Nova Scotia Environment: Provides guidelines and regulations for environmental health and safety in construction projects. • Canadian Environmental Health Association: Offers resources on sustainable building practices and environmental health. • Canada Green Building Council – Atlantic Chapter: Promotes sustainable health and safety practices in green retrofitting. • Efficiency Nova Scotia: Supports sustainable retrofit projects that improve environmental health and energy efficiency.
Support for Key Competencies	Acadia University • Chemistry, Bachelor, Master • Environmental and Sustainability Studies, Bachelor Cape Breton University • Chemistry, Bachelor • Environmental Studies, Bachelor Dalhousie University • Chemistry, Bachelor, Master • Environmental Studies (minor), Bachelor • Food Bioscience (minor), Bachelor • Food Science and Technology, Master, Doctorate Dalhousie University Faculty of Agriculture • Food Bioscience (minor), Bachelor Mount Saint Vincent University • Chemistry, Bachelor Saint Mary's University • Chemistry, Bachelor • Environmental Studies, Bachelor

	St. Francis Xavier University • Chemistry, Bachelor, Master • Climate and Environment, Bachelor University of King's College • Chemistry, Bachelor • Environmental Studies (minor), Bachelor
Considerations on Workforce Capacity & Skills	• Increasing demand for professionals with expertise in sustainable health and safety practices may create workforce gaps. • Limited understanding of green building certifications and IEQ standards may slow green retrofit adoption. • Ongoing training is required to keep up with evolving environmental health regulations and sustainability trends.

2. TECHNOLOGISTS AND TECHNICIANS IN GEOMATICS AND METEOROLOGY

NOC 22212-Technologists and Technicians in Geomatics and Meteorology

Drafting technologists and technicians prepare engineering designs, drawings and related technical information, such as building information models (BIM), in multidisciplinary engineering teams or in support of engineers, architects or industrial designers, or they may work independently. They are employed by consulting and construction companies, utility, resource and manufacturing companies, all levels of government and by a wide range of other establishments.

Typical Educational Background:

- Completion of secondary school is usually required.
- Completion of a two- to three-year college program in engineering design and drafting technology or in a related field is usually required for Drafting and Design Technologists.
- Completion of a one- to two-year college program in drafting or completion of a three- to four-year apprenticeship program or four to five years of related experience plus completion of college or industry courses in drafting are usually required for Drafting Technicians.
- Trade certification for Draftspersons is available, but voluntary in Ontario.
- Certification in engineering design and drafting technology or in a related field through provincial associations of Engineering/Applied Science Technologists and Technicians may be required by employers.
- A period of supervised work experience, usually two years, is required before certification.

Key Competencies for Retrofits

- Conducting site surveys using tools such as GIS and LIDAR to assess existing conditions for retrofit planning.
- Creating accurate digital models of building sites to guide retrofit design and implementation.
- Mapping energy efficiency and climate impact data to inform retrofit strategies.
- Applying knowledge of geographic and weather data to support the integration of adaptive and resilient building strategies.
- Collaboration with project teams to ensure geospatial data aligns with green retrofit goals.
- Soft Skills: Strong problem-solving, data analysis, and communication skills to deliver actionable insights for retrofit projects.

Responsible Organizations	• Geomatics Association of Nova Scotia (GANS): Provides training and support on GIS and data applications for sustainable projects. • Canadian Institute of Geomatics (CIG): Offers education on integrating geomatics into green building initiatives. • Canada Green Building Council – Atlantic Chapter: Promotes the use of geospatial data in sustainable design and retrofitting. • Efficiency Nova Scotia: Supports geospatial analyses for optimizing retrofit strategies.
Support for Key Competencies	Dalhousie University • AutoCAD, Certificate Nova Scotia Community College • CAD Technician - Mechanical, Diploma • Drafting - Architectural, Diploma
Considerations on Workforce Capacity & Skills	• Limited availability of professionals skilled in applying geomatics to green retrofits may slow project timelines. • Demand for expertise in advanced tools like GIS, LIDAR, and energy mapping could create skills gaps. • Continuous training is essential to adopt emerging geospatial technologies and integrate them into green retrofits.

3. INTERIOR DESIGNERS AND INTERIOR DECORATORS

NOC 52121-Interior designers and interior decorators

Interior designers and interior decorators conceptualize and produce aesthetic, functional and safe designs for interior spaces in residential, commercial, cultural, institutional and industrial buildings. They are employed by architectural and interior design firms, retail establishments, construction companies, hospitals, airlines, hotel and restaurant chains, and other establishments, or they may be self-employed.

Typical Educational Background:

Interior Designers

- A university degree or college diploma in interior design is usually required.
- The National Council for Interior Design Qualification (NCIDQ) examination may be required after six years of combined study and experience.
- Certification by a provincial institute or association is required to use protected titles related to interior designers in all provinces except Prince Edward Island.

Interior Decorators

- A college certificate or diploma in interior decoration is usually required.
- Membership in the Canadian Decorators' Association is available to qualified decorators.

Key Competencies for Retrofits

- Selecting and recommending sustainable and low-emission interior materials, such as recycled finishes, non-toxic paints, and eco-friendly furnishings.
- Incorporating energy-efficient lighting and adaptive lighting systems into interior designs.
- Applying design principles to optimize natural light and improve indoor environmental quality.
- Ensuring designs align with green building standards and contribute to energy performance improvements.
- Understanding life cycle assessment (LCA) and embodied carbon to guide sustainable material selection.
- Soft Skills: Strong communication, client engagement, and problem-solving skills to align designs with retrofit goals and occupant needs.

Responsible Organizations	• Interior Designers of Nova Scotia: Provides education on sustainable design practices. • Canada Green Building Council – Atlantic Chapter: Promotes green building principles for interior design professionals. • International Interior Design Association (IIDA): Offers resources for integrating sustainable materials into designs. • Efficiency Nova Scotia: Supports adoption of energy-efficient lighting and materials in retrofits.
Support for Key Competencies	Eastern College • Interior Decorating, Diploma Maritime Business College • Interior Decorating, Diploma
Considerations on Workforce Capacity & Skills	• Limited knowledge of sustainable materials and green design strategies may hinder progress in retrofits. • Growing demand for designers with expertise in energy-efficient and sustainable interiors could create skills gaps. • Continuous training is necessary to stay updated on emerging green building technologies and certifications.

4. CONSTRUCTION MILLWRIGHTS AND INDUSTRIAL MECHANICS

NOC 72400- Construction millwrights and industrial mechanics

Construction Millwrights and Industrial Mechanics (Millwrights) install and maintain machinery and equipment in factories and production plants. This group includes Industrial Textile Machinery Mechanics and Repairers. Construction Millwrights work for millwrighting contractors. Industrial Mechanics (Millwrights) work for manufacturing plants, utilities, and other industrial firms.

Typical Educational Background:

- High school or equivalent (usually).
- Training through a 7,200-hour apprenticeship program with four apprenticeship levels: to become an apprentice you first need to have a job - enter an apprenticeship agreement either directly through an employer or after graduating from a college-level pre-apprenticeship program; learn on the job, mentored by a certified journeyperson who signs off on skills in a logbook.
- Trade Qualifier option, 10,800 hours and other criteria.
- Certification for Industrial Mechanics (Millwrights) is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Industrial Mechanics (Millwrights).
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Installing and maintaining energy-efficient mechanical systems, such as HVAC systems, heat pumps, and ventilation units.
- Retrofitting and optimizing existing mechanical systems to improve energy performance and reduce emissions.
- Assessing and repairing mechanical components to align with green building standards and sustainability goals.
- Knowledge of low-carbon and high-performance equipment to support energy-efficient retrofits.
- Ensuring compliance with environmental and safety standards during installation and maintenance activities.
- Soft Skills: Strong communication, problem-solving, and teamwork skills to collaborate effectively with retrofit teams and clients.

Responsible Organizations	• Canadian Millwright and Machine Erectors Association: Provides resources and training on sustainability-focused mechanical work. • Efficiency Nova Scotia: Supports initiatives for integrating energy-efficient systems in retrofits. • Nova Scotia Apprenticeship Agency: Offers training for millwrights and mechanics in green building technologies. • Canada Green Building Council – Atlantic Chapter: Promotes education on sustainable practices for mechanical systems in retrofits.
Support for Key Competencies	Nova Scotia Community College • Electro Mechanical Technician (pre-apprenticeship), Diploma • Industrial Mechanical (pre-apprenticeship), Certificate Nova Scotia Apprenticeship Agency • Industrial Mechanic (Millwright) - Apprenticeship, Certificate of Qualification • Industrial Mechanic (Millwright) - Trade Qualifier, Certificate of Qualification

Considerations on Workforce Capacity & Skills	• Increased demand for skilled millwrights with expertise in energy-efficient systems may lead to workforce gaps. • Limited familiarity with low-carbon equipment and retrofitting techniques could slow project progress. • Continuous training is essential to stay updated on green building technologies and compliance requirements.

5. HEAVY EQUIPMENT OPERATORS

NOC 73400-Heavy equipment operators

Heavy Equipment Operators use a variety of mobile machines and attachments. They excavate, grade, and landscape earth. They also move materials and equipment. They work for construction companies, heavy equipment contractors, public works departments and pipelines, logging, cargo handling, and other companies.

Typical Educational Background:

- High school or equivalent (usually).
- Some high school, college, or industry courses in heavy equipment operating combined with on-the-job training are required.
- Internal company certification may be required by some employers.
- Trade Qualifier option, 8,100 hours, and other criteria.
- Certification for Heavy Equipment Operators is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Heavy Equipment Operators.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Operating equipment for site preparation and demolition with minimal environmental impact.
- Managing material handling for green retrofits, including efficient movement and disposal of debris.
- Familiarity with low-emission and fuel-efficient heavy machinery to support sustainable construction practices.
- Ensuring compliance with environmental standards and safety regulations during operations on retrofit sites.
- Adopting precision techniques to minimize waste and preserve existing building elements during retrofits.
- Soft Skills: Strong teamwork, adaptability, and problem-solving skills to coordinate effectively with construction teams and site managers.

Responsible Organizations	• Nova Scotia Road Builders Association: Provides resources and training for operators on sustainable equipment use. • Canadian Association of Equipment Distributors: Offers guidance on adopting eco-friendly heavy machinery. • Efficiency Nova Scotia: Supports the integration of low-emission equipment in retrofit projects. • Canada Green Building Council – Atlantic Chapter: Promotes sustainable practices for construction equipment use.

Support for Key Competencies	Commercial Safety College • Backhoe Operator, Certificate • Dozer Operator, Certificate • Excavator Operator, Certificate • Heavy Equipment Operator Training, Certificate • Loader Operator, Certificate Dexter Institute • Heavy Equipment Operator, Certificate Maritime Environmental Training Institute • Construction and Oilfield Driver (Class 3), Certificate • Earthmoving Operator, Certificate Nova Scotia Community College • Heavy Equipment Operator, Certificate Operating Engineers Training Institute of Nova Scotia • Fundamentals of Earthmoving, Certificate Nova Scotia Apprenticeship Agency • Heavy Equipment Operator (Dozer) - Trade Qualifier, Certificate of Qualification • Heavy Equipment Operator (Excavator) - Trade Qualifier, Certificate of Qualification • Heavy Equipment Operator (Tractor-Loader-Backhoe) - Trade Qualifier, Certificate of Qualification
Considerations on Workforce Capacity & Skills	• Increased demand for operators trained in sustainable and low-emission practices may create workforce shortages. • Limited availability of low-carbon heavy equipment could delay green retrofit projects. • Ongoing training is needed to adopt environmentally responsible techniques and technologies.

6. FLOOR COVERING INSTALLERS

NOC 73113-Floor covering installers

Floor Covering Installers install many types of resilient or carpet floor coverings in residential, commercial, industrial, and institutional buildings. They work for construction companies, floor-covering contractors, and carpet outlets, or they may be self-employed.

Typical Educational Background:

- High school or equivalent (usually).
- Over four years of work experience in the trade and some courses in floor covering installation are usually required to be eligible for trade certification.
- Trade Qualifier option, 8,100 hours, and other criteria.
- Certification for Floor Covering Installers is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Floor Covering Installers.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Installing sustainable and low-emission flooring materials, such as bamboo, cork, and recycled products, to support green retrofit goals.
- Ensuring proper insulation and underlayment to improve energy efficiency and indoor environmental quality.
- Familiarity with materials that reduce embodied carbon and comply with green building standards.
- Applying waste reduction practices during material installation, including precise cutting and recycling leftover materials.
- Maintaining compliance with environmental safety standards, including proper handling of adhesives and finishes.
- Soft Skills: Strong communication, teamwork, and problem-solving skills to coordinate effectively with construction teams and clients.

Responsible Organizations	• Construction Association of Nova Scotia: Provides training and resources for floor covering installers on sustainable practices. • National Floor Covering Association of Canada: Offers guidance on green materials and installation techniques. • Canada Green Building Council – Atlantic Chapter: Promotes resources on green building practices for floor installers. • Efficiency Nova Scotia: Offers support and resources for adopting energy-efficient flooring solutions in retrofits.
Support for Key Competencies	Carpenter Millwright College (CMC) Inc. • Floor Covering Installation, Certificate Nova Scotia Apprenticeship Agency • Floor Covering Installer - Trade Qualifier, Certificate of Qualification
Considerations on Workforce Capacity & Skills	• Limited familiarity with sustainable and low-emission flooring materials may hinder green retrofit progress. • Increased demand for installers skilled in sustainable flooring solutions may create workforce gaps. • Ongoing training is necessary to keep up with green building standards and material advancements.

7. TRANSPORT TRUCK DRIVERS

NOC 73300-Transport truck drivers

Transport truck drivers drive straight trucks or tractor-trailers to transport freight. Long-haul truck drivers operate heavy trucks over urban, interurban, provincial and international routes, while short-haul and local transport truck drivers operate over urban and short interurban routes. They are employed by transportation, manufacturing, distribution and moving companies, and trucking employment service agencies, or they may be self-employed.

Typical Educational Background:

- Completion of secondary school is usually required.
- On-the-job-training is provided.
- Completion of an accredited driver training course of up to five months duration, through a vocational school or community college, may be required.
- A Class 3 or D licence is required to drive straight-body trucks.
- A Class 1 or A licence is required to drive long combination vehicles.
- Air brake endorsement (Z) is required for drivers who operate vehicles equipped with air brakes.
- Transportation of dangerous goods (TDG) certification is required for drivers who transport hazardous products or dangerous goods.
- Additional licensing endorsement or certification may be required to drive articulated trucks.

Key Competencies for Retrofits

- Transporting low-carbon building materials and equipment for green retrofit projects efficiently and safely.
- Familiarity with handling and transporting prefabricated retrofit components to minimize waste and energy use.
- Understanding logistical requirements for delivering materials to retrofitting sites while reducing fuel consumption and emissions.
- Maintaining compliance with environmental standards, such as idling reduction policies and eco-friendly driving practices.
- **Soft Skills:** Strong communication, adaptability, and organizational skills to coordinate with contractors, suppliers, and construction teams.

Responsible Organizations	• Nova Scotia Trucking Safety Association: Provides training on eco-friendly driving practices and transport safety for retrofit projects. • Canadian Trucking Alliance: Promotes green transportation initiatives and best practices for reducing emissions. • Efficiency Nova Scotia: Supports initiatives to incorporate fuel-efficient and low-emission transportation strategies. • Trucking HR Canada: Offers resources and training for sustainable practices in the trucking industry.
Support for Key Competencies	Breton Commercial Truck Training • Miles to Go Class 1 (Tractor Trailer), Certificate • Miles to Go Class 3 (Straight Truck), Certificate Commercial Safety College • Straight Truck Training, Certificate • Tractor Trailer Internship Program, Certificate Dexter Institute

	• Truck Driver Class 3, Certificate Maritime Environmental Training Institute • Class 1 Driver Tractor Trailer, Certificate Operating Engineers Training Institute of Nova Scotia • Truck Driver Class 3, Certificate Transport Training Centres of Canada • Straight Truck Program (Class 3), Certificate • Transport Training Program (Class 1) with Internship, Certificate
Considerations on Workforce Capacity & Skills	• Increased demand for transport drivers with knowledge of sustainable logistics for green retrofits may lead to shortages. • Limited availability of low-emission transport vehicles could impact green retrofit project timelines. • Ongoing training is needed for drivers to adopt eco-friendly driving habits and understand their role in green construction.

8. CONSTRUCTION TRADE HELPERS AND LABOURERS

NOC 75110-Construction trades helpers and labourers

Construction trades helpers and labourers assist skilled tradespersons and perform labouring activities at construction sites, in quarries and in surface mines. They are employed by construction companies, trade and labour contractors, and surface mine and quarry operators.

Typical Educational Background:

- Some high school education may be required.
- On-the-job training is provided.
- Some experience as a General Construction Labourer may be needed for Construction Trade Helpers.
- Some pipeline workers, like Stabbers, Mandrel Operators and Preheater Tenders, usually need one season of experience in oil and gas pipeline construction.
- Flagmen/women may need a traffic control certificate.
- Riggers and slingers may require a rigging certificate.
- Trade Qualifier option for Construction Craft Workers, 5,400 hours, and other criteria.
- Certification for Construction Craft Workers is voluntary in Nova Scotia.
- Write and score a minimum of 70% on the Red Seal exam for Construction Craft Workers.
- Red Seal Endorsement (RSE) allows for interprovincial mobility.

Key Competencies for Retrofits

- Assisting in the installation of energy-efficient systems such as HVAC units, lighting, and insulation for green retrofits.
- Preparing sites for retrofitting, including demolition, materials removal, and remediation while adhering to environmental standards.
- Handling and managing sustainable and low-carbon building materials during retrofitting projects.
- Supporting construction teams in implementing adaptive and resilient building strategies to improve energy performance and durability.
- Maintaining safety and environmental compliance during the handling and disposal of materials.
- **Soft Skills:** Strong teamwork, adaptability, and problem-solving skills to collaborate effectively with contractors and specialists on retrofit sites.

Responsible Organizations	• Construction Association of Nova Scotia: Provides training and resources for labourers to develop green building and retrofitting skills. • Efficiency Nova Scotia: Offers guidance on energy-efficient construction practices for labourers. • Labourers' International Union of North America (LiUNA): Supports training and certification in green construction and safety practices. • Canada Green Building Council – Atlantic Chapter: Promotes education and resources on green building for construction trades.
Support for Key Competencies	Commercial Safety College • Road Building Labourer, Certificate Dexter Institute • Heavy Civil Skilled Worker, Certificate Maritime Environmental Training Institute • Safety Certified Labourer, Certificate • Scaffolding, Certificate Nova Scotia Community College • Housing Construction Fundamentals, Certificate of Completion Nova Scotia Apprenticeship Agency • Construction Craft Worker - Trade Qualifier, Certificate of Qualification
Considerations on Workforce Capacity & Skills	• Growing demand for labourers with experience in handling sustainable materials and supporting energy-efficient retrofits may create workforce shortages. • Limited awareness of sustainability practices among construction helpers could slow down green retrofitting adoption. • Ongoing training is necessary to ensure labourers are familiar with energy-efficient technologies and environmental standards.

9.Considerations on Workforce Capacity & Skills for **Secondary Professions**

- Low green literacy levels and knowledge on energy efficiency and sustainability
    - Limited green literacy and an understanding of sustainable practices, energy-efficient materials, and low-carbon technologies, slows down the rate of energy efficient solutions being implemented.
    - Resistance to adopting new sustainability-focused processes and methods can arise due to reliance on traditional approaches, causing inefficiencies in retrofitting projects.
- Challenge to keep up with technology advancements and energy efficiency development
    - Lack of sufficient training in handling innovative materials and tools, such as energy-efficient finishes, low-carbon flooring, and specialized retrofit equipment, can compromise project quality.
    - Challenges in operating advanced tools, such as Building Information Modeling (BIM) software or machinery suited for sustainable construction, necessitate targeted upskilling efforts.
- Difficulties in coordinating across disciplines to implement energy efficiency
    - Difficulty in coordinating interdisciplinary tasks, especially for general construction labourers and equipment operators, emphasizes the need for better communication and team integration in retrofitting projects.

New Action (Transportation) sets emission standards and improves efficiency.

2. **Sustainable food supply chain system in track and trace (Quick Train Canada) Online**

This course focuses on developing a comprehensive understanding of monitoring shipments with tracking and tracing practices, technology, and transaction protocols. The course explores the complexities of track and trace in relation to authenticity, safety, and sustainability, addressing issues related to environmental impact, social equity, and economic viability.

3. **Construction and the Environment (Quick Train Canada) Online**

This course equips students with knowledge and skills to thrive in a low-carbon economy by analyzing and managing environmental impacts in construction. Students learn about environmental regulations, sustainable practices, and innovative materials to reduce the carbon footprint in the construction industry.

4. **Mapping and Compassing (Quick Train Canada) Online**

This microcredential teaches map interpretation, ground and map measurements, and internet mapping software basics. It prepares learners for careers in ecological conservation, environmental tourism, and resource management.

5. **Whole building life cycle assessment (LCA) Professional Online (Quick Train canada)**

The Whole-Building Life Cycle Assessment Professional microcredential equips learners with knowledge and skills to effectively use LCA in construction design. Learners will gain foundational knowledge of life cycle thinking, embodied carbon, and LCA standards and methods, enabling them to conduct whole-building LCAs and calculate the carbon impact of building materials. Upon completion, learners will have advanced knowledge and skills in whole-building LCA, experience conducting whole-building LCA using Athena LCA software, and the ability to interpret results and create proper environmental building declarations.

6. **Essentials of Net-Zero and Passive House Construction (British Columbia Institute of Technology) Online**

The Essentials Net-Zero and Passive House Construction microcredential equips individuals with the skills to construct high-performance buildings meeting BC Energy Step Code, Net-Zero Energy, and Passive House standards. The program covers building enclosures, electrical and mechanical systems, and processes for these new codes and standards. Upon completion, learners will have the confidence and skills to ensure project compliance and achieve high-performance levels.

This microcredential focuses on sustainability practices within the supply chain sector, using the Supply Chain Operations Reference (SCOR) Model to navigate sustainability through environmental, social, and economic pillars. Students will learn about sustainability's importance, business drivers, supplier relationships, and improvement strategies, preparing them for the low-carbon economy.

Appendix 5: Key Findings

What We Heard During Interviews

This section is a detailed version of the key challenges and topics identified during our interviews:

i. Policy Makers

Challenges Identified

Policy makers include those who participate in or influence federal, provincial, or municipal governments and energy regulators. We interviewed 8 policy makers.

Challenges fell under two categories:

A. Energy Efficiency in Implementation of Retrofits
B. Engaging Marginalized Communities in Skilled Trades

A. Incorporating Energy Efficiency into the Implementation of Retrofits

Permitting and Rebates

- Unfamiliarity with permitting processes and accessing rebates to undertake energy efficiency retrofits by homeowners, contractors, and municipalities creates delays and discourages project implementation.
- Compulsory certification requirements in Nova Scotia related to energy efficiency retrofits can overcomplicate and prolong project approvals, especially when adopting new technologies.
- The process to access federal funding, grants, and other incentives is complex, slowing down the adoption of energy-efficiency measures and frustrating those willing to go through the arduous process.

Resistance to Stricter Building Codes

- Developers' are resistant to adopting higher energy efficiency standards due to perceived increased costs and misalignment with market demand for affordable and quickly available housing.

- Current codes can be perceived as inadequate for driving meaningful energy efficiency gains, yet enforcement of stricter codes is met with significant pushback, as it can result in added construction costs for projects.
- The lack of climate literacy among developers and existing tradespeople generates resistance to change and in the adoption of new efficiency initiatives. There is a limited sense of the urgency and importance of these initiatives.

Low green literacy

- A general lack of awareness and urgency exists among developers and property owners, about the financial and environmental benefits of retrofits and energy efficiency. This is partly due to the perceived non alignment between the government's emissions goals & rising housing demand.
- There is a need to educate and inform communities in smaller and rural areas as many of them remain unaware of green career pathways, opportunities and the support available for retrofits. Tailored community outreach must be consistent and respect cultural differences.
- Misaligned communication channels have resulted in low public engagement, particularly in rural regions. There is support for individuals and incentives they can access, but a lack of centralization and consistent outreach to generate necessary climate literacy remains.

Delivery and Navigation Support

- The skilled trades sector can have pinch points in service delivery due to inefficiencies in deliveries of material to construction sites, rendering workers unable to start working. This can be misinterpreted as a labour or supply shortage.
- Property owners struggle with navigating the complexity of available supports and construction permits. Accessible advisory services and awareness campaigns are needed to guide residential property owners through complex information about financial incentives and rebates, as well as retrofit strategies and options.

Awareness

- Retrofits often focus on superficial fixes like heating systems without prioritizing foundational measures like insulation, even though there are incentives to support deeper retrofits.
- Scheduled residential retrofits do not always take full advantage of efficiency opportunities, accessing all available incentives.

- Collaboration between tradespeople and policymakers could better align retrofit designs with practical needs of homeowners and developers. Collaboration is needed to build workforce capacity and match increasing demand.

Complexity of Retrofit Requirements

- There is a burden on residential property owners to navigate energy retrofit requirements without professional support. Support offered is not centralized and can be challenging to access.
- Limited architectural or engineering guidance often leads to suboptimal decisions, reducing the effectiveness of retrofits. Especially when not taking advantage of all available financial incentives.
- Programs providing education and advisory services for property owners could alleviate this challenge, and although more are being developed, there is still a long way to go.

B. Engaging Marginalized Communities

Workplace Harassment, Cultural and Systemic Barriers

- Prevalence of workplace harassment and lack of inclusivity are significant deterrents for women and underrepresented groups to participate and thrive in skilled trades.
- Personal protective equipment (PPE) often does not accommodate diverse needs, creating a poor fit that can be hazardous to individuals and peers.
- Cultural sensitivity training for instructors and employers is insufficient, leading to uncomfortable or hostile work environments where stigmas and stereotypes are commonly accepted.

Lack of Rural Access & Transportation

- Opportunities are often concentrated in urban areas, making them inaccessible to rural and Indigenous communities who lack proper access to transportation.
- There is a significant need for distributed education models to bring affordable and accessible training closer to rural and on-reserve apprentices, both via online resources, and extending training to rural areas.

- Lack of transportation and infrastructure in rural areas worsens the accessibility challenge, as individuals who are interested cannot mobilize to where the training is offered, and satellite campuses or spaces available are scarce.

Inaccessible Training Schedules Wraparound supports like childcare and transportation are essential to help people from marginalized communities participate in training.

- Many programs do not offer flexible scheduling, leaving individuals unable to balance work, training, and personal responsibilities.
- There is limited financial assistance for tools and resources like PPE, which is expensive and required for some base-level trades training.
- Creating new opportunities for marginalized communities is not addressing the root cause of all the challenges which stem from historic racism and harassment.

Long Certification Process

- Trades requiring multiple certifications, such as heat pump installation, discourage new entrants due to complexity. This happens more for trades with compulsory red seal requirements.
- Variability in certification standards across provinces further complicates entry into the skilled trades. Some provinces have more relaxed compulsory trades requirements, making them more appealing for some individuals.
- Addressing certification challenges requires simplification and alignment of standards, particularly for new green technologies.

Historical Mistrust, Low Representation, & Lack of Tailored Outreach

- There is a lack of tailored communication efforts to inform equity-deserving communities about skilled trade opportunities. It is necessary to ensure outreach reaches beyond traditional bubbles.
- Historical mistrust of institutions and initiatives has created barriers to engagement. This is especially true with initiatives to improve schooling success of Indigenous communities. Education and training options must be made available in Mi'kmaw communities.
- Trusted community champions are needed to act as bridges for building awareness and trust. These individuals can inspire and guide youth members to succeed in the industry. But first, there must be an increase in representation rates of people from equity-deserving communities.

Low Apprenticeship Completion Rates

- Financial constraints and a lack of support systems contribute to low completion rates among marginalized groups often struggling financially or with hard skills like math.
- Exam anxiety and inadequate preparation are barriers to successful certification, especially to those individuals who do not have a history of thriving in schooling systems.
- Programs offering mentorship and academic assistance have shown promise in improving completion rates but remain limited in scope.

ii. Enablers

Challenges Identified

Enablers include those in the private sector (construction & energy efficiency retrofits), training providers, academic institutions, and local job agencies. We interviewed 21 enablers). They identified challenges in two categories:

A. Implementation of Retrofits
B. Engaging Marginalized Communities in Skilled Trades

A. Challenges in the Implementation of Retrofits

High Upfront Costs

- The high initial costs (reimbursable) for upgrading electrical panels or installing heat pumps are a significant burden for low-income households. Rebate programs often require upfront payments for complementary required services or contractors, which excludes those without access to sufficient capital.
- Even with rebates, the out-of-pocket expenses remain prohibitive for many homeowners, especially when not covered by financial incentives.
- Financial incentives are heavily reliant on government funding, creating uncertainty and instability with political shifts.

Low Awareness of Incentives

- Many homeowners, especially in rural and low-income areas, are unaware of available programs, financial incentives and other benefits they can access.
- Green literacy among professionals and the general public is inconsistent; even architects and tradespeople lack basic knowledge about energy-efficient practices.
- Education efforts fail to emphasize practical benefits such as cost savings and improved air quality, limiting uptake and interest.
- Misaligned promotion and communication strategies hinder engagement with marginalized groups who still report low awareness of career pathways for green jobs and how to access energy efficiency support.

Delayed Building Codes

- Delays in implementing updated building codes, such as Nova Scotia's slow adoption of national standards, impede energy efficiency progress.
- New codes do not require energy efficiency upgrades during major renovations, missing opportunities for impactful retrofits.
- Lack of integration between energy efficiency goals and affordable housing development creates tension, as higher energy efficiency is perceived to come at a higher cost.
- Voluntary measures in building codes fail to drive widespread adoption of energy-efficient retrofits.

Complex Incentives & Inconsistent Funding Multiple steps and extensive paperwork make rebate programs challenging to navigate, particularly for marginalized groups.

- Inconsistent funding for programs like Canada Greener Homes creates uncertainty for consumers and contractors of what is available at the moment of application.
- Coordination between different programs, such as those managed by Efficiency Nova Scotia and Nova Scotia Power, is lacking, and information is not centralized.
- Homeowners often lack guidance to choose and access the most suitable incentives, and take advantage of their retrofitting project.

Worker Shortages

- There is a shortage of tradespeople trained in emerging technologies like solar installations and deep retrofits. Despite transferable skills, more efficiency specific knowledge is needed.
- Microcredentials for tasks like HVAC installation address gaps but need scaling and alignment with industry needs in regards to energy efficiency.

- Practical training on energy efficiency retrofits is insufficient, with 60–70% of skills learned on the job site rather than through formal education.
- Some universities resist non-credit training models, such as microcredentials, slowing upskilling.

Price Sensitivity

- The construction industry prefers minimal compliance with energy efficiency standards due to cost concerns coming from more expensive materials and longer duration of construction.
- Builders prioritize speed over meeting net-zero goals to be able to meet high housing demand.
- Subcontracting specialized tasks like solar installations prevents companies from building internal capacity to implement energy efficiency at a large scale.
- Industry members often resist stricter building code requirements, even when feasible, because the permitting processes take too long.

B. Challenges in Engaging Marginalized Communities in Skilled Trades

Workplace Culture, Harassment, and Exclusion

- Persistent harassment and exclusion in male-dominated worksites deter women and other marginalized groups from succeeding.
- Toxic masculinity reinforces dangerous behaviours. Lack of accessibility accommodations prevents injured workers from joining the trades workforce after healing.
- Predominantly white workplace cultures make it hard for Black, Indigenous, and People of Colour to integrate, unless they conform to norms and accept discrimination.
- Inadequate accommodations, such as Personal Protective Equipment (PPE) that doesn't fit women and disabled workers, creates exclusion in the workforce.

Inaccessible Education

- Training programs are geographically concentrated in urban areas, making them inaccessible for rural residents and Mi'kmaw communities.
- Apprenticeship programs don't have standardized teaching methods, which leads to uneven learning and skill development.
- Unpaid training periods disproportionately affect marginalized individuals with family responsibilities who cannot afford to stop receiving an income.

- Awareness of alternative training models like microcredentials, offering more flexible and affordable options, is limited due to lack of publicity and scarcity of such programs.

Lack of Representation

- Women and people from equity-deserving communities rarely see role models in trades, reducing interest and confidence due to their low representation.
- Recruitment efforts often fail to connect with grassroots networks in marginalized communities, which are better positioned to help.
- Racism and sexism in unions and industry bodies create barriers for the certification and advancement opportunities for Black workers.
- DEI initiatives are seen as superficial and fail to address root causes of exclusion, there is an opportunity to have a more honest discussion about the topic. These initiatives are very important but perhaps it is useful to start talking more about inclusivity and equity, and not diversity for the sake of diversity. reassess implementation.

Transportation and Finances

- Costs associated with training and relocating for programs are significant hurdles for many participants who cannot continue their development after a rural training centre is closed.
- Lack of transportation and childcare options disproportionately impacts marginalized individuals who do not have the financial means to cover these expenses.
- Criminal records and test anxiety prevent individuals from entering or succeeding in skilled trades even if support programs are offered.
- Insufficient wraparound supports, such as wage subsidies, limit program effectiveness as participants cannot fully concentrate on succeeding in the training to meet their other responsibilities.

Students Struggle to Pass Exams

- High failure rates on certification exams, like the Red Seal, discourage participation. The training received and what candidates are tested on can have disparities causing challenges, and expensive retakes limit success rates.
- Training programs often lack alignment with real-world job requirements, creating skill gaps.
- Apprenticeship structures do not adequately prepare marginalized groups for industry demands.
- There is limited guidance for educators on addressing the diverse needs of students' cultural backgrounds and learning styles, including learning disabilities.

Stigma

- Trades are undervalued in some communities, viewed as a last resort compared to university education. This is partly due to low awareness of career pathways and negative stereotypes.
- Negative perceptions of trades discourage women, minorities, and young workers from exploring these careers.
- Efforts to promote trades fail to highlight their financial viability and societal importance.
- Marginalized communities face generational and cultural barriers to seeing trades as viable career options.

iii. Beneficiaries

Challenges Identified

Beneficiaries are Black, Indigenous or People of Colour, or are Newcomers to Canada, women, students, or early/mid-career professionals. We interviewed 10 beneficiaries.

A. Challenges to joining skilled trades workforce and entering green jobs

Low Green Literacy and Awareness of Opportunities

- Green literacy levels are low, especially with individuals who are not actively involved in green jobs, and in rural areas.
- Green jobs are poorly marketed, and sometimes don't have accurate job titles or clear descriptions.
- With the high demand for trades, there is an opportunity for the government to increase promotion of trades and green jobs to match with the increased demand for housing and combat labour shortages.

Financial & Systemic Barriers

- Older and mid-career professionals face hardships securing access to loans and financial support for their education and training. They can be stereotyped and expected to already be established professionals.
- Lack of clear guidance of required certifications creates confusion and leaves candidates unprepared when neither job postings or educational institutions can articulate clear career pathways and requirements.

- Common preconception of trades as a white male-dominated field creates cultural and systemic barriers. Women report struggling to be taken seriously, and racial biases discourage entrants from diverse backgrounds, reporting having some clients initially doubting their skill level due to their background.

Underrepresentation of People from Equity-Deserving Communities

- Underrepresentation is a self-reinforcing cycle. Lack of clear representation of women and other equity-deserving groups discourages participation. Informants say few women are present in the HVAC industry, conferences, and classrooms.
- Younger generations want more role models and relatable mentors to see green jobs as viable career paths, especially for Black, Indigenous and People of Colour in rural areas.
- Due to deeply entrenched stereotypes about people from equity-deserving communities, they have to put in extra effort to succeed. A young professional even reported facing criticism for being young and stereotyped as a “dumb blonde.”

Access to Education

- Training programs are often too time-intensive and expensive, making them inaccessible to a large number of individuals who lack the financial resources and transportation.
- Rural and Mi’kmaw communities lack access to training because of a lack of training facilities and no adequate availability of transportation.
- Sustainability and green literacy education are introduced too late in children’s schools and even post-secondary programs, creating a lack of basic knowledge and interest.

Low Retention

- Comparatively lower salaries for green job professionals in Nova Scotia causes skilled workers to leave the province, stifling innovation and local expertise.
- Perceived limited job opportunities, even for qualified professionals, can be discouraging for those who are interested in joining the local workforce.
- Lack of suitable facilities and amenities in construction worksites, specially with smaller non-unionized businesses, creates a challenging working environment. This includes washrooms and changing facilities, PPE, and other necessities.

Low Prioritization of Sustainability

- Individuals with experience in trades have noted that often contractors prioritize cost over sustainability and quality in retrofitting projects.
- Education centres fail to highlight green career pathways and connect students with key organizations, worsening the lack of centralization of resources and fomenting low awareness and interest levels.
- Older generations and contractors have demonstrated friction in the adoption of green energy initiatives. This issue tends to be experienced to a greater degree in rural communities.