



***Building
a
Low-Carbon Future
for
Sudbury &
Manitoulin***

**Report from the 2018 Sudbury-Manitoulin
Low-Carbon Building Skills Partnership Project**

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**Sudbury
& Manitoulin**
Workforce Planning
Planification en
main-d'oeuvre

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EXECUTIVE SUMMARY

BUILDING A LOW-CARBON FUTURE FOR SUDBURY & MANITOULIN

The 2018 Sudbury-Manitoulin Low-Carbon Building Skills (LCBS) Partnership Project has provided an opportunity for lead partner [reThink Green](#) to collaborate with [Workforce Planning for Sudbury & Manitoulin](#) to conduct research into the current availability of, and the readiness of our workforce to provide, low-carbon building skills. The findings of this research are reported here.

In order to fulfil commitments to reduce greenhouse gas (GHG) emissions made in Ontario's Climate Change Action Plan for 2016-2020, **the previous provincial government identified the need for a workforce trained in low-carbon building skills such as: building retrofits, new green construction and building operations, and energy management.** This LCBS Partnership Project has examined the present availability of these key skills, and the training that provides them, in Sudbury-Manitoulin.

THIS REPORT PROVIDES AN OVERVIEW OF:

- The identification of low-carbon design and building standards, the organizations that establish and regulate them, and the training and certification provided;
- The role of architecture and engineering in low-carbon building, and the increasing need for energy and facilities managers to efficiently operate these buildings;
- Implications for new construction and retrofits in both the industrial, commercial and institutional (ICI) and residential construction sectors;
- The growing awareness of the benefits of and need for a low-carbon built environment, particularly in municipalities and First Nations communities in Sudbury-Manitoulin;
- The role and availability of home energy advisors; and,
- An indication of the capacity of the Sudbury-Manitoulin workforce to provide these skills toward a low-carbon built environment.

Finally, this research into the availability of low-carbon building skills (LCBS) in Sudbury-Manitoulin has led to the formation of three recommendations that, if implemented, may assist in advancing the state of readiness of our low-carbon workforce.

INTRODUCTION

The 2018 Sudbury-Manitoulin Low-Carbon Building Skills (LCBS) Partnership Project has provided an opportunity for lead partner [reThink Green](#) to collaborate with [Workforce Planning for Sudbury & Manitoulin](#) (WPSM) to conduct this research into the current availability of, and the readiness of our workforce to provide, low-carbon building skills.

It is the mission of reThink Green to bring together ideas, partners and resources to build a more sustainable community, and falls within the mandate of WPSM to support or lead new and innovative partnerships, programs and activities to address current and projected labour market issues. This partnership has been well suited to support this research into the current capacity of the green workforce in Sudbury-Manitoulin.

This research commenced on March 12, 2018, to meet objectives established by the previous provincial government. Funding was provided by the Ministry of Advanced Education and Skills Development's (MAESD) 2017/18 LCBS Partnership Fund through the Employment and Training Division. Note that this Ministry was renamed Training, Colleges and Universities (MTCU) on June 29, 2018.

As stated in the initial Request for Proposals: The objective of this initiative is to meet key commitments in Ontario's Climate Change Action Plan (CCAP) for 2016-2020. **To reduce greenhouse gas (GHG) emissions the province needs a workforce skilled in building retrofits, new green construction and building operations, and energy management.** Ensuring that workers have the appropriate skills means developing the skills of the existing workforce and training new workers for opportunities in green building. Regardless of changes in policy since the election of a new government in June 2018, including the cancellation of the Green Ontario Fund on June 19, 2018, and of the Cap and Trade program on July 3, 2018, this research has proceeded in the spirit and intent of the project as originally approved.

The following report provides an overview of: the growing awareness of the benefits of a low-carbon built environment; the identification of low-carbon design standards; the role of architecture and engineering; the increasing need for energy and facilities management; implications for new construction and retrofits; the role of home energy advisors; and an indication of the capacity of the Sudbury-Manitoulin workforce to provide these low-carbon building skills toward a low-carbon built environment.

WHY THE NEED FOR LOW-CARBON BUILDING SKILLS

According to the [Canada Green Building Council](#), buildings generate up to 35% of our greenhouse gas (GHG) emissions. Improving the energy efficiency of our built environment will allow us to reduce our GHG emissions and limit the rate of further global warming. Additionally, reducing the amount of energy used for heating and cooling buildings means real financial savings for renters and owners. These savings could then, for example, be re-invested in the purchase of an electric vehicle to further reduce our individual GHG emissions. The cumulative effect of these actions leads to greater sustainability for our economy and our planet.

As summarized from the ministry's original Call for Proposals and Application Guide: Reducing energy use and GHG emissions from the built environment requires that we strengthen our training, workforce and technical capacity around low-carbon building. **Low-carbon building has been defined as: the practice of designing, constructing, operating, maintaining, and removing buildings in ways that conserve natural resources and reduce GHG emissions.** Achieving a low-carbon built environment requires a workforce with the right skills and training. In other words, we will need to develop and expand our low-carbon building skills (LCBS).

[Building an Ontario Green Jobs Strategy](#), a report released by Environmental Defence, Blue Green Canada, and the Clean Economy Alliance in April of 2017, is a valuable resource upon which the previous provincial government based the identification of key LCBS.

THESE LCBS INCLUDE, BUT ARE NOT LIMITED TO, THE ABILITY TO:

- Design and plan retrofits and new green construction with a view to sustainability and low, zero or net-neutral carbon emissions;
- Understand interrelated building issues such as the effective integration of technologies, automated operations, and energy management;
- Apply “thermal literacy” regarding building envelope, airtightness and seal, and the reduction or elimination of thermal bridging;
- Install low-emission mechanical systems including heating, ventilation, and air conditioning (HVAC) to meet standards, manufacturer's specifications and/or codes;
- Specify, install, and maintain energy efficient furnaces, boilers, on-demand water heaters, geo-exchange systems, solar thermal systems, heat pumps; and,
- Promote the use of high efficiency lighting technologies.

RESEARCH METHODOLOGY

This research into the current capacity and availability of a green and/or low-carbon workforce in Sudbury-Manitoulin has included a review of the available literature and stakeholder websites. In addition, numerous interviews have been conducted with expert advisors and key informants in post-secondary education, the industrial, commercial and institutional (ICI) and residential construction sectors, several municipalities and First Nations, and trade union leadership representing skilled tradespersons in Sudbury-Manitoulin.

THESE FINDINGS ARE INTENDED TO INFORM DECISION-MAKERS AS THEY IDENTIFY:

- what constitutes a low-carbon building skill;
- which of these skills are required to achieve a low-carbon workforce;
- what segments of our workforce currently possess these skills;
- any shortages and/or gaps related to low-carbon building skills; and,
- avenues to address skills training issues related to low-carbon building skills.

This research has not investigated green, alternative and/or renewable energy, or environmental conservation initiatives and the occupations related to these. Although interconnected and clearly of great importance, for the purpose of this research energy and the environment have been viewed as research areas separate from low-carbon building skills. In addition, to avoid any suggestion of endorsement, neither does this research examine the specifics or relative merits of available low-carbon building materials, technologies and suppliers, or heating and cooling components and systems.

DISCLAIMER

Reported information assumes that the online source data is current and accurate and does not necessarily represent the views of the Ministry of Training, Colleges and Universities (MTCU) or the Government of Ontario.

LOW-CARBON DESIGN & BUILDING STANDARDS

Every building project, whether in the industrial, commercial and institutional (ICI) or residential sectors, a new-build or a retrofit, begins with a design concept and planning for its construction. This then seems a good place to begin this report. There are several well-established low or lower-carbon and energy efficient building design standards and supporting organizations that are recognized nationally and internationally. The most common are listed and briefly described here along with findings related to the extent of their availability in Sudbury-Manitoulin.

NATURAL RESOURCES CANADA INITIATIVES

EnerGuide Rating System | ENERGY STAR® for New Homes | R-2000

[Natural Resources Canada](#) (NRCan) licenses service organizations and builders to deliver these initiatives to promote energy-efficient homes. NRCan also delivers energy efficiency initiatives for [buildings](#) and [industry](#). Visit the website and select the Energy | Energy Efficiency tabs to learn more.

EnerGuide Rating System for Homes

An EnerGuide home evaluation and report identifies a home's energy use and recommends renovations for improved performance. A **Registered Energy Advisor** performs an assessment and provides a consumption-based EnerGuide rating for the home in gigajoules per year (GJ/year). As of January 1st, 2019, all new EnerGuide evaluations must take place using the updated GJ system as prescribed by the [EnerGuide Rating System version 15](#).

ENERGY STAR® for New Homes Standard

[ENERGY STAR®](#) certified homes are constructed by NRCan-licensed builders using common building practices. **An ENERGY STAR® certified home is on average 20% more energy efficient than a typical new home built to the 2012 Ontario Building Code standard**, with [common features](#) such as energy-efficient windows, a heat recovery ventilator (HRV) to recapture lost heat and provide outdoor air, and 400 kwh/year of electrical savings obtained through ENERGY STAR® certified lighting and appliances. Certified homes must also meet certain thresholds for airtightness.

R-2000 Building Standard

[R-2000](#) certified homes are “best-in-class energy-efficient homes” constructed by trained and licensed R-2000 builders to meet this voluntary national standard. **An R-2000 certified home is on average 50% more energy-efficient than a typical new home built to code.** Last updated in 2012, the R-2000 technical requirements include measures for energy efficiency, improved indoor air quality and environmental responsibility in construction and operation.

NRCan Service Providers | Sudbury-Manitoulin

A November 2018 [search](#) of the *Find a service provider for new homes* webpage yielded few results:

NRCAN SERVICE ORGANIZATIONS | NONE IN SUDBURY-MANITOULIN

- There were seven results in a search for: EnerGuide | Service Organizations | Ontario (Sudbury & District);
- The two service organizations in closest proximity to Sudbury-Manitoulin are: [EnerTest Corporation](#) in Orillia and [Ontario First Nations Technical Services Corporation](#) in Thunder Bay;
- Both organizations provide services for all three NRCan initiatives.

ENERGY STAR® BUILDERS | NONE IN SUDBURY-MANITOULIN

- There were five results in a search for: ENERGY STAR® | Homebuilders | Ontario (Sudbury & District);
- The ENERGY STAR® homebuilder in closest proximity to Sudbury-Manitoulin is [Cedarland Homes Ltd.](#) in Parry Sound.

R-2000 BUILDERS | NONE IN SUDBURY-MANITOULIN

- There were zero results in a search for: R-2000 | Homebuilders | Ontario (Sudbury & District);
- Results were the same in searches for North Bay, Sault & District, and Thunder Bay;
- A search for Muskoka listed [Bert French & Son Ltd.](#) in Port Sydney, however, the company website indicates that the owner retired and closed this business in 2016.

It is evident from the information available on the NRCan website that participation in these energy-efficiency initiatives for residential buildings is extremely low in Sudbury-Manitoulin.

NRCAN NET ZERO ENERGY PILOT

A net zero energy home uses only as much energy as it can produce from on-site renewable energy. The 2013 R-2000 [Net Zero Energy Pilot](#) resulted in 23 homes completed by 2016. Three Ontario builders participated: two from Guelph and one from Ottawa. All houses in the pilot were certified with a zero gigajoule (0 GJ) rating under NRCAN's [EnerGuide Rating System version 15](#). **This pilot has demonstrated that R-2000 homes can reach net zero performance using off-the-shelf technologies and building methods.**

On November 13, 2018, it was reported in various [news media](#) that a North Bay man has built the first certified net zero home in northern Ontario.

The home was modelled by a certified energy advisor and features 7.8 KW of solar on the roof, triple-glazed windows, a cold climate air source heat pump heating and cooling system, waste water heat recovery, an air source heat pump water heater and an innovate building envelope design by BASF.

PASSIVE HOUSE

Passive House (PH) is a highly energy efficient building design and construction standard that originated in Germany. The goal is to reduce heat losses to an absolute minimum so that no traditional heating or cooling systems are required, **allowing for energy savings of up to 90% compared with typical building stock**. Achieving this standard [requires](#): ultra-high-performance windows, airtight construction, a super-insulated building envelope, a ventilation system to supply fresh air, and a highly-efficient heat recovery unit that allows the heat in exhausted air to be re-used. PH design uses the sun, internal heat sources and heat recovery for winter warmth and uses passive cooling techniques such as strategic shading for summer comfort. **There are two recognized PH standards: The International and the North American.**

International Passive House Standard | Institute | Association

Founded in 1996 in Germany, the [Passive House Institute](#) (PHI) developed the International PH Standard, conducts independent research, and provides training and certification for designers and tradespersons. The [International Passive House Association](#) (iPHA) is a global network of PH stakeholders that works to promote this standard and increase public understanding of its importance. [Passive House Canada](#) and the [North American Passive House Network](#) are affiliated to the International PH Association.

PHI CERTIFIED DESIGNERS | ONE IN SUDBURY-MANITOULIN

A November 2018 [search](#) of the PHI website for Certified Passive House Designers in Ontario yielded four results in the north:

- Two PH designers in Thunder Bay and one in Timmins;
- One Certified Passive House Consultant (CPHC) in Greater Sudbury:
 - [Ken Ritari](#) of Kince Home Improvements is based in Naughton;
 - Although certified in 2016 Mr. Ritari has not yet constructed a PH home.

PHI CERTIFIED TRADESPERSONS | NONE IN SUDBURY-MANITOULIN

A November 2018 [search](#) of the PHI website for Certified Passive House Tradespersons in Ontario yielded a total of six results. Two of these are in Minden but none are listed for Sudbury-Manitoulin or elsewhere in the North.

Passive House Canada

Founded in 2013 as the Canadian Passive House Institute West (CanPHI West), [Passive House Canada](#) was formed in 2016 to provide the building community with a single national organization. Based in Victoria, BC, PH Canada is a national non-profit professional association that advocates for PH building and offers [training](#) and certification to the International Standard.

PH CANADA CERTIFIED PROFESSIONALS | TWO IN SUDBURY-MANITOULIN

A November 2018 [search](#) of the *Members* page on the PH Canada website yielded four results in northern Ontario:

- One in each of North Bay and Thunder Bay;
- Two in the Sudbury Region:
 - [Ron Beck](#), owner of Beck Construction in Alban; and,
 - [Rob Fleury](#), architectural technologist with Centreline Architecture in Greater Sudbury.

North American Passive House Standard | Passive House Institute U.S.

Some PH professionals practicing in North America came to believe that, for PH to be practical, cost effective, and widely adopted, the established passive building concepts and standards had to adapt to North America's more extreme climates. The [Passive House Institute U.S.](#) (PHIUS) was established in 2007 and a distinct North American PH Standard was developed. PHIUS offers professional [training](#), [certification](#) for building products, and is implementing an updated standard: [PHIUS + 2018 Building Standard: Getting to Zero](#).

A November 2018 [search](#) of PHIUS's *Find a Professional* webpage yielded multiple results for southern Ontario, however, **no PHIUS certified professionals are listed in northern Ontario.**

LEED®

[Leadership in Energy and Environmental Design®](#) (LEED®) is a rating system recognized in over 160 countries. LEED® certification provides independent, third-party verification that a building, home or community was designed and built for high performance in key areas of human and environmental health: location and transportation, sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. There are four levels of certification: LEED® certified, silver, gold and platinum. The **LEED® AP** designation denotes a LEED® Accredited Professional. The availability in Sudbury-Manitoulin of professionals with the LEED® AP designation will be examined in the following section, *Architecture & Engineering*.

The national not-for-profit organization [Canada Green Building Council](#) (CaGBC) holds the Canadian license for the **LEED® green building rating system** and delivers programs and courses including LEED® accreditation exam preparation. The CaGBC has been working since 2002 to reduce the environmental impact of the built environment and to advance green building and sustainable community development practices.

CaGBC ZERO CARBON BUILDING STANDARD

Released in May, 2017 the [Zero Carbon Building Standard](#) provides a way for new and existing buildings to reach zero carbon. Using carbon as the key performance metric, this standard encourages more renewable energy generation both on and off the building site. [15 Pilot Projects](#) are currently participating in a two-year pilot although none of these projects are in Sudbury-Manitoulin.

ENERGIESPRONG

[Energiesprong](#) is a unique approach to building retrofits that was first developed in the Netherlands. Where a typical net zero energy retrofit includes re-cladding, replacement of the mechanical system, and the addition of solar panels, Energiesprong employs pre-fabricated components and off-site assembly so that the retrofit is completed within days.

Energiesprong is an initiative of [Sustainable Buildings Canada](#) (SBC), a non-profit organization established in 2002 that works to advance the state of the built environment. SBC hosts an annual [Green Building Festival](#) and contributes to policy and program initiatives related to the building code and municipal sustainability. SBC provides [education](#) and training for professionals, [research](#), and program services for utilities, government and agencies. SBC proposes to focus on retrofits of social housing and has completed essential background research; three reports are available on the SBC website. This initiative is in the developmental stage and has not yet been applied in Ontario.

The low-carbon design and building standards described in this section are the most common in Canada, but there are others. Despite the existence of so many tested methods for reducing greenhouse gas (GHG) emissions from our built environment, it is clear from the search results that their adoption is slow in coming to Sudbury-Manitoulin and northern Ontario in general.

ARCHITECTURE & ENGINEERING

Turning low-carbon design concepts and standards into physical structures involves the professions of architecture and engineering. This research has focused on identifying firms in both fields that are based in Sudbury-Manitoulin, have staff with the relevant credentials, and have demonstrated expertise in low-carbon building and/or services that support environmental sustainability. These criteria have then eliminated large firms with provincial, national and international operations; these firms are presumed to have the internal capacity to provide expertise as required for any low-carbon building project.

It must be stated that these results are not necessarily comprehensive and have been limited by the information available through online search engines. Small “boutique” firms, in-house specialists, or sole-proprietor operations that neither advertise nor have a web presence may have been overlooked. Neither does this listing imply that any professional provider of architectural and/or engineering services could not also fulfil a client’s requirements for low-carbon design. Additionally, designs may incorporate low-carbon and sustainability concepts without also seeking official certification for the project. Official certification by LEED® or Passive House, for example, adds financial cost to the project budget and so certification is usually driven by client preference.

ARCHITECTURE

SELECTED ARCHITECTURAL FIRMS | SUDBURY-MANITOULIN

The number of architectural firms based in Sudbury-Manitoulin is small, and this list is further limited by the above-stated criteria. The two firms selected have offices in the City of Greater Sudbury:

[Centreline Architecture](#)

- Established in 2007 as Centreline Design Inc. offering custom residential designs;
- Rebranded as Centreline Architecture; Increasingly serves Industrial, Commercial and Institutional (ICI) clients;
- Partner and Senior Technologist Rob Fleury is a **Passive House Canada Certified Professional**.

[Yallowega Bélanger Salach Architecture](#)

- Established in 1964; Extensive experience in ICI and residential design;
- Intern Architect Jordan Chappell is a **LEED® Accredited Professional (LEED® AP)**.

AVAILABLE TRAINING

Two post-secondary educational institutions in the City of Greater Sudbury deliver programs in architecture and architectural technology. These are:

Laurentian University | McEwen School of Architecture

Since 2013 the curriculum of the [McEwen School of Architecture](#) has highlighted design for northern Ontario, with an emphasis on developing expertise in wood and other sustainable materials. The McEwen School is committed to sustainability, in both the sense of the Seventh Generation Principle upheld by Indigenous peoples and as defined by the 1987 [Brundtland Report](#) of the UN World Commission on Environment and Development:

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

In alignment with this focus on sustainability the McEwen School's curriculum integrates energy efficiency, low-carbon design concepts and building skills throughout its program in theory, design studio and design-build work. Rather than committing to any one standard, credential or certification such as LEED®, Passive House or R-2000, the McEwen School considers these a foundation upon which to build. With the first graduates of the Master of Architecture (M. Arch) soon to launch their professional careers, the future availability and application of sustainable design concepts and skills in Sudbury-Manitoulin is promising.

Collège Boréal | Architectural Technician & Architectural Technology Programs

[Collège Boréal](#) offers a two-year Ontario College Diploma program for Architectural Technicians and a three-year Ontario College Advanced Diploma program for Architectural Technologists. These programs are offered in French at the City of Greater Sudbury campus.

Collège Boréal received funding through the Ministry of Advanced Education and Skills Development's Low-Carbon Building Skills (LCBS) Training Fund and is currently developing LCBS programming that is anticipated to become available in January 2019. This post-graduate certificate will combine elements of low-carbon design and building automation with a focus on the building envelope.

A number of [architectural technology programs](#) are available through the Ontario community college system. **One to be noted is the Post-Diploma Graduate Certificate in [Green Architecture](#) offered by Algonquin College in Ottawa.** Students complete the Canada Green Building Council (CaGBC) courses: *Leadership in Energy and Environmental Design® Green Building Strategies*, and *Green Associate (GA) Preparation*, and are then eligible to write the [Green Building Certification Inc](#) (GBCI) LEED® Green Associate exam toward that credential.

This leads to the first recommendation for decision makers:

It is recommended that the Ministry of Training, Colleges and Universities (MTCU) seek to partner with the private sector to deliver established LCBS training programs through the Ontario community college system.

ENGINEERING

Most engineering firms with offices in Sudbury-Manitoulin service the mining industry in various capacities. Only local engineering firms with demonstrated experience in low-carbon building and/or services that support environmental sustainability have been considered for this list.

SELECTED ENGINEERING FIRMS | SUDBURY-MANITOULIN

[A2S Consulting Engineers](#)

- Founded in 2014, A2S “strives to be responsible corporate citizens and lead by example in our social and environmental initiatives;”
- A2S has won several [Wood WORKS!](#) Awards;
- Principal Engineer Aaron Dent is a **LEED® Accredited Professional** (LEED® AP)

[CDCD Engineering Ltd](#)

- Incorporated 1979; Consulting Engineering Practice established 1994;
- **Architectural Services:** Restorations, Retrofit, Renovations, Building Envelopes;
- **Electrical Services:** Energy Conservation Technologies and Management, Automated Control and Monitoring Systems, Building Energy Audits;
- **Mechanical Services:** Heating, Ventilating and Air Conditioning (HVAC); Air Quality, Filtration and Exhaust; Heating and Refrigeration Plants; Heat Pumps and Thermal Storage; District Heating and Cooling; Building Services Automation.

[John R Hamalainen Engineering Ltd](#)

- Consulting Engineering Practice established 1987;
- **Mechanical Services:** HVAC, Indoor Air Quality Monitoring and Analysis, Energy Recovery Systems, Geo-Thermal Ground Source Heating Systems;
- **Electrical Services:** Energy Usage Studies and Analysis, Direct Digital Controls for Building Automation, Energy Audits, Energy Management.

AVAILABLE TRAINING

Residents of Sudbury-Manitoulin and northeastern Ontario will have to relocate or study online in order to engage in green building engineering and technology programs. The post-secondary educational programs in engineering and engineering technology available in Sudbury-Manitoulin are focused on supporting heavy industry and mining rather than the built environment. These programs are:

Laurentian University | Chemical, Mechanical, and Mining [Engineering](#).

Cambrian College | Chemical, Civil, Electrical, Electromechanical (Mechatronics), Mining, and Power [Engineering Technology](#).

Collège Boréal | Computer, Construction (Civil and Mining), Electrical, and Electronics [Engineering Technology](#).

A multitude of [engineering technology programs](#) are available throughout the Ontario community college system. Available engineering and engineering technology programs that focus on building sciences are explored further in the following section.

ENERGY & FACILITIES MANAGEMENT

As the complexity of heating, cooling and operating systems for buildings steadily increases, and as businesses, governments, landlords and homeowners become ever more concerned with the financial and environmental costs of energy usage, new areas of specialization have emerged. Highly-skilled occupations related to energy auditing and management, as well as facilities management, are increasingly necessary for the effective and efficient operations of large buildings.

Undergraduate degree programs in electrical, mechanical, environmental, software and computer systems engineering are all possible pathways into a specialization in energy and/or facilities management, usually as a graduate certificate. [Engineers Canada](#) maintains a listing of accredited undergraduate engineering programs by province. **Two new programs in Ontario** (established 2012) **are an indication of an increasing view to sustainability in the field:** [Sustainable and Renewable Energy Engineering](#) at Carleton University, and [Green Process Engineering](#) at the University of Western Ontario.

An **energy auditor** evaluates how energy is being used in a building or facility and identifies where consumption can be reduced. An **energy manager** also conducts energy audits and uses that information to design programs to increase energy efficiency and reduce energy-related costs. This may include the redesign of industrial processes, the retrofit of buildings and equipment, and the planning of energy-related systems for new projects. Private-sector training for these certifications is available through the [Canadian Institute for Energy Training \(CIET\)](#).

A **facilities manager** is responsible for leading and scheduling the maintenance and services of one or more facilities and so needs some expertise in multiple areas such as: mechanical, electrical and plumbing (MEP); heating, ventilation and air conditioning (HVAC); engineering and construction; building automation and fire suppression systems; real estate and leasing; and budgeting and project management. The previously noted CIET also offers [Building Operator Certification](#) training.

These professionals are often employed in staff positions with large organizations such as property development and management companies, social housing departments of municipalities, educational institutions and hospitals, and industrial and manufacturing operations. **This research has obtained no information as to how many may be employed in these positions in Sudbury-Manitoulin**, nor as to the anticipated demand. It can, however, be safely assumed that with increased awareness around energy conservation these fields will experience continued growth.

AVAILABLE TRAINING

The post-secondary engineering and engineering technology programs available in Sudbury-Manitoulin have been noted previously and do not include any offerings around building sciences. The good news is that colleges elsewhere in the province do offer programs that support energy and building systems management. **Some examples of these are:**

- [Bachelor of Engineering – Building Systems Engineering](#) | Conestoga College
- [Electromechanical Engineering Technology – Building Automation](#) | George Brown College
- [Energy Management – Built Environment](#) and [Building Systems Engineering Technician](#) | Seneca College
- [Sustainable Building Design and Construction](#) | Fleming College
- [Sustainable Energy and Building Technology](#) | Humber College

With growing awareness of and demand for these skill sets, it is possible that more of these types of applied technology programs will become available in Sudbury-Manitoulin and across northern Ontario.

The next sections will examine the construction industry and the availability in Sudbury-Manitoulin of low-carbon building skills and training programs for new-builds and retrofits in the industrial, commercial and institutional (ICI) and residential sectors. It is ultimately the knowledge and hands-on skills of builders that transform green architectural and engineering concepts into reality.

NEW CONSTRUCTION & RETROFITS

The construction of new homes and buildings has always been based on need and demand. In the private sector there must be some certainty of a return on investment (ROI) for the industry to thrive, and in the public sector the community benefit must be balanced with the ability of the tax base to support the project. **When it comes to building green, the message received from several Expert Advisors in the construction sector is: it is the client who drives the machine.**

Just how green a home or building will be then reflects the preferences of the buyer, or of the industrial, commercial or institutional (ICI) client. Price point, or what the consumer is able or willing to pay for certain features, is also a key consideration and often a limiting factor. **Conversely, consumers who want and can afford a custom-built Passive House or LEED®-certified building can have it; the expertise, the design standards, the materials and technology are available.**

With both an aging and declining population, Sudbury-Manitoulin has not seen a major residential housing boom since the population explosion of the post-WWII years, a trend that continued into the late 1970s and early 1980s as those baby-boomers moved into homes of their own. Much of that older housing stock is still in use today and needs replacement or extensive retrofits to meet today's energy performance standards. Here too, the costs of the needed retrofits are limiting factors for many owners and buyers of older homes.

The [Ontario Building Code](#), also known as Ontario Regulation 332/12 made under the *Building Code Act*, 1992, is one obvious mechanism for improving energy efficiency in the built environment. The previous provincial government set ambitious goals that, if fully implemented, would require buildings built after 2030 to be carbon neutral. [Supplementary Standard SB-12](#), *Energy Efficiency for Housing*, affects building permits issued after January 1, 2017 and requires enhanced insulation values and building seal, drain water heat recovery systems, and higher standards for heat recovery ventilators among other measures.

It is worth noting here that amendments to a Regulation such as the Building Code can be approved by the Premier and Cabinet without debate in the Legislature and that, as a result, significant changes that support or revoke green building initiatives can occur relatively quickly.

INDUSTRIAL, COMMERCIAL & INSTITUTIONAL (ICI) CONSTRUCTION & AVAILABLE TRAINING

This research has benefited greatly from information provided by Expert Advisors from the ICI construction industry including: the Executive Director of the Northeastern Ontario Construction Association (NOCA); the Business Manager of the Sheet Metal Workers and Roofers (SMWIA) Local 504; a Representative of the United Brotherhood of Carpenters & Joiners Local 2486; the Training Facilitator and the Trainer from the Labourers' International Union of North America (LiUNA) Local 493; and, the Training Co-Ordinator and the Business Manager of the United Association (UA) of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry Local 800. Their support of and contributions to this research are gratefully acknowledged.

These ICI construction organizations represent approximately the same geographic area and can speak with authority to the state of readiness of the ICI workforce in northeastern Ontario to provide green and low-carbon building skills (LCBS). There is a consensus that, while it is the client who makes the decisions as to what kind of building will be constructed, **the ICI workforce has the skills and training necessary to meet green and low-carbon building requirements.** The following is a brief summary of the information obtained from these sources:

The Northeastern Ontario Construction Association (NOCA) represents over 300 contractors, manufacturers and suppliers, service providers, consulting firms, and training and personnel providers in the ICI construction industry. The boundaries of NOCA's territory are defined by Moosonee to the North, Bracebridge to the South, Pembroke to the East, and Blind River to the West. NOCA's Mission is to represent the interests of its membership in a pursuit for excellence and to advocate for safety, education, fairness, and sustainable growth for the entire industry. In an interview conducted as part of this research the Executive Director of NOCA emphasized that, **when it comes to building green, all decisions are made by the owner and/or funder of the project.** As with any construction project the terms and conditions, including the application of any low-carbon building standards, are written into the contract; the builder and/or contractor must then comply with the contractual obligations.

The **Sheet Metal Workers and Roofers (SMWIA) Local 504** represents 300 journeypersons and 20-25 apprentices in an area covering Kapuskasing to just north of Parry Sound, and from Mattawa to Sault Ste. Marie. These skilled tradespersons install waterproof membranes, decking and roofing materials, and exterior finishes such as specialized sheeting, cladding and insulation on buildings. Sheet metal workers fabricate and install ductwork for air handling and heating, ventilation and air-conditioning (HVAC) systems. **With regard to specific low-carbon building skills:** these tradespersons receive

training in the installation of green roofs (although there is little demand for this in northern Ontario), upgrades to HVAC systems, and the construction of District Heating and Cooling Systems. Exterior cladding materials with photovoltaic (PV) capabilities have recently been developed and it is anticipated that SMWIA members will also install these products.

It was noted during an interview with Local 504's Business Manager that a building owner's willingness to invest in energy efficient upgrades is directly related to the degree of their commitment to that facility. A factory owner with a long-term view will invest in upgrades to insulation, cladding and HVAC systems whereas the owner of a strip mall or apartment building will not if the intent is to simply improve the appearance of the facility for quick resale.

It must be noted that, to achieve a low-carbon built environment, a great deal of this work will be executed by carpenters; it is their training and skills that will have the greatest impact.

Members of the [United Brotherhood of Carpenters & Joiners Local 2486](#) are journeypersons and apprentices in the skilled trades of Drywall, Acoustic and Interior Systems Mechanic, and General Carpenter. As a Training Delivery Agent (TDA) approved by the Ministry of Training, Colleges and Universities (MTCU), Local 2486 provides the in-school portion of apprenticeship training for the drywall trade at its Drywall Training Center in Greater Sudbury. The in-school portion of apprenticeship training for General Carpenter is offered at three northern colleges: Cambrian, Canadore, and Northern.

As of July 2018, the membership of Local 2486 was approximately 1070 journeypersons and 250 apprentices. However, **it is estimated that the ICI construction industry will experience a shortage of 150 to 200 carpenters in the near future** as planned infrastructure and industrial projects get under way. Local 2486 has jurisdiction from Cochrane to Parry Sound, and from North Bay to Sault Ste. Marie, including White River and Chapleau.

Because Local 2486 is an affiliate of an international labour organization, members also have access to training provided by the [Carpenters International Training Center](#) (ITC) located in Las Vegas, NV. A full listing of course offerings can be viewed [here](#). **Available training specific to Low-Carbon Building Skills (LCBS) includes:** Building Envelope (BE) Principles; BE Air and Moisture; BE Thermal Barrier; BE Spray Foam; and BE Advanced Skills. Also available are: Building Information Modeling, Green Building Awareness, Insulating Concrete Forms, and Solar Installer Level 1 and Level 2 Qualification. In addition, the Carpenters International Certification Council (CICC) offers five distinct Building Envelope certifications, one of which, the [Certified Building Envelope Technician](#) (CBET), is accredited by the National Commission for Certifying Agencies (NCCA) based in Washington, D.C. Typically, Local 2486 sends its own trainers to take these courses so that they return prepared to instruct others.

Members of the [Labourers' International Union of North America \(LiUNA\) Local 493](#) are journeypersons and apprentices in the skilled trades of Construction Craft Worker and Construction Craft Labourer. Local 493 represents over 1000 members in construction and industrial units in a territory covering Sudbury, North Bay, Timmins and surrounding areas. As a Training Delivery Agent (TDA), Local 493 provides the in-school portion of apprenticeship training for both trades at its training facility in Greater Sudbury. Regarding low-carbon building skills (LCBS), **these trades are experienced in the installation of ground-mounted solar photovoltaic (PV) fields and wind farms.** Specific training for these skills is usually provided by the manufacturer and/or distributor of the components to be installed for a particular project.

[Local 800](#) of the United Association (UA) of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States, Canada, Australia and Ireland represents 354 journeypersons and 89 apprentices in northeastern Ontario from their offices in Greater Sudbury and Sault Ste. Marie. UA Local 800 is also a TDA, with 16 certified trainers providing apprenticeship training and enhanced courses for journeypersons in the skilled trades of Welder, Steamfitter and Plumber. UA members fabricate, install and service piping systems in applications ranging from potable water distribution, oil and gas pipelines and the construction of nuclear plants, to fire sprinkler and heating, ventilation, air conditioning and refrigeration (HVACR) systems.

According to the Training Co-Ordinator of Local 800, **the UA is already green.** Water resource management and conservation, with a focus on the re-use of water resources and the safety of the water supply are a priority. The qualification standard for the steamfitter trade requires training in solar applications, while UA members who install, service and maintain HVACR systems have received training in the safe handling and replacement of refrigerants, geothermal applications, and heat and energy recovery technologies.

As with the Carpenters & Joiners, members of the UA have access to training provided through a larger international organization. Most UA training materials are now available [online](#) with such course offerings as Solar Water Heating Systems: Fundamentals and Installation, and Energy Auditing Practices. Through a partnership with the U.S. Green Building Council (USGBC), the UA also offers GPRO (Green Professional Building Skills Training) courses for members including: GPRO-Fundamentals of Building Green, GPRO-Green Mechanical Systems and GPRO-Green Plumbing Systems. GPRO is a comprehensive international training and certificate program that teaches the principles of sustainability and trade-specific green construction knowledge to people who build, renovate and maintain buildings. [GPRO Training for the Trades](#) is also available through the Canada Green Building Council (CaGBC).

In the course of this consultation with UA Local 800, the financial cost of energy efficient components and systems was again raised as a factor in the decisions made around low-carbon building. Another concern expressed was that, while technologies are constantly improving, there is a need to be realistic about the limitations imposed by geography and climate, particularly if a single standard is to be applied to the entire province by a mechanism such as the Building Code.

The organizations and trades examined here were selected for the degree of their potential involvement with green building in the ICI sector. Clearly, the training programs and necessary low-carbon building skills (LCBS) are available in the ICI industry; it is the demand for green building practices that is lacking.

MUNICIPALITIES & FIRST NATIONS COMMUNITIES

Any discussion of the demand for green institutional construction must also consider the experience of municipalities and First Nations communities with energy efficiency initiatives and low-carbon building. In the course of this research interviews were held with representatives of several municipalities in Sudbury-Manitoulin as well as with the Infrastructure Specialist for the United Chiefs and Councils of Mniidoo Mnising (UCCMM). These findings are condensed as follows:

As both the managers and custodians of public assets, municipal governments and staff are acutely aware of the bottom-line benefits of energy efficiency since every dollar saved on energy use becomes available for other services and infrastructure projects. Small municipalities in Sudbury-Manitoulin are struggling to balance a shrinking tax base with the demands of basic operating expenses and compliance with provincially-mandated services. As the largest municipality, the City of Greater Sudbury may have a bigger tax base but also has more infrastructure to maintain and operate, including many [social housing](#) facilities built to meet decades-old standards.

The senior municipal staff interviewed have vigorously pursued all available grants and subsidies to fund the installation of energy efficient street and facility lighting, the upgrading of windows, and the addition of extra insulation when, for example, an arena gets a new roof. However, in the words of one staff member: *better windows won't help if you can see daylight through the cracks in the walls*. Given the sheer volume of aging municipal infrastructure it is unlikely that municipalities in Sudbury-Manitoulin will be able to invest in retrofits or new green buildings without financial support from the federal and provincial levels of government. Nevertheless, municipalities are highly aware of the benefits of building

green, and there is a real desire to replace or retrofit aging municipal infrastructure to meet low-carbon standards when the opportunity arises and the budget allows.

The United Chiefs and Councils of Mnidoo Mnising ([UCCMM](#)) is an organization that provides resource, support and advisory services for six member First Nations (FN) communities in Sudbury-Manitoulin. An August 2018 interview with the UCCMM's Infrastructure Specialist, who is also the Building Inspector, confirmed that low-carbon building is a priority for FN communities. As with municipalities however, trade-offs are often made with regard to the desired degree of energy efficiency and the limitations of fixed budgets. It must also be noted that all FN construction falls under the [National Building Code](#) rather than the Ontario Building Code.

New-built housing in the UCCMM member FN communities is increasingly employing insulated concrete forms (ICF) for basements, while full-build ICF construction has been used for infrastructure projects including: two water treatment plants, the Sheguiandah Round House, and the new school in Birch Island. When the funding is available geothermal heating and cooling systems are preferred and have been installed in facilities such as the Ojibwe Cultural Foundation in M'Chigeeng and the Sheguiandah Health Centre. Housing Managers for some of the member FN communities have accessed [Hydro One](#) rebates for the installation of energy efficient LED lighting; other initiatives have included the installation of in-floor heating in new commercial buildings and solar retrofits in M'Chigeeng.

[Wahnapiatae First Nation](#) (WFN) is located in the northeast of the Greater Sudbury area. WFN has established a Sustainable Development Department with highly qualified staff and owns and operates the Tahgaiwinini Technical & Environmental Services Group. In alignment with its focus on environmental sustainability WFN opened its energy efficient community centre in 2012. The Centre of Excellence was inspired by LEED® design principles and features recycled and green building products, passive solar heating, geothermal technology and low-impact storm water management. With 60 of its approximately 320 members residing in WFN, the construction of new housing will be incremental and funding-dependent. It can, however, be safely assumed that sustainability will be a consideration in all projects.

[Atikameksheng Anishnawbek](#) First Nation (FN) is located just south of the southwest boundary of the City of Greater Sudbury. Providing another example of the interest of FN communities in sustainable development, a September 2018 Request for Proposals for the architectural design of a 12,000 square foot office building specifies that the design and construction of the facility must incorporate energy efficiency and sustainability. This office building will anchor a new business park and is expected to be completed in 2019.

Although these findings are preliminary, this research has confirmed that awareness of and desire for low-carbon and green building is well advanced in municipalities and First Nations communities. However, little progress will be made toward a public sector low-carbon built environment without adequate financial resources.

The following section will examine residential construction.

RESIDENTIAL CONSTRUCTION & STANDARDS

The [Canadian Home Builders' Association](#) (CHBA) sponsors an annual Home Buyer Preference survey to discover what buyers want. The 2017 survey results reflected a desire for more storage space, followed by kitchen features such as islands and quartz countertops. Also demonstrated by these results was an increased interest in energy efficiency, with high efficiency windows and energy efficient appliances appearing near the bottom of the list. Another significant finding was that, in seeking greater energy efficiency, **only 16% of respondents were motivated by a concern for the environment while 60% were motivated by savings on utilities.** At the time of this writing the results of the 2018 survey are only available for a fee, however, a key informant in the residential construction sector shared that building envelope has now entered the top ten of features desired by consumers. If home buyers want an airtight building envelope we can anticipate that builders will provide it.

In its *Architectural Technology Program Standard*, the Ministry of Training, Colleges and Universities (MTCU) defines building envelope as: *the waterproof elements of a building which enclose conditioned spaces and systems through which thermal energy may be transferred to or from the exterior.* The envelope then is what keeps the heat in; it is the physical separation between the inside and the outside of a building that resists air, water, heat, light, and noise transfer. Passive House and LEED® design standards place great emphasis on the airtightness of the building envelope.

The current requirements for the general level of energy efficiency and airtightness of new homes are prescribed by [Supplementary Standard SB-12](#) of the Ontario Building Code, which in turn cites the standard set by Natural Resources Canada (NRCan) for R-2000 and [ENERGY STAR® certified](#) homes.

Builders can meet the NRCan Standard in one of two ways:

By applying the **Prescriptive** path, builders construct homes based on predetermined specifications outlined in the Standard. Builders must meet a set of minimum requirements and then choose from a

series of upgrade options to which points are allocated. **The chosen features must add up to a certain number of points**, which have been pre-determined based on the province and climate zone in which the house is located. In other words, a builder incorporates features from a checklist that add up to a certain total point value; the resulting building should then meet the Standard.

By applying the **Performance** path, builders construct homes to meet the energy performance target outlined in the Standard for that province and climate zone. Under this path, builders must still meet the set of minimum requirements, but then have a high degree of flexibility in the choices they make to reach the energy target. **Once the home is built, it is [evaluated](#) using an energy simulation software to ensure it meets the required energy target.** In other words, the home must undergo physical testing, such as blower door testing, to ensure that it meets the Standard.

Both the Prescriptive and Performance paths are considered equally valid methods of achieving an ENERGY STAR® for New Homes label, and both paths require on-site verification by an energy advisor. The final section of this report will examine the availability of energy advisors in Sudbury-Manitoulin and the training required.

Builders will of course comply with the requirements of the Building Code, but considering the lack of NRCan service providers in Sudbury-Manitoulin, to what degree is performance testing being applied to residential construction in this region?

This research suggests that performance testing of new homes is not routine. In attending a regular membership meeting of the Sudbury & District Home Builders' Association (SDHBA) it was learned that one experienced developer and builder had only recently witnessed his first demonstration of a blower door test while at a conference. From the discussion that followed it was determined that this testing is not available locally and that out-of-town providers are reluctant to make the trip unless there are four or five homes to test at a time, such as in a new subdivision. Many builders remain unconvinced of the need for performance testing, and both the demand for and the availability of qualified testing service providers will have to increase before builders widely adopt the practice of performance testing.

Unfortunately, this research has not been able to determine an exact count of all residential builders and renovators conducting business in Sudbury-Manitoulin, nor has it produced comprehensive findings as to the degree of their training and capabilities with respect to low-carbon building skill sets. The time period of this research coincided with the busiest time of the year for builders - the construction season - and it was difficult to schedule interviews. Further, the high level of dissatisfaction expressed around the Green Ontario Fund and its abrupt cancellation left even fewer builders and contractors willing to discuss low-carbon and green building skills and initiatives.

What follows then is a brief summary of information compiled from key informants in the residential construction sector:

- As with the industrial, commercial & institutional (ICI) construction sector, it is the home buyer who ultimately determines what will be built. Few builders will construct a Passive House on speculation in the hope that it will eventually find a buyer.
- Home buyers are willing to spend their money on high-end and highly visible features and are less willing to invest in additional insulation. Recent results from the Home Buyer Preference survey indicate that this view may be changing.
- Concerns were again expressed that driving energy efficiency in new homes solely through the Building Code may not have the intended effect if the additional costs drive home buyers to purchase older, less efficient homes. One key informant felt strongly that rebates and subsidies for the retrofit of older homes should continue to be available to limit this effect.
- Concerns were also expressed as to the level of training and degree of qualification in the home building and renovations industry in general. **Carpentry is a voluntary trade**, which is defined by the [Ontario College of Trades](#) as a trade in which certification is not legally required in order to practice. Therefore, there is no consistent training or performance standard that must be met in order to call oneself a carpenter or home renovator.
- Further to the above, the “underground economy” in home renovations has long been, and continues to be, a concern for reputable builders and renovators. It is the home owner seeking to reduce costs for renovations that fuels the demand, and there is a largely unqualified and unregulated renovation industry ready to meet it. As ever, buyer beware.
- As an affiliate of the Ontario and Canadian associations, the [Sudbury & District Home Builders’ Association](#) (SDHBA) and its members abide by a Code of Ethics and are greatly concerned with the reputation and professionalism of the residential construction industry. By way of establishing a standard of quality in home renovations, the SDHBA endorses the [RenoMark™](#) program.
- It can be difficult to convince an older generation of builders to change their practices.

- There is limited consensus among builders as to the best way to build for energy efficiency.
- The current requirements of the Ontario Building Code are only grudgingly accepted by some.
- There *are* designers, builders, renovators, and green technology installers and service providers available in Sudbury-Manitoulin with the necessary knowledge, training and experience to contribute to a low-carbon built environment. However, there are not many. Refer to **Appendix B** to view the database of identified low-carbon services and providers.

Regarding the establishment of common standards for low-carbon residential retrofits, the Green Ontario Fund (GreenON) was making progress in the short period of its existence. The GreenON Rebates Program, administered by the Heating, Refrigeration and Air Conditioning Institute of Canada ([HRAI](#)), required that “participating” contractors hold specific certifications to qualify for rebates on the installation of high-efficiency windows, insulation, and air or ground source (geothermal) heat pumps. Note that the planned rebates for residential solar photovoltaic (PV) installations were not implemented before the program was cancelled.

For example, the GreenON qualification standard established for installers of air-source heat pumps (ASHP) was: to hold a 313A or 313D refrigeration and air conditioning license issued by the Ontario College of Trades; to review the GreenON Fund ASHP Orientation; and, to complete the *Save on Energy* Heating & Cooling Program Training. Window installers were required to have completed the [Window Wise](#) certification offered by the Siding and Window Dealers Association of Canada (SAWDAC).

Clear and common standards level the playing field for tradespersons and contractors and increase consumer confidence in the quality of the work performed. **This leads to the second recommendation for decision makers:**

It is recommended that the provincial government maintain and expand upon the trades qualifications and certifications required for low-carbon retrofits and installations as previously established by the Green Ontario Fund.

To conclude this examination of the residential construction sector we must consider the overall availability of tradespersons in general. Irrespective of the capacity to provide low-carbon building skills (LCBS), the demographic profile of our Sudbury-Manitoulin trades workforce is of growing concern. When it comes to the hiring and training of the next generation of skilled tradespersons, industries have fallen far behind in securing an adequate supply for the future.

A 2016 [report](#) produced by Workforce Planning for Sudbury & Manitoulin (WPSM) examined the trades workforce and analyzed demographic data for the compulsory trades made available by the Ontario College of Trades. **Compulsory trades are those for which apprenticeship training and qualification standards are prescribed.** It must be noted that carpenters are not included in the construction trades data because, as practitioners of a voluntary trade, they are not required to register with the College. However, it has been learned anecdotally that **the average age of a carpenter in Sudbury-Manitoulin is approaching 58 years.** Consider Table 3 found on page eight of this report:

Table 3: Average Age by Trade Sector | Journeyperson (JP) and Apprentice (APP) | Greater Sudbury, District of Sudbury and District of Manitoulin | March 2016

Average Age	Greater Sudbury		District of Sudbury		Manitoulin District	
	JP	APP	JP	APP	JP	APP
Construction	40.7	29.6	43.6	27.8	50.3	28.8
Industrial	41.3	30.5	34.0	27.8	74.0	25.8
Motive Power	47.5	30.9	43.6	25.6	48.1	32.9
Service	38.6	34.7	41.6	25.9	38.7	30.8
Overall	41.8	31.1	42.3	27.3	49.6	30.0

As noted in this report:

- Manitoulin District data are skewed by a significant number of older workers in small populations;
- It is important to note that although the data appears to show that compulsory trades have the oldest journeypersons, **little is known about journeypersons in the voluntary trades as they are not required to register;**
- Several newer trends are surfacing: many older workers, including journeypersons, are choosing not to retire, and some employers are beginning to hire older workers due to their work experience, work ethic, etc.

When the data in Table 3 is totaled for all of Sudbury-Manitoulin, the overall average age of journeypersons is 44.6 years, while the overall average age of apprentices is 29.5 years. Clearly, the experienced trades workforce is aging, and the replacement supply is not much younger. **The province of Ontario must invest in apprenticeship and trades training to ensure an adequate supply of these skills for the future.**

Nevertheless, when it comes to the future development and application of low-carbon building skills (LCBS) in the Sudbury-Manitoulin trades workforce there is cause for optimism.

The Millennial generation (those born between 1981 and 1996) is now established in the workforce, and the senior members of Generation Z (those born in 1997 and later) are entering their post-secondary years. Throughout their public-school years, members of these two generations have received

instruction in the importance of recycling and waste reduction, and the importance of conserving our environment. **The ongoing retirements of the Baby Boom generation will, in all probability, facilitate a generational shift in perspective regarding the value of, and need for, a low-carbon built environment.**

AVAILABLE TRAINING

It must be emphasized that graduates of college-based trades training programs are not yet experts in their fields. The purpose of these programs is to provide learners with the foundational knowledge and skills needed for entrance to formal apprenticeship or other workplace-based training. **It takes many years of on-the-job experience to produce a competent tradesperson in any skilled trade.**

As discussed in a previous section of this report, there are currently no post-secondary programs available in Sudbury-Manitoulin that specifically address low-carbon building skills (LCBS) and building operations. However, **Collège Boréal, as well as Canadore College in North Bay and Northern College in Timmins, received funding through the Ministry of Training, Colleges and Universities' (MTCU) LCBS Training Fund for professional, resource and course development.** We can look forward to new college-based LCBS programming becoming available as early as January 2019.

Currently, two colleges in Sudbury-Manitoulin offer programs that can, or can with some adaption, assist in preparing the low-carbon trades workforce of the future. These programs are:

Cambrian College | [Carpentry Renovation Techniques](#) | 3 Semesters

In the third semester of this program learners are introduced to renovation and retrofit techniques that enhance a home's energy efficiency.

Cambrian College | [Heating, Ventilation & Air Conditioning Technician](#) | 4 Semesters

Owing to the fact that many homes and buildings in Sudbury-Manitoulin are heated with natural gas, propane or oil, this program is focused on preparing learners for certification as Oil Burner and Gas Technicians. Included are courses in: Refrigeration; Heat Loss & Gain; Air Conditioning & Heat Pumps; and, Advanced Hydronics.

Collège Boréal | [Carpentry and Renovation Techniques](#) | 40 weeks

In the second semester of this program students receive introductory instruction in elements of low-carbon building such as: the effective installation of doors, windows and vapour barriers, and the construction of double-stud framed walls; Cross-Laminated Timber (CLT), also known as [Tall Wood](#), construction; LEED® design principles; and, building science and energy management.

Collège Boréal | [Plumbing Technician](#) | 3 Semesters

This program includes instruction in hydronic systems and techniques for energy and water conservation.

This leads to a third recommendation for decision-makers:

That the existing [Window Wise](#) certification for window installers provided by the Siding and Window Dealers Association of Canada (SAWDAC) be included in every college-based carpentry and home renovations program in Ontario.

This one-day course provides participants with an industry-recognized certification that will enhance the skill set and employability of program graduates.

[Kenjgewin Teg](#) is an educational institution based in M'Chigeeng on Manitoulin Island that provides, among other services, access to post-secondary programs. Built in 2018, the **Anishinabek Skills, Innovation and Research Centre** currently offers essential workplace certifications such as *Working at Heights* and *Confined Spaces* and is in the process of expanding its programming to provide introductory training in such areas as welding and trades fundamentals, with more programs anticipated.

Low-carbon building skills (LCBS) training programs have also been developed by the private sector and industry associations. Some of these, such as Window Wise, LEED® and GPro, have already been highlighted, and more are listed below. This list is by no means comprehensive yet speaks to the readiness of many industries to embrace low-carbon building.

- The **Canadian Home Builders' Association** (CHBA) offers [Qualified Net Zero Training](#);
- The **Heating, Refrigeration and Air Conditioning Institute of Canada** (HRAI) offers a number of [training programs](#) for this industry and was the approved GreenON provider of certification training for installers of geothermal (Ground Source Heat Pump) systems;

- **NAIMA Canada** (North American Insulation Manufacturers Association) represents manufacturers of fiberglass, rock wool, and slag wool insulation and offers free [Insulation and Air Sealing](#) e-training and certification for contractors;
- The **Ontario Home Builders' Associations** (OHBA), through its [Institute of Building Excellence](#) (IBE), offers professional development courses for its members; and,
- The **Wood Works!** program of the Canadian Wood Council offers free [elearning](#) courses.

The final section of this report will examine the availability of energy advisors in Sudbury-Manitoulin and the training required for this occupation.

ENERGY ADVISORS

The Energy Advisor is essential to the implementation of Natural Resources Canada (NRCan) [initiatives](#) around energy efficiency in our residential built environment. An NRCan Registered Energy Advisor (REA) takes measurements and notes on a home's mechanical equipment (HVAC system and/or furnace), windows and insulation levels, and conducts a blower door test to measure the home's air tightness. The Energy Advisor uses this data and NRCan's HOT2000 energy simulation software to find a home's current and potential energy ratings. A blower door test depressurizes the air in a house and measures the air changes per hour at specific pressures. This test also allows the Energy Advisor to demonstrate where the main drafts are located.

There is exactly one Energy Advisor based in Sudbury-Manitoulin. This lone service provider is attached to the United Way Centraide North East Ontario Home Weatherization Program.

It must be noted that, despite the cancellation of the Green Ontario Fund, there continue to be some retrofit and rebate programs available for low-income homeowners. In 2016, [United Way Centraide North East Ontario](#) established the **Home Weatherization Program** in partnership with [Union Gas](#) and [GreenSaver](#) to provide free home assessments and weatherization upgrades for income-eligible Union Gas customers across their geographic district. Homes built before 1975 receive upgrades to insulation in walls, attics and basements in order to reduce energy consumption and related costs.

AVAILABLE TRAINING

The training required to become an NRCan [Registered Energy Advisor](#) (REA) is not available through any post-secondary educational institution, nor is this training open to anyone who does not have a very specific set of background skills and work experience.

Candidates for the REA training program must possess knowledge and experience in areas such as: the EnerGuide rating system; residential construction practices for low-rise housing; energy-efficient renovation practices; building science; basic arithmetic, geometry and computers skills; data collection requirements; energy simulation modeling using HOT2000; and, good client relations. Alternatively, a college diploma and work experience in Home Inspection, Exterior Inspection, Structural Inspection, Interior Insulation Inspection, and/or Heating Inspection are pathways to access REA training. Candidates must also pass the NRCan Foundation Level exam and the Energy Advisor exam.

CONCLUSION

In order to fulfil commitments to reduce greenhouse gas (GHG) emissions made in Ontario's Climate Change Action Plan for 2016-2020, **the previous provincial government identified the need for a workforce trained in low-carbon building skills such as: building retrofits, new green construction and building operations, and energy management.** The 2018 Sudbury-Manitoulin Low-Carbon Building Skills (LCBS) Partnership Project has examined the availability of these key skills, the training that provides them, and the readiness of the Sudbury-Manitoulin workforce to supply them.

This report began with an analysis of low-carbon design and building standards, associated training programs, and their availability in Sudbury-Manitoulin. Thanks to Laurentian University's McEwen School of Architecture and Collège Boréal's Architectural Technician and Technology programs, **low-carbon design skills and training have been addressed.**

This research has revealed, however, that there are large gaps in the available skills and training programs required for green building operations and energy management in Sudbury-Manitoulin.

On a positive note, **LCBS training programs and delivery mechanisms for the industrial, commercial and institutional (ICI) construction workforce are well established.** The LCBS training programs and the skills required for any ICI green building project have been developed and can be rapidly mobilized when needed. However, this training will not be conducted on a routine basis without a consistent demand for LCBS skills from the builders and owners who make the decisions as to how green and/or low-carbon a building will be.

In the residential construction, renovation and retrofit industry the availability of LCBS skills and training programs is limited. Demand for these skills and services depends on home owners' and buyers' willingness to invest in energy efficiency measures. Nevertheless, specialized services are available and can be provided by a small number of custom builders and, for example, solar and geothermal system installers.

In conclusion, those who want and can afford to build green in Sudbury-Manitoulin can presently access the necessary design expertise and low-carbon building skills; these are available, if in limited supply. Going forward, when considering the total cost of a low-carbon built environment, it is important to look beyond the up-front expense of building green and factor in the long-term reduction in greenhouse gas (GHG) emissions and owners' future savings on energy bills.

RECOMMENDATIONS

This research into the availability of low-carbon building skills (LCBS) in Sudbury-Manitoulin has led to the formation of the following three recommendations:

1. **It is recommended that the Ministry of Training, Colleges and Universities (MTCU) seek to partner with the private sector to deliver established LCBS training programs through the Ontario community college system.**

There is no need for colleges to re-invent the extensive LCBS training that has already been developed, tested and proven in the private sector. A model for this is the Post-Diploma Graduate Certificate in [Green Architecture](#) offered by Algonquin College in Ottawa. Students complete the Canada Green Building Council (CaGBC) course *Leadership in Energy and Environmental Design (LEED®) Green Building Strategies and Green Associate (GA) Exam Preparation* and are then eligible to write the [Green Building Certification Inc \(GBCI\) LEED® \(GA\) exam](#) toward that credential.

2. **It is recommended that the provincial government maintain and expand upon the trades qualifications and certifications required for low-carbon retrofits and installations as previously established by the Green Ontario Fund.**

This recommendation follows from one made in the source document [Building an Ontario Green Jobs Strategy](#) to pilot a Building Performance Institute that would oversee rigorous credentialing, quality assurance and standards-setting programs for home performance professionals, and require certification of all contractors delivering home performance improvements under its umbrella.

And finally,

3. **It is recommended that the existing [Window Wise](#) certification for window installers provided by the Siding and Window Dealers Association of Canada (SAWDAC) be included in every college-based carpentry and home renovations program in Ontario.**

This one-day course provides participants with an industry-recognized certification that will enhance the skill set and employability of program graduates.

ADDITIONAL RESOURCES

For considerations of space, this report on the availability of low-carbon building skills (LCBS) in Sudbury-Manitoulin could not include all the resources that were reviewed. These additional resources are provided for the benefit of readers wanting to learn more.

- **Canada Green Building Council (2017): [A Roadmap for Retrofits in Canada](#): *Charting a path forward for large buildings* | The 2018 Report is available for purchase from the same website.**
- **“Canada’s Handiest Man” Steve Maxwell’s website: [Bailey Line Road](#) | Clear and concise explanations of many low-carbon building techniques and technologies.**
- **Environmental Defence, Blue Green Canada, and the Clean Economy Alliance (2017): [Building an Ontario Green Jobs Strategy](#)**
- **Grand Valley Construction Association Journal (2017): [The Technology and Green Design Issue](#)**
- **Northern Ontario Business, December 14, 2018: [A different take on construction](#): *Centreline Architecture touts passivehaus design concept for Northern Ontario***
- **Ontario Homebuilder Magazine (2017): [Climate Change Issue](#)**

APPENDIX A | EXPERT ADVISORS & KEY INFORMANTS

The reThink Green Low-Carbon Building Skills Program Manager, Dawn Graham, acknowledges and thanks the following for their contributions to this research:

EXPERT ADVISORS		
Dave Arnold	P. Eng. Vice President	Dalron Homes
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Scott Florence	Managing Director	reThink Green
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Anthony Iannucci	Training Co-Ordinator	UA Local 800 United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry
Roger Michaud	Business Manager Financial Secretary	SMWIA Local 504 Sheet Metal Workers and Roofers
Denis Shank	Executive Director	NOCA Northeastern Ontario Construction Association
Nicholas Warus	Business Manager	UA Local 800
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KEY INFORMANTS		
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Philip Adams	Chair School of Skills Training	Cambrian College
Dave Baerg	President Certified Energy Advisor HRAI Accredited HVAC Designer	Baerg's Home Performance Solutions
Hank Beaven	Trainer Executive Board Member	LiUNA Local 493 Laborers' International Union of North America
Ron Beck	Passive House Certified	Beck Construction
Silvio Berti	Municipal Coordinator	Municipality of Central Manitoulin
Ed Casteels	President	Eco Advantage Energy Advisors Inc.
Annette Clarke	Chief Administrative Officer Clerk	Town of Gore Bay
Jamie Coote	Residential Account Manager	Union Gas
Caroline Corbett	Associate Dean Trades, Technology & Justice Programs	Canadore College

Elizabeth De Luisa	Executive Officer	SDHBA Sudbury & District Home Builders' Association
Dan Diotte	Builder & General Contractor	Barné Building & Construction Inc.
Rob Fleury	Architectural Technologist	Centreline Architecture
Todd Gordon	Economic Development Officer	Billings Township
Dave Hall	Trades Manager	Kenjgewin Teg
Louise Hawes	Training Facilitator	LiUNA Local 493
JoAnne MacLellan	Dean School of Skills Training	Cambrian College
Colin MacLeod	National Distribution Manager	3M Window Film Canada
Merdick McFarlane	General Carpenter Insulated Concrete Form Builder	Providence Bay
Ray Moreau	Infrastructure Specialist Building Inspector	UCCMM United Chiefs and Councils of Mnidoo Mnising
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Jason Neal	Executive Director	SAWDAC Siding and Window Dealers Association of Canada
David Nixon	Training Specialist	STEP Sustainable Technologies Evaluation Program
John O'Grady	Partner Prism Economics & Analysis	With thanks for the PowerPoint: <i>Future Industry Training Needs as Part of the LCBS Initiative</i>
Denis R. Ouimette	Professor & Coordinator Architectural Technology Program	College Boreal
Peter Peroff	HVAC & Hydronic Technical Specialist	EMCO Corporation
Andre Probst	Proprietor Designer & Installer	Manitoulin Off-Grid Systems
Ken Ritari	Certified Passive House Consultant	Kince Home Improvements
Tim St. Amand	Proprietor Designer & Installer	Manitoulin Geothermal Pro-Gas Energy Services
Dan Saumur	Manager of Maintenance Services	Greater Sudbury Housing Corporation
Adam Seiling	Certified Energy Advisor Home Weatherization Program	United Way Centraide North East Ontario
David Williamson	Chief Administrative Officer	Town of NEMI Northeastern Manitoulin and the Islands
Louie Zagordo	Past President SDHBA	President SLV Homes

APPENDIX B | DATABASE OF LCBS SERVICE PROVIDERS

LOW-CARBON BUILDING SERVICES DATABASE

DECEMBER 2018



SERVICE PROVIDERS	ADDRESS	PHONE	WEB EMAIL	ADDITIONAL INFO
ARCHITECTURE DESIGN				
Centreline Architecture	73 Elm St Sudbury	(705) 618-1767	centrelinearchitecture.ca	Passive House Certified Professional
Yallowega Bélanger Salach Architecture	255 Larch St Sudbury	(705) 675-3383	ybsa.ca	LEED® Accredited Professional
BUILDERS RENOVATORS				
Cusinato Developments	328 Walford Rd Sudbury	(705) 522-4837	cusinatodevelopments.com	Energy Efficient Custom Homes
Guy Belanger Homes Ltd	60 Onwatin Lake Rd Hanmer	(705) 969-4164	houzz.com/pro/belangerhomes	Energy Efficient Homes
J & S Construction	2600 Kingsway Blvd Sudbury	(705) 524-3292	jsconstruction.ca	Insulated Concrete Form (ICF) Construction
Lantaigne Services	905 ON-535 Noelville	(705) 898-2672	reall@on.aibn.com	Insulated Concrete Form (ICF) Construction
Merdick McFarlane	Providence Bay Manitoulin Island	Contact @ Facebook	facebook.com/merdick.mcfarlane	Insulated Concrete Form (ICF) Construction
Pat Taylor Contracting Inc	210 Horseshoe Lake Rd Estaire	(705) 522-2736	ptce.ca	Insulated Concrete Form (ICF) Construction
Quality Contracting	1191 Lansing Ave Sudbury	(705) 586-3622	qualitycontracting.ca	Window Wise Certified Installers
Quantum Home Builders Inc	695 Second Ave Espanola	(705) 869-9935	quantumhomebuilders.ca	Insulated Concrete Form (ICF) Construction
Sheppard Custom Building	93 Albert St Mindemoya	(705) 377-4630	N/A	Structural Insulated Panel (SIP) Construction
South Shore Builders	Manitoulin Island	(705) 859-2238	southshorebuilders.ca	Building Science Certified Soya Spray Foam ICF
ENERGY AUDITS				
CDCD Engineering Ltd.	303 Cedar St Sudbury	(705) 674-8457	cdcdengineering.com	Energy Audits Heat Pumps Thermal Storage
John R. Hamalainen Engineering Ltd.	2166 Armstrong St Sudbury	(705) 522-5745	consultingengineers.ca	Geothermal Energy Audits Automation
The Mountain Electric Company	297 Clear Lake Dr Espanola	(705) 863-3210	tmecc.ca	Automation Energy Audits
ENGINEERING				

A2S Consulting Engineers	289 Cedar St Sudbury	(705) 222-0420	a2sa.ca	LEED® Accredited Professional
CDCD Engineering Ltd.	303 Cedar St Sudbury	(705) 674-8457	cdcdengineering.com	Thermal Storage Automation Energy Audits Heat Pumps
John R. Hamalainen Engineering Ltd.	2166 Armstrong St Sudbury	(705) 522-5745	consultingengineers.ca	Geothermal Energy Audits Automation
GEOTHERMAL HEAT PUMPS				
Campeau Heating	2288 Lasalle Blvd Sudbury	(705) 560-2441	campeauheating.com	Geothermal
Climate Control Sudbury	311 Harrison Dr Sudbury	(705) 207-1320	climatecontrolsudbury.ca	Geothermal Heat Pumps
Greater City Mechanical	2450 Evans Rd Val Caron	(705) 897-8499	greatercitymechanical.ca	Geothermal Heat Pumps
Ingleton Sheet Metal Ltd	795 Kingsway Blvd Sudbury	(705) 674-1571	ingletonsheetmetal.ca	Heat Pumps
Lavallee Plumbing and Heating Ltd	1732 Radar Rd Hanmer	(705) 693-9475	lavalleeplumbingandheating.com	Heat Recovery Ventilators
Manitoulin Geothermal	6084 King St Mindemoya	(705) 377-6436	progasenergy.com/Geothermal	Geothermal
MWM Witherell Mechanical	74 Mumford Dr Lively	(705) 522-6445	smartenergycanada.ca	Geothermal Solar
Northern Air 669 Heat	1360 Kelly Lake Rd Sudbury	(705) 669-4328	669-heat.com	HVAC Design Heat Pumps
INSULATORS				
Eco Insulation®	302 Black Lake Rd Lively	(705) 692-3626	facebook.com/ecoinsulationsudbury	Soya Cellulose Insulation
Fibron Insulations Inc	2018 Kingsway Blvd Sudbury	(705) 566-4912	fibron.ca	Blown-In & Spray Foam Insulation
Furoy's Insulation	2912-2 Poole Court Val Caron	(705) 897-2805	furoyinsulation.ca	Spray Foam Insulation
PASSIVE HOUSE CERTIFIED				
Ron Beck	Beck Construction Alban	Message @ PH Canada	passivehousecanada.silkstart.com/directory	Passive House Certified Professional
Rob Fleury	Technologist Centreline Architecture	(705) 618 -1767	centrelinearchitecture.ca	Passive House Certified Professional
Ken Ritari	Kince Home Improvements Naughton	(705) 207-0970	kincehome@gmail.com	Passive House Certified Professional
SOLAR OFF-GRID				
BRS Battery Ltd	3450 Hwy 144 Chelmsford	(705) 855-0473	brsbattery.com	Storage Batteries 12V Appliances
Energy Logic Renewable Energy	463 Mead Blvd Espanola	(705) 662-8959	energylogic@eastlink.ca	Renewable Energy Systems

Enviro Energy	4853 MR 55 Whitefish	(705) 918-1825	enviroenergysolar.ca	Renewable Energy Systems
Manitoulin Off-Grid Systems	2304 Government Rd Providence Bay	(705) 859-2933	andreprobst@creativedesign.on.ca	youtube.com/watch?v=TI Awz7D5ydc
MWM Witherell Mechanical	74 Mumford Dr Lively	(705) 522-6445	smartenergycanada.ca	Geothermal Solar Systems
Nauss Plumbing & Heating	120 McCulloch Dr Espanola	(705) 869-1683	garnetplumbing@bellnet.ca	Solar Systems
Nauss Plumbing & Heating	2590 Lasalle Blvd Sudbury	(705) 566-2359	naussplumbing.ca	Solar Systems
Northshore Energy Outfitters	958 Panache Lake Rd Whitefish	(705) 618-5109	energy-outfitters.ca/home	Solar Wind Hybrid Systems
Pro Sol Propane & Solar Systems	3000 Falconbridge Hwy Sudbury	(705) 560-3387	prosolenenergy.ca	Solar Wind Systems
Solar Associates	1314 Lasalle Blvd Sudbury	(705) 521-1773	solarassociates.ca	Solar Systems Off-Grid
Raw Solar	5 Westview Cres Lively	(705) 618-0726	rawsolar.ca	Solar Systems Off-Grid
SUSTAINABILITY OTHER				
Yvon Champoux Inc	Notre-Dame-du-Nord Quebec	1-877-823-2253	maisonschampoux.com/en	Energy efficient prefabricated homes
Electric Vehicles of Greater Sudbury	facebook.com/evsudbury	(705) 561-1397	evsudbury@gmail.com	Promotes greener vehicles
Manitoulin Permaculture	facebook.com/manitoulinpermaculture	N/A	manitoulinpermaculture.com	Sustainability 4-Season Greenhouse

This Low-Carbon Building Services Database is a living document. To add your low-carbon business or service please contact reThink Green: info@rethinkgreen.ca

The background is a solid green color with several large, overlapping circles. Each circle has a decorative border made of a repeating geometric pattern of triangles and lines. The circles vary in size and are scattered across the page.

2018 Sudbury-Manitoulin Low-Carbon Building Skills Partnership Project
reThink Green
Workforce Planning for Sudbury & Manitoulin